The Toledan Tables

A review of the manuscripts and the textual versions
with an edition

by

FRITZ S. PEDERSEN

Part 4

Tables, types E-U
Indices

Historisk-filosofiske Skrifter **24:4**
Det Kongelige Danske Videnskabernes Selskab
The Royal Danish Academy of Sciences and Letters

Commission Agent: C.A. Reitzels Forlag · Copenhagen 2002

Contents of Part 4.

Composed in Palatino and `Courier` (WP5.1; HP LJ 6MP) by F.S.P.
Printed in Denmark by Special-Trykkeriet Viborg A/S
ISSN 0106-0481
ISBN 87-7876-266-9 (this part); 87-7876-267-7 (set of 4 parts)

Tables

(Types E-U)

E. Equations of sun, moon and planets.

EA. Common set. Mainly Albatenian.

Toomer 1968, no. 37 and 39-44.

Sources. These tables are generally the same as the equation tables of Albattani (Nallino II p. 78-83, 108-37). The Albattani tables, except the table for the sun, are similar to the Handy Tables. For Venus, however, Albattani replaces the equation values from the Handy Tables by his values for the sun; this change is inherited by the Toledan table EA71.Ece. See Toomer 1968 p. 65. – The tables of "statio prima" (=.Sta) in EA41...81 are the same as those of Alkhwarizmi / Maslama, Suter Tab. 27-56. These are, however, ultimately derived from some Ptolemaic source, perhaps Albattani, or possibly from a source even closer to the vulgate Toledan tables. See the preamble for EA41-81 for some discussion of this.

Parallels. Tables similar to the present ones are ubiquitous in collections that are derived from Albattani or from the Toledan tables.[1] Such parallels are ignored in the following. – The tables EA11 (apart from .Lat) and EA41-81 (apart from .Sta) are also in Ibn al-Kammad, Madrid 10023, 36r-44v. This parallel is ignored too.

Canons and testimonia. See under EA01, EA11, and EA41-81, separately.

EA01. Equation of sun.

Toomer 1968 no. 37. – From Albattani, Nallino II p. 78-83. – Herz (1894 p.51) printed the tabular values from ms. Wj. He recognized the eccentricity as the Albatenian one (p.53).

Witnesses: **{a0}** Ct,7v-8r; Oo,2v-3r; Pz,110r-v; Mc,2r-v; Mb,34v-35r; Ey,24v-27r; Da,189v-190r; Ea,33v-34r. – **{a1}** Xa,12v-13r; Cq,20-21; Fc,3v-4v; Ps,32v-33v; Sg,88, 89-91; Wd,11v-12r; Fh,14v-15v; Xw,11v-12r. – **{a2}** Cz,52r-53r; Cj,124v-125v; Md,55v-56v; Mp,190r-v; Vp,107r-108r. – **{aX}** Vo,23r,23v-24v; Xr,61v-(62r); R,34r-36v; Ov,50r-51r; Cu,56r-57r; Ep,25r-27v. – **{aT}** Lu,32v-33v; Oj,105r-106r; P,93v-94v; Da4,147r-v. – **{k}** Eh,72v-73v; Lw,68v-69v; Ou,46v-47v; Eg,8v-9r; Co,152r-v; Cn,86v-87r. – **{d}** Op,32r-33r; C,284-286; Lb,2r-3r; Pa,18r-19r; A,197r-198r; Fj,18r-19r; Nc,86r-87r; Pb,3r-4r; Pv,2r (signs 4-5 only); Wj,180r-181r; Fd2,20r,17v-18r; Gr3,90r-91r; Ok,22r-23r. – **{e}** Eq,48r-49r; Ek3,82r-83r; Xc,42v-43r; Vj,65v-66v; Ej,49r-v. – **{x}** Vx,131v-132v; Oc,54r-55r; X,130r-131r; Vz,45r-46r; Mv,72r-73r; Cm,182r-183r; B,122r-123r; T,279r-v; Lf,70r-71r; Lg,149r-150r; Lh,114r-115r; Xj,253r-254r; Xg,33r-34r; G,37v-38v; Xb,52v-53v; Es,154r-155r; Fb,43r-44r; Pq,162r-163r; Oy,50r-51r; Wa,53r-v; Ow,133r-134r; Nu,118r-119r. – **{p}** O,47v-48v; Pd,49v-51r; Ch2,154r-v. – **{?}** Py,37r-v (m2); Ch,51r-52r (:Savasorda 2); Fd,3v-4r (:Novara); Ut,125r-v (:?). – Lost from ms. {a1} Ad.

Canons: Ca92 ~ Cb141b (for solar equation, like Batt. 33); CcB08 (solar equation, same as Alkhwarizmi tr. Adelard); Ca127 ~ Cb171a ~ Cc238 (for true syzygy, like Batt. 42). All use the term "aequatio solis", mostly for referring to the tabular values. A reference to a general heading is only in the Khw/M canon CcB08.2 "in paginam *tadil* id est examinis". This canon may have affected the table-headings in mss. Mb Pz, since it is present in both these manuscripts.

Headings. – General:

(1: none) :: {a0:} Ct Mc Oo Da; {a1:} Sg Fh Xw; {aX:} Vo Xr; {aT:} Da4; {d:} Lb Ok; {k:} Cn; {?:} Py.
(2) (Rectitudo solis+ Pz**) Solis tadil** :: {a0:} Pz Mb.
(3) Cursus solis :: {a1:} Xa Cq Ps Wd.
(4) Aequatio (/-ones Lu Oj P Cm Wa**) solis** :: {a0:} Ea; {aT:} Lu Oj P; {aX:} R; {d:} Pa A Fj Nc Pb Pv Wj Fd2 Gr3; {x:} Cm X Fb Wa; {?:} Ch.

---

1 Thus, of the manuscripts connected with John of Lignères, Pn,29r-v shows a solar equation table with Alfonsine values (cf. Poulle 1984), and a lunar equation table with Alfonsine values as an alternative to EA11.Ear. Such equation tables are also found in Fc2,112v-113v, among eclipse tables (see JA13).

(5) (**Prima+** O Pd, Op! C! Ou! Ov! Vp! Ut!) **Tabula aequationis solis** :: {a0:} Ey; {a2:} Cz Cj Mp Vp; {aX:} Ov Cu Ep!; {k:} Eh Lw Eg Ou Co; {d?:} Op C; {e:} Eq Ek3 Xc Vj Ej; {x-}; {p:} O Pd; {?:} Ut. – "prima" is placed first in O Pd, variously in the rest cited.

(6: other) Ch2 ("Solis"); Fc & Md ("De sole"); Fd.

Body of table:

Normally **(7) Aequatio solis**, with few exceptions (in Md Cn Ch2 Ch). Entrance columns: varying, not noted here; **(8) Tabulae numeri** is common in the early witnesses, **(9) Lineae numeri** in the late ones.

Versions. In R Ep O Pd this table is coupled with a declination table that shows values as in BA21 but has been doubled by mirroring about 90°, so as to fit the present range. Ey adds a different declination table (BA22). – Fd, in the context of the Novara tables, shows a layout with column-headings not unlike BA21a. – In Albattani, the tables of solar and lunar equations are coupled together. This feature is not found here.

Values: same as in Albattani, Nallino II p. 78-83. Nallino has emended the values (cf. ibid., p.223), and quotes no variants. Accordingly, the Castilian version ($ba below) has been used for comparison instead of Nallino's, which is only quoted on one occasion.

A recomputation[1] using Albattani's solar eccentricity of 2;4,45 (Batt. 28, Nallino I p. 44:12) shows frequent differences of up to 2" from the consensus of the witnesses collated below. Discrepancies of 3" or more are found in a few isolated places, and on four larger intervals, as follows. On *1s27°-2s4°* and *5s1°-5s16°*, all witnesses agree with each other and with the Albattani witness $ba, so that the error must be from their common source. On *3s17°-4s2°* and *4s12°-4s21°*, the vulgate is often in disagreement with Ou Co $ba; the latter may be generally closer to the recomputation, but neither possibility fits strikingly well.

Text. Collated for values: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** Lu; **{k}** Ou Co; **{d}** Pa A; **{e}** Eq Xc; **{x}** Es Xg. – Headings according to Xa. – Ou adds alternative readings (here denoted as Ou.pc), which are much like the vulgate readings.

Also quoted: **$ba** = Batt., Paris Arsenal 8322, 52r-54v. The entrances are in degrees, rather than in signs and degrees. **$c** = recomputation; see "Values". Second-values are rounded. They are quoted in the apparatus if, after rounding, they differ by 3" or more from the adopted reading. Otherwise they are not normally quoted, not even where they agree with a reading that has not been adopted.

Readings chosen. In the edition below, the vulgate readings are normally accepted, even against readings that are likely to be Albatenian. The main split in the tradition, as usual, is between *Ou Co $ba* and the rest; indeed, where $ba differs from the vulgate, either $ba is in error, or else it agrees with Ou.ac Co. If the accepted reading differs from the consensus of Ou Co $ba, it is underscored. One gross error (f4,16) has, however, been corrected, and the corrected value has been italicized.

Ou Co often agree with Nallino's edition of Albattani against the vulgate whereas $ba has the vulgate reading or its own reading, e.g., at g2,20; o3,4; o3,15-16; g4,9; g4,29-30; o5,27-28; and in several places on the stretch o3,17-4,0 (here, as an exception, Nallino is quoted for illustration). In these places the readings of Ou Co are no doubt Albatenian. I do not, however, use underscoring on that account alone, since I have not verified Nallino's readings. I do not know why $ba is closer to the vulgate than Ou Co are. See Pr:04(2.3) for some other examples of this.

Variant groups. – *Ou Co* are in error against Nallino and the rest at g0,26-27; n1,15-16; g4,6; n5,2; n5,6; o5,27-28. Other error groups: *Pa A* (o2,0; g3,0; 05,8); *Ou.pc Eq Xc Es Xg* (n-o 5,23 only); *Eq Xc*, often. Generally, the readings of the vulgate are uniform.

---

1 From: SEMA(x) = arc tan(eccentricity * sin(x) / [60 + eccentricity * cos(x)]), where x is the solar mean argument; cf., e.g., Cb141a. – "SEMA" above, and other similar names, are van Dalen's names for variables in his program "Table-Analysis". They are used in the present section (E*), and in some other places, to avoid ambiguity.

Cursus solis.

Tabulae numeri				Aequatio solis			Tabulae numeri				Aequatio solis		
Si	Gr	Si	Gr	Gr	Mi	Se	Si	Gr	Si	Gr	Gr	Mi	Se
0	1	11	29	0	2	2	1	1	10	29	0	59	35
0	2	11	28	0	4	2	1	2	10	28	1	1	19
0	3	11	27	0	6	2	1	3	10	27	1	3	3
0	4	11	26	0	8	2	1	4	10	26	1	4	46
0	5	11	25	0	10	1	1	5	10	25	1	6	28
0	6	11	24	0	12	1	1	6	10	24	1	8	8
0	7	11	23	0	14	1	1	7	10	23	1	9	47
0	8	11	22	0	16	0	1	8	10	22	1	11	25
0	9	11	21	0	18	0	1	9	10	21	1	13	0
0	10	11	20	0	19	59	1	10	10	20	1	14	35
0	11	11	19	0	21	58	1	11	10	19	1	16	9
0	12	11	18	0	23	57	1	12	10	18	1	17	41
0	13	11	17	0	25	55	1	13	10	17	1	19	12
0	14	11	16	0	27	52	1	14	10	16	1	20	43
0	15	11	15	0	29	49	1	15	10	15	1	22	12
0	16	11	14	0	31	47	1	16	10	14	1	23	40
0	17	11	13	0	33	42	1	17	10	13	1	25	6
0	18	11	12	0	35	38	1	18	10	12	1	26	30
0	19	11	11	0	37	33	1	19	10	11	1	27	53
0	20	11	10	0	39	26	1	20	10	10	1	29	15
0	21	11	9	0	41	20	1	21	10	9	1	30	37
0	22	11	8	0	43	13	1	22	10	8	1	31	55
0	23	11	7	0	45	6	1	23	10	7	1	33	13
0	24	11	6	0	46	58	1	24	10	6	1	34	28
0	25	11	5	0	48	49	1	25	10	5	1	35	41
0	26	11	4	0	50	38	1	26	10	4	1	36	51
0	27	11	3	0	52	26	1	27	10	3	1	37	59
0	28	11	2	0	54	14	1	28	10	2	1	39	5
0	29	11	1	0	56	2	1	29	10	1	1	40	10
1	0	11	0	0	57	45	2	0	10	0	1	41	14
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)

(a0,29) 1 Pz. **(a1,0)** 0 Oo; *ras.* Pa. **(f0,8)** 17 Oo. **(f0,24)** 47 Ct; 45 Co. **(f0,28)** 44 Eq. **(g0,1-8)** 1, 1, 1, 2, 2, 2, 1, 1 Ou.ac Co $ba. **(g0,11)** 59 Eq Xc. **(g0,16)** 17 Oo; 46 Ou.ac Co $ba. **(g0,18)** 58 $ba. **(g0,19)** 34 Oo. **(g0,20)** 27 Ou.ac; 37 Co. **(g0,22)** 23 Co. **(g0,23)** 5 Eq Xc; 2 $ba. **(g0,24)** 50 Ou.pc; 28 A; 38 $ba. **(g0,25)** 39 Co. **(g0,26-27)** 36, 28 Ou.ac Co. **(g0,29)** 51 Co. **(g1,0)** 49 Pz Co $ba $c. **(h2,0)** *ras.* Pa; 1 Xg. **(m1,1)** 1 $ba. **(n1,1)** 49 Xc. **(n1,15-16)** 21, 22 Ou.ac Co. **(n1,19)** 28 Oo. **(n1,23)** 32 Eq. **(n1,27)** 38 Oo. **(o1,1)** 25 Oo; 36 $ba. **(o1,5)** 18 Oo. **(o1,10)** 25 Eq. **(o1,19)** 33 $ba. **(o1,20)** 55 $ba. **(o1,21)** 38 Oo. **(o1,23)** 53 Co; 10 $c. **(o1,26)** 41 Cq.ac. **(o1,27-29)** (38,)2, 11, 18 $c. **(o2,0)** 18 Pa A; 23 $c.

Tabulae numeri				Aequatio solis			Tabulae numeri				Aequatio solis		
Si	Gr	Si	Gr	Gr	Mi	Se	Si	Gr	Si	Gr	Gr	Mi	Se
2	1	9	29	1	42	18	3	1	8	29	1	59	10
2	2	9	28	1	43	21	3	2	8	28	1	59	10
2	3	9	27	1	44	23	3	3	8	27	1	59	8
2	4	9	26	1	45	23	3	4	8	26	1	59	4
2	5	9	25	1	46	21	3	5	8	25	1	58	57
2	6	9	24	1	47	17	3	6	8	24	1	58	50
2	7	9	23	1	48	10	3	7	8	23	1	58	40
2	8	9	22	1	49	0	3	8	8	22	1	58	28
2	9	9	21	1	49	48	3	9	8	21	1	58	13
2	10	9	20	1	50	35	3	10	8	20	1	57	56
2	11	9	19	1	51	20	3	11	8	19	1	57	38
2	12	9	18	1	52	4	3	12	8	18	1	57	20
2	13	9	17	1	52	45	3	13	8	17	1	56	59
2	14	9	16	1	53	23	3	14	8	16	1	56	33
2	15	9	15	1	53	59	3	15	8	15	1	56	3
2	16	9	14	1	54	34	3	16	8	14	1	55	31
2	17	9	13	1	55	7	3	17	8	13	1	54	58
2	18	9	12	1	55	39	3	18	8	12	1	54	24
2	19	9	11	1	56	9	3	19	8	11	1	53	48
2	20	9	10	1	56	36	3	20	8	10	1	53	10
2	21	9	9	1	56	59	3	21	8	9	1	52	30
2	22	9	8	1	57	21	3	22	8	8	1	51	47
2	23	9	7	1	57	42	3	23	8	7	1	51	2
2	24	9	6	1	58	1	3	24	8	6	1	50	16
2	25	9	5	1	58	17	3	25	8	5	1	49	28
2	26	9	4	1	58	30	3	26	8	4	1	48	39
2	27	9	3	1	58	41	3	27	8	3	1	47	46
2	28	9	2	1	58	50	3	28	8	2	1	46	50
2	29	9	1	1	58	57	3	29	8	1	1	45	52
3	0	9	0	1	59	4	4	0	8	0	1	44	53
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)

(e-g) *m2* A. – **(f2,22)** 56 Oo. **(g2,1)** 26 $c. **(g2,2)** 31 Eq Xc; 28 $c. **(g2,3)** 22 Ou.pc; 28 $c. **(g2,4)** 26 $c. **(g2,14)** 59 Oo. **(g2,16)** 24 Oo. **(g2,20)** 35 Ou.ac Co. **(g2,21)** 51 A. **(g2,23)** 24 Ou.pc; 44 Eq Xc. **(g2,25)** 16 Oo; 27 Eq. **(g2,29)** 58 Ou.pc. **(g3,0)** 4<-> Pz; 3 Ou.ac Co $ba; 20 Pa A; al() 3 Pa*gl*. **(h4,0)** 4: 3,3,4 Cq. **(k4,0)** 8: 8,8,8 Cq. **(m4,0)** 1: 1,1,1 Cq. **(n3,15)** 55 Eq Xc. **(n3,17)** 55 Ou.ac. **(n3,18)** 55 Ou.pc, *ut vid.* **(n3,23)** ii Cq; 50 Co. **(o3,1)** 8 Ou.ac Co $ba. **(o3,4)** 3 Ou.ac Co. **(o3,6)** 5<-> A; 55 $ba. **(o3,10)** 59 $c. **(o3,11)** 8 Ou.pc. **(o3,13)** 56 $c. **(o3,14)** 30 Ou.ac Co. **(o3,15)** 0 Ou.ac Co. **(o3,16)** 28 Ou Co; 39 Eq; 38 Xc; 34 $c.

```
(o3,17-4,0):    58 30 54 13, 30 46 52 20 33, 39 45 50 55 55  Ou Co;
               [58 30 54 14, 30 47  3 20 33, 39 45 50 55 56  Nallino;]
                18 26 54 14, 30 47  3 20 38, 39 45 51 52 56  $ba;
           (55,) 3 29 53 15, 34 52  7 21 32, 41 48 53 56 57  $c.
```

(o3,22) 48 Oo. **(o3,25)** 33 Oo.

Tabulae numeri				Aequatio solis			Tabulae numeri				Aequatio solis		
Si	Gr	Si	Gr	Gr	Mi	Se	Si	Gr	Si	Gr	Gr	Mi	Se
4	1	7	29	1	43	53	5	1	6	29	0	59	29
4	2	7	28	1	42	50	5	2	6	28	0	57	34
4	3	7	27	1	41	46	5	3	6	27	0	55	38
4	4	7	26	1	40	41	5	4	6	26	0	53	41
4	5	7	25	1	39	35	5	5	6	25	0	51	44
4	6	7	24	1	38	23	5	6	6	24	0	49	46
4	7	7	23	1	37	9	5	7	6	23	0	47	48
4	8	7	22	1	35	53	5	8	6	22	0	45	49
4	9	7	21	1	34	35	5	9	6	21	0	43	51
4	10	7	20	1	33	16	5	10	6	20	0	41	52
4	11	7	19	1	31	59	5	11	6	19	0	39	53
4	12	7	18	1	30	33	5	12	6	18	0	37	53
4	13	7	17	1	29	8	5	13	6	17	0	35	52
4	14	7	16	1	27	41	5	14	6	16	0	33	50
4	15	7	15	1	26	13	5	15	6	15	0	31	48
4	16	7	14	1	*24*	44	5	16	6	14	0	29	46
4	17	7	13	1	23	14	5	17	6	13	0	27	43
4	18	7	12	1	21	42	5	18	6	12	0	25	38
4	19	7	11	1	20	9	5	19	6	11	0	23	31
4	20	7	10	1	18	34	5	20	6	10	0	21	24
4	21	7	9	1	16	58	5	21	6	9	0	19	17
4	22	7	8	1	15	21	5	22	6	8	0	17	9
4	23	7	7	1	13	42	5	23	6	7	0	15	1
4	24	7	6	1	12	1	5	24	6	6	0	12	53
4	25	7	5	1	10	17	5	25	6	5	0	10	45
4	26	7	4	1	8	32	5	26	6	4	0	8	36
4	27	7	3	1	6	46	5	27	6	3	0	6	27
4	28	7	2	1	5	0	5	28	6	2	0	4	18
4	29	7	1	1	3	12	5	29	6	1	0	2	9
5	0	7	0	1	1	22	6	0	6	0	0	0	0
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)

(e-g) *partim m2* A. — **(f4,5)** 31 Pz. **(f4,9)** xxxo Oo. **(f4,11)** 3<-> Lu. **(f4,16)** 24: Pz.pc Ou.ac Co Pa A $ba $c; 25 *cett.* **(f4,23)** 14 Ou.pc; 11 Pa.?pc. **(g4,1-2)** 56, 53 $c. **(g4,3-4)** 47, 43 Ou.ac Co $ba. **(g4,5)** 32 $c. **(g4,6)** 26 Ou.ac Co. **(g4,7-8)** 6, 49 Ou.ac Co $ba. **(g4,9)** 32 Ou.ac Co. **(g4,10)** 15 Ou.ac Co $ba; 19 $c. **(g4,11)** 55 Ou.ac Co $ba. **(g4,12)** 43 Co; 37 $c. **(g4,13)** 7 Ou.ac Co; 50 $ba; 13 $c. **(g4,14)** 40 $ba; 47 $c. **(g4,15-16)** 14, 48 Ou.ac Co $ba; 20, 51 $c. **(+g4,15)** 12 Eq Xc. **(g4,17)** 13 Ou.ac Co; 18 $ba; 20 $c. **(g4,18-19)** 45, 10 Ou.ac Co $ba; 48, 14 $c. **(g4,20)** 39 $c. **(g4,21)** 28 Pa A*(m2)*; (17,)2 $c. **(g4,22-23)** 22, 43 Ou.ac Co $ba. **(g4,25)** 16 Eq Xc. **(g4,26)** 35 $c. **(g4,27)** 48 $ba; 49 $c. **(g4,29-30)** 13, 24 Ou.ac Co. **(h6,0)** 5 Co. **(m)** *vacat* Co. **(m6,0)** 0: 0, 0, 0 Cq. **(n5,1)** 55 Ct. **(n5,2)** 58 Ou.ac Ou*mg*. Co. **(n5,4)** 54 Ct Co. **(n5,6)** 48 Ou.ac Co. **(n5,11-12)** 34?, 35 Oo. **(n5,14)** 37 Eq. **(n5,23)** 14 Ou.pc Eq Xc Es Xg. **(o5,1)** 20 Lu; 33 $c. **(o5,2-4)** 41, 48, 54 $c. **(o5,5)** 43 Ou.ac Co $ba; 58 $c. **(o5,6)** 45 Oo; (50,)2 $c. **(o5,7)** (48,)5 $c. **(o5,8)** 50 Pa A; (46,)6 $c. **(o5,9-16)** (44,)7, (42,)7, (40,)6, (38,)4, (36,)1, 58, 54, 49 $c. **(o5,21)** 19 Ou.pc. **(o5,23)** 59 Xa Ou.pc Eq Xc Es Xg; 50 Lu Co; 15 Ou.ac; 2 $c. **(o5,26)** 16 Ou.pc. **(o5,27-28)** 26, 19 Ou.ac Co.

EA11. Equation of moon.

Toomer 1968, no. 39. — The values of the sub-table .Ear were printed by Herz (1894 p.52) from ms. Wj. — Comprises the sub-tables

.Ece: equation of centrum
.Pro: minutes of proportion
.Dbr: variation of epicyclic diameter
.Ear: equation of argument
.Lat: latitude.

All the sub-tables are from Albattani (Nallino II p.78-83).

Witnesses: **{a0}** Ct,10r-11r; Oo,5r-6r; Pz,112v-113v; Mc,4v-5v; Mb,37r-38v; Ey,29v-32r; Da,192r-193r; Ea,36r-37r. — **{a1}** Xa,15r-16r; Ad,71r-72r; Cq,25-27; Fc,8r-10v; Ps,35v-38r; Ps,38v-39r (=.Lat, apart); Sg,98-103; Wd,14r-15r; Fh,19r-21v; Xw,14r-15r, 16v. — **{a2}** Cz,55v-58r; Cj,128v-131r; Md,60r-62v; Mp,193r-195v; Vp,110v-113r. — **{aX}** Vo,28r-30v; R,39r-40v,67r-v; Ov,53v-56r; Cu,57v-60r; Ep,30r-32v. — **{aT}** Lu,36r-38v; Oj,109r-111v; P,95r-97v; Da4,149v-150v. — **{k}** Eh,75r-77v; Lw,70r-72v; Ou,48r-50v; Eg,9v-10v; Eg,30r-31r; Co,153r-154r; Cn,87r-88v. — **{d}** Op,35v-38r; C,291-296; Lb,5r-7v; Pa,21r-23v; A,200r-202v; Fj,21r-23v; Nc,89r-92v; Pb,6r-8v; Pv,4r-6v; Wj,183r-185v; Fd2,22r-24v; Gr3,93r-95v; Ok,26v-29r. — **{e}** Eq,51v-54r; Ek3,83v-86r; Xc,45v-48r; Vj,69r-71v; Ej,52r-54v. — **{x}** Vx,135r-137v; Oc,57v-60r; X,133v-136r; Vz,48v-51r; Mv,73v-76r; Cm,185v-188r; B,125v-128r; T,281r-282r; Lf,73v-76r; Lg,152v-155r; Lh,118v-121r; Xj,256v-259r; Xg,36v-39r; G,41r-43v; Xb,56r-58v; Es,157v-160r; Fb,46v-49r; Pq,165v-168r; Oy,53v-56r; Wa,55r-56r; Ow,136v-139r; Nu,121v-124r. — **{p}** O,51r-53v; Pd,52v-55r; Ch2,155r-157v. — **{?}** Py,38r-v (m2,fgt.); Ch,20v-23r (:Savasorda 1); Ch,52v-55r (:Savasorda 2); Pn,30r-32v (:Jo. Lin.); Ut,127r-128v (:?). — Duplicates: {e} Eg, one appended to main collection; {?} Ch, within two separate collections. For {a1} Ps, see "Versions" below.

Canons. Sub-tables .Ece .Dbr .Pro .Ear are cited by the canons: Ca95 ~ Cb143 ~ CcC1-2 (lunar equation, like Albattani 36). Ca127 ~ Cb171b ~ Cc239 (true syzygy, like Albattani 42).

Headings implied by these canons: *General:* "aeqụatio lunae perfecta" (Ca95 rubric; cf. Class {k} of the manuscripts); "t. aequationis lunae" Ca127, Cc239. — *.Ece:* "aequatio puncti" Ca95, CcC1-2; "aequatio centri" Cb143. — *.Pro:* "minuta partium" Ca95, CcC1-2; "minuta proportionalia" Cb143. — *.Dbr:* "aequatio diversitatis diametri circuli (+lunae Cb) brevis" Ca95, CcC1-2, Cb143. — *.Ear:* "aequatio (/coaequatio CcC) partis lunae" Ca95, Ca127, Cc239(p.c.), CcC1-2; "aequatio argumenti" Cb143, Cb171b. — A comparison with the table headings listed below shows that canons Cb mostly carry the later, vulgate, version whereas the versions in Ca and Cc agree with parts of {a0} and sometimes with {k}.

Sub-table .Lat is cited in Ca124, CaB04, Cb163 and Cc219 (lunar latitude; all like Batt. 38) and in Ca146, Ca151 (which are two different translations from Batt. 43). It is everywhere assumed to be part of the lunar equation table, as it is in Albattani.

Headings. First table only. Many rare cases are left out. — General:

(1: none) :: {a0:} Ct Mc Oo Da; {a1:} Ad Sg Fh Xw; {aX} Vo; {aT:} Da4; {d:} Lb(m1) Ok; {k:} Cn; {?:} Ch(20v) Py.
(2) Cursus lunae :: {a1:} Xa Cq Ps Wd.
(3) Tabula (-lae Lb) **aequationis lunae perfectae** (+prima Ou) :: {k:} Eh Lw Ou Eg(9v,30r) Co; {d:} Lb(m2).
(4) Aequatio (/-ones Lu Oj P Pd) **lunae** :: {a0:} Ea; {aT:} Lu Oj P; {d:} Pa A Fj Nc Pb Pv Wj Fd2 Gr3; {x:} X Wa; {p:} Pd; {?:} Ch(52v).
(5) Tabula (-ae Fc; **+prima** Ov Vp O Op! C!.Ut!) **aequationis lunae** :: {a0:} Ey; {a1:} Fc; {a2:} Cz Cj Md Mp Vp; {aX:} Ov R Cu Ep!; {d?:} Op C; {e:} Eq Ek3 Xc Vj Ej; {x-}; {p:} O; {?:} Ut Pn. — "prima" is placed last in Op C Ut.
(6: other) :: Pz ("Tabula lunae"); Mb ("Lunae tadil"); Md ("De luna", prefixed to (5)); Ch2 ("Lunae").

Entrance columns: normally, **(7) Tabulae numeri** (:: Ct Oo Da and other early witnesses), or **(8) Lineae numeri.** Other repeated headings: **(9) Lineae numeri communes** :: {d:} Lb Pa A Fj Nc Pb Pv Wj Fd2 Gr3; {x:} Xj; {p:} O Pd. — **(10) Lineae numeri communes centro et argumento** :: {a2:} Mp; {e:} Xc Vj Ej; {x:} Vx Oc Vz Xb Es; {?:} Pn.

.Ece: **(11) Aequatio centri** :: normally. Also repeated: **(12) Aequatio (/coaequatio** Oo Mc Mb**) puncti** (+vel portionis Mb) :: {a0:} Ct Oo Pz Mc Mb Da; {k:} Eh.pc Ou Cn. — **(13) Aequatio portionis** (+puncti Eh; +perfecti Lw; +vel puncti vel centri Co) :: {k:} Eh.ac Lw Eg(9v) Co. — **(14: other),** e.g.: Oo ("Verificatio centri", prefixed to the above); Ch (20v,52v: "Rectitudo centri"); Fh. — **(15: none)** :: Eg.

.Pro: **(16) Proportionalia** :: normally, with **Minuta** more or less loosely attached. — **(17) Minuta partium** :: {a0:} Pz Da; {k:} Lw Ou Co Cn. — **(18: other)** :: Ct ("Minuta"); Mc ("M. proportionis"); R Ch. — **(19: none)** :: Mb Oo Eh.

.Dbr: **(20) Aequatio (/coaeq-** Oo Pz Mc Mb) **diversitatis diametri** (*om.* Pz Mc Mb) **circuli (+lunae** Oo Lu P) **brevis** :: {a0:} Ct Oo Pz Mc Mb; {aT:} Lu P; {k:} Ou Cn; {?:} Ut Py.
(21) Aequatio circuli brevis :: {aX:} Cu; {k:} Eh Lw Eg(9v,30r) Co; {?:} Pn.
(22) Aequatio diversitatis (+diametri Da Wa) :: {a0:} Da; {e:} Eq Ek3 Xc Vj Ej; {x:} Wa.
(23) Diversitas diametri circuli lunae brevis :: {a1:} Xa Ad Cq Ps! Fh Xw Wd; {aX:} Vo!; {aT:} Da4; {d:} Ok.
(24) Diversitas diametri :: {a0:} Ea; {a1:} Fc Sg; {a2:} Cz Cj; {d:} Lb Pa A Fj Nc Pb Pv Wj Fd2 Gr3; {x:} Mv B Lh Xg G Fb Pq Ow Nu.
(25) Diversitas diametri (*om.* Op C, Vx Oc X Vz Xb Es) **circuli brevis** :: {d?:} Op C; {a2:} Mp Vp!; {x:} Vx Oc X Vz Cm T Lf Lg Xj Xb Es Oy.
(26) Circulus brevis :: {aX:} R Ep; {p:} O Pd Ch2.
(27: other) :: Ey ("Diversitas diam. epicycli"); Oj ("Aequ. diversitatis diam. epicycli"); Ch (20v: "Rectitudo diametri epicycli"; 52v "Longitudo longior"); Md Ov.

.Ear: **(28) Aequatio argumenti** :: normally.
(29) Aequatio (/coaeq- Oo Pz Mc Mb) **partis** (portionis Eg(9v)) **lunae** :: {a0} Ct Oo Pz Mc Mb Da; {k:} Eh Lw Ou Eg(9v,30r) Co Cn.
(30) Coaequatio (aequatio Ps Vo) **argumenti lunae** :: {a1:} Xa Ad Cq Ps Fh!; {aX} Vo; {aT:} Da4.
(31) Aequatio portionis vel argumenti lunae :: {aT:} Lu Oj P!.
(32: other) :: Ea ("Aequatio anomaliae"); Oo ("<-> argumenti", prefixed to the above); Ch (20v,52v "Rectitudo portionis").

.Lat: **(33) Latitudo lunae** :: normally. — **(34) Latitudo lunae et est ascendens** :: {aT:} Lu Oj P; {?:} Ch(20v,52v). — **(35: other)** :: Py ("Latitudo lunae occulta"); Cj & R ("Latitudo").

Sources and parallels. The table is the same as Albattani, Nallino II p. 78-83, where the order is: (solar equation), .Ear .Ece .Pro .Dbr .Lat. The Albatenian table is partly derived from Almagest V,8; see Nallino II p. 226-7 and below.

The Handy Tables (Stahlman 1960 p. 249-54, table 15; also, e.g., Vat. gr. 304, 199r-201v) show much the same values; cf. Toomer 1968 p. 58. The order is: (solar equation), .Ece .Pro .Ear .Dbr, plus a separate table for latitudes. However, .Ear has values in degrees and minutes only, and the latitude table has other values than .Lat. Both these features are as in Almagest V,8. The Handy Tables have not been used for comparison in the present connection.

Versions. Ps has sub-table .Lat in one piece, after the rest. I have not listed this sub-table separately. — All witnesses show the sub-tables in the order indicated, except that Ey Ep interchange sub-tables .Dbr and .Ear. — Pn adds a sub-table "Aequatio argumenti Alfonsi", after the rest; otherwise there are no additions or omissions.

Values. Each sub-table has been recomputed, using, where applicable, Albattani's eccentricity of 10;19 (Batt. 30: Nallino I p. 52:29, 53:7) and his epicycle radius of 5;15 (Nallino I p. 51:37). For recomputing .Pro I have also used the maximum equations of anomaly of 5;1 at apogee and 7;40 at perigee, obtained from .Ear and .Dbr. By comparison with the recomputed values ("expectation", for short), some features may be noted for each sub-table, as follows:

Sub-table **.Ece:**[1] Albattani has taken the values for 6°(6)90(3)180 from Almagest V,8 (col. 3 Toomer), interpolating for the rest (Nallino II p. 226). The result is good, deviating from expectation by no more than 2′ on the interval 1°-4s0°. Greater deviations, of up to 5′, are found at about 4s2°-10°, 4s27°-5s4° and 5s21°-27°, and are the result of errors in the Almagest (for which cf. Toomer p. 237 n. 30). The recomputed values are quoted where they differ by 3′ or more from those adopted. The variant values in our manuscripts do not cause any conspicuous deviations.

Sub-table **.Pro**[2] deviates from expectation by 1′ or less. I do not quote the recomputed values.

---

1 Recomputed as: LECC(x) = arc tan(eccentricity * sin(x) / (rho(x) + eccentricity * cos(x))), where:
rho(x) = ((60-eccentricity)**2 - (eccentricity*sin(x))**2) **(1/2) + eccentricity * cos(x), and
x is the double elongation, or the "centrum" of Cb143.

2 Recomputed as: LIFC(x) = 60 * (pmax(x)-pmax0) / (pmax180-pmax0), where:
pmax0 and pmax180 are the maximum equations of anomaly at apogee and perigee (cf. Olaf Pedersen 1974 p.197. Values: 5;1 and 7;40, see above);

Sub-table **.Dbr:**[1] Albattani has taken the values for 6°(6)90(3)180 from Almagest V,8 (col. 5 Toomer), interpolating for the rest (Nallino II p. 226-27). On the stretch 0s1°-2s0° the present values are up to 5′ greater than those recomputed. This reflects a similar systematic error in the Almagest; cf. Toomer 1984 p. 237 n. 30. The feature is in all manuscripts and in $ba, as would be expected. From 2s1° on, the discrepancy is 2′ or less everywhere. I do not quote the recomputed values.

Sub-table **.Ear**[2] normally differs by up to 2" from the recomputation; these cases are not listed. Deviations of 3" or greater are all listed in the apparatus. They are confined to the intervals 0s25°-28°, 2s0°-1°, 3s3°-9°, 3s16°-17°, 3s19°-25°, and 4s11°-21°. The table is similar to Almagest V,8 (col. 4 Toomer), and the error around 3s5° may be caused by forcing the maximum to be 5;1 as it appears in the Almagest; I cannot explain the other errors. Ou Co $ba $bn often show their own readings against the vulgate. These readings fit the recomputation about as well as do the vulgate readings.

Sub-table **.Lat**[3] shows a number of deviations of up to 2", not noted. I do note a score of greater differences; they seem to occur randomly. The table is symmetrical about 90°, and so are most of the deviations, suggesting that one half is mirrored from the other.

Text. Collated for values: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** Lu; **{k}** Ou Co; **{d}** Pa A; **{e}** Eq Xc; **{x}** Es Xg. — Headings according to Xa; "Cursus lunae", which is a repeated page-heading in Xa, is here reproduced once. — Ou attaches alternative readings to the first three tables. These readings are here denoted as Ou.pc, and the corresponding primary readings as Ou.ac or just Ou. The Ou.pc readings are much like the vulgate readings.

Also quoted: **$c** = recomputed values, quoted in selection for sub-tables .Ece, .Ear and .Lat; see "Values" above. **$ba** = Albattani, Paris Arsenal 8322, 52r-54v. **$bn** = Albattani, as printed by Nallino (II p. 78-83). Nallino has recomputed the table, and mentions some cases of deviation (*ibid.*, p.226). In these places he has in fact printed what he reports as the manuscript reading, and elsewhere (e.g., p4,11-16) readings have not been smoothed either. However, I choose to take Nallino's readings as Albatenian only if they are supported by Ou Co, or by $ba, or both.

I normally adopt the readings of the majority of Ct Oo Pz Xa Cq Lu, underscoring where they differ from the Albatenian readings represented by the majority of $ba, $bn, and either or both of Co Ou.ac. In five places (m4,28; p4,21; f5,23; p1,3; p4,28) I have corrected gross errors, the last three of which may be Abjad errors. The corrected readings are italicized. In some cases Co Ou.ac have the Albatenian readings alone, as confirmed from Nallino's edition, whereas $ba has the reading of our vulgate.

Variant groups, all sub-tables: *Ou.ac Co $bn ($ba)* (Albatenian readings, e.g., m2,5-11; $ba may, however, join {d} and the vulgate); *Pa A* (often); the *vulgate* against Ct (Oo (Pz)) {k,d} (at p1,24, p4,21, m4,28); *Xa Lu Eq Xc Ou.pc* (m0,27); *Eq Xc Es Xg* (f0,18, p3,14); *Eq Xc* (often); *Es Xg* (some 4 cases). Other groupings seem scattered.

$ba, when disagreeing with Ou Co $bn, agrees with Pa A at (p1,0) and (m4,0) about errors that may be coincidental, and at (j3,24), where it is correct against what may be a secondary error in Ou Co. At (p1,3), $ba is correct against all the rest. In other cases $ba either agrees with the vulgate or is in error.

---

pmax(x) = arc sin(epicycle_radius / rho(x)), where rho(x) is the distance of the epicycle centre from the Earth, same as in the note to .Ece above.

1 Recomputed as the difference
LEAP (i.e., lunar equation of anomaly at perigee) - LEAA (i.e., lunar equation of anomaly at apogee), where
LEAA(x) = arc tan(epicycle_radius * sin(x) / (60 + epicycle_radius * cos(x)));
LEAP(x) = arc tan(lunar_quotient * sin(x) / (1 + lunar_quotient * cos(x)));
lunar_quotient = epicycle_radius / (60 - 2 * eccentricity).

2 Same as the function LEAA in the note to .Dbr, above.

3 Recomputed as: LLAT(x) = arc sin(sin(x) * sin(max_latitude)), where
x = the distance from the node, and max_latitude = 5°.

Cursus lunae.

				(Ece)		**(Pro)**	**(Dbr)**		**(Ear)**			**(Lat)**		
Tabulae numeri				Aequa tio centri		Pro por tio na lia	Diversi tas di ametri circuli lunae brevis		Coae quatio argu menti lunae			Lati tudo lunae		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Se	Gr	Mi	Se
0	1	11	29	0	9	0	0	3	0	4	50	0	5	13
0	2	11	28	0	18	0	0	5	0	9	40	0	10	27
0	3	11	27	0	27	0	0	7	0	14	29	0	15	40
0	4	11	26	0	36	0	0	10	0	19	18	0	20	53
0	5	11	25	0	45	0	0	12	0	24	7	0	26	7
0	6	11	24	0	53	0	0	14	0	28	56	0	31	19
0	7	11	23	1	2	0	0	17	0	33	44	0	36	31
0	8	11	22	1	11	0	0	19	0	38	32	0	41	42
0	9	11	21	1	20	0	0	21	0	43	19	0	46	52
0	10	11	20	1	29	0	0	24	0	48	5	0	52	1
0	11	11	19	1	38	0	0	26	0	52	51	0	57	9
0	12	11	18	1	47	1	0	28	0	57	36	1	2	16
0	13	11	17	1	55	1	0	31	1	2	20	1	7	23
0	14	11	16	2	4	1	0	33	1	7	4	1	12	30
0	15	11	15	2	13	1	0	35	1	11	47	1	17	36
0	16	11	14	2	22	1	0	38	1	16	28	1	22	35
0	17	11	13	2	31	1	0	40	1	21	8	1	27	33
0	18	11	12	2	39	1	0	42	1	25	47	1	32	31
0	19	11	11	2	48	1	0	45	1	30	25	1	37	29
0	20	11	10	2	57	2	0	46	1	35	3	1	42	27
0	21	11	9	3	5	2	0	49	1	39	39	1	47	23
0	22	11	8	3	14	2	0	52	1	44	13	1	52	17
0	23	11	7	3	23	2	0	54	1	48	45	1	57	8
0	24	11	6	3	31	2	0	56	1	53	17	2	1	56
0	25	11	5	3	40	2	0	59	1	57	48	2	6	40
0	26	11	4	3	49	2	1	1	2	2	17	2	11	22
0	27	11	3	3	57	3	1	3	2	6	43	2	16	2
0	28	11	2	4	6	3	1	6	2	11	5	2	20	40
0	29	11	1	4	15	3	1	8	2	15	25	2	25	17
1	0	11	0	4	23	3	1	10	2	19	44	2	29	52
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)

(e0,27) 4 $ba. **(e0,28)** 3 Oo. **(f0,1)** 8 Cq. **(f0,3)** 29 Ou.pc. **(f0,4)** 26 Oo. **(f0,6)** 23 Ct. **(f0,12)** 46 Ou.ac Co $ba $bn. **(f0,15)** 14 Co. **(f0,18)** 40 Eq Xc Es Xg. **(f0,24)** 39 Pz; 3 Eq. **(f0,25)** 49 $ba. **(f1,0)** xviii Oo. **(g0,12-13)** 0,0 Ou.ac Co $ba $bn. **(g0,20)** 1 Eq, Xc.ac. **(g0,26)** 3 Ou Co $bn. **(j0,1)** 5 $ba. **(j0,3)** 14 $ba. **(j0,5)** 7 Co. **(j0,8)** 29 Oo; 49 $ba. **(j0,11)** 25 Ct. **(j0,19)** 44 Pa A. **(j0,20)** 47 Ou Co Eq Xc Es Xg $ba $bn. **(j0,29)** 9 Cq. **(k0,12)** 1 Pz. **(k0,20-26, 0,27-1,0)** 2--2, 3--3 Pz. **(L0,8)** 37 Oo. **(L0,11)** 53 Pa A. **(L0,13)** 0 $ba. **(L0,16)** 18 Eq Xc. **(L0,19)** 31 $bn; =30 $c. **(L0,27)** 8 Eq Xc. **(L1,0)** 18 Ou.ac Co. **(m0,1)** 55 $ba. **(m0,3)** 30 *aut* 19 Co; 39 Pa A. **(m0,4)** 20 Oo. **(m0,7)** 45 $bn. **(m0,8)** 33 Ou.pc; 3 Eq; 38 Xc. **(m0,15)** 46 Ou.ac Co. **(m0,22)** 18 Pa A. **(m0,25)** 47 Ou.ac Co; 4 $ba; 44 $c. **(m0,26)** 12 $c. **(m0,27)** 13 Xa Lu Ou.pc Eq Xc; 38 $c. **(m0,28)** 6 Ou.ac Co; 2 $c. **(m0,29)** 26 Ou.ac Co $bn. **(m1,0)** 45 Ou.ac Co $ba $bn. **(n0,10-11)** 1,1 Pa A. **(o0,9)** 42 Xc. **(o0,21)** 57 A. **(o0,23)** 56 Oo; 59 Es Xg. **(o0,26)** 1 A. **(o0,29)** 15 Es. **(p0,1)** 14 Co; 11 Pa A; 53 $ba. **(p0,6)** 13 Eq Xc. **(p0,14)** 36 Pa A. **(p0,15)** 33 $bn $c. **(p0,17)** 34 Co; 37 $c. **(p0,18)** 36 $c. **(p0,19)** 28 Ct; 26 Ou.ac; 36 Co; 34 $c. **(p0,20)** 29 Ou.ac Co. **(p0,24)** 57 Co. **(p0,25)** 37 $bn; 39 $c. **(p0,28)** 39 $bn; 42 $c. **(p0,29)** 14 $ba. **(p1,0)** 22 Ou.pc; 32 Pa A $ba.

				(Ece)		(Pro)	(Dbr)		(Ear)			(Lat)		
Tabulae numeri				Coae quatio centri		Pro por tio na lia	Diver sitas cir culi brevis		Coae quatio argu menti lunae			Lati tudo lunae		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Se	Gr	Mi	Se
1	1	10	29	4	32	3	1	12	2	24	1	2	34	24
1	2	10	28	4	41	4	1	14	2	28	16	2	38	52
1	3	10	27	4	49	4	1	16	2	32	30	2	43	*17*
1	4	10	26	4	58	4	1	19	2	36	42	2	47	39
1	5	10	25	5	7	4	1	21	2	40	52	2	51	57
1	6	10	24	5	15	4	1	23	2	44	58	2	56	10
1	7	10	23	5	24	5	1	25	2	49	2	3	0	21
1	8	10	22	5	33	5	1	27	2	53	5	3	4	29
1	9	10	21	5	41	5	1	29	2	57	6	3	8	35
1	10	10	20	5	50	5	1	31	3	1	3	3	12	39
1	11	10	19	5	59	6	1	33	3	4	57	3	16	39
1	12	10	18	6	8	6	1	35	3	8	48	3	20	35
1	13	10	17	6	16	6	1	37	3	12	37	3	24	26
1	14	10	16	6	25	7	1	39	3	16	23	3	28	15
1	15	10	15	6	33	7	1	40	3	20	6	3	32	0
1	16	10	14	6	42	7	1	42	3	23	46	3	35	41
1	17	10	13	6	50	8	1	44	3	27	22	3	39	17
1	18	10	12	6	58	8	1	45	3	30	55	3	42	49
1	19	10	11	7	7	8	1	47	3	34	25	3	46	17
1	20	10	10	7	15	9	1	48	3	37	52	3	49	40
1	21	10	9	7	23	9	1	49	3	41	16	3	53	0
1	22	10	8	7	32	9	1	51	3	44	37	3	56	16
1	23	10	7	7	40	10	1	53	3	47	54	3	59	28
1	24	10	6	7	48	10	1	54	3	51	7	4	2	37
1	25	10	5	7	56	10	1	56	3	54	17	4	5	38
1	26	10	4	8	4	11	1	58	3	57	23	4	8	37
1	27	10	3	8	12	11	1	59	4	0	24	4	11	34
1	28	10	2	8	20	11	2	1	4	3	22	4	14	22
1	29	10	1	8	28	12	2	2	4	6	16	4	17	7
2	0	10	0	8	36	12	2	3	4	9	6	4	19	47
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)

(f1,3) xii Oo. **(f1,8)** 32 Eq. **(f1,12)** 7 Ou.ac Co $ba $bn. **(f1,17)** 58 Pz. **(f1,21)** 32 Oo. **(f1,29)** 18 Ou.ac; 23 Co. **(g1,1-28)** 3--11, 11, 11: M(?), *(vacat),* 3--11 Oo. **(g1,1)** 4 Ou.ac Co. **(g1,10-2,0)** 5, 6--12: 6--12, 12 Ou.ac Co. **(g1,10)** 6 Oo. **(j1,11)** 34 Ou.ac **(j1,16)** x'n (=49) Oo. **(j1,17)** 48 $ba. **(j1,18)** 46 Ou.ac Co; 44 Pa A. **(j1,19)** 48 Ou Co. **(j1,20-21)** 49, 50 Ou.ac Co. **(j1,24)** 55 $bn; 52 $c. **(k1,25-26)** 4,4 Pa. **(L1,2)** 30 Oo. **(L1,6)** 45 $bn. **(L1,7)** 48 Co. **(L1,13)** 1<-> Pa. **(L1,16)** 24 Co. **(L1,19)** 37 Eq Xc. **(L1,22)** 43 Co. **(m1,1)** 30 Ou.ac; 3 Co $bn; 9 $ba; 2 $c. **(m1,2-3)** 20, 34 Ou.ac Co $bn. **(m1,4)** 44 Ou.ac Co; 43 $ba $bn. **(m1,5)** lix Oo; 51 Ou.pc; 12 $bn. **(m1,6)** *in ras.* Oo; 57 Co $ba; 17 $bn; 59";31 $c. **(m1,7)** 42 $bn. **(m1,8-10)** 6, 7, 4 Ou.ac Co $ba $bn. **(m1,11)** 17 $bn; 56 $c. **(m1,15)** 4 $ba. **(m1,17)** 23 Eq Xc. **(m1,18)** 5 Pz. **(m1,19)** 26 Ou.ac **(m1,23)** 14 Ou.ac Co. **(m1,24-25)** 6, 16 $bn $c. **(m1,27)** 25 $bn; =24 $c. **(m1,28)** 23 Pa A. **(m2,0)** 9 $c. **(o1,1)** 33 Oo; 35 $ba. **(o1,13)** 25 $ba. **(o1,14)** 30 Oo. **(o1,28)** 4 Pa A. **(p1,1)** 32 Ou.pc. **(p1,2)** 25 Ou.pc; 12 $ba. **(p1,3)** 17: $ba $bn; 15 $c; 57 *omnes.* **(p1,5)** 56 Ou.ac Ou.pc Co $bn $c; 16 $ba; 52 Eq Xc. **(p1,6)** 17 Ou.pc; 11 $bn $c. **(p1,7)** 24 $c. **(p1,8)** 39 Ou.ac Co; 33 $c. **(p1,9)** 39 $c. **(p1,10)** 29 Ou.ac Co; 42 $c. **(p1,11-24)** 39, 35--37: 35--35(!), 15 Ou.ac. **(p1,12)** 36 Eq Xc. **(p1,13)** 36 Ct, Xg.?ac; 27 Ou.ac Co $ba $bn; 35 Eq Xc. **(p1,19)** 47 Ou.pc. **(p1,20)** 10 Ou.pc **(p1,23)** 38 Ou.pc. **(p1,24)** 35 Ct Oo Ou.ac Co Pa A $ba $bn; 36 $c. **(p1,27)** 30 Ou.pc Co $ba $bn $c; 34 Ou *in contextu, fuit fort.* 30. **(p1,28-29)** 19, 4 $c. **(p2,0)** 46 $ba; 44 $c.

				(Ece)		(Pro)	(Dbr)		(Ear)			(Lat)		
Tabulae numeri				Coae quatio centri		Pro por tio na lia	Diver sitas dia metri		Aequatio argu menti			Lati tudo lunae		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Se	Gr	Mi	Se
2	1	9	29	8	44	13	2	5	4	11	53	4	22	22
2	2	9	28	8	52	13	2	6	4	14	37	4	24	51
2	3	9	27	8	59	14	2	7	4	17	18	4	27	14
2	4	9	26	9	7	14	2	9	4	19	54	4	29	34
2	5	9	25	9	15	15	2	10	4	22	25	4	31	49
2	6	9	24	9	22	15	2	12	4	24	51	4	33	59
2	7	9	23	9	30	15	2	13	4	27	12	4	36	4
2	8	9	22	9	37	16	2	14	4	29	28	4	38	4
2	9	9	21	9	44	16	2	15	4	31	41	4	40	0
2	10	9	20	9	52	17	2	16	4	33	51	4	41	52
2	11	9	19	9	59	17	2	17	4	35	57	4	43	38
2	12	9	18	10	6	18	2	18	4	37	57	4	45	18
2	13	9	17	10	13	18	2	19	4	39	52	4	46	52
2	14	9	16	10	20	19	2	20	4	41	43	4	48	20
2	15	9	15	10	27	19	2	21	4	43	29	4	49	44
2	16	9	14	10	34	20	2	22	4	45	10	4	51	3
2	17	9	13	10	41	20	2	23	4	46	46	4	52	17
2	18	9	12	10	48	21	2	24	4	48	17	4	53	25
2	19	9	11	10	55	21	2	25	4	49	43	4	54	28
2	20	9	10	11	2	22	2	26	4	51	5	4	55	25
2	21	9	9	11	8	22	2	27	4	52	23	4	56	17
2	22	9	8	11	15	22	2	29	4	53	36	4	57	4
2	23	9	7	11	21	23	2	30	4	54	43	4	57	45
2	24	9	6	11	27	23	2	31	4	55	43	4	58	21
2	25	9	5	11	33	24	2	32	4	56	39	4	58	51
2	26	9	4	11	39	24	2	33	4	57	30	4	59	15
2	27	9	3	11	44	25	2	34	4	58	16	4	59	35
2	28	9	2	11	50	25	2	35	4	58	56	4	59	50
2	29	9	1	11	55	26	2	36	4	59	31	4	59	58
3	0	9	0	12	0	26	2	37	5	0	2	5	0	0
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)

(b2,9) 8 Co. **(e2,12)** 9 Eq $ba. **(e2,13)** 9 $ba. **(e2,20-21)** 10,10 $ba. **(f2,1)** 14 Oo. **(f2,15)** 28 Oo. **(f2,25)** 32 Es Xg. **(f2,26)** 29 A. **(f2,27)** 49 Pa A.ac. **(g2,1-7)** 13 14 14 15 15 15 16 Ou.ac Co; 12 13 13 14 14 15 15 $bn. **(g2,8-24)** 16--22, 23, 23: 15, 15, 16--22 $ba. **(g2,9)** 17 Ou.pc. **(g2,11)** 18 Ou.pc. **(g2,20)** 21 Es Xg. **(g2,25-29)** 23 24 24 25 25 $bn. **(j2,4)** 8 Eq.ac. **(j2,6-8)** 11, 12, 13 $ba. **(j2,22-24)** 28, 29, 30 Ou.ac Co. **(j2,23)** 31 Oo.?ac. **(k3,0)** 4 Oo A.ac. **(L2,1)** 12 Oo. **(L2,3)** 18 Eq; 1{{9}} Xc. **(L2,6)** 25 $ba. **(L2,8)** 28 Ou.ac Co. **(L2,10)** 34 Oo Ou.ac Co. **(L2,11-28)** 35, 37, 39--58: 36, 39--58, 59 $ba. **(L2,13)** 38 $bn; =39 $c. **(L2,15)** 44 Oo. **(L2,28)** 59 Xa Ou.ac Co $bn. **(m2,1)** 5 Eq Xc; 33 $bn; 56 $c. **(m2,2)** 36 $bn. **(m2,3)** 19 Oo; 8 $bn; =18 $c. **(m2,5)** 24 Ou.ac Co $bn. **(m2,6)** 46 Ou.ac Co $ba $bn; 50 $c. **(m2,7)** 7 Ou.ac Co $bn; 22 Ou.pc; =12 $c. **(m2,8)** 26 Ou.ac Co $ba $bn; 30 $c. **(m2,9-11)** 43 (48 $ba), 54 (55 $bn), 59 Ou.ac Co $ba $bn; 51, 31, 41 Eq; {{5}}1, 41, 57 Xc; 43, 52, 57 $c. **(m2,13-14)** 57, 52 Eq. **(m2,16)** 45 Oo. **(m2,19)** 42 Xa Ou.pc Eq Xc Es Xg. **(m2,22)** 26 Ou.pc. **(m2,27)** 26 $ba. **(m2,28)** 0 Ou.ac Co $ba $bn; 50 Ou.pc. **(m2,29)** 36 Ou.ac Co $ba $bn. **(n3,0)** 4 Pa A. **(o2,1)** 23 Eq. **(o2,2)** 28 Pz. **(o2,3)** 26 $bn; =27 $c. **(o2,5)** 21 Oo. **(o2,12)** 44 $ba. **(o2,23)** 58 Co. **(o2,25)** 59 Co Eq Xc. **(o2,27)** 19 $ba. **(o3,0)** 50 Pz. **(p2,1)** 20 Ou.ac Co $bn; 21 Oo; 18 $c. **(p2,2)** 49 Ou.ac Co $ba $bn. **(p2,3)** 15 Ou.ac Co; 19 $ba. **(p2,4)** 24 Oo Xc. **(p2,11)** 28 Oo; 39 Ou.ac Co. **(p2,13)** 12 Ou.ac Co. **(p2,19)** 39 Ou.ac Co. **(p2,21)** 27 Ou Co. **(p2,25)** 55 Lu. **(p2,26)** 35 Ou.ac Co. **(p2,27)** 25 Ou.pc. **(p2,28)** *ras., fuit* 5<.> $ba; 47 $bn; 49 $c. **(p2,29)** 57 Ou.ac Co $ba $c; 56 $bn; 38 Pa A.

				(Ece)		(Pro)	(Dbr)		(Ear)			(Lat)		
Tabulae numeri				Aequa tio centri		Pro por tio na lia	Diver sitas dia metri		Aequatio argu menti lunae			Lati tudo lunae		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Se	Gr	Mi	Se
3	1	8	29	12	5	27	2	37	5	0	26	4	59	58
3	2	8	28	12	10	27	2	37	5	0	44	4	59	50
3	3	8	27	12	15	28	2	38	5	0	55	4	59	35
3	4	8	26	12	20	28	2	38	5	0	59	4	59	15
3	5	8	25	12	24	29	2	38	5	1	0	4	58	51
3	6	8	24	12	28	30	2	38	5	0	57	4	58	21
3	7	8	23	12	32	30	2	38	5	0	49	4	57	45
3	8	8	22	12	36	31	2	39	5	0	37	4	57	4
3	9	8	21	12	39	31	2	39	5	0	21	4	56	17
3	10	8	20	12	42	32	2	39	5	0	1	4	55	25
3	11	8	19	12	45	32	2	39	4	59	32	4	54	28
3	12	8	18	12	48	33	2	39	4	58	55	4	53	25
3	13	8	17	12	51	33	2	40	4	58	12	4	52	17
3	14	8	16	12	54	34	2	40	4	57	24	4	51	3
3	15	8	15	12	56	35	2	40	4	56	33	4	49	44
3	16	8	14	12	58	35	2	40	4	55	38	4	48	20
3	17	8	13	13	0	36	2	40	4	54	33	4	46	52
3	18	8	12	13	2	36	2	40	4	53	20	4	45	18
3	19	8	11	13	4	37	2	40	4	52	0	4	43	38
3	20	8	10	13	5	37	2	39	4	50	33	4	41	52
3	21	8	9	13	6	38	2	39	4	49	2	4	40	0
3	22	8	8	13	7	38	2	38	4	47	26	4	38	4
3	23	8	7	13	8	39	2	37	4	45	47	4	36	4
3	24	8	6	13	9	39	2	36	4	44	6	4	33	59
3	25	8	5	13	8	40	2	36	4	42	23	4	31	49
3	26	8	4	13	7	40	2	35	4	40	31	4	29	34
3	27	8	3	13	7	41	2	34	4	38	31	4	27	14
3	28	8	2	13	6	41	2	33	4	36	23	4	24	51
3	29	8	1	13	5	42	2	32	4	34	9	4	22	22
4	0	8	0	13	4	43	2	31	4	31	50	4	19	46
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)

(d3,11) 29 Pz. **(f3,6)** 29 Ou Co. **(f3,11)** 44 Es Xg. **(f3,23-24)** 7, 8 Ou Co. **(f3,25)** 2 $ba; 9 $bn. **(f3,26)** 8 $bn. **(f4,0)** 0 Eq Xc. **(g3,1)** 26 $bn. **(g3,3)** 27 $bn. **(g3,6)** 29 Ou. **(g3,7)** 31 Co.ac. **(g3,8-9)** 30, 30 A.?ac. **(g3,14-17)** 33, 33(34 Co?), 34, 35 Ou Co; 34, 34, 35, 35 $bn. **(g4,0)** 42 Ou Co Pa A Eq Xc. **(j3,23-24)** 38, 38 Ou Co; 38, 37 Pa A $ba $bn. **(j3,26)** 36 Pa A. **(j3,27-29)** 35, 34, 33 Ou Co Pa A $ba $bn. **(L3,5)** 0 Ou Co Eq Xc; 1{(0}} Pa; 10 A. **(L3,12)** 59 Ou Co. **(L3,15-17)** 57, 56, 55 $ba. **(L3,28)** 35 Oo. **(L4,0)** 33 Xc.ac. **(m3,3)** 54 Ou Co $ba; 52 Es Xg; (1,)0 $c. **(m3,4-5)** 5, 59 Eq Xc; (1,)8, 11 $c. **(m3,6)** (1,)9 $c. **(m3,7)** 45 $bn; (1,)0 $c. **(m3,8)** 47 $c. **(m3,9)** 31 Oo Eq.ac; 27 $c. **(m3,11)** 52 $ba. **(m3,13)** 11 $ba $bn. **(m3,14)** 34 Co. **(m3,16)** 34 $c. **(m3,17)** 34 $bn; 29 $c. **(m3,18)** 30 $bn; 19 $c. **(m3,19)** 10 $bn; 3 $c. **(m3,20-22)** 43, 12, 32 $bn; 41, 14, 41 $c. **(m3,23)** 46 Oo; 27 Ou Co; (46,)2 $c; =47 $bn. **(m3,24)** 17 $c; =6 $bn. **(m3,25)** 33 Eq; 34 Xg; 24 $bn; 27 $c. **(m3,26)** 33 Xg. **(m3,28)** 23 *vel* 33 A; 33 Eq. **(m3,29)** 8 Ou Co. **(m4,0)** 7 Pa A $ba; 15 Es. **(n3,1)** 5 Eq Xc. **(o3,1)** *vacat* Eq; *ras.* Xc. **(o3,18)** 44 Pa A. **(o3,22)** 37 Ou. **(o3,23)** 33 Pz. **(o3,26)** 39 Es. **(o4,0)** 29 Oo. **(p3,1)** 52 Ou Co; 57 $ba $c; 56 $bn. **(p3,2)** 30 $ba; 47 $bn; 49 $c. **(p3,11)** 27 $bn. **(p3,13)** 27 Es; 16 $bn. **(p3,14)** 2 Eq Xc Es Xg. **(p3,15)** 4 Pz; 42 Ou Co; 45 $ba. **(p3,18)** 28 Oo. **(p3,19)** 30 Pz. **(p3,25)** 49 *vel* 40 A; 59 $ba. **(p3,26)** 39 Co; 59 $ba. **(p3,27)** 19 $ba. **(p3,28)** 49 Ou Co $ba $bn. **(p3,29)** 20 Ou Co $bn; 18 $c.

				(Ece)		**(Pro)**	**(Dbr)**		**(Ear)**			**(Lat)**		
Tabulae numeri				Aequa tio centri		Pro por tio na lia	Diver sitas dia metri		Coae quatio argu menti			Lati tudo lunae		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Se	Gr	Mi	Se
4	1	7	29	13	3	43	2	30	4	29	26	4	17	7
4	2	7	28	13	1	44	2	29	4	26	56	4	14	22
4	3	7	27	12	59	44	2	27	4	24	23	4	11	30
4	4	7	26	12	56	45	2	26	4	21	44	4	8	37
4	5	7	25	12	53	45	2	25	4	18	58	4	5	38
4	6	7	24	12	50	45	2	23	4	16	5	4	2	35
4	7	7	23	12	46	46	2	22	4	13	6	3	59	28
4	8	7	22	12	41	46	2	21	4	10	3	3	56	16
4	9	7	21	12	36	47	2	19	4	6	57	3	53	0
4	10	7	20	12	30	47	2	18	4	3	47	3	49	40
4	11	7	19	12	23	47	2	17	4	0	32	3	46	17
4	12	7	18	12	16	48	2	15	3	57	11	3	42	49
4	13	7	17	12	9	48	2	14	3	53	44	3	39	17
4	14	7	16	12	2	49	2	12	3	50	9	3	35	41
4	15	7	15	11	54	49	2	10	3	46	27	3	32	0
4	16	7	14	11	46	50	2	9	3	42	38	3	28	15
4	17	7	13	11	38	50	2	7	3	38	45	3	24	26
4	18	7	12	11	29	51	2	5	3	34	50	3	20	36
4	19	7	11	11	20	51	2	3	3	30	52	3	16	39
4	20	7	10	11	11	52	2	1	3	26	52	3	12	39
4	21	7	9	11	2	52	1	58	3	22	49	3	8	*35*
4	22	7	8	10	53	53	1	56	3	18	41	3	4	29
4	23	7	7	10	43	53	1	54	3	14	26	3	0	21
4	24	7	6	10	33	53	1	51	3	10	5	2	56	10
4	25	7	5	10	22	54	1	49	3	5	41	2	51	57
4	26	7	4	10	11	54	1	46	3	1	13	2	47	39
4	27	7	3	10	0	54	1	43	2	56	39	2	43	17
4	28	7	2	9	48	55	1	41	2	52	*1*	2	38	*52*
4	29	7	1	9	35	55	1	38	2	47	20	2	34	24
5	0	7	0	9	22	55	1	35	2	42	36	2	29	52
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)

(e4,13) 11 Pa A. **(e4,14)** 11 Pa A Eq. **(e4,15-18)** 10--10 Pz. **(f4,2-5)** (12,)58, 56, 53, 49 $c. **(f4,6)** 51 Ou Co; 46 $c. **(f4,7-10)** 42, 37, 32, 27 $c. **(f4,17)** 28 Eq. **(f4,23)** 49 Pz. **(f4,27-5,0)** (9,)56, 44, 31, 17 $c. **(g4,6-19)** 46, 46 47 47 48(3), 49 49 50 50 51 51, 52 $bn. **(+g4,8)** 45 Oo. **(+g4,11-19)** 48 48, 49 49 50 50 51 51, 52 Ou Co. **(g4,24)** 54 $ba. **(g5,0)** 54 Pz. **(h4,21)** 2 Pa Eq. **(h4,22)** 2 Pa. **(j4,14)** 13 Ou Co. **(j4,15)** 11 Pz Ou Co. **(j4,16)** 19 Cq.?ac. **(j4,17)** 1 $ba. **(j4,23)** 53 Ct. **(L4,2-6)** 27, 25, 22, 19, 17 $ba. **(L4,5)** xq (=14) Oo. **(L4,9)** 5 Co. **(L4,15)** 44 A. **(L4,27)** 55 Eq. **(L4,29)** 38 Oo. **(L5,0)** 35 Oo. **(m4,2)** 57 Ou Co; 37 Pa A. **(m4,5)** 54 Lu; 50 A. **(m4,6)** 6 $bn. **(m4,9)** 58 $bn. **(m4,10)** 48 Ou Co $ba $bn. **(m4,11)** 27 $c. **(m4,12-17)** 10, 42, 6, 23, 33, 42 Ou Co $ba $bn; 4, 36, 2, 24, 41, 53 $c. **(m4,18)** (35,)0 $c. **(m4,19-21)** 56, 57 (56 $ba; 58 $bn), 52 (57 Co) Ou Co $ba $bn; (31,)2, (27,)0, 53 $c. **(+m4,20)** 53 Xg. **(+m4,21)** 43 A. **(m4,22)** 4 A. **(m4,23)** 25 Ou Co $ba $bn. **(m4,25)** 42 Ou Co $ba $bn; 4 A. **(m4,28)** 1: Ct Oo Pz Ou Co Pa A $ba $bn; 2 $c; 50 *cett.* **(m4,29)** 2 Pz; 30 Xc. **(n4,24)** 3 $ba. **(o4,1)** 15 Pz. **(o4,10)** x'o (=48) Oo. **(o4,12)** 12 Oo. **(o4,27)** 48 $ba. **(p4,1)** 30 $ba; 4 $c. **(p4,2)** *vacant* Eq Xc; 19 $c. **(p4,3)** 34 Pa A. **(p4,4)** 36 Ou Co $bn. **(p4,5)** 30 Pz. **(p4,8)** 26 Co; 17 Pa A. **(p4,10)** 10 Ou Co. **(p4,11-16)** 20 51 20 51 10 35 $bn; 17 49 17 40 0 16 $c. **(+p4,12)** 40 Pz. **(+p4,13)** 19 Eq.ac. **(p4,17)** 27 Ou Co; 47 $bn. **(p4,18)** 35 Ou Co $ba; 55 $bn. **(p4,20)** 42 $c. **(p4,21)** 35: Ct Ou Co Pa A $ba $bn; xxxo (=38) Oo; 39 $c; 30 *cett.* **(p4,22)** 39 Oo; 28 Ou Co; 33 $c. **(p4,23)** 24 $c. **(p4,25)** 56 Ou Co $ba $bn. **(p4,28)** 52: Ou Co $ba $bn; 50 $c; 12 *cett.* **(p4,29)** 44 Eq Xc; 25 $bn. **(p5,0)** 22 Pz.

				(Ece)		(Pro)	(Dbr)		(Ear)			(Lat)		
Tabulae numeri				Aequa tio centri		Pro por tio na lia	Diver sitas dia metri		Aequatio argu menti			Lati tudo lunae		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Se	Gr	Mi	Se
5	1	6	29	9	8	56	1	32	2	37	49	2	25	17
5	2	6	28	8	53	56	1	29	2	32	57	2	20	40
5	3	6	27	8	38	56	1	26	2	28	1	2	16	2
5	4	6	26	8	22	56	1	24	2	23	2	2	11	22
5	5	6	25	8	5	57	1	21	2	18	0	2	6	40
5	6	6	24	7	48	57	1	18	2	12	55	2	1	56
5	7	6	23	7	31	57	1	16	2	7	48	1	57	8
5	8	6	22	7	14	57	1	13	2	2	36	1	52	17
5	9	6	21	6	56	57	1	10	1	57	22	1	47	23
5	10	6	20	6	39	58	1	8	1	52	4	1	42	27
5	11	6	19	6	21	58	1	5	1	46	44	1	37	29
5	12	6	18	6	3	58	1	2	1	41	21	1	32	31
5	13	6	17	5	45	58	0	59	1	35	56	1	27	33
5	14	6	16	5	27	58	0	56	1	30	29	1	22	35
5	15	6	15	5	8	59	0	52	1	25	0	1	17	34
5	16	6	14	4	49	59	0	49	1	19	29	1	12	30
5	17	6	13	4	30	59	0	46	1	13	57	1	7	23
5	18	6	12	4	11	59	0	42	1	8	23	1	2	16
5	19	6	11	3	52	59	0	39	1	2	48	0	57	9
5	20	6	10	3	32	59	0	36	0	57	11	0	52	1
5	21	6	9	3	12	59	0	32	0	51	32	0	46	52
5	22	6	8	2	52	60	0	29	0	45	51	0	41	42
5	23	6	7	2	*32*	60	0	25	0	40	9	0	36	31
5	24	6	6	2	11	60	0	21	0	34	26	0	31	19
5	25	6	5	1	50	60	0	18	0	28	42	0	26	6
5	26	6	4	1	29	60	0	15	0	22	58	0	20	53
5	27	6	3	1	7	60	0	11	0	17	14	0	15	40
5	28	6	2	0	45	60	0	8	0	11	30	0	10	27
5	29	6	1	0	23	60	0	4	0	5	45	0	5	13
6	0	6	0	0	0	60	0	0	0	0	0	0	0	0
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)

(b5,10) 01 Pz. **(d5,20)** 11 Pz. **(e5,22)** 20 $ba. **(f5,3)** 28 Oo; 37 Ou Co. **(f5,7)** xxxii? Cq; 32 $bn. **(f5,10)** 34 Pa; 3<-> A.ac. **(f5,11)** 22 Pz. **(f5,21-25)** 11, 50, 29, 7, 45 Ou Co, *cf. (f5,24-28)*; 9, 49, 28, 7, 46 $c. **(+f5,21)** 32 Ct. **(+f5,23)** 32: Lu Pa A Eq Xc Es Xg $ba $bn; 28 $c; *alia* Ou Co; 12 *cett.* **(f5,26-27)** 25, 4 $c. **(f5,29)** 33 Oo. **(g5,1-22)** 55 56(4) 57(5) 58(5) 59(7) Ou Co; 55 56(4) 57(4) 58(6) 59(6) 60 $bn. **(g5,5)** 56 Eq.ac. **(j5,8)** 14 Ou Co. **(j5,29)** 8 Co. **(j6,0)** 1 Eq Xc. **(k5,8)** 1 Pa A. **(L5,1)** 38 Ou Co. **(L5,3)** 38 Oo. **(L5,10)** 51 Ou Co. **(L5,11-12)** 40, 42 A. **(L5,17)** 14 Ou Co. **(L5,20)** 56 Ou. **(L5,21)** 2 Eq; 32 Xc. **(L5,22)** 46 Ou. **(m5,1)** 39 $ba. **(m5,2)** 47 Xa. **(m5,8)** 37 Ou Co $bn. **(m5,11)** 42 Co; 45 $bn. **(m5,16-26)** 28, 53, 18, 42, 5, 16, 46, 6, 22, 8, 57 Ou Co. **(+m5,17)** 58 Oo Es Xg; 56 $bn. **(m5,20)** xiii Cq.?ac. **(m5,27)** 13 Co. **(n5,18)** 0 Pz. **(o5,17)** 8 Oo. **(o5,18)** 3 Oo. **(o5,21)** 47 Pa A. **(o5,26)** 22 Pa A. **(o5,27)** 16 A. **(p5,3)** 7 Pz. **(p5,8)** 16 $ba. **(p5,11-13)** 34, 36, 37 $c. **(p5,14)** 34 $bn. **(p5,15)** 35 $ba. **(p5,16)** 19 Ou. **(p5,17)** 33 Ou Co. **(p5,25)** 16 Pz; 7 Ou Co $ba $bn. **(p5,27)** 49 Pz. **(p6,0)** 9 *vel* 0 Xc.

EA41-81. Equations of five planets.

Toomer 1968, no. 40-44. — Each equation table is composed of:

(A) a composite table of equations, as in Albattani (Nallino II p. 108-137), containing the sub-tables

- **.Ece:** equation of centrum
- **.Pro:** minutes of proportion
- **.Dlo:** variation of epicyclic diameter for the far distance
- **.Ear:** equation of argument
- **.Dpr:** variation of epicyclic diameter for the near distance.

(B) **.Sta:** sub-table of stations. This is the same as in Alkhwarizmi / Maslama (Suter tab. 27-56); it is, however, Ptolemaic and may ultimately derive from Albattani or the Handy Tables (Neugebauer 1962 p. 101).

Tables (A) and (B) are combined in the entire tradition; exceptions (mss. Mb and Ps; see EB21) are few and unimportant.

Witnesses: see section (C) below, and under each table.

Canons: Ca97-101 ~ CcC04-7 ~ Cb145-48 (for planetary longitudes, like Albattani 45); Ca104 ~ CcC10 ~ Cb150 (same, note on Mercury); Ca107 ~ Cb152 (stations, like Albattani 46); Ca118 ~ Cc224 (for latitudes, same as Albattani 47).

Ca107 says, and Cb152 implies, that .Sta forms part of the equation table.

Table-headings implied by the canons: *.Ece:* "Aequatio cuspidis" Ca97+; "Aequatio puncti" CcC04+; "Aequatio centri" Cb145+. — *.Pro:* "Minuta partium" Ca97+ Ca104 CcC04+ CcC10; "Minuta proportionalia" Cb145+ Cb151. — *.Dlo / .Dpr:* "(Aequatio <?diversitatis> diametri circuli brevis) ... in longitudine longiori / propiori" Ca97+; "Diversitas diametri epicycli (+planetae Cb) in longitudine longiori / propiori" CcC04+ ?Cb145+; "Diversitas <?**> longitudinum" Ca104 CcC10; "Diversitas diametri" Cb151. — *.Ear:* "Aequatio portionis" Ca97+ Ca104 CcC04+ CcC10; "Aequatio argumenti" Cb145+ Cb150. — *.Sta:* "Statio (+eius Cb) prima" Ca107 CcB13 Cb152.

A comparison with the lists of headings under each of tables EA41-81 shows that canons Ca and CcC carry versions that resemble the headings in manuscript classes {a0, k} of the tables; so these versions are presumably archaic. Canons Cb are much like the vulgate versions of the tables.

Headings: see the section for each table.

(A). Sub-tables .Ece, .Pro, .Dlo, .Ear, .Dpr.

Note on sources: relation of Albattani to Handy Tables. The Toledan tables show all the features that are peculiar to the tables of Albattani, and no doubt they derive from them.

The Albattani tables have close counterparts in the Handy Tables, both these sets being derived from Almagest XI,11. The Almagest has values for 6°(6)90°(3)180°, of which only those for 6°(6)180° are computed independently (cf. Almagest XI,10 with Toomer's note p. 548 n. 54). On the other hand, both the Handy Tables and Albattani contain values for each degree up to 180°. In either case the extra values have been found by interpolation from the Almagest values; cf. Nallino II p. 238.

Albattani (including the Toledan tables) and the Handy Tables have some peculiarities in common against the Almagest. Thus, both compute the sub-table .Ece as the sum of the Almagest sub-tables 3 and 4; and they do not reproduce the "sixtieths" of the Almagest, but offer an interpolation function (.Pro) depending on the true anomaly instead of the mean anomaly (Neugebauer 1975 p. 1003).

Albattani differs from the Handy Tables by substituting the solar equation for the original equation of Venus in EA71.Ece. This feature is shared by the Toledan tables (cf. Toomer 1968 p. 65).

No doubt Albattani used the Handy Tables as a model; but as appears from the versions $hts and $htv of the Handy Tables, which are described below and turn out to differ much, it is uncertain what form of the Handy Tables he used. This question, in turn, depends on an investigation of the tradition of the Handy Tables, not to be taken up here. For the present purpose, the Handy Tables will be used for guessing at Albatenian readings if no better sources are available.

Values of (A). Large characteristic variants are noted under each table. The parameters, quoted to each table, are as in the Almagest. Recomputation: see below, "Sources collated", under the symbol "$c".

The Albatenian (and so the Toledan) values may contain some improvements against the Almagest and the Handy Tables. One such example is EA51:(f5,1-24), where the values agree better with a recomputation than does the Almagest plus the Handy Tables (version $htv). In .Dlo and .Dpr, the Albatenian (/Toledan) values often differ slightly from the Almagest. This cannot be just by error since, as often as not, they are closer to expectation than are the Almagest values. It is more probable that .Dlo and .Dpr have been computed afresh by Albattani.

The Toledan tables generally share these peculiarities. Indeed, it is hard to find deviations from Albattani that cannot be perceived as errors (e.g., slides, passim) or as attempts at repairing errors (perhaps EA81: L1,13-17, interpolation different from Albattani).

Notable instances where the Toledan version departs from the sources or from the recomputed values are listed in the preamble or the apparatus to each table. Disagreement with recomputed values is mostly inherited from Albattani, and is often found where the Almagest values were already off standard. Slides, which are not always readily identifiable when tables vary slowly, may be suspected where deviations occur in series, as shown by underscored values.

The sub-tables .Pro have not been recomputed. I reproduce the version of the vulgate and the archaic witnesses, which is tolerably consistent with the Albatenian text. I have not collated $htv for these sub-tables.

Witnesses collated for tabular values of (A): **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** Lu; **{k}** Ou Co; **{d}** Pa A; **{e}** Eq Xc; **{x}** Es Xg. – Headings according to Xa.

Sources collated for comparison with tabular values of (A). – Alkhwarizmi / Maslama (**$km**) has only been collated for sub-table .Sta, for which see (B) below.

$bn = Albattani, ed. Nallino, vol. II, p. 108-137. Collated throughout. Apart from a note on p. 238, Nallino says nothing about the status of his text. However, when the values disagree with the Toledan vulgate and the archaic versions, they normally agree with Ou Co, or with $ba (below). or with some of $pm $htv $hts. As in EA11, the reading will be taken as Albatenian when corroborated in some such way; see "Constitution of the text of (A)", later in this section.

$ba = Albattani, Paris Arsenal 8322, 66v-81r. Castilian version of Albattani. Collated throughout. Cannot be considered as a pure text: indeed, it often joins the vulgate and the archaic versions against $bn Ou Co, e.g., at EA61:(f3,8+).

$pm = Almagest XI,11, values as printed by Toomer 1984 p. 549-553. Collated for arguments 6°(6)90°(3)180°; not collated for .Pro nor for EA71.Ece. $pm generally agrees with the Arabo-Latin version of the Almagest (Liechtenstein printing of 1515), except that the latter has numerous errors, mostly of Abjad type. The differences between the Almagest and the Albatenian readings, as defined below, do not correspond to differences between the two versions of the Almagest. – In the notes for .Ece, the Almagest values listed are the sum of Almagest XI,11, cols. 3 and 4; cf. Nallino II p. 241.

$hts = Handy Tables, edition of Stahlman 1960, p.295-324, tables 41-45. Collated throughout, though not for EA71.Ece. – Stahlman's edition is based on ms. Vat. gr. 1291. For the present tables Stahlman records his deviations from the Halma edition (which, among other manuscripts, is based on Par. gr. 2399 and 2493; see Stahlman p.19-20). He notes (p.141) that the divergences from Halma are extremely few, and takes this as showing that the readings are relatively secure.

From the present collation it turns out that the values of $hts are much closer to Albattani (and especially to $bn) than are the values of $htv, below; cf., e.g., the passage EA51:(f5,1-24), where the present values agree with Albattani whereas $htv agrees with the Almagest. In fact it is possible to collate all values of $hts with Albattani and the Toledan tables, and this has been done here. In view of the likelihood that $htv is genuine (since it is close to the Almagest), one may suspect that $hts depends on a source like Albattani. Occasionally (e.g., at EA81:L1,13-17) $hts even shows readings that agree with the archaic and vulgate Toledan tables against our witnesses for Albattani. Thus, for the present purpose, no conclusions will be drawn from the readings of $hts, though it will be used as a source of readings that are possibly Albatenian.

$htv = Handy Tables, Vat. gr. 304, 219v-234r. This source covers all argument values, as does $hts; but here it is collated only where $pm is present, and on a few further selected intervals, mainly as a check on the Almagest readings. It is not collated for sub-tables .Pro.

$htv commonly agrees with the Almagest where both are present, even against Albattani and $hts. An example is in EA51:(f5,1-24). This makes it plausible that the present values are independent of $hts. – $htv uses a interpolation scheme different from that found in $hts and Albattani; this makes it essentially useless to collate $htv for all values. Two examples must suffice for showing this:

(EA51:j5,1+):

```
(21) 20 20 19 18 18 17 16 16 15 14 14 13 ...   $htv
(21)  -  - 19  -  - 17  -  - 15  -  - 13 ...   Almagest
(21) 21 20 19 19 18 17 17 16 15 15 14 13 ...   Albattani & $hts
```

(EA81:f0,6+):

```
17 20 22 25 27 30 32 35 37 40 42 45 47 50 52 55 57  0  2  $htv
17  -  -  -  -  - 32  -  -  -  -  - 47  -  -  -  -  -  2  Almagest
17 20 23 25 28 30 32 35 38 40 43 45 47 50 53 55 58  0  2  Albattani & $hts
```

$c: recomputed value. Recomputation has been made for sub-tables .Ece,[1] .Ear,[2] .Dlo[3] and .Dpr[4] only, and separately for each degree, instead of using the interpolation exemplified just above. $c is quoted where $pm is present and both $pm and $c differ from the adopted text. $c is also quoted wherever it differs from the adopted text by 3′ or more. It is not quoted elsewhere except in a few interesting cases. In other words, whether or not there is an apparatus note for other reasons, silence about $c normally just means that the adopted value is within 3′ of $c. The parameters used, which are the standard ones from the Almagest, are noted under each table.

(A), readings chosen. I adopt the vulgate and archaic readings, presented by the majority of Ct Oo Pz Xa Cq Lu. I use underscoring where such a majority does not exist, or where the adopted reading differs from one that is likely to be Albatenian. In view of the above, Albatenian readings are assumed to be those shown by the consensus of Ou or Co with either $ba, $bn, or both; in cases of doubt, $hts may also be adduced as a witness for Albatenian readings. I have corrected five conspicuous errors (EA71:(j5,20-22; L5,9) and EA81:(L4-8)); the corrected values have been italicized.

---

1 Recomputed as: EC(x) = arc tan(2*r / [(3600-r**2)**(1/2) + eccentricity*cos(x)]), where r = eccentricity*sin(x).
For Mercury, however, MEC(x) = arc tan(eccentricity * sin(x) / [[3600 - {eccentricity* (sin(2*x) + sin(x))}**2]**(1/2) + {eccentricity * 2*cos(x)+cos(2*x)}]).

2 Recomputed as: EAC(x) = arc tan(epicycle_radius * sin(x) / [60 + epicycle_radius * cos(x)]).

3 Recomputed as the difference EAC(x) - EAA(x), where EAC is as in the note to .Ear just above, whereas:
EAA(x) = arc tan(first_quotient * sin(x) / [1 + first_quotient * cos(x)]), where
first_quotient = epicycle_radius / (60 + eccentricity).

4 Recomputed as the difference EAP(x) - EAC(x), where EAC is as in the note to .Ear above, whereas:
EAP(x) = arc tan(second_quotient * sin(x) / [1 + second_quotient * cos(x)]), where
second_quotient = epicycle_radius / (60 - eccentricity).

(B). Sub-tables for stations (.Sta).

Values and sources. The tables of stations are the same as those found in the manuscripts of Alkhwarizmi / Maslama. The Alkhwarizmian tables are combined with tables of planetary equations; so, like these, they are required to show values for each degree up to 180°. The same range is found in their Toledan counterparts.

The values are computed on a different principle from those of Almagest XII,8,[1] so this is not the source. However, they are essentially the same as in the Handy Tables and in Albattani (Neugebauer 1962 p. 101); and they are based on parameters from the Almagest (Stahlman 1960 p. 157). Thus they are Ptolemaic, and unrelated to the Alkhwarizmian planetary theory (Neugebauer, *loc.cit.*). This ought to mean that, in their present form, they are imports into the Alkhwarizmian context.[2]

The source does not seem to be the Handy Tables; cf. the note on $htv below, and "Variant groupings" under (C) below. Thus it will here be assumed to be Albattani, as this set of values is the only one that is quite compatible with ours.

The Albattani table has values for every 6th degree; so if this is in fact the source, our table must have been constructed by interpolation for the missing single-degree values.[3] Such a table seems to survive in two independent versions, one being represented by the Toledan manuscripts of class {k} (mss. Ou Co in the present collation), and the other by the rest of the Toledan tradition plus Alkhwarizmi / Maslama; and the latter two are also quite possibly independent of each other.[4] Thus perhaps both the Toledan versions really depend on other sources than the Alkhwarizmian one, perhaps on some Albatenian source where the required interpolation had already been done. One such, derived, Albatenian version may then also be the source of the Alkhwarizmi / Maslama table.

Witnesses collated for tabular values of (B): as under (A) above, thus, **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** Lu; **{k}** Ou Co; **{d}** Pa A; **{e}** Eq Xc; **{x}** Es Xg.

Sources collated for comparison with tabular values of (B). — **$km** = Alkhwarizmi / Maslama, Adelard, Suter 1914 p. 138-67, tables 27-56. Single manuscripts are denoted by qualifiers, thus, e.g., **$km.CN** for the manuscripts denoted "C" and "N" in Suter's edition. When the tradition is split, and the minority reading is obviously in error, it is not quoted except where it agrees with a variant in the Toledan-table witnesses.

$bn = Albattani, Nallino II p. 138-139. Collated for the arguments 6°(6)180°, which are those present. The values may have been corrected by Nallino from the second-station table also present, and from the Handy Tables (Nallino II p. 245 with note 2).

$ba = Albattani, Paris Arsenal 8322, 81v-82r. Collated for the same arguments as $bn.

$htv = Handy Tables, Vat. gr. 304, 239v-241v. Arguments, 3°(3)180°; thus, apart from the values for every sixth degree corresponding to Albattani's, $htv shows intermediate values. These, to be sure, normally agree with those of our tables. However, on six-degree intervals where the increment is an odd number of minutes, discrepancies are common; cf. the examples in the apparatus under EA41:q1,1+ and

---

1 Cf. Nallino II p. 245. The Almagest uses the mean centrum (=mean distance of the epicycle centrum from the apogee of the eccentric) as argument for the table of stations, as pointed out by Suter p. 58, whereas the Handy Tables use the true centrum (=the geocentric distance of the same from the same: Stahlman 1960 p. 156). All the Arabic tables follow the Handy Tables.

2 According to Ibn Almuthanna (Q34: Goldstein 1967 p. 45:19, 171:22; Millás 1963 p. 119; Cambr. Gonv. & Caius 456 p. 37 is illegible), some tables of the first station did occur together with or after Alkhwarizmi's equation tables. Ibn Almuthanna does not give any details that might serve to identify the tables in question, except that both the versions of Goldstein mention values in signs and degrees only; but this is not conclusive. — Suter (1914 p. 58) is of the opinion that the table is Alkhwarizmian and borrowed by Albattani; but the Ptolemaic origin makes this unlikely.

3 The manner of interpolation is, however, uncertain, and it is not evident that every sixth value is a key value; cf. "Constitution of text", below.

4 See "Relation to Alkhwarizmi / Maslama", at the end of the present section.

EA41:q2,15+. Thus, whether or not the intermediate values are due to interpolation, at least our tables have not had access to them; so I ignore them, only excerpting $htv for every sixth degree except in the examples mentioned and in a few other places.

$hts = Handy Tables, edition of Stahlman (see (A) above), p.335-339, tables 51-55. Shows much the same readings as $htv. Has values for every third degree, but, like $htv, it has here normally been collated for every sixth degree. Stahlman gives notes on disagreements with Halma's edition; there are very few such notes, and they are ignored here.

$bn $ba $hts $htv display their values as integral degrees plus minutes. They have been tacitly converted to signs, degrees and minutes for the purpose of collation.

(B), readings chosen. As before, I reproduce the Toledan vulgate and archaic versions, i.e., the majority of Ct Oo Pz Xa Cq Lu. For a quick overview, underscoring is used where the adopted values differ from $km. Thus, inconveniently, underscoring is left out where the adopted values and $km have errors in common, but it does appear where $km is in error against the Toledan witnesses and the parallel tradition; cf. below. Generally, however, the differences between $km and the adopted values are not extensive.

The values have also been cursorily checked for smoothness, but they have not been recomputed. Nor has interpolation been used for deciding among variants; indeed, the tables vary too slowly to make it plain whether they are intended to be piecewise linear, or whether some other interpolation scheme was used.

Relation of (B) to Alkhwarizmi / Maslama ($km). As is plain from the apparatus for column (q) of each of the tables, $km often agrees with the vulgate and archaic witnesses against the consensus of mss. Ou Co, the latter being supported by the witnesses for Albattani and the Handy Tables. Conversely, $km may agree with Ou Co and/or with the Albattani witnesses against all or most of the Toledan witnesses; but these places are scattered and much less extensive. Thus it seems safe to assume that *$km plus the Toledan vulgate and archaic witnesses* form an error group against Ou Co, Albattani, and the Handy Tables. — $km has some errors against the vulgate and archaic witnesses (e.g., EA61:(q0,7+)), and the converse occurs often. Many of these errors look like slides. In short, though $km may be less faulty than the Toledan witnesses mentioned, there is nothing very definite to show that either depends on the other.

(C). All sub-tables.

Text: Summary of witnesses and sources collated for tabular values.

Sub-tables .Ece .Pro .Dlo .Ear .Dpr:

All values:	Ct Oo Pz; Xa Cq; Lu; Ou Co; Pa A; Eq Xc; Es Xg; $bn $ba.
All values except EA71.Ece:	$hts.
(.Ece .Dlo .Ear .Dpr), all values:	$c (though this is rarely quoted; see above)
(.Ece .Dlo .Ear .Dpr), values 6°(6)90°(3)180°, except EA71.Ece:	$pm $htv.

On a few intervals, shown in the apparatus, $htv is excerpted for each degree.

Sub-table .Sta:

All values:	Ct Oo Pz; Xa Cq; Lu; Ou Co; Pa A; Eq Xc; Es Xg; $km.
Every 6th degree:	$bn $ba $hts $htv.

On some intervals, shown in the apparatus, $hts $htv are excerpted for every 3rd degree.

Variant groups. Several of the sub-tables vary slowly on long stretches, thus increasing the probability of slides and run-on errors. In the following summary I try to avoid such places. This means that most variants are quoted from columns (f, j, L, n). Column (q), though not very suitable, is also adduced because .Sta needs to be represented. For the connection of this sub-table with $km, see section (B) above; the present section takes no account of $km.

The *Ptolemaic* witnesses used here ($pm $htv) are not *prima facie* representative, but in fact they mostly agree between themselves, so their quality will not be further discussed. Of the witnesses used for *Albattani,* $bn may have been corrected by Nallino without notice, and $ba vacillates between $bn and the vulgate Toledan tradition. I have used $hts as an indicator of putative Albatenian readings, as mentioned earlier.

Taken as a whole, our tradition depends on Albattani rather than on Ptolemy: indeed, deviations shared with Albattani against $htv $pm are numerous, e.g., EA51:(f4,23-5,0), not to speak of the substitution of EA71.Ece, mentioned at the beginning of section EA. The Albatenian text, as far as it can be defined here, may in fact be the closest common ancestor: examples where all our witnesses differ from Albattani (as corroborated, for this purpose, by Ptolemaic readings) are found at EA61:(j3,3; q6,0) and EA81(j4,21; q3,0), but all look insignificant.

The Albattani witnesses $ba $bn are most often joined by *Ou Co* against the rest (e.g., EA61:(n5,13-29) and passim); this was noticed by Toomer (1968 p. 68) as concerns Ou. Such readings may be assumed to originate in an Albatenian tradition. *Ou Co,* when on their own, are often in error against Albattani and the rest, e.g., EA41:(n5,16-27); EA61:(L2,2-3; L2,5), independent of the majority.

Varying combinations of the witnesses *Ct, Oo, Pz,* and the group *Pa A,* may join Ou Co against the rest of the tradition, which is then presumably in error. Examples: EA41:(f1,0); EA51:(L2,11); EA61:(q2,23; j5,1); EA71:(L2,3; L2,26; L3,5; f4,20); EA81:(j0,5; L2,22; L4,8).

Conversely, loose groupings of *Ct, Oo, Pz,* joined by *Xa, Cq,* are occasionally in error against the rest, thus, at EA61:(f2,14; f4,20); EA71:(L1,7; L5,9); EA81:(L0,1); *Xa Cq* alone, at EA71:(j5,1-6; n5,22). Some of these errors may be old ones, corrected in the rest of the tradition: note, e.g., the Abjad errors at EA71:L5,9, in Ct ?Oo ?Pz.ac Xa Cq Lu Xg, and perhaps at EA71:j5,1-6, in Xa Cq only.

Pa A are often in error, e.g., at EA51:(q5,1-2); EA61:(+q4,23); EA71:(L5,19); EA81:(p0,19-1,0; L1,26; L2,6: L5,20). Some of these errors are Abjad errors.

On the whole, then, *Ou Co* stand apart as a separate strain; and *Ct, Oo, Pz, (Pa A)* are non-interdependent classes at the root of the main tradition. The rest, i.e., *(Xa Cq), Lu, ((Eq Xc) (Es Xg)),* may be called the *vulgate* in the strict sense; this contains many errors against Albattani. Classes within the vulgate (apart from the possible grouping Xa Cq, above):

Eq Xc Es Xg may form a group, but common readings are few, and some may be secondary corrections, e.g.: EA41:(f5,5), where the group joins Ou Co $bn, possibly because of correction; EA61:(q3,11), joining $km; EA71:(q1,0); EA71:(j5,21-22), where an obviously faulty reading has been repaired, with a result which is still slightly off the Albatenian reading.

Eq Xc have many errors in common; cf. EA71:(L2,7; n2,1-3,0) and a dozen other instances. *Es Xg* constitute another group: for errors, cf., e.g., EA41:(g5,8-20); EA71:(L0,24). Some of the common readings may in fact be common corrections, e.g., EA61:(L4,26); also, at EA51:(L5,11), Es Xg agree with the Albatenian reading, but this may be a coincidence due to attempts at smoothing the tabular differences.

EA41. Equation of Saturn.

Toomer 1968, no. 40. — From Albattani, Nallino II p. 108-13; but "statio prima" is like Khw/M, Suter Tab.27-32 p.138-43. See notes to EA41-81.

Witnesses: **{a0}** Ct,12v-13v; Oo,8v-9v; Pz,115v-116v; Mc,7v-8v; Mb,40v-41v; Ey,34v-37r; Da,194r-195v; Ea,38v-39v. — **{a1}** Xa,18r-19r; Ad,74r-75r; Cq,31-33; Fc,14r-16v; Ps,41v-44r; Sg,110-115; Wd,17r-18r; Fh,25r-27v; Xw,17r-18r. — **{a2}** Cz,60v-63r; Cj,133v-136r; Md,64v-67r; Mp,198r-200v; Vp,115v-118r. — **{aX}** Vo,34r-36v; R,70r-72v; Ov,58v-61r; Cu,60v-63r; Ep,34r-36v. — **{aT}** Lu,41r-43r, 44r; Oj,114r-116v; P,98r-100v; Da4,152v-153v. — **{k}** Eh,78r-80v; Lw,73r-75v; Ou,51r-53v; Eg,11r-12r; Eg,31v-32r (incomplete); Co,154v-155v; Cn,88v-91r. — **{d}** Op,40v-43r; C,301-306; Lb,10r-12v; Pa,26r-28v; A,205r-207v; Fj,26r-28v; Nc,95r-97v; Pb,17r-19v; Pv,9r-11v; Wj,188r-(v); Fd2,27r-29v; Gr3,98r-100v; Ok,32v-34r. — **{e}** Eq,56v-59r; Ek3,86v-89r; Xc,50v-53r; Vj,74r-76v; Ej,57r-59v. — **{x}** Oc,20v-21r (supplement), 62v-64r (start missing); X,138v-141r; Vz,53v-56r; Mv,76v-79r; Cm,190v-193r; B,130v-133r; T,283v-284v; Lf,78v-81r; Lg,157v-160r; Lh,123v-126r; Xj,261v-264r; Xg,41v-44r; G,46r-48v; Xb,61r-63v; Es,162v-165r; Fb,51v-54r; Pq,170v-173r; Oy,58v-61r; Wa,57r-59r; Ow,141v-144r; Nu,126v-129r. — **{p}** O,56r-58v; Pd,56v-59r; Ch2,158r-160v. — **{?}** Ch,23v-26r (:Savasorda 1); Ch,62r-64v (:Savasorda 2); Pn,33r-35v (:Jo. Lin.). — Duplicates: {k} Eg, one copy is at the end of the collection; {?} Ch, in separate collections.

Headings. — General:

(1: none) :: {a0:} Ct Mc Mb Oo Da, {a1:} Cq Sg Fh Xw, {aT:} Da4.m1; {k:} Eg(31v); {d?} Lb Ok.
(2) (Cursus+ Ps Wd**) Saturni** :: {a1:} Xa Ad Ps Wd; {aX} Vo; {p:} Ch2.
(3) Aequatio (/-ones Lu Oj P Da4(m2) X**) Saturni** :: {a0:} Ea; {aT:} Lu Oj P Da4(m2); {d:} Pa A Fj Nc Pb Pv Wj! Fd2 Gr3; {x:} X T Fb Wa; {p:} Pd; {?:} Ch(23v,62r).
(4) Tabula aequationis Saturni (+prima Ov! Vp! Ou Op C O!**)** :: {a0:} Ey; {a1:} Fc!, {a2:} Cz Cj Md Mp Vp; {aX:} Ov R Cu Ep!; {k:} Eh Lw Ou Eg(11r) Co; {d?:} Op C; {e:} Eq Ek3 Xc Vj Ej; {x-}; {p:} O; {?:} Pn. — "prima" is variously placed in Vp Ov O.
(5: other) :: Pz ("Tabula Saturni, Saturni thadil"); Md ("De Saturno", prefixed to (4) above); Cn Oc(20v,fgt.).

Entrance columns: normally, **(6) Tabulae numeri** (earlier), or **(7) Lineae numeri** (later). — **(8) Lineae numeri communes** :: {d:} Lb Pa A Fj Nc Pb Pv Wj Fd2 Gr3; {p:} O Pd; {x:} Xj. — **(9) Lineae numeri communes centro et argumento** :: {a2:} Mp; {e:} Xc Vj Ej; {x:} Oc Vz Xb Es; {?:} Pn. — **(10: other)** :: Ch(23v,62r: "Ordo numeri").

.Ece: **(11) Aequatio centri** :: normally. — **(12) Aequatio (/coaeq-** Pz Oo**) puncti** {a0:} Ct Oo Pz Mc Mb Da, {k:} Eh Lw Ou Eg(11r) Co. — **(13) Coaequatio centri** {a1:} Xa Ad Cq; {aT:} Da4. — **(14: other)** :: Ps Eg(31v) Oc(20v); Ch(23v,62r: "Rectitudo centri").

.Pro: mostly, **(15) Proportionalia,** with **Minuta** before or after. — **(16) Minuta partium** (+vel similitudinis Oo) :: {a0:} Oo Pz Da!; {k:} Eh Lw Ou Co Cn. — **(17: other)** :: Ct (just the denomination sign "Minuta"); Mb Pn Eg(31v) Oc(20v); Ch(23v,62r: "Puncta proportionum").

.Dlo: **(18) Longitudo longior** :: normally. — **(19) Longitudo longior sive diversitas diametri** {a1:} Xa(pc) Ad(pc) Fh Xw, {d:} Ok. — **(20: other)** :: Eg(31v) Oc(62v,20v).

.Ear: mostly, **(21) Aequatio argumenti** :: normally. — **(22) Aequatio (/coaeq-** Pz Oo**) portionis** (+vel argumenti Lu) :: {a0:} Ct Oo Pz Mc Mb! Da; {aT:} Lu Oj P; {k:} Lw Ou Eg(11r) Co Cn. — **(23) Coaequatio argumenti** {a1:} Xa Ad Cq, {aT:} Da4. — **(24: other)** :: Ps ("Arg. aequ."); C Eh Eg(31v) Oc(20v); Ch(23v,62r: "Rectitudo portionis").

.Dpr: **(25) Longitudo propior** (/proprior, occasionally; /propinquior R Pa A Fj Gr3 Eg(11r)) **(+sive diversitas diametri** Xa.m2 Ad.m2**)** :: normally. — **(26: other)** :: Eg(31v) Wj Oc(20v).

.Sta: **(27) Statio Saturni prima** or **Statio prima Saturni** :: normally. — **(28) Statio prima** {a0:} Ey; {a2:} Vp; {aX} R Cu; {aT:} Lu; {k:} Cn; {d:} Lb Pa A Fj Nc Pb Pv Fd2 Gr3; {x:} Ow; {p:} O Pd Ch2; {?} Ch(23v,62r). — **(29: other)** :: Da Wj Eg(11r,31v) Oc(20v) X. Mb Ps show separate tables; see "Versions".

Versions. Ep interchanges the sub-tables .Dlo and .Dpr. — Ey shows the order "... .Ear .Dlo .Dpr ...", with .Dlo .Dpr under the common heading "Diversitas diametri epicycli". Mb Ps have .Sta apart from the rest; cf. EB21. In the rest of the witnesses the sub-tables are ordered as indicated.

Values. Parameters: eccentricity 3;25, radius of epicycle 6;30.

Peculiarities: *.Dpr:* Agreement with the recomputed values is a little worse than usual: thus, e.g., between 30° and 60° the tabular values are 11′-20′ against 9′-17′ calculated. Most such cases are due to imprecision in the Almagest values used. As usual, I list the deviations that are 3′ or greater, whether or not the tabular values are the independently computed ones that originate in the Almagest.

Text. For detailed references and summary on coverage, see preface to EA41-81. – Witnesses collated for values, entire table: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** Lu; **{k}** Ou Co; **{d}** Pa A; **{e}** Eq Xc; **{x}** Es Xg. – Headings according to Xa. "Saturni", which is a repeated page-heading in Xa, is here reproduced once.

Parallels collated for values, all sub-tables except .Sta: for all degrees of the argument, **$ba** = Batt., Paris Arsenal 8322, 66v-69r; **$bn** = Batt., Nallino II p. 108-13; **$hts** = Stahlman 1960, table 41. – Collated for 6°(6)90°(3)180°: **$htv** = Handy Tables, Vat. gr. 304, 219v-222r; **$pm** = Almagest XI,11, Toomer p.549.

Parallels collated for .Sta: for all degrees of the argument, **$km** = Khw/M, Suter table 27-32, first stations. – At 6-degree intervals only: **$ba** = *ms. cit.*, 81v; **$bn** = *op. cit.*, p. 138; **$hts** = Stahlman 1960, table 51; **$htv** = *ms. cit.*, 239v. In some passages, $hts and $htv may be quoted at 3-degree intervals, but this is not general; cf. under EA41-81, section (B).

Recomputation: **$c,** for .Ece .Dlo .Ear .Dpr only, and quoted in selection, mainly where it differs from the adopted text by 3′ or more; see under EA41-81, section (A). For the parameters, see "Values" above.

Saturni.

				(Ece)		(Pro)	(Dlo)		(Ear)		(Dpr)		(Sta)		
Tabulae numeri				Coaequatio centri		Proportionalia	Longitudo longior		Coaequatio argumenti		Longitudo propior		Statio prima Saturni		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
0	1	11	29	0	7	-60	0	0	0	6	0	1	3	22	44
0	2	11	28	0	14	60	0	1	0	12	0	1	3	22	44
0	3	11	27	0	21	60	0	1	0	18	0	1	3	22	44
0	4	11	26	0	27	60	0	1	0	24	0	2	3	22	45
0	5	11	25	0	33	60	0	2	0	30	0	2	3	22	45
0	6	11	24	0	39	60	0	2	0	36	0	2	3	22	45
0	7	11	23	0	46	60	0	2	0	42	0	3	3	22	46
0	8	11	22	0	52	60	0	3	0	48	0	3	3	22	46
0	9	11	21	0	58	59	0	3	0	54	0	3	3	22	46
0	10	11	20	1	5	59	0	3	1	0	0	4	3	22	46
0	11	11	19	1	11	59	0	4	1	6	0	4	3	22	47
0	12	11	18	1	17	59	0	4	1	11	0	5	3	22	47
0	13	11	17	1	24	58	0	4	1	17	0	5	3	22	47
0	14	11	16	1	30	58	0	4	1	23	0	6	3	22	48
0	15	11	15	1	36	57	0	5	1	28	0	6	3	22	48
0	16	11	14	1	43	57	0	5	1	34	0	7	3	22	48
0	17	11	13	1	49	56	0	5	1	40	0	7	3	22	49
0	18	11	12	1	55	56	0	5	1	45	0	8	3	22	49
0	19	11	11	2	1	56	0	6	1	51	0	8	3	22	50
0	20	11	10	2	7	55	0	6	1	57	0	8	3	22	50
0	21	11	9	2	13	55	0	6	2	2	0	9	3	22	51
0	22	11	8	2	19	55	0	6	2	8	0	9	3	22	51
0	23	11	7	2	25	54	0	7	2	13	0	9	3	22	52
0	24	11	6	2	31	54	0	7	2	18	0	10	3	22	52
0	25	11	5	2	37	53	0	7	2	24	0	10	3	22	53
0	26	11	4	2	43	53	0	7	2	29	0	10	3	22	53
0	27	11	3	2	49	52	0	7	2	34	0	10	3	22	54
0	28	11	2	2	55	52	0	8	2	40	0	11	3	22	54
0	29	11	1	3	1	51	0	8	2	45	0	11	3	22	55
1	0	11	0	3	7	51	0	8	2	50	0	11	3	22	56
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(e0,28) 1 Co. **(f0,3)** 20 Ou Co $ba $bn $hts; 19 $c. **(f0,5)** 23 Eq. **(f0,6)** 40 $ba. **(f0,10)** 50 Xg. **(f0,13)** 23 Ct; 25 $ba. **(f0,14)** 33 Pz. **(f0,16)** 48 Oo.ac. **(f1,0)** 6 Ct Oo Ou Co Pa A $ba $bn $hts $htv $pm $c. **(g0,13-14)** 59, 59 Co. **(g0,16)** 5<-> Ou. **(g0,17)** 57 $ba. **(g0,19)** 51 Oo. **(g0,22)** 54 Eq Xc. **(h-j, Inscr.)** sive diversitas diametri *ins.* Xa(m1). **(h)** *vacat* Co; *om.* Pa. **(j0,4)** 2 Cq. **(j0,7)** 3 Eq. **(j0,14-26)** 5(3) 6(4) 7(5) 8 $hts. **(j0,27)** 8 $ba $hts. **(j1,0)** 0 Ou. **(L0,2)** 13 Oo; 16 Eq. **(L0,16)** 24 Xc. **(L0,25)** 23 Ou. **(m-n, Inscr.)** propior: proprior Xa, *saepius;* sive diversitas diametri *ins.* Xa(m1). **(m)** *vacat* Co; *om.* Pa. **(n0,1-1,0)** 0--8 *(=col. (j))* Ou. **(+n0,1-7)** 0 1(3) 2(3) Co $ba $bn $hts. **(+n0,10)** 3 $ba $bn $hts. **(+n0,12)** 4 Co $ba $bn $hts $htv $pm $c. **(+n0,13-17)** 5 5 6 6 7 Co $ba $bn $hts. **(+n0,16)** 6 Oo. **(+n0,18)** 7 Co $ba $bn $hts $htv $pm; 6 $c. **(+n0,21)** 8 Co $ba $bn $hts. **(+n0,24)** 9 Co $ba $bn $hts $htv $pm; 8 $c. **(+n0,27)** 11 Pz $ba. **(p0,1-1,0)** 12...12 Pz Cq. **(q0,4)** 44 Co. **(q0,7-1,0)** 46--55, 56: 45, 46--55 Ou; 45(4), 46(2), 45(2), 46, 47, 48(2), 49(3), 50, 51(2), 52(2), 53, 54(2), 55 Co. **(+q0,10)** 47 Eq Xc. **(+q0,12)** 46 $bn $ba $hts $htv. **(+q0,29)** 56 Eq.

				(Ece)		(Pro)	(Dlo)		(Ear)		(Dpr)		(Sta)		
Tabulae numeri				Coaeq uatio centri		Prop orti ona lia	Longi tudo lon gior		Coaeq uatio argu menti		Longi tudo pro pior		Statio prima Saturni		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
1	1	10	29	3	12	50	0	9	2	55	0	12	3	22	57
1	2	10	28	3	18	50	0	9	3	0	0	12	3	22	58
1	3	10	27	3	23	49	0	9	3	5	0	12	3	22	59
1	4	10	26	3	29	49	0	9	3	10	0	13	3	23	0
1	5	10	25	3	34	48	0	9	3	15	0	13	3	23	1
1	6	10	24	3	39	48	0	10	3	20	0	13	3	23	2
1	7	10	23	3	45	47	0	10	3	25	0	14	3	23	3
1	8	10	22	3	50	46	0	10	3	30	0	14	3	23	4
1	9	10	21	3	55	46	0	10	3	35	0	14	3	23	5
1	10	10	20	4	0	45	0	10	3	40	0	15	3	23	6
1	11	10	19	4	5	44	0	11	3	45	0	15	3	23	7
1	12	10	18	4	10	44	0	11	3	50	0	15	3	23	8
1	13	10	17	4	15	43	0	11	3	54	0	16	3	23	9
1	14	10	16	4	20	42	0	11	3	59	0	16	3	23	10
1	15	10	15	4	25	42	0	11	4	3	0	16	3	23	11
1	16	10	14	4	30	41	0	12	4	8	0	17	3	23	12
1	17	10	13	4	35	41	0	12	4	13	0	17	3	23	13
1	18	10	12	4	40	40	0	12	4	17	0	17	3	23	14
1	19	10	11	4	44	39	0	13	4	22	0	18	3	23	15
1	20	10	10	4	48	38	0	13	4	26	0	18	3	23	16
1	21	10	9	4	52	37	0	13	4	30	0	18	3	23	17
1	22	10	8	4	57	36	0	13	4	34	0	19	3	23	18
1	23	10	7	5	1	35	0	14	4	38	0	19	3	23	19
1	24	10	6	5	5	35	0	14	4	42	0	19	3	23	20
1	25	10	5	5	9	34	0	14	4	46	0	19	3	23	21
1	26	10	4	5	13	33	0	14	4	50	0	19	3	23	22
1	27	10	3	5	17	32	0	15	4	53	0	20	3	23	24
1	28	10	2	5	21	31	0	15	4	57	0	20	3	23	25
1	29	10	1	5	25	30	0	15	5	1	0	20	3	23	26
2	0	10	0	5	29	30	0	15	5	4	0	20	3	23	28
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(e1,21-22) 5,5 Oo. **(f1,3)** 33 Pz. **(f1,15)** 20 Pz. **(f1,18)** 39 Ou Co $ba $bn $hts $htv $pm; =40 $c. **(f1,20)** 44 Ou. **(g1,8)** 47 Oo.ac Ou Co $bn $hts. **(g1,10)** 46 $bn. **(g1,11-14)** 45, 44, 44, 43 Ou Co $ba $bn $hts. **(g1,16)** 42 Ou Co $ba $bn $hts. **(g1,19-25)** 40...35, 35 $hts. **(g1,26)** 34 Ou Co $hts. **(g1,27)** 33 Ou $hts. **(g1,28)** 32 Ou $ba $bn $hts. **(g1,29)** 31 Ou Co $ba $bn $hts. **(h)** *vacat* Co; *om.* Pa. **(j1,1)** 8 Ou Co $bn $hts. **(j1,16)** 11 Oo $hts. **(j1,19-2,0)** 13(3), 14(3), 15(6) Eq; 13(3), 14(4), 15(5) Xc. **(+j1,19)** 12 Ou Co $ba $bn $hts. **(+j1,23)** 13 Ou Co $ba $bn $hts. **(+j1,27)** 14 Ou Co $ba $bn $hts. **(+j1,28)** 14 Ou Co $ba $hts. **(k1,1)** 2: A*v.l.;* 3 Pa A. **(L1,1)** 35 $ba. **(L1,3)** 50 Co. **(L1,12)** 49 $ba $htv $pm; =50 $bn $hts $c. **(L1,13)** 55 $bn. **(L1,15)** 13 Pz. **(L1,17)** 3 Co. **(L1,19)** 27 Oo. **(L1,22)** 35 $ba. **(L1,23)** 28 Oo. **(L1,25)** 45 Ou. **(L1,28)** 58 $hts. **(L2,0)** 5 $bn. **(m)** *vacat* Co; *om.* Pa. **(n1,1-27)** 12--19, 20: 12, 12--19 $ba. **(+n1,1-6)** 22(3), 23(3) Oo. **(+n1,4)** 10'30" $c. **(+n1,7)** 11 $c. **(+n1,10)** 12 $c. **(+n1,12)** 16 $ba *(ad n1,13).* **(+n1,13-2,0)** 13 13 14(4) 15(4) 16(4) 17(4) $c. **(+n1,22)** 18 $bn. **(+n1,27)** 19 Ou Co $bn $hts. **(p1,1-2,0)** 12(3), 13(3), 12, 13(23) Oo; 12(4), 13(26) Co. **(p1,4)** 22 Ou; *n.l.* A. **(q1,1-1,24)** *see Appendix.* **(q1,25-2,0)** *see Appendix.* **(+q1,26)** 23 Eq Xc. **(+q1,27)** 23 Pa A Xc. **(+q1,28)** 24 Pa A Xc; 23 $km.O. **(+q1,29)** 25 Xc. **(+q2,0)** 26 Xc.

				(Ece)		(Pro)	(Dlo)		(Ear)		(Dpr)		(Sta)		
Tabulae numeri				Coaeq uatio centri		Prop orti ona lia	Longi tudo lon gior		Coaeq uatio argu menti		Longi tudo pro pior		Statio prima Saturni		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
2	1	9	29	5	33	29	0	15	5	8	0	20	3	23	29
2	2	9	28	5	37	28	0	16	5	12	0	20	3	23	30
2	3	9	27	5	41	27	0	16	5	15	0	20	3	23	32
2	4	9	26	5	44	26	0	16	5	19	0	20	3	23	33
2	5	9	25	5	47	25	0	16	5	22	0	20	3	23	34
2	6	9	24	5	50	24	0	16	5	25	0	20	3	23	36
2	7	9	23	5	53	23	0	17	5	28	0	21	3	23	37
2	8	9	22	5	56	22	0	17	5	31	0	21	3	23	38
2	9	9	21	5	59	21	0	17	5	34	0	21	3	23	40
2	10	9	20	6	2	20	0	17	5	37	0	21	3	23	41
2	11	9	19	6	5	19	0	17	5	40	0	21	3	23	42
2	12	9	18	6	7	18	0	18	5	42	0	21	3	23	44
2	13	9	17	6	10	16	0	18	5	45	0	21	3	23	45
2	14	9	16	6	12	15	0	18	5	47	0	21	3	23	47
2	15	9	15	6	14	14	0	18	5	49	0	21	3	23	49
2	16	9	14	6	16	13	0	18	5	51	0	21	3	23	51
2	17	9	13	6	18	12	0	18	5	53	0	21	3	23	53
2	18	9	12	6	19	11	0	18	5	55	0	21	3	23	55
2	19	9	11	6	21	9	0	18	5	57	0	22	3	23	57
2	20	9	10	6	22	8	0	18	5	59	0	22	3	23	58
2	21	9	9	6	23	7	0	18	6	0	0	22	3	23	59
2	22	9	8	6	25	6	0	18	6	2	0	22	3	24	1
2	23	9	7	6	26	5	0	19	6	4	0	22	3	24	3
2	24	9	6	6	27	4	0	19	6	5	0	22	3	24	4
2	25	9	5	6	28	3	0	19	6	7	0	22	3	24	6
2	26	9	4	6	28	2	0	19	6	8	0	22	3	24	7
2	27	9	3	6	29	1	0	19	6	9	0	23	3	24	8
2	28	9	2	6	30	+ 1	0	19	6	10	0	23	3	24	9
2	29	9	1	6	30	2	0	19	6	11	0	23	3	24	10
3	0	9	0	6	31	3	0	19	6	12	0	23	3	24	11
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(b2,5-27) 5--26, 27; *(vac.)*, 5--26 Oo. **(f2,3)** 40 $hts. **(f2,7)** 54 Co. **(f2,8)** 50 Pz. **(f2,12)** =7 $pm; 5 $c. **(f2,13)** 9 $ba; 7 $c. **(f2,18)** =19 $pm; 18 $c. **(f2,23)** 27 Oo.?ac. **(f2,24)** =27 $pm; 26 $c. **(g2,5-12)** 24...17 $ba. **(+g2,13-17)** 17...14, 12 Eq; 17...14, 13 Xc. **(+g2,13)** 17 Ou Co. **(+g2,14-26)** 16...4 Oo. **(g2,18)** 10 Pz. **(g2,26-27)** 3, 2 Cq *ut vid.* **(g2,28)** addatur *add.* Ct Ou Co; adde *add.* Eq Xc. **(h)** *vacat* Co; *om.* Pa. **(j2,1-3,0)** 15--19: 25--29 *additis ubique decem* Oo. **(j2,4-5)** 17, 17 $ba. **(j2,6)** 17 Ou Co $ba $bn $hts $htv $pm $c. **(j2,11)** 18 Eq Xc. **(j2,20-22)** 19...19 Ou Co $bn. **(+j2,22)** 19 Eq Xc $ba $hts. **(j2,24; j3,0)** 9, 9 $htv. **(L2,6)** 29 $ba. **(L2,7)** 21 Ou. **(L2,24-29)** 6 8 9 10 11 12 Ou Co; 5...10 $c. **(+L2,29)** 12 Es. **(L3,0)** 11 $ba $c. **(m)** *vacat* Co; *om.* Pa. **(n2,18)** 22 Ou Co $bn $hts. **(n2,27-28)** 22(2) Ou Co. **(n2,29)** 22 Ou Co. **(n3,0)** 22 Ou Co $htv $pm $c. **(q2,1-14)** *see Appendix.* **(+q2,7)** 35 Pz. **(q2,15-3,0)** *see Appendix.* **(+q2,15)** 50 $km.

Lineae vel tabulae numeri				(Ece) Coaequatio centri		(Pro) Proportionalia	(Dlo) Longitudo longior		(Ear) Coaequatio argumenti		(Dpr) Longitudo propior		(Sta) Statio Saturni prima		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
3	1	8	29	6	31	4	0	19	6	12	0	23	3	24	12
3	2	8	28	6	31	5	0	20	6	12	0	23	3	24	13
3	3	8	27	6	31	6	0	20	6	12	0	23	3	24	15
3	4	8	26	6	31	7	0	20	6	13	0	24	3	24	16
3	5	8	25	6	30	8	0	20	6	13	0	24	3	24	18
3	6	8	24	6	30	9	0	20	6	13	0	24	3	24	19
3	7	8	23	6	29	10	0	20	6	13	0	24	3	24	20
3	8	8	22	6	29	11	0	20	6	13	0	24	3	24	22
3	9	8	21	6	28	12	0	20	6	13	0	25	3	24	23
3	10	8	20	6	28	13	0	21	6	12	0	25	3	24	24
3	11	8	19	6	27	14	0	21	6	12	0	25	3	24	26
3	12	8	18	6	26	15	0	21	6	12	0	25	3	24	27
3	13	8	17	6	25	16	0	21	6	11	0	25	3	24	28
3	14	8	16	6	24	17	0	21	6	10	0	25	3	24	30
3	15	8	15	6	22	18	0	21	6	9	0	25	3	24	31
3	16	8	14	6	21	19	0	20	6	8	0	25	3	24	32
3	17	8	13	6	19	20	0	20	6	7	0	25	3	24	33
3	18	8	12	6	17	20	0	20	6	5	0	25	3	24	34
3	19	8	11	6	16	21	0	20	6	3	0	25	3	24	36
3	20	8	10	6	14	22	0	20	6	2	0	25	3	24	37
3	21	8	9	6	12	23	0	20	6	0	0	24	3	24	39
3	22	8	8	6	10	24	0	20	5	59	0	24	3	24	40
3	23	8	7	6	8	24	0	20	5	57	0	24	3	24	41
3	24	8	6	6	6	25	0	20	5	55	0	24	3	24	42
3	25	8	5	6	4	26	0	19	5	53	0	24	3	24	44
3	26	8	4	6	1	27	0	19	5	51	0	24	3	24	45
3	27	8	3	5	58	28	0	19	5	49	0	24	3	24	47
3	28	8	2	5	55	28	0	19	5	47	0	23	3	24	48
3	29	8	1	5	52	29	0	19	5	44	0	23	3	24	49
4	0	8	0	5	49	30	0	19	5	41	0	23	3	24	50
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(f3,19) 15 Pz. **(f3,28)** 56 Co. **(g3,13-18)** 15...20 $ba $bn $hts; 15 17 18 18 19 20 Ou Co. **(g3,19-27)** 20...24, 24...27 Ou Co $ba $bn; 20...25, 25...27 $hts. **(+g3,19-21)** 22, 23, 24 A.ac *ut vid.* **(+g3,27)** 27 Ct Pa A. **(h)** *vacat* Co; *om.* Pa. **(j3,10)** 20 Eq. **(j3,16-26)** 21(2), 20(9) Ou Co; 21(2), 20(8), 19 $bn $hts; 21(3), 20(5), 19(3) $ba. **(+j3,16-17)** 21, 21 Oo. **(+j3,25-4,0)** 29(6) Oo Pz. **(L3,3)** 13 Eq Xc. **(L3,4)** 12 Oo. **(L3,9)** 12 $htv $pm; =13 $c. **(L3,14)** 11 $bn. **(L3,18)** 6 $bn. **(L3,19)** 4 Ou Co $bn $hts. **(L3,23)** 59 Oo Xc. **(L3,27)** 48 Ou Co $ba $bn $hts $htv $pm $c. **(L3,28)** 46 $ba $hts; 45 $c. **(L3,29)** 43 Ou Co $ba $bn $hts $c. **(L4,0)** 42 $htv; 40 $hts $pm $c. **(m)** *vacat* Co; *om.* Pa. **(n3,1-8)** 13(3), 14(5) Oo. **(+n3,6)** 23 $htv $pm $c. **(n3,9)** 24 Ou Co $ba $bn $htv $pm; 23 $c. **(n3,10-11)** 24, 24 Ou Co $ba $bn $hts. **(n3,12)** 24 $hts $htv $pm; 23 $c. **(n3,15)** 24 $htv $pm; 23 $c. **(n3,20)** 24 $bn. **(n3,21)** 26 Ou Co; 25 $ba $hts $htv $pm; 23 $c. **(n3,22)** 26 Ou Co. **(q3,2)** 14 Ou Co. **(q3,8)** 23 Oo. **(q3,10)** 25 Ou Co. **(q3,13)** 29 Ou Co. **(q3,16)** *n.l.* A. **(q3,17-24)** 34, 36, 38, 39, 40, 41, 42, 43 Ou Co. **(+q3,17)** 34 $km. **(+q3,18)** 35 $km $bn $hts $htv; 36 $ba. **(q3,24-25)** *n.l.* A. **(+q3,24)** 43 $km $bn $ba $hts $htv. **(q3,27)** 46 Ou Co.

				(Ece)		**(Pro)**	**(Dlo)**		**(Ear)**		**(Dpr)**		**(Sta)**		
Tabulae numeri				Coaequatio centri		Proportionalia	Longitudo longior		Coaequatio argumenti		Longitudo propior		Statio prima Saturni		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
4	1	7	29	5	46	30	0	19	5	37	0	23	3	24	51
4	2	7	28	5	43	31	0	19	5	34	0	23	3	24	52
4	3	7	27	5	40	32	0	19	5	31	0	23	3	24	53
4	4	7	26	5	36	32	0	19	5	28	0	23	3	24	55
4	5	7	25	5	32	33	0	18	5	24	0	22	3	24	56
4	6	7	24	5	28	34	0	18	5	21	0	22	3	24	57
4	7	7	23	5	24	35	0	18	5	18	0	22	3	24	58
4	8	7	22	5	20	36	0	18	5	14	0	22	3	24	59
4	9	7	21	5	16	37	0	18	5	10	0	21	3	25	0
4	10	7	20	5	12	37	0	17	5	6	0	21	3	25	1
4	11	7	19	5	8	38	0	17	5	2	0	21	3	25	2
4	12	7	18	5	3	39	0	17	4	58	0	20	3	25	3
4	13	7	17	4	58	40	0	17	4	54	0	20	3	25	4
4	14	7	16	4	53	41	0	17	4	50	0	20	3	25	5
4	15	7	15	4	48	42	0	17	4	45	0	19	3	25	6
4	16	7	14	4	43	42	0	16	4	41	0	19	3	25	7
4	17	7	13	4	38	43	0	16	4	36	0	19	3	25	8
4	18	7	12	4	33	44	0	16	4	31	0	18	3	25	9
4	19	7	11	4	28	44	0	16	4	26	0	18	3	25	10
4	20	7	10	4	23	45	0	15	4	21	0	18	3	25	11
4	21	7	9	4	17	46	0	15	4	16	0	17	3	25	12
4	22	7	8	4	12	46	0	15	4	11	0	17	3	25	13
4	23	7	7	4	6	47	0	14	4	6	0	17	3	25	14
4	24	7	6	4	0	48	0	14	4	0	0	16	3	25	15
4	25	7	5	3	54	49	0	14	3	55	0	16	3	25	16
4	26	7	4	3	48	49	0	13	3	49	0	16	3	25	17
4	27	7	3	3	42	50	0	13	3	43	0	15	3	25	18
4	28	7	2	3	36	50	0	13	3	37	0	15	3	25	18
4	29	7	1	3	30	51	0	12	3	31	0	14	3	25	19
5	0	7	0	3	24	51	0	12	3	25	0	14	3	25	19
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(a5,0) 4 Oo. **(e4,24)** 3 $ba. **(f4,4)** 33 Co. **(f4,6)** 38 Oo; 27 Ou Co. **(f4,12)** 2 $pm $c. **(f4,13)** 59 Ou Co $ba; 57 $c; =58 $bn $hts. **(g4,4)** 33 Oo. **(g4,13-29)** 40--50, 51: 39, 40--50 Eq Xc. **(+g4,19)** 45 Ou Co, Eq *(ad 4,20)*. **(g4,20)** 46 Ou Co. **(g4,22)** 47 Ou Co. **(g5,0)** 52 Co $hts. **(h)** *vacat* Co; *om.* Pa. **(j4,4)** 18 Ou. **(j4,9)** 17 Ou Co Es. **(j4,15)** 16 $ba. **(j4,22)** 14 Oo. **(j4,23)** 15 $ba $bn $hts. **(j4,24)** 15 $hts. **(j4,26)** 14 $ba $bn $hts. **(j4,27)** 14 $pm; =13 $c. **(k4,25)** *vacat* Oo. **(L4,2)** 33 Oo; 35 Ou Co $ba $bn; =34 $hts. **(L4,3)** 32 $bn. **(L4,4)** 38 Oo. **(L4,5)** 25 Ou Co $bn $hts. **(L4,11)** 1 Ou; ii *vel* li Co. **(L4,18)** 30 $htv $c. **(m)** *vacat* Co; *om.* Pa. **(n4,1)** 24 Ou Co. **(n4,5-6)** 23, 23 $ba. **(n4,9)** 22 Co $bn $hts $htv $pm; 20 $c. **(n4,12)** 21 Ou Co $ba $bn $hts $htv $pm; 19 $c. **(n4,15)** 29 Pz; 20 Ou Co $ba $bn $hts $htv $pm; =19 $c. **(n4,18)** 19 Ou Co $ba $bn $hts $htv $pm; =18 $c. **(n4,21)** 18 Ou Co $ba $bn $htv $pm; =17 $c. **(n4,24)** 17 Ou Co $ba $bn $hts $htv $pm; =16 $c. **(n4,27)** 16 Ou Co. **(n4,29)** 15 Ou Co Pa A. **(q4,3)** 54 $km. **(q4,4)** 54 Ou Co. **(q4,6)** 56 Ou Co. **(q4,20)** 12 Co. **(q4,23)** 13 Ou Co. **(q4,24)** 14 Ou Co $bn $ba $hts $htv. **(q4,25-29)** 15 16 17 17 18 Ou Co.

				(Ece)		(Pro)	(Dlo)		(Ear)		(Dpr)		(Sta)		
Tabulae numeri				Coaequatio centri		Proportionalia	Longitudo longior		Coaequatio argumenti		Longitudo propior		Statio prima Saturni		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
5	1	6	29	3	18	52	0	12	3	19	0	14	3	25	20
5	2	6	28	3	12	53	0	11	3	13	0	13	3	25	20
5	3	6	27	3	6	53	0	11	3	7	0	13	3	25	21
5	4	6	26	2	59	54	0	11	3	1	0	12	3	25	21
5	5	6	25	2	52	54	0	10	2	54	0	12	3	25	22
5	6	6	24	2	46	55	0	10	2	48	0	12	3	25	22
5	7	6	23	2	40	55	0	9	2	42	0	11	3	25	23
5	8	6	22	2	34	56	0	9	2	36	0	11	3	25	23
5	9	6	21	2	27	56	0	8	2	29	0	11	3	25	24
5	10	6	20	2	21	57	0	8	2	23	0	10	3	25	24
5	11	6	19	2	14	57	0	7	2	16	0	10	3	25	25
5	12	6	18	2	7	57	0	7	2	9	0	9	3	25	25
5	13	6	17	2	0	58	0	6	2	2	0	9	3	25	25
5	14	6	16	1	53	58	0	6	1	55	0	9	3	25	25
5	15	6	15	1	46	58	0	6	1	48	0	8	3	25	26
5	16	6	14	1	39	59	0	5	1	41	0	8	3	25	26
5	17	6	13	1	32	59	0	5	1	34	0	7	3	25	26
5	18	6	12	1	25	59	0	5	1	27	0	7	3	25	27
5	19	6	11	1	18	59	0	5	1	20	0	6	3	25	27
5	20	6	10	1	11	60	0	4	1	13	0	6	3	25	27
5	21	6	9	1	4	60	0	4	1	6	0	5	3	25	28
5	22	6	8	0	57	60	0	4	0	59	0	5	3	25	28
5	23	6	7	0	50	60	0	3	0	52	0	4	3	25	28
5	24	6	6	0	43	60	0	3	0	45	0	4	3	25	28
5	25	6	5	0	36	60	0	3	0	38	0	3	3	25	29
5	26	6	4	0	29	60	0	2	0	31	0	3	3	25	29
5	27	6	3	0	22	60	0	2	0	23	0	2	3	25	29
5	28	6	2	0	15	60	0	1	0	16	0	2	3	25	30
5	29	6	1	0	8	60	0	1	0	8	0	1	3	25	30
6	0	6	0	0	0	60	0	0	0	0	0	0	3	25	30
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(e5,4) 3 Eq.ac. **(f5,2)** 17 Pz. **(f5,3)** 5 Ou Co $bn $hts $htv $pm; 7 $c. **(f5,5)** 53 Ou Co Eq Xc Es Xg $bn $hts. **(f5,16)** 49 A.ac. **(f5,17)** 36 Pz. **(f5,24)** 44 $pm; =43 $c. **(g5,5-7)** 55, 56, 56 Ou Co. **(g5,8-20)** 56--59, 60: 55, 56--59 Es Xg. **(+g5,9)** 57 Ou Co. **(+g5,12)** 58 $ba $bn. **(+g5,14)** 59 $ba. **(g5,15)** 59 $ba $bn $hts. **(+g5,16)** 58 Ou Co. **(+g5,18-19)** 60, 60 $ba; 59, 60 $hts. **(g5,20)** 59 Ou Co $bn; =60 $hts. **(g5,21)** 59 Ou Co. **(h)** *vacat* Co; *om.* Pa. **(j5,9)** 9 $htv $pm $c. **(j5,19-28)** *see Appendix.* **(+j5,20-23)** *see Appendix.* **(k5,22)** 4 $ba. **(L5,1)** 18 Ou Co. **(L5,5)** 55 Ou Co $bn $hts. **(L5,6)** 49 Oo. **(L5,16)** 4{{2}} Pa. **(m)** *vacat* Co. **(n5,1)** 13 $ba $bn $hts. **(n5,10)** 12 Oo. **(n5,12)** 10 Ou Co $ba $bn $hts $htv $pm; =9 $c. **(n5,15)** 9 Ou Co $pm; =8 $htv; 7 $c. **(n5,17-27)** 8(2), 7(2), 6(2), 5(2), 4(2), 3 Ou Co. **(n5,28)** 1 $ba $bn $hts. **(o5,13-5,28)** 1...1 Pz. **(p5,3-5,28)** 15...15 Pz. **(q5,1-15)** *see Appendix.* **(q5,16-6,0)** *see Appendix.* **(+q5,18)** 8 $ba; 26 $km. **(+q5,21)** 27 $km. **(+q5,24)** 2{{9}} Xc.

EA41: Appendix to the apparatus.

(q1,1-1,24) 57 58 59 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20: *plerique,* $km;
56 57 58 59 0 1 2 3 4 5 6 7 8 9 10 11 13 14 15 16 17 19 20 21 Ou Co;
- - - - - 1 - - - - - 7 - - - - - 14 - - - - - 21 $bn $ba;
- - 58 - - 1 - - 4 - - 7 - - 11 - - 14 - - 18 - - 21 $htv $hts.

(q1,25-2,0) 21 22 24 25 26 28: *plerique;*
22 23 24 26 27 28 Ou Co $km;
- - - - - 28 $bn $ba;
- - 25 - - 28 $htv $hts.

(q2,1-14) 29 30 32 33 34 36 37 38 40 41 42 44 45 47: *plerique,* $km;
29 21 32 34 35 36 36 39 40 41 43 44 45 47 Ou Co ("21": *ita* Ou Co);
- - - - - 36 - - - - - 44 - - $bn $ba;
- - 32 - - 36 - - 40 - - 44 - - $htv $hts.

(q2,15-3,0) 49 51 53 55 57 58 59 1 3 4 6 7 8 9 10 11: *plerique,* $km *fere;*
48 50 51 53 54 56 59 0 1 2 3 5 6 8 9 11 Ou Co;
- - - 53 - - - - - 2 - - - - - 11 $bn $ba;
49 - - 53 - - 58 - - 2 - - 7 - - 11 $htv $hts.

(j5,19-28) 5 4 4 4 3 3 3 2 2 1: *plerique;*
. . 5 . . 4 . . 2 . $pm;
5 5 5 4 4 4 3 3 2 2 $htv;
4 4 4 3 3 3 2 2 2 1 $bn;
4 4 4 3 3 3 2 2 1 1 Ou Co;
5 4 4 3 3 3 2 2 1 1 $c;
(+j5,20-23) 5 4 4 4 $ba $hts.

(q5,1-15) 20 20 21 21 22 22 23 23 24 24 25 25 25 25 26: *plerique;*
20 20 21 21 22 22 23 23 23 24 24 24 25 25 25 $km;
20 20 21 22 22 23 24 24 25 25 25 26 26 26 27 Ou Co;
- - - - - 23 - - - - - 26 - - - $bn $ba;
- - 21 - - 23 - - 25 - - 26 - - 27 $hts $htv.

(q5,16-6,0) 26 26 27 27 27 28 28 28 28 29 29 29 30 30 30: *plerique,* $km *fere;*
27 27 27 27 28 28 28 28 28 29 29 29 29 29 29 Ou Co;
- - 28 - - - - - 29 - - - - - 29 $bn $ba(*v.i.*)
- - 28 - - 28 - - 29 - - 29 - - 29 $hts $htv.

EA51. Equation of Jupiter.

Toomer 1968, no. 41. — From Albattani, Nallino II p. 114-19, but "statio prima" is like Khw/M, Suter Tab.33-38 p.144-49.

Witnesses: **{a0}** Ct,14v-16r; Oo,10v-12r; Pz,117v-119r; Mc,9v-11r; Mb,42r-v; Ey,38v-41r; Da,196v-197v; Ea,40v. — **{a1}** Xa,20r-21v; Ad,76r-77v; Cq,35-38; Fc,18v-21r; Ps,45v-48r; Sg,119-124; Wd,19r-20r; Fh,29v-32r; Xw,19r-20v. — **{a2}** Cz,64v-67r; Cj,137v-140r; Md,69r-71v; Mp,202r-204v; Vp,119v-122r. — **{aX}** Vo,38v-41r; R,74r-76v; Ov,62v-65r; Cu,63v-66r; Ep,38r-40v. — **{aT}** Lu,45v-48r; Oj,118r-120v; P,101r-103v; Da4,154v (fgt.). — **{k}** Eh,81r-83v; Lw,76r-78v; Ou,54r-56v; Eg,12v-13v; Co,156r-157r; Cn,89r-91v. — **{d}** Op,44v-47r; C,309-314; Lb,14r-16v; Pa,30r-32v; A,209r-211v; Fj,30r-32v; Nc,99r-101v; Pb,21r-23v; Pv,13v-16r; Fd2,31r-33v; Gr3,102r-104v; Ok,36r-38v. — **{e}** Eq,60v-63r; Ek3,89v-92r; Xc,54v-57r; Vj,78r-80v; Ej,61r-63v. — **{x}** Oc,65v-68r; X,142v-145r; Vz,57v-60r; Mv,79v-82r; Cm,194v-197r; B,134v-137r; T,285v-286v; Lf,82v-85r; Lg,161v-164r; Lh,127v-130r; Xj,265v-268r; Xg,45v-48r; G,50r-52v; Xb,65r-67v; Es,166v-169r; Fb,55v-58r; Pq,174v-177r; Oy,62v-65r; Wa,59v-61r; Ow,145v-148r; Nu,130v-133r. — **{p}** O,60r-62v; Pd,60r-62v; Ch2,161r-163v. — **{?}** Ch,26v-29r (:Savasorda 1); Ch,65r-67v (:Savasorda 2); Pn,36r-38v (:Jo. Lin.). — Duplicates in {?} Ch, each in its own collection.

Headings. — General:

(1: none) :: {a0:} Ct Mc Mb Da, {a1:} Sg Fh Xw, {d?} Lb Ok.
(2) Aequatio (/**-ones** Lu Oj P X) **Iovis** :: {a0:} Oo Ea; {a1:} Xa Ad Cq Wd; {aT:} Lu Oj P Da4; {d:} Pa A Fj Nc Pb Pv Fd2 Gr3; {x:} X Wa; {p:} Pd; {?:} Ch(26v,65r).
(3) Iovis :: {aX} Vo; {p:} Ch2.
(4) Tabula aequationis Iovis (+prima Ov! Vp! Op C Ou O!) :: {a0:} Ey; {a1:} Fc!, {a2:} Cz Cj Md Mp Vp; {aX:} Ov R Cu Ep!; {k:} Eh Lw Ou Eg Co; {d?:} Op C; {e:} Eq Ek3 Xc Vj Ej; {x-}; {p:} O; {?:} Pn. — "prima" is placed after "tabula" in Vp Ov O.
(5: other) :: Pz ("Tabula Iovis, Rectitudo Iovis"); Md ("De Iove", then (4) above); Ps Cn.

Entrance columns: normally, **(6) Tabulae numeri** (earlier), or **(7) Lineae numeri** (later). — **(8) Lineae numeri communes** :: {d:} Lb Pa A Fj Nc Pb Pv Fd2 Gr3; {p:} O Pd; {x:} Xj. — **(9) Lineae numeri communes centro et argumento** :: {a2:} Mp; {e:} Xc Vj Ej; {x:} Oc Vz Xb Es Wa; {?:} Pn. — **(10: other)** :: Ps ("L. communis n."); Ch(26v,65r: "Ordo n."); Pz Eh.

.Ece: **(11) Aequatio centri** :: normally. — **(12) Aequatio puncti** {a0:} Ct Oo Da; {k:} Ou. — **(13) Aequatio puncti et portionis** :: {k:} Eh Lw Eg! Co. — **(14: other)** :: Pz ("Ae. c. sive puncti"); Cn Ch.
— The "aequatio puncti et portionis" of Class {k} is Albattani's phrase; cf. Nallino's translation "Aequatio anomaliae et centri" and his commentary (II p. 239-40, 240 n. 1). It occurs in EA61-81 too.

.Pro: normally, **(15) Proportionalia,** with **Minuta** before or after. — **(16) Minuta partium** :: {a0:} Pz Da; {k:} Lw Ou Eg Co Cn. — **(17: other)** :: Ct (just the sign "Minuta"); Oo Mb Fd2 Eh Pn Ch(26v,65r).

.Dlo: **(18) Longitudo longior,** everywhere.

.Ear: **(19) Aequatio argumenti** :: normally. — **(20) Aequatio portionis** :: {a0:} Ct Oo Da; {aT:} Lu Oj P; {k:} Lw Ou Eg Co Cn. — **(21) Coaequatio argumenti** :: {a1:} Ad Fh. — **(22: other)** :: Pz ("Aequatio argumenti id est portionis"); Eh; Ch(26v,65r).

.Dpr: **(23) Longitudo propior** (proprior, occasionally; propinquior R Pa A Fj Gr3 Eg) :: everywhere.

.Sta: mostly, **(24) Statio Iovis prima** or **(25) Statio prima Iovis.** — **(26) Statio prima** :: {a0:} Ey; {a2:} Vp; {aX} Ov R Cu; {aT:} Lu; {d:} Lb Pa A Fj Nc Pb Pv Fd2 Gr3; {p:} O Pd Ch2; {?} Pn Ch(26v,65r). — **(27: other)** :: Mb Ps Eh Eg. — Mb Ps show separate tables; see "Versions".

Versions. Ep interchanges sub-tables .Dlo and .Dpr. — Ey shows the order "... .Ear .Dlo .Dpr ...", with .Dlo .Dpr under the common heading "Diversitas diametri epicycli". Mb Ps have .Sta apart from the rest; cf. EB21. In the rest of the witnesses the sub-tables are ordered as indicated.

Values. Parameters: eccentricity of deferent 2;45, radius of epicycle 11;30. — Peculiarities and errors:
.Ece: At (f2,6/12/18/24), the values are slightly different from the Almagest, which is joined by $c. This may be because of a slide. — (f3,11+) deviate from the Almagest, but none of the possibilities fits the recomputed values strikingly well; there may be independent slides in the Albatenian witnesses and in the vulgate. — (f4,23) until (f5,24): the Albatenian values and our vulgate are consistently 1 or 2 less than the Almagest. The result fits the recomputed values better than the Almagest does, and may be due to correction by Albattani.
.Ear: (L3,2-9), slide in Albattani (Ou Co, also in Nallino's edition). The vulgate and $ba show a different, less comprehensive slide. Only $htv and the Almagest have the expected values.

Text. For detailed references and summary on coverage, see preface to EA41-81. — Witnesses collated for values, entire table: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** Lu; **{k}** Ou Co; **{d}** Pa A; **{e}** Eq Xc; **{x}** Es Xg. — Headings according to Xa. "Iovis", a repeated page-heading in Xa, is ignored.

Parallels collated, all sub-tables except .Sta: for all degrees of the argument, **$ba** = Batt., Paris Arsenal 8322, 69v-72r; **$bn** = Batt., Nallino II p. 114-119; **$hts** = Stahlman 1960, table 42. — Collated for 6°(6)90°(3)180°: **$htv** = Handy Tables, Vat. gr. 304, 222v-225r; **$pm** = Almagest XI,11, Toomer p.550.
Parallels collated for .Sta: for all degrees of the argument, **$km** = Khw/M, Suter table 33-38, first stations. — At 6-degree intervals only: **$ba** = *ms. cit.*, 81v; **$bn** = *op. cit.*, p. 138; **$hts** = Stahlman 1960, table 52; **$htv** = *ms. cit.*, 240r. In passages, $hts and $htv may be quoted at 3-degree intervals, but this is not general; see under EA41-81, section (B).

Recomputation: **$c,** for .Ece .Dlo .Ear .Dpr only, and quoted in selection, mainly where it differs from the adopted text by 3' or more; see under EA41-81, section (A). For the parameters, see "Values" above.

Aequatio Iovis.

				(Ece)		**(Pro)**	**(Dlo)**		**(Ear)**		**(Dpr)**		**(Sta)**		
Tabulae numeri				Aequa tio centri		Prop orti ona lia	Longi tudo lon gior		Aequa tio argu menti		Longi tudo pro pior		Statio prima Iovis		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
0	1	11	29	0	6	-60	0	0	0	10	0	0	4	4	5
0	2	11	28	0	11	60	0	1	0	20	0	1	4	4	5
0	3	11	27	0	16	60	0	1	0	29	0	1	4	4	5
0	4	11	26	0	22	60	0	1	0	39	0	1	4	4	5
0	5	11	25	0	27	60	0	2	0	49	0	2	4	4	5
0	6	11	24	0	32	60	0	2	0	59	0	2	4	4	5
0	7	11	23	0	37	60	0	2	1	8	0	2	4	4	6
0	8	11	22	0	42	60	0	3	1	18	0	3	4	4	6
0	9	11	21	0	47	60	0	3	1	27	0	3	4	4	6
0	10	11	20	0	53	60	0	3	1	37	0	3	4	4	6
0	11	11	19	0	58	60	0	4	1	46	0	4	4	4	6
0	12	11	18	1	3	60	0	4	1	56	0	4	4	4	6
0	13	11	17	1	8	59	0	4	2	6	0	5	4	4	7
0	14	11	16	1	13	59	0	5	2	15	0	5	4	4	7
0	15	11	15	1	18	59	0	5	2	24	0	6	4	4	7
0	16	11	14	1	23	59	0	5	2	33	0	6	4	4	8
0	17	11	13	1	28	58	0	6	2	43	0	7	4	4	8
0	18	11	12	1	33	58	0	6	2	52	0	7	4	4	8
0	19	11	11	1	38	58	0	6	3	2	0	8	4	4	9
0	20	11	10	1	43	57	0	7	3	11	0	8	4	4	9
0	21	11	9	1	48	57	0	7	3	20	0	8	4	4	9
0	22	11	8	1	53	57	0	7	3	30	0	9	4	4	10
0	23	11	7	1	58	56	0	8	3	39	0	9	4	4	10
0	24	11	6	2	3	56	0	8	3	48	0	9	4	4	11
0	25	11	5	2	8	55	0	8	3	57	0	10	4	4	12
0	26	11	4	2	13	55	0	9	4	6	0	10	4	4	13
0	27	11	3	2	17	54	0	9	4	15	0	10	4	4	14
0	28	11	2	2	22	54	0	9	4	24	0	11	4	4	15
0	29	11	1	2	27	53	0	10	4	33	0	11	4	4	16
1	0	11	0	2	31	53	0	10	4	42	0	11	4	4	17
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(f0,1-3) 6, 6, 22 Oo; 7, 12, 17 Ou Co; 5, 11, 16 $c. **(f0,4)** 27 Oo; 21 $bn. **(f0,6)** 31 $htv $pm; 31'30" $c. **(f0,9)** 46 Ou Co. **(f0,11)** 57 Ct. **(f0,12)** 2 $htv $pm; =3 $c. **(f0,16)** 24 Cq *ut vid.* **(f0,20)** 46 Co. **(+f0,24)** 2 $htv $pm; =3 $c. **(+f0,26)** 12 Ou Co. **(f0,29)** 26 $bn. **(f1,0)** 32 $ba. **(g0,11)** 59 Ou Co. **(g0,12)** 59 Ou Co $bn; =60 $hts. **(g0,16)** 58 Ou Co. **(g0,20-1,0)** 57, 57--53: 57--53, 52 Ou Co. **(h)** *vacat* Co; *om.* Pa. **(j0,12)** 5 $htv $pm; 4 $c. **(j0,18)** 7 $htv $pm; 6 $c. **(j0,24)** 9 $htv $pm; 8 $c. **(j1,0)** 11 $htv $pm; 10 $c. **(k0,1-1,0)** {{4}}, 4...4 Pz. **(L0,3)** xxii Oo. **(L0,6)** 58 Ou Co $ba $bn $hts $htv $pm $c. **(L0,8)** 17 A. **(L0,9)** 28 Ou Co $ba $bn $hts. **(L0,11-12)** 47, 57 Ou Co $ba; 47, 56 $bn $hts. **(L0,16)** 34 Ou Co $ba $bn $hts. **(L0,25)** 50 Eq.ac. **(m-n, Inscr.)** proprior Xa, *saepius.* **(m)** *vacat* Co; *om.* Pa. **(n0,1-1,0)** =*(j0,1-1,0)* $htv. **(+n0,12)** 5 Co $pm $c. **(n0,13)** 4 Pz Xa Cq. **(+n0,17-28)** 7--10, 11: 6, 7--10 $ba $bn $hts. **(q0,1-1,0)** 5(10), 6(5), 7(2), 8(2), 9, 10(2), 11, 12(2), 14, 15(2), 16, 17 Ou; 5(10), 6(3), 7, 6, 7(2) *etc. ut ms. Ou,* Co. **(q0,9)** 5 $km.ON. **(q0,12)** 5 $bn $ba $hts; =6 $htv. **(q0,24)** 12 $bn $ba $hts $htv. **(q1,0)** 16 $ba.

				(Ece)		(Pro)	(Dlo)		(Ear)		(Dpr)		(Sta)		
Tabulae numeri				Aequatio centri		Proportionalia	Longitudo longior		Aequatio argumenti		Longitudo propior		Statio prima Iovis		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
1	1	10	29	2	36	52	0	10	4	51	0	11	4	4	18
1	2	10	28	2	41	51	0	11	5	0	0	12	4	4	19
1	3	10	27	2	45	51	0	11	5	8	0	12	4	4	20
1	4	10	26	2	50	50	0	11	5	17	0	13	4	4	21
1	5	10	25	2	55	50	0	12	5	26	0	13	4	4	22
1	6	10	24	2	59	49	0	12	5	34	0	13	4	4	23
1	7	10	23	3	4	49	0	12	5	43	0	14	4	4	24
1	8	10	22	3	8	48	0	13	5	52	0	14	4	4	25
1	9	10	21	3	12	47	0	13	6	0	0	14	4	4	26
1	10	10	20	3	16	47	0	13	6	9	0	15	4	4	27
1	11	10	19	3	20	46	0	14	6	17	0	15	4	4	28
1	12	10	18	3	24	46	0	14	6	25	0	15	4	4	29
1	13	10	17	3	28	45	0	14	6	33	0	16	4	4	30
1	14	10	16	3	32	44	0	15	6	41	0	16	4	4	31
1	15	10	15	3	36	43	0	15	6	49	0	17	4	4	32
1	16	10	14	3	40	43	0	15	6	57	0	17	4	4	33
1	17	10	13	3	44	42	0	16	7	5	0	18	4	4	34
1	18	10	12	3	47	41	0	16	7	12	0	18	4	4	35
1	19	10	11	3	51	40	0	16	7	20	0	19	4	4	37
1	20	10	10	3	55	39	0	17	7	28	0	19	4	4	38
1	21	10	9	3	58	38	0	17	7	35	0	19	4	4	40
1	22	10	8	4	2	37	0	17	7	43	0	20	4	4	42
1	23	10	7	4	5	36	0	18	7	50	0	20	4	4	43
1	24	10	6	4	8	35	0	18	7	57	0	20	4	4	44
1	25	10	5	4	12	35	0	18	8	4	0	21	4	4	46
1	26	10	4	4	15	34	0	19	8	11	0	21	4	4	48
1	27	10	3	4	18	33	0	19	8	17	0	21	4	4	49
1	28	10	2	4	21	32	0	19	8	24	0	21	4	4	51
1	29	10	1	4	24	31	0	20	8	31	0	22	4	4	52
2	0	10	0	4	27	30	0	20	8	37	0	22	4	4	53
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(b1,16) 17 Cq. **(e1,22)** 3 Co. **(f1,6)** 58 $pm; 58'30" $c. **(f1,11)** 24 A. **(f1,15)** 26 $ba. **(f1,18)** 48 $ba. **(f1,22)** 52 Co. **(f2,0)** 26 $pm $c. **(g1,2)** 52 $bn $hts. **(g1,12)** 45 Ct Ou Co $bn $hts. **(h)** *vacat* Co; *om.* Pa. **(j1,2)** 10 Xa. **(j1,6)** 13 $htv $pm $c. **(j1,11)** 13 Ou Co. **(j1,12)** 15 $htv $pm $c. **(j1,13)** 15 $hts. **(j1,18)** 17 $htv $pm $c. **(j1,23)** x4 Oo.ac?. **(j1,24)** 19 $htv $pm $c. **(j2,0)** 21 $htv $pm; =20 $c. **(L1,3)** 18 Co. **(L1,5)** 27 Pz. **(L1,6)** 39 Ou Co. **(L1,9)** 1 Ou Co $bn $hts. **(L1,12)** 26 $htv; 24 $c. **(L1,13)** 23 Ou Co. **(L1,21)** 36 $bn. **(L1,28)** xxo (=28) Oo. **(L2,0)** 38 Pa A. **(m)** *vacat* Co; *om.* Pa. **(n1,3)** 13 Pa A. **(n1,4)** 12 Ou Co $ba $bn $hts. **(n1,7)** 13 Ou Co $ba $bn $hts. **(n1,10)** 14 Ou Co $ba $bn $hts. **(n1,13)** 15 Ou Co $ba $bn $hts. **(n1,15-25)** 16(2) 17(2) 18(2) 19(2) 20(2) 21 Ou Co; 16 17(2) 18(2) 19(3) 20(3) $ba $bn $hts. **(+n1,24)** 21 Eq. **(n1,28)** 22 Ou Co. **(q1,1-15)** *see Appendix.* **(q1,16-30)** *see Appendix.* **(+q1,19-20)** 36, 39 $km.

				(Ece)		(Pro)	(Dlo)		(Ear)		(Dpr)		(Sta)		
Tabulae numeri				Aequa tio centri		Prop orti ona lia	Longi tudo lon gior		Aequa tio argu menti		Longi tudo pro pior		Statio prima Iovis		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
2	1	9	29	4	30	29	0	20	8	44	0	22	4	4	55
2	2	9	28	4	33	28	0	21	8	50	0	23	4	4	56
2	3	9	27	4	36	27	0	21	8	56	0	23	4	4	57
2	4	9	26	4	39	26	0	22	9	2	0	23	4	4	59
2	5	9	25	4	42	25	0	22	9	8	0	23	4	5	1
2	6	9	24	4	44	24	0	22	9	14	0	24	4	5	2
2	7	9	23	4	46	22	0	23	9	20	0	24	4	5	4
2	8	9	22	4	48	21	0	23	9	26	0	24	4	5	6
2	9	9	21	4	50	20	0	23	9	31	0	25	4	5	7
2	10	9	20	4	52	19	0	24	9	36	0	25	4	5	9
2	11	9	19	4	54	18	0	24	9	40	0	25	4	5	11
2	12	9	18	4	56	17	0	24	9	46	0	26	4	5	12
2	13	9	17	4	58	16	0	25	9	51	0	26	4	5	14
2	14	9	16	5	0	15	0	25	9	56	0	26	4	5	15
2	15	9	15	5	1	14	0	25	10	0	0	27	4	5	17
2	16	9	14	5	3	13	0	26	10	5	0	27	4	5	19
2	17	9	13	5	5	12	0	26	10	9	0	27	4	5	21
2	18	9	12	5	6	11	0	26	10	13	0	28	4	5	22
2	19	9	11	5	7	10	0	26	10	17	0	28	4	5	24
2	20	9	10	5	8	9	0	26	10	21	0	28	4	5	26
2	21	9	9	5	9	8	0	26	10	25	0	29	4	5	27
2	22	9	8	5	10	7	0	27	10	29	0	29	4	5	29
2	23	9	7	5	11	6	0	27	10	32	0	29	4	5	31
2	24	9	6	5	12	5	0	27	10	35	0	29	4	5	32
2	25	9	5	5	13	4	0	27	10	38	0	30	4	5	34
2	26	9	4	5	14	3	0	27	10	41	0	30	4	5	36
2	27	9	3	5	14	2	0	27	10	44	0	30	4	5	37
2	28	9	2	5	15	1	0	27	10	47	0	30	4	5	39
2	29	9	1	5	15	+ 1	0	27	10	49	0	30	4	5	41
3	0	9	0	5	15	2	0	27	10	51	0	30	4	5	42
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(b3,0) 30 Xg. **(e2,14)** 4 Eq. **(f2,1)** xix Oo. **(f2,6)** 42 $pm $c. **(f2,7)** 42 Xg. **(f2,11)** 44 Eq.ac. **(f2,12)** 55 $pm $c. **(f2,18)** 5 $pm $c. **(f2,22-23)** 11, 12 Ou Co. **(f2,24)** 13 Ou Co; 11 $pm $c. **(f2,26)** 13 $ba $bn $hts. **(f2,28)** 14 Ou Co $ba $bn $hts. **(f2,29-3,0)** 14, 14 $bn, *cf. Nallino II p. 238.* **(g2,1)** 28 Eq. **(g2,7)** 23? Oo.?ac. **(g2,19-28)** 10, 9--1: 9--1, 0 Ou Co $bn $hts. **(g2,28)** addatur *add.* Ct*(m2?)*, Oo Xa Ou; adde *add.* Eq Xc. **(g2,29)** 2 Oo; addatur *add.* Cq *(m2?)* Co. **(g3,0)** 1 Oo. **(h)** *vacat* Co; *om.* Pa. **(j2,4-13)** 21, 22(3), 23(3), 24(3) Ou Co $ba $bn $hts. **(+j2,6)** 23 $htv $pm; =22 $c. **(+j2,7-9)** 22(3) Oo. **(j2,14-24)** 25(4), 26(7) $ba; 25(4), 26(5), 27(2) $bn; 25(4), 26(6), 27 $hts; 25(3), 26(6), 27(2) Ou Co. **(+j2,18)** 25 $htv $pm $c. **(+j2,24)** 26 $htv $pm; =27 $c. **(j3,0)** 26 $htv $pm; 28 $c. **(k2,4)** 11 (!) Eq; 10 Xc. **(L2,3)** 53 Ou Co. **(L2,10)** 35 Ou Co. **(L2,11)** 41 Oo Ou Co Pa A $ba $bn $hts. **(L2,18)** 8 Co. **(L2,23)** xxxn (=39) Oo. **(L2,28)** 48 Eq. **(L3,0)** 52 Es. **(m)** *vacat* Co; *om.* Pa. **(n2,5-12)** 24(3) 25(3) 26(2) Ou Co $ba $bn $hts. **(n2,13-23)** 26 27(3) 28(3) 29(4) Ou Co $ba $bn $hts; 27(3) 28(3) 29(4) 38 Oo. **(n2,24)** 30 Oo Ou Co $ba $bn $hts $htv $pm; =29 $c. **(n2,28)** 31 Ou Co. **(n2,29)** 31 Ou Co $bn $hts. **(n3,0)** 31 Ou Co $bn $hts $htv $pm; =30 $c. **(q2,1)** 54 Ou Co $km. **(q2,2)** 55 Ou Co. **(q2,4)** 58 Oo. **(q2,6)** 52 $ba. **(q2,7-8)** 3, 5 Ou Co. **(q2,11)** 10 Ou Co. **(q2,12)** 11 Ou Co; 52 $ba. **(q2,14)** 16 Ou Co $km. **(q2,20)** 25 Ou Co. **(q2,23)** 30 Ou Co. **(q2,26)** 35 Ou Co. **(q2,27)** 36 Es. **(q2,29)** 40 Ou Co.

Tabulae numeri				(Ece) Centri aequatio		(Pro) Proportionalia	(Dlo) Longitudo longior		(Ear) Aequatio argumenti		(Dpr) Longitudo propior		(Sta) Statio prima Iovis		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
3	1	8	29	5	15	3	0	27	10	53	0	31	4	5	43
3	2	8	28	5	15	4	0	28	10	55	0	31	4	5	44
3	3	8	27	5	15	5	0	28	10	57	0	31	4	5	46
3	4	8	26	5	15	5	0	28	10	59	0	31	4	5	47
3	5	8	25	5	15	6	0	28	11	0	0	31	4	5	48
3	6	8	24	5	15	7	0	28	11	1	0	31	4	5	50
3	7	8	23	5	14	8	0	28	11	2	0	31	4	5	51
3	8	8	22	5	14	9	0	28	11	2	0	31	4	5	52
3	9	8	21	5	14	10	0	28	11	3	0	31	4	5	54
3	10	8	20	5	13	11	0	29	11	3	0	32	4	5	55
3	11	8	19	5	12	12	0	29	11	3	0	32	4	5	56
3	12	8	18	5	11	13	0	29	11	3	0	32	4	5	58
3	13	8	17	5	10	14	0	29	11	2	0	32	4	5	59
3	14	8	16	5	9	15	0	29	11	2	0	32	4	6	0
3	15	8	15	5	8	16	0	29	11	2	0	32	4	6	1
3	16	8	14	5	6	17	0	29	11	1	0	32	4	6	3
3	17	8	13	5	4	18	0	30	11	0	0	32	4	6	4
3	18	8	12	5	3	19	0	30	10	59	0	32	4	6	6
3	19	8	11	5	1	20	0	30	10	57	0	33	4	6	7
3	20	8	10	4	59	21	0	30	10	55	0	33	4	6	8
3	21	8	9	4	57	22	0	30	10	53	0	33	4	6	10
3	22	8	8	4	55	22	0	30	10	51	0	33	4	6	11
3	23	8	7	4	53	23	0	30	10	48	0	33	4	6	12
3	24	8	6	4	51	24	0	30	10	45	0	33	4	6	14
3	25	8	5	4	49	25	0	30	10	42	0	33	4	6	15
3	26	8	4	4	47	26	0	30	10	39	0	33	4	6	17
3	27	8	3	4	45	27	0	30	10	35	0	33	4	6	19
3	28	8	2	4	43	28	0	30	10	31	0	33	4	6	20
3	29	8	1	4	42	29	0	29	10	27	0	33	4	6	22
4	0	8	0	4	41	30	0	29	10	23	0	33	4	6	24
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(a4,0) 3 Oo, Pz.ac. **(e3,20)** 5 Ou Co $ba $hts. **(e3,21)** 5 $htv $pm. **(f3,1)** 14 $bn, *prave, cf. Nallino II p. 238.* **(f3,7)** 14 $bn. **(f3,10)** 14 Oo. **(f3,11-29)** *see Appendix.* **(f4,0)** 40 Ou Co $bn $hts; 39 $c. **(g3,17)** x[[.]] Oo. **(g3,22)** 23 Xc. **(h)** *vacat* Co; *om.* Pa. **(j3,3)** 27 $htv $pm; =28 $c. **(j3,6)** 27 $htv $pm; 29 $c. **(j3,9)** 27 $htv $pm; 29 Oo $ba $bn $c. **(j3,10-14)** 28...28 Co. **(+j3,12)** 28 $htv $pm; 30 $c. **(j3,15)** 28 Co $htv $pm; 30 Pa A $c. **(j3,16)** 28 Co; 30 Pa A. **(j3,17)** xx<-> Co. **(j3,18)** 29 $htv $pm; xx<-> Co; =30 $c. **(j3,21)** 29 $htv $pm; 30 $c. **(j3,29)** 30 $bn. **(j4,0)** 30 $htv $pm $c. **(k3,4)** 11 Ou Co $bn. **(k3,16-17)** 10,10 Pz. **(L3,2-9)** *see Appendix.* **(L3,15)** 1 $htv $pm $c. **(L3,25)** 47 Pz. **(L4,0)** 24 $pm $c. **(m)** *vacat* Co; *om.* Pa. **(+n3,6)** 32 $htv $pm $c. **(n3,9)** 32 Pz $htv $pm $c. **(n3,15-18)** 33...33 Pz. **(+n3,15)** 33 $htv $pm $c. **(+n3,18)** 33 $htv $pm $c. **(n3,19-20)** 32, 32 Oo; 32, 33 $hts. **(+n3,24)** 34 $htv $pm; =33 $c. **(+n3,27)** 34 $htv $pm; =33 $c. **(n4,0)** 34 $htv $pm; =33 $c. **(p3,22)** 5 Oo. **(p3,30)** 5 Oo. **(q3,2)** 45 Ou Co. **(q3,8)** 53 Ou Co. **(q3,11)** 57 Ou Co. **(q3,14)** 1 Ou Co. **(q3,15)** 2 Ou Co $km. **(q3,16-17)** 4, 5 Ou Co. **(q3,18)** 5 Eq Xc. **(q3,20)** 9 Ou Co. **(q3,23)** 13 Ou Co. **(q3,25)** 16 Ou Co. **(q3,26)** 19 Eq. **(q3,28-29)** 21, 23 Ou Co.

				(Ece)		(Pro)	(Dlo)		(Ear)		(Dpr)		(Sta)		
Tabulae numeri				Aequa tio centri		Prop orti ona lia	Longi tudo lon gior		Aequa tio argu menti		Longi tudo pro pior		Statio prima Iovis		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
4	1	7	29	4	38	31	0	29	10	19	0	32	4	6	25
4	2	7	28	4	35	32	0	29	10	15	0	32	4	6	27
4	3	7	27	4	32	33	0	29	10	10	0	32	4	6	29
4	4	7	26	4	29	34	0	29	10	5	0	32	4	6	30
4	5	7	25	4	26	35	0	29	10	0	0	32	4	6	32
4	6	7	24	4	23	36	0	29	9	54	0	32	4	6	34
4	7	7	23	4	20	37	0	28	9	48	0	32	4	6	35
4	8	7	22	4	16	38	0	28	9	42	0	31	4	6	36
4	9	7	21	4	12	39	0	28	9	36	0	31	4	6	37
4	10	7	20	4	9	40	0	28	9	30	0	31	4	6	38
4	11	7	19	4	5	41	0	28	9	24	0	31	4	6	39
4	12	7	18	4	1	41	0	28	9	17	0	31	4	6	41
4	13	7	17	3	58	42	0	27	9	10	0	31	4	6	42
4	14	7	16	3	54	43	0	27	9	2	0	30	4	6	43
4	15	7	15	3	50	43	0	27	8	54	0	30	4	6	44
4	16	7	14	3	46	44	0	26	8	47	0	30	4	6	45
4	17	7	13	3	42	45	0	26	8	39	0	30	4	6	46
4	18	7	12	3	38	46	0	26	8	31	0	29	4	6	47
4	19	7	11	3	34	46	0	25	8	22	0	29	4	6	48
4	20	7	10	3	30	47	0	25	8	13	0	28	4	6	49
4	21	7	9	3	25	47	0	25	8	4	0	28	4	6	50
4	22	7	8	3	21	48	0	24	7	55	0	27	4	6	51
4	23	7	7	3	16	48	0	24	7	45	0	27	4	6	52
4	24	7	6	3	11	49	0	24	7	36	0	26	4	6	53
4	25	7	5	3	7	49	0	23	7	26	0	26	4	6	54
4	26	7	4	3	2	50	0	23	7	16	0	25	4	6	55
4	27	7	3	2	57	50	0	23	7	6	0	25	4	6	56
4	28	7	2	2	53	51	0	22	6	55	0	24	4	6	57
4	29	7	1	2	48	51	0	22	6	45	0	23	4	6	58
5	0	7	0	2	43	52	0	21	6	34	0	22	4	6	59
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(a5,0) 4 Oo Co.ac A. **(e4,27)** 3 Eq. **(f4,3)** 33 $pm; 31 $c. **(f4,5)** 25 Ou Co. **(f4,8)** 19 Ou. **(f4,9)** 13 $htv $pm; =12 $c. **(f4,13-14)** 59, 59 Co. **(f4,23-5,0)** *see Appendix.* **(g4,1-2)** 21, 22 Oo. **(g4,7-11)** 36...40 Ou Co $bn $hts. **(g4,12)** 42 Oo. **(g4,13-22)** 41 42 43 43 44 45 45 46 47 47 $bn $hts. **(g4,23-29)** 49 49 50 50 51 51 52 Ou Co. **(h)** *vacat* Co; *om.* Pa. **(j4,16)** 27 Co.ac $ba. **(j4,24)** 23 $htv $pm $c. **(j4,27)** 22 $bn $htv $pm $c; =23 $hts. **(j4,29)** 21 $bn. **(j5,0)** 22 Ou Co Eq Xc Es Xg; 20 $c; =21 $ba $bn $htv $pm, *cett.* **(k4,5)** 9 Eq. **(k4,21)** 7 Oo. **(k4,22)** 8 Co. **(L4,12)** 28 Eq; 18 Xc; 16 $pm; =17 $c. **(L4,15)** 55 $bn $c; 52 $htv. **(L4,16)** 46 Pa A. **(L4,18)** 30 $pm $c. **(L4,23)** 46 Ou Co $bn $hts. **(L4,26)** 15 $hts. **(L4,27)** 5 Ou Co $bn $hts $htv $c. **(m)** *vacat* Co; *om.* Pa. **(n4,3)** 33 $htv $pm; =32 $c. **(n4,6)** 33 $htv $pm; =32 $c. **(n4,9)** 32 $htv $pm; =31 $c. **(n4,12)** 32 $htv $pm; 30 $c. **(n4,14)** 31 Pa. **(n4,15)** 31 $htv $pm; 29 $c. **(n4,18)** 30 $htv $pm; 28 $c. **(n4,20)** 29 Ou Co $bn. **(n4,25)** 25 Ou Co $bn $hts. **(n4,27)** 24 Ou Co $ba $bn $hts. **(n5,0)** 23 $htv $pm $c. **(p5,0)** 5 Pz. **(q4,1)** 27 Pz; 26 Ou Co. **(q4,5)** 33 $km. **(q4,7-15)** *see Appendix.* **(+q4,8)** 37 Co Eq Xc. **(+q4,11)** 31 A. **(q4,16-5,0)** *see Appendix.* **(+q4,18)** 46 $htv.

				(Ece)		(Pro)	(Dlo)		(Ear)		(Dpr)		(Sta)		
Tabulae numeri				Aequa tio centri		Prop orti ona lia	Longi tudo lon gior		Aequa tio argu menti		Longi tudo pro pior		Statio prima Iovis		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
5	1	6	29	2	39	52	0	21	6	23	0	22	4	7	0
5	2	6	28	2	34	53	0	20	6	12	0	21	4	7	1
5	3	6	27	2	29	53	0	19	6	0	0	21	4	7	2
5	4	6	26	2	24	53	0	19	5	48	0	20	4	7	2
5	5	6	25	2	19	54	0	18	5	36	0	19	4	7	3
5	6	6	24	2	14	54	0	17	5	24	0	18	4	7	4
5	7	6	23	2	9	55	0	17	5	12	0	18	4	7	5
5	8	6	22	2	4	55	0	16	5	0	0	17	4	7	5
5	9	6	21	1	58	56	0	15	4	47	0	16	4	7	6
5	10	6	20	1	53	56	0	15	4	34	0	16	4	7	6
5	11	6	19	1	48	57	0	14	4	21	0	15	4	7	7
5	12	6	18	1	42	57	0	13	4	8	0	14	4	7	7
5	13	6	17	1	37	57	0	13	3	55	0	14	4	7	8
5	14	6	16	1	31	58	0	12	3	42	0	13	4	7	8
5	15	6	15	1	25	58	0	11	3	29	0	13	4	7	9
5	16	6	14	1	20	58	0	11	3	16	0	12	4	7	9
5	17	6	13	1	15	59	0	10	3	3	0	11	4	7	9
5	18	6	12	1	9	59	0	9	2	49	0	10	4	7	10
5	19	6	11	1	4	59	0	9	2	35	0	10	4	7	10
5	20	6	10	0	58	59	0	8	2	21	0	9	4	7	10
5	21	6	9	0	52	60	0	7	2	7	0	8	4	7	10
5	22	6	8	0	47	60	0	7	1	53	0	7	4	7	10
5	23	6	7	0	41	60	0	6	1	39	0	7	4	7	11
5	24	6	6	0	35	60	0	5	1	26	0	6	4	7	11
5	25	6	5	0	30	60	0	5	1	11	0	5	4	7	11
5	26	6	4	0	24	60	0	4	0	57	0	4	4	7	11
5	27	6	3	0	18	60	0	3	0	43	0	3	4	7	11
5	28	6	2	0	12	60	0	2	0	29	0	2	4	7	11
5	29	6	1	0	6	60	0	1	0	15	0	1	4	7	11
6	0	6	0	0	0	60	0	0	0	0	0	0	4	7	11
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(e5,9-10) 2,2 Pz. **(e5,18)** 0 Oo. **(e5,19)** 0 Oo Co. **(e5,20-21)** 1,1 Pz. **(f5,1-24)** *see Appendix*. **(+f5,7)** 8 Ou Co. **(+f5,12)** 43 Pz Ou Co. **(+f5,13)** 36 Ou Co $bn. **(+f5,19)** 3 Pa A. **(+f5,23)** 51 Pz; 42 Ou Co $bn $hts. **(+f5,24)** 36 $bn. **(+f5,27)** 17 $pm $c. **(g5,1)** 53 Eq Xc. **(g5,4)** 54 Ou Co. **(g5,7-6,0)** 55(3), 56(3), 57(3), 58(3), 59(4), 60(8) Ou Co. **(+g5,20)** 60 $bn $hts. **(h)** *vacat* Co; *om.* Pa. **(L5,9)** 37 $htv; =47 $c. **(L5,10)** 35 Ou Co $ba $bn $hts. **(L5,11)** 22 Ou Co Es Xg $ba $bn $hts. **(L5,12)** 9 Ou Co $ba $bn $hts $htv $pm $c. **(L5,13)** 56 Ou Co $ba $bn $hts. **(L5,18)** x'ii Oo. **(L5,19)** 25 Ou Co. **(L5,24)** 25 Ou Co.pc $ba $bn $hts $htv $pm $c. **(L5,28)** xxii Oo. **(L5,29)** 16 Ct Oo. **(m)** *vacat* Co; *om.* Pa. **(n5,1-25)** 22(2), 21, 20(2), 19, 18(2), 17, 16(2), 15, 14(2), 13, 12, *(=col. (j) duobus additis)* 11, 10, 9(2), 8...4 $htv. **(+n5,3)** 20 Ou Co $ba $bn $hts. **(+n5,6)** 19 $pm $c. **(+n5,9)** 17 $pm $c. **(+n5,12)** 15 $pm $c. **(+n5,15)** 12 Ou Co $ba $bn $hts. **(+n5,23)** 6 Ou Co $bn $hts. **(+n5,24)** 5 Ou Co $bn $hts $pm $c. **(q5,1-6,0)** 1, 1, 2, 3, 3, 4, 5, 5, 6, 7, 7, 8, 8, 9, 9, 10(3), 11(11), 11 (10 Co) Ou Co. **(q5,1)** 1 Pa A $km. **(q5,2)** 0 Pa A. **(q5,4)** 3 Pa; *n.l.* A. **(q5,5)** *n.l.* A. **(q5,8)** 6 Eq Xc. **(q5,12)** 8 $bn $ba $hts $htv. **(q5,16-17)** 9, 10 Oo; 10, 10 Xg. **(q5,18)** 9 $km; 11 $bn $ba $hts $htv. **(q5,22)** 11 Eq. **(q5,23)** 10 $km.

EA51: Appendix to the apparatus.

```
(q1,1-15)     18 19 20 21 22 23 24 25 26 27 28 29 30 31 32:  plerique, $km;
              18 19 20 20 21 22 23 24 25 26 27 28 29 30 31   Ou Co;
               -  -  -  -  - 22  -  -  -  -  - 28  -  -  -   $bn $ba;
               -  - 19  -  - 22  -  - 25  -  - 28  -  - 31   $hts $htv.

(q1,16-30)    33 34 35 37 38 40 42 43 44 46 48 49 51 52 53:  plerique, $km fere;
              32 33 34 36 37 38 39 40 42 43 45 46 48 50 52   Ou Co;
               -  - 34  -  -  -  -  - 43  -  -  -  -  - 52   $bn $ba
               -  - 34  -  - 39  -  - 43  -  - 48  -  - 52   $hts $htv.

(f3,11-29)    12 11 10  9  8 6 4 3 1 59 57 55 53 51 49 47 45 43 42:  plerique;
              13 12 11 10  9 8 6 4 3  1 59 57 55 53 51 49 47 45 43   Ou Co $ba $bn $hts;
              13 12 11 10  9 8 7 6 4  3  1 59 57 55 53 51 49 47 44   $htv;
               - 12  -  - 10 - - 6 -  -  1  -  - 55  -  - 49  -  -   $pm;
              12 11 10  9  8 6 5 4 2  0 59 57 55 53 51 49 46 44 41   $c.

(L3,2-9)      55 57 59  0 1 2 2 3:  plerique, $hts $ba;
              56 59  0  1 2 2 2 3   Ou Co $bn;
              55 57 58 59 0 1 2 2   $htv;
               - 57  -  - 0 - - 2   $pm;
              55 57 58 59 0 1 2 3   $c.

(f4,23-5,0)   16 11 7 2 57 53 48 43:  omnes, $bn $ba $hts;
              17 12 8 3 58 54 49 44   $c;
              17 13 9 4 59 55 50 45   $htv;
               - 13 - - 59  -  - 45   $pm.

(q4,7-15)     35 36 37 38 39 41 42 43 44:  plerique, $km;
              36 38 39 40 41 42 43 44 45   Ou, Co(v.i.);
               -  -  -  -  - 42  -  -  -   $bn $ba;
               -  - 38  -  - 42  -  - 45   $hts $htv.

(q4,16-5,0)   45 46 47 48 49 50 51 52 53 54 55 56 57 58 59:  plerique, $km;
              46 47 48 49 50 51 52 53 54 55 56 57 58 59  0   Ou Co;
               -  - 48  -  -  -  -  - 54  -  -  -  -  -  0   $bn $ba;
               -  - 48  -  - 51  -  - 54  -  - 57  -  -  0   $hts, $htv(v.i.).

(f5,1-24)     39 34 29 24 19 14  9  4 58 53 48 42 37 31 25 20 15  9 4 58 52 47 41 35:
                                                                 omnes, $ba $bn $hts;
               .  . 29  .  . 14  .  . 58  .  . 42  .  . 25  .  .  9 .  . 52  .  . 35   $c;
              40 35 30 25 20 15 10 14 59 54 48 43 38 32 27 22 16 10 5 59 53 48 42 36   $htv;
               -  - 30  -  - 15  -  - 59  -  - 43  -  - 27  -  - 11 -  - 53  -  - 36   $pm.
```

EA61. Equation of Mars.

Toomer 1968, no. 42. — From Albattani, Nallino II p. 120-25, but "statio prima" is like Khw/M, Suter Tab.39-44 p.150-55. See notes to EA41-81.

Witnesses: **{a0}** Ct,17r-18r; Oo,13r-14r; Pz,120r-121r; Mc,12r-13r; Mb,43r-v; Ey,42v-45r; Da,198v-200r; Ea,42v-43v. — **{a1}** Xa,22v-23v; Ad,86v-87v; Cq,40-42; Fc,23r-25v; Ps,49v-52r; Sg,128-133; Wd,21v-22v; Fh,34r-36v; Xw,21v-22v. — **{a2}** Cz,68v-71r; Cj,141v-144r; Md,73v-76r; Mp,206r-208v; Vp,123v-126r. — **{aX}** Vo,43r-45v; R,41r-43v; Ov,66v-69r; Cu,66v-69r; Ep,42r-44v. — **{aT}** Lu,49v-52r; Oj,122r-124v; P,104r-106v. — **{k}** Eh,84r-86v; Lw,79r-81v; Ou,57r-59v; Eg,14r-15r; Co,157v-158v; Cn,91v-93r. — **{d}** Op,48v-51r; C,317-322; Lb,18r-20v; Pa,34r-36v; A,213r-215v; Fj,34r-36v; Nc,103r-105v; Pb,25r-27v; Pv,18r-20v; Fd2,35r-37v; Gr3,106r-108v; Ok,40v-43r. — **{e}** Eq,64v-67r; Ek3,92v-95r; Xc,58v-61r; Vj,82r-84v; Ej,65r-67v. — **{x}** Oc,69v-72r; X,146v-149r; Vz,61v-64r; Mv,82v-85r; Cm,198v-201r; B,138v-141r; T,287v-288v; Lf,86v-89r; Lg,165v-168r; Lh,131v-134r; Xj,269v-272r; Xg,49v-52r; G,54r-56v (start missing); Xb,69r-71v; Es,170v-173r; Fb,59v-62r; Pq,178v-181r; Oy,66v-69r; Wa,62r-63v; Ow,149v-152r; Nu,134v-137r. — **{p}** O,64r-66v; Pd,63v-66r; Ch2,164r-166v. — **{?}** Ch,68r-70v (:Savasorda 2); Ch,29v-32r (:Savasorda 1; numbers aberrant); Pn,39r-41v (:Jo. Lin.). — Duplicates in {?} Ch, each in its own collection.

Headings. — General:

(1: none) :: {a0:} Ct Oo Mc Mb Da, {a1:} Ad Sg Fh Xw, {d?:} Lb Ok.
(2) (Cursus+ Ps Wd) **Martis** :: {a1:} Xa Cq Ps Wd; {p:} Ch2. — *Added:* **+Aequatio Martis** Xa Cq.
(3) Aequatio (**/-ones** Lu Oj P X) **Martis** :: {a0:} Ea; {aT:} Lu Oj P; {d:} Pa A Fj Nc Pb Pv Fd2 Gr3; {x:} X Wa; {p:} Pd; {?:} Ch(29v,68r).
(4) Tabula aequationis Martis (**+prima** Ov! Vp! Ou Op C O!) :: {a0:} Ey; {a1:} Fc!, {a2:} Cz Cj Md Mp Vp; {aX:} Ov R Cu Ep!; {k:} Lw Ou Eg Co; {d?:} Op C; {e:} Eq Ek3 Xc Vj Ej; {x-}; {p:} O; {?:} Pn. — "prima" is variously placed in Vp Ov O.
(5: other) :: Pz ("Tabula Martis"); Md ("De Marte", then the above); Vo Eh Cn.

Entrance columns: mostly, **(6) Tabulae numeri** (earlier); **(7) Lineae numeri** (later). — **(8) Lineae numeri communes** :: {d:} Lb Pa A Fj Nc Pb Pv Fd2 Gr3; {p:} O Pd; {x:} Xj. — **(9) Lineae numeri communes centro et argumento** :: {a2:} Mp; {e:} Xc Vj Ej; {x:} Oc! Vz Xb Es; {?:} Pn. — **(10: other)** :: Pz ("Lineae n. tabulae n."); Fh & Ok (both "T. vel l.n."); Ps Lf Ch (29v,68r).

.Ece: **(11) Aequatio centri** :: normally. — **(12) Aequatio puncti** :: {a0:} Ct Oo Da, {k:} Ou. — **(13) Aequatio portionis vel puncti** (p.v.p.: Eg; po. et pu. Lw; pu. et po. Co) :: {k:} Lw Eg Co. — **(14: other)** :: Pz ("Aequatio centri id est puncti"); Cn ("Aeq. cuspidis"); Eh Ch(29v,68r).

.Pro: mostly, **(15) Proportionalia,** with **Minuta** before or after. — **(16) Minuta partium** :: {a0:} Pz Da; {k:} Eh Lw Ou Eg Co Cn. — **(17) Partium** (with **m'a** attached) :: Mb Oo. — **(18: other)** :: Ct (just the sign "minuta"); Ch(29v,68r).

.Dlo: **(19) Longitudo longior,** except: **(20)** Pz ("Longior longitudo"); Eh (none).

.Ear: **(21) Aequatio argumenti** :: normally. — **(22) Aequatio portionis** {a0:} Ct Oo Da; {aT:} Lu Oj P; {k:} Eh Lw Ou Eg Co Cn. — **(23: other)** :: Pz ("aeq. arg. \portionis/"); Ps G; Ch(29v,68r).

.Dpr: **(24) Longitudo propior** (proprior, occasionally; propinquior Pa A Fj Gr3 Eg) :: everywhere.

.Sta: **(25) Statio Martis prima** or **(26) Statio prima Martis** :: normally. — **(27) Statio prima** :: {a0:} Ey; {a2:} Vp; {aX} R Cu; {aT:} Lu; {d:} Lb Pa A Fj Nc Pb Pv Fd2 Gr3; {x:} Wa; {p:} O Pd Ch2; {?} Pn Ch(29v,68r). — **(28: other)** :: Eg Ps. — Mb Ps show separate tables; see "Versions".

Versions. Ep interchanges sub-tables .Dlo and .Dpr. — Ey shows the order "... .Ear .Dlo .Dpr ...", with .Dlo .Dpr under the common heading "Diversitas diametri epicycli". Mb Ps have .Sta apart from the rest; cf. EB21. In the rest of the witnesses the sub-tables are ordered as indicated.

Values. Parameters: eccentricity of deferent 6;0, radius of epicycle 39;30.

Text. For detailed references and summary on coverage, see preface to EA41-81. — Witnesses collated for values, entire table: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** Lu; **{k}** Ou Co; **{d}** Pa A; **{e}** Eq Xc; **{x}** Es Xg. — Headings according to Xa. Xa Cq have "Martis" as a general page-heading, here reproduced once; in both mss. "Aequatio Martis" heads the table for sign 1, and forms part of the entrance-column headings of the tables for signs 2-3.

Parallels collated, all sub-tables except .Sta: for all degrees of the argument, **$ba** = Batt., Paris Arsenal 8322, 72v-75r; **$bn** = Batt., Nallino II p.120-125; **$hts** = Stahlman 1960, table 43. — Collated for 6°(6)90°(3)180°: **$htv** = Handy Tables, Vat. gr. 304, 225v-228r; **$pm** = Almagest XI,11, Toomer p.551.

Parallels collated for .Sta: for all degrees of the argument, **$km** = Khw/M, Suter table 39-44, first stations. — At 6-degree intervals only: **$ba** = *ms. cit.*, 81v; **$bn** = *op. cit.*, p. 138; **$hts** = Stahlman 1960, table 53; **$htv** = *ms. cit.*, 240v. In passages, $hts and $htv may be quoted at 3-degree intervals, but this is not general; see under EA41-81, section (B).

Recomputation: **$c,** for .Ece .Dlo .Ear .Dpr only, and quoted in selection, mainly where it differs from the adopted text by 3′ or more; see under EA41-81, section (A). For the parameters, see "Values" above.

Errors. — *.Ece* (f3,8+): the vulgate and $ba show a slide against the consensus of the Almagest, the Handy Tables, $bn and mss. Ou Co. This is a clear example of $ba forming an error group together with the vulgate against Ou Co.

.Sta (q0,7+): the vulgate partly agrees with Ou Co and Albattani instead of with $km. Perhaps this is due to slides that cancel each other out; or else $km is in error alone.

Martis.

				(Ece)		(Pro)	(Dlo)		(Ear)		(Dpr)		(Sta)		
Tabulae numeri				Aequa tio centri		Prop orti ona lia	Longi tudo lon gior		Aequa tio argu menti		Longi tudo pro pior		Statio prima Martis		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
0	1	11	29	0	11	-60	0	2	0	24	0	2	5	7	28
0	2	11	28	0	22	60	0	3	0	48	0	3	5	7	29
0	3	11	27	0	33	60	0	4	1	12	0	4	5	7	30
0	4	11	26	0	44	60	0	6	1	36	0	6	5	7	31
0	5	11	25	0	55	60	0	7	2	0	0	7	5	7	32
0	6	11	24	1	5	59	0	8	2	24	0	9	5	7	33
0	7	11	23	1	16	59	0	10	2	48	0	10	5	7	34
0	8	11	22	1	27	59	0	11	3	12	0	12	5	7	34
0	9	11	21	1	38	59	0	12	3	36	0	13	5	7	35
0	10	11	20	1	49	59	0	14	3	59	0	15	5	7	36
0	11	11	19	2	0	59	0	15	4	23	0	16	5	7	37
0	12	11	18	2	10	59	0	16	4	46	0	17	5	7	38
0	13	11	17	2	21	58	0	18	5	10	0	18	5	7	39
0	14	11	16	2	32	58	0	19	5	34	0	20	5	7	40
0	15	11	15	2	42	58	0	20	5	57	0	21	5	7	42
0	16	11	14	2	53	57	0	22	6	21	0	22	5	7	44
0	17	11	13	3	3	57	0	23	6	44	0	24	5	7	45
0	18	11	12	3	13	57	0	24	7	8	0	26	5	7	47
0	19	11	11	3	24	56	0	26	7	32	0	28	5	7	49
0	20	11	10	3	35	56	0	27	7	56	0	29	5	7	51
0	21	11	9	3	45	56	0	28	8	19	0	31	5	7	52
0	22	11	8	3	56	55	0	30	8	43	0	32	5	7	54
0	23	11	7	4	6	55	0	32	9	6	0	34	5	7	56
0	24	11	6	4	16	55	0	33	9	30	0	35	5	7	59
0	25	11	5	4	26	54	0	35	9	54	0	37	5	8	2
0	26	11	4	4	36	54	0	37	10	18	0	39	5	8	4
0	27	11	3	4	46	53	0	38	10	41	0	41	5	8	6
0	28	11	2	4	56	53	0	40	11	5	0	42	5	8	9
0	29	11	1	5	6	52	0	41	11	28	0	44	5	8	12
1	0	11	0	5	16	52	0	43	11	51	0	46	5	8	15
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(a1,0) t Pz; 0 Oo Cq.ac. **(f0,3)** 34 Oo; 23 $ba. **(f0,4)** 24 $ba. **(f0,14-15)** 22, 41 Oo. **(f0,16)** 52 Pz. **(f0,27-29)** 45, 50, 7 $ba. **(g0,6)** 60 Ou Co $ba. **(g0,11-12)** 58 58 $bn. **(g0,27)** 54 Eq.ac. **(g0,29-1,0)** 54, 54 Pz. **(h)** *vacat* Co. **(j0,3)** 3 Oo. **(j0,4)** 5 Ct. **(j0,9)** 13 Xa. **(j0,25)** 36 Ou Co. **(j1,0)** 42 Ou Co $ba $bn $hts $htv $pm; 41 $c. **(L0,3)** xN (=19) Oo. **(L0,7)** 43 Ou Co. **(L0,9)** 35 Ou Co $ba $bn $hts. **(L0,11)** 26 Pz. **(L0,12-13)** 47 11 $bn. **(L0,17)** 54 Pz; 45 Ou Co $bn $hts. **(L0,19)** 22 Co. **(L0,21)** 18 Ou Co. **(L0,23)** 7 Ou Co $bn $hts. **(L0,29)** 21 Oo. **(L1,0)** 5 Oo; 54 $htv; 50 $c. **(m-n, Inscr.)** proprior Xa, *saepius.* **(m)** *vacat* Co. **(n0,6)** 8 Ou Co $ba $bn $hts; =9 $htv $pm. **(n0,11-26)** *see Appendix.* **(+n0,11)** 16 $ba. **(+n0,23-0,24)** 35, 34 Pz. **(n0,28-29)** 43, 45 Ou Co $ba $bn $hts. **(q0,7-16)** *see Appendix.* **(+q0,11-16)** *see Appendix.* **(q0,17-26)** *see Appendix.* **(+q0,18)** 44 $ba. **(+q0,24-26)** *see Appendix.*

				(Ece)		(Pro)	(Dlo)		(Ear)		(Dpr)		(Sta)		
Aequatio Martis Tabulae numeri				Aequa tio centri		Prop orti ona lia	Longi tudo lon gior		Aequa tio argu menti		Longi tudo pro pior		Statio Martis prima		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
1	1	10	29	5	26	51	0	44	12	15	0	48	5	8	18
1	2	10	28	5	36	51	0	46	12	38	0	50	5	8	21
1	3	10	27	5	45	50	0	47	13	1	0	51	5	8	24
1	4	10	26	5	55	50	0	49	13	25	0	53	5	8	27
1	5	10	25	6	4	49	0	51	13	48	0	55	5	8	30
1	6	10	24	6	13	49	0	52	14	11	0	56	5	8	33
1	7	10	23	6	22	48	0	54	14	34	0	58	5	8	37
1	8	10	22	6	31	47	0	55	14	57	1	0	5	8	41
1	9	10	21	6	40	47	0	57	15	20	1	1	5	8	45
1	10	10	20	6	49	46	0	58	15	43	1	3	5	8	49
1	11	10	19	6	58	45	0	59	16	6	1	5	5	8	53
1	12	10	18	7	7	45	1	1	16	29	1	6	5	8	57
1	13	10	17	7	16	44	1	2	16	52	1	8	5	9	2
1	14	10	16	7	24	44	1	3	17	15	1	10	5	9	6
1	15	10	15	7	32	43	1	5	17	38	1	11	5	9	9
1	16	10	14	7	41	42	1	6	18	1	1	13	5	9	13
1	17	10	13	7	49	41	1	8	18	24	1	15	5	9	17
1	18	10	12	7	57	40	1	9	18	46	1	16	5	9	21
1	19	10	11	8	5	40	1	11	19	9	1	18	5	9	26
1	20	10	10	8	13	39	1	12	19	31	1	20	5	9	31
1	21	10	9	8	20	38	1	13	19	53	1	22	5	9	36
1	22	10	8	8	27	37	1	15	20	16	1	24	5	9	41
1	23	10	7	8	35	36	1	16	20	38	1	26	5	9	46
1	24	10	6	8	42	35	1	17	21	0	1	28	5	9	51
1	25	10	5	8	50	34	1	19	21	23	1	30	5	9	56
1	26	10	4	8	57	33	1	21	21	45	1	32	5	10	1
1	27	10	3	9	4	32	1	22	22	7	1	34	5	10	6
1	28	10	2	9	11	31	1	24	22	29	1	36	5	10	11
1	29	10	1	9	18	30	1	26	22	51	1	38	5	10	16
2	0	10	0	9	24	30	1	27	23	13	1	40	5	10	21
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(e1,27) 8 Pz. **(f1,10)** 19 Co. **(f1,11)** 58: *aut* 56 Xg; 56 Es. **(f1,14)** 28 Lu. **(f1,21)** 21 Oo.ac Ou Co $c. **(f1,22)** 28 Ou Co $ba $bn $hts $c. **(f1,25)** 5 Co. **(f1,26)** 56 Ct.?pc. **(f1,27)** 41 $ba; 5 $bn. **(f1,28)** 12 Es Xg. **(f2,0)** 28 $htv; =24 $c. **(g1,11)** 46 Ou Co. **(g1,19)** 49 $ba. **(g1,25-27)** 35 34 33 $bn $hts. **(g1,28-29)** 32, 31 Ou Co $bn $hts. **(j1,1)** 43 Oo. **(j1,3-4)** 46, 48 Ou Co. **(j1,4)** 46 Xc. **(j1,5)** 50 Ou. **(j1,6)** 51 $htv $pm; 50 $c. **(j1,9)** 56 Ou Co $hts. **(j1,12)** 0 $htv $pm; (0;)59 $c. **(j1,14)** 4 Ou Co $ba $bn $hts. **(j1,16)** 7 Ou Co $ba $hts. **(j1,24)** 18 $htv $pm $c. **(j1,25)** 14 $ba. **(j2,0)** 26 Pa A $htv; 28 $c. **(k1,13)** 17 Pz. **(k2,0)** 22 Oo; 33 Ou. **(L1,6)** 1 $htv; 10 $c. **(L1,7)** 38 A. **(L1,11)** 7 Ou Co. **(L1,14)** 50 Pz. **(L1,19)** 7 Pz. **(L1,21)** 33 Pz; 13 Ou Co. **(L1,25)** 33 Pz. **(L1,28)** 10 Es. **(m1,8)** 0 Pz. **(n1,6)** 57 $bn. **(n1,25)** 39 Ou. **(n1,26)** 33 A. **(q1,3)** 23 Ou. **(q1,4)** *n.l.* A. **(q1,6)** 34 Co. **(q1,7)** 36 Ou Co. **(q1,11)** 54 Ou Co. **(q1,12)** 50 $ba. **(q1,13)** 1 Ou Co. **(q1,14)** 5 Ou Co $km. **(q1,17)** 16 Ou Co. **(q1,19-1,20)** *vacat* Pz. **(q1,24)** 52 Ou Co. **(q1,27)** 5 Oo. **(q1,29)** 15 $km.C.

				(Ece)		(Pro)	(Dlo)		(Ear)		(Dpr)		(Sta)		
Aequatio Martis tabulae numeri				Aequa tio centri		Prop orti ona lia	Longi tudo lon gior		Aequa tio argu menti		Longi tudo pro pior		Statio Martis prima		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
2	1	9	29	9	31	29	1	29	23	35	1	42	5	10	27
2	2	9	28	9	37	28	1	31	23	57	1	44	5	10	33
2	3	9	27	9	43	27	1	32	24	18	1	46	5	10	39
2	4	9	26	9	49	26	1	34	24	40	1	48	5	10	44
2	5	9	25	9	55	25	1	36	25	1	1	50	5	10	50
2	6	9	24	10	0	24	1	37	25	22	1	53	5	10	56
2	7	9	23	10	5	23	1	39	25	44	1	55	5	11	2
2	8	9	22	10	10	22	1	41	26	5	1	57	5	11	8
2	9	9	21	10	15	21	1	43	26	26	1	59	5	11	14
2	10	9	20	10	20	20	1	45	26	47	2	1	5	11	19
2	11	9	19	10	25	19	1	47	27	8	2	3	5	11	25
2	12	9	18	10	29	17	1	49	27	29	2	6	5	11	31
2	13	9	17	10	34	16	1	51	27	50	2	8	5	11	37
2	14	9	16	10	38	15	1	53	28	11	2	10	5	11	43
2	15	9	15	10	42	14	1	55	28	31	2	12	5	11	50
2	16	9	14	10	46	13	1	57	28	52	2	14	5	11	56
2	17	9	13	10	50	12	1	59	29	12	2	16	5	12	2
2	18	9	12	10	53	11	2	1	29	32	2	19	5	12	9
2	19	9	11	10	57	10	2	3	29	52	2	21	5	12	15
2	20	9	10	11	0	9	2	5	30	12	2	23	5	12	21
2	21	9	9	11	3	8	2	8	30	32	2	26	5	12	28
2	22	9	8	11	6	7	2	10	30	52	2	28	5	12	34
2	23	9	7	11	9	6	2	12	31	11	2	30	5	12	40
2	24	9	6	11	12	4	2	14	31	30	2	33	5	12	47
2	25	9	5	11	15	3	2	16	31	49	2	35	5	12	53
2	26	9	4	11	17	2	2	18	32	8	2	38	5	12	59
2	27	9	3	11	19	1	2	21	32	27	2	41	5	13	6
2	28	9	2	11	21	+ 1	2	23	32	46	2	43	5	13	12
2	29	9	1	11	22	2	2	25	33	4	2	46	5	13	18
3	0	9	0	11	23	3	2	28	33	22	2	49	5	13	25
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(a3,0) 2 Oo. **(b3,0)** 30 Pz. **(e2,6-7)** 9, 9 Pa. **(f2,14)** 39 Ct.ac Oo. **(f2,20)** 8 Pz. **(f2,24)** 13 Oo. **(f2,27)** 18 Oo. **(f2,28-29)** 20, 21 $ba. **(g2,10)** xo Oo. **(g2,27)** addatur *add.* Ct Lu Ou Co; adde *add.* Eq Xc. **(j2,8)** 40 Pa A; 42 Es. **(j2,16)** 59 Es.ac. **(k2,2)** 24 Co. **(k2,5)** 24 Ou. **(L2,2-3)** 58, 16 Ou Co. **(L2,4)** 49 Xc. **(L2,5)** 50 Ou Co. **(L2,10)** 44 Pz. **(L2,12)** 28 Ct. **(L2,22)** 54 Oo. **(L2,27)** 26 Pz. **(L2,28)** xi\v/ii (=?) Oo. **(m2,10)** 1 Co. **(n2,12)** 4 $ba. **(n2,16-17)** 15, 17 $bn. **(n2,25)** 34 $ba. **(n3,0)** 45 $pm.A; 55 $pm.BC; 50 $c. **(p2,26)** 13 Ou.pc Co. **(p2,27-28)** 12, 12 Eq Xc. **(p2,29-3,0)** 12, 12 Xc. **(q2,1-3)** 25, 32, 38 Ou Co. **(q2,6)** 57 $ba. **(q2,7-9)** 1, 7, 13 Ou Co. **(q2,14)** 44 Ou Co. **(q2,17)** 3 Ou Co. **(q2,18)** 1 $htv. **(q2,19-22)** 16, 22, 28, 35 Ou Co. **(q2,23)** 41 Ct Oo Ou Co Pa A. **(q2,25-29)** 54, 0, 6 (5 Co), 13, 19 (20 Co.ac) Ou Co. **(q2,26)** 57 Es. **(q3,0)** 22 $bn.

				(Ece)		(Pro)	(Dlo)		(Ear)		(Dpr)		(Sta)		
Aequatio Martis tabulae numeri				Aequa tio centri		Prop orti ona lia	Longi tudo lon gior		Aequa tio argu menti		Longi tudo pro pior		Statio Martis prima		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
3	1	8	29	11	24	3	2	30	33	40	2	52	5	13	31
3	2	8	28	11	24	4	2	32	33	58	2	55	5	13	36
3	3	8	27	11	24	5	2	34	34	15	2	58	5	13	41
3	4	8	26	11	24	6	2	36	34	32	3	1	5	13	46
3	5	8	25	11	24	7	2	39	34	49	3	3	5	13	51
3	6	8	24	11	24	8	2	42	35	6	3	7	5	13	57
3	7	8	23	11	24	9	2	44	35	23	3	10	5	14	3
3	8	8	22	11	23	10	2	47	35	40	3	13	5	14	9
3	9	8	21	11	22	11	2	49	35	56	3	16	5	14	14
3	10	8	20	11	21	12	2	51	36	12	3	19	5	14	20
3	11	8	19	11	20	13	2	54	36	28	3	22	5	14	26
3	12	8	18	11	19	14	2	57	36	43	3	25	5	14	31
3	13	8	17	11	17	15	2	59	36	58	3	28	5	14	38
3	14	8	16	11	15	16	3	1	37	13	3	31	5	14	42
3	15	8	15	11	13	16	3	4	37	27	3	35	5	14	48
3	16	8	14	11	11	17	3	6	37	41	3	38	5	14	53
3	17	8	13	11	9	18	3	9	37	55	3	42	5	14	59
3	18	8	12	11	6	19	3	12	38	9	3	45	5	15	5
3	19	8	11	11	3	20	3	15	38	23	3	49	5	15	11
3	20	8	10	11	0	21	3	18	38	36	3	53	5	15	17
3	21	8	9	10	57	22	3	21	38	49	3	57	5	15	22
3	22	8	8	10	53	22	3	24	39	1	4	1	5	15	28
3	23	8	7	10	49	23	3	27	39	13	4	5	5	15	34
3	24	8	6	10	45	24	3	31	39	24	4	9	5	15	39
3	25	8	5	10	41	25	3	34	39	35	4	13	5	15	44
3	26	8	4	10	37	26	3	37	39	45	4	17	5	15	49
3	27	8	3	10	33	27	3	41	39	55	4	22	5	15	55
3	28	8	2	10	29	28	3	44	40	4	4	26	5	16	0
3	29	8	1	10	25	29	3	48	40	13	4	31	5	16	6
4	0	8	0	10	21	30	3	52	40	21	4	36	5	16	11
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(a4,0) 3 Oo. **(e3,1-20)** 1...1 $ba. **(e3,21)** 11 Ou Co $bn $hts $htv $pm $c. **(f3,3-6)** 25...25 Ou Co $ba $hts $htv $c; 25, -, -, 25 $pm. **(f3,8-26)** *see Appendix*. **(+f3,8)** 24 Xg. **(+f3,9)** 23 Xc. **(f3,27)** 36 Ou Co $bn; 37 $hts $htv $pm $c. **(f3,28-29)** 32, 27 Ou Co $bn $hts $c. **(f4,0)** 22 Ou Co $bn $hts $htv $pm $c. **(g3,1)** 4 $hts. **(g3,6)** 9 Ou Co. **(g3,13-14)** 14, 15 Ou Co $bn $hts. **(g3,15)** 17 Oo.ac, Es. **(g3,22)** 23 Ou. **(g4,0)** 0 Cq. **(h3,14)** 2 Xc. **(j3,2)** 34 Oo. **(j3,3)** 35 $bn $htv $pm $c. **(j3,4)** 37 Ou Co $bn $hts. **(j3,6)** 32 Pz. **(j3,8)** 46 Ou Co $bn $hts. **(j3,12)** 56 $htv $pm; 58 $c. **(j3,16)** 9 $c. **(j3,18)** 13 $pm; 14 $c. **(j3,19)** 16 Co.ac. **(j3,21)** 22 $pm; 23 $c. **(j3,22)** 23 Ou Co. **(j3,24)** 32 $pm; 33 $c. **(j3,27)** 43 $pm; 42 $c. **(j3,28)** 45 $bn. **(j4,0)** 54 $pm; =52 $c. **(k3,13)** 37 Oo; 30 Pz. **(k3,18)** 37 Co, *ut vid.* **(k3,28-4,0)** 48...48 Pz. **(L3,4)** 23 Ou. **(L3,15)** 37 Oo. **(L3,18)** 20 Ou. **(L3,20)** 26 Pz. **(L3,21)** 41 $htv; 48 $pm; =49 $c. **(L3,26)** 42 $ba. **(L3,27)** 56 $pm; =55 $c. **(L4,0)** 23 $pm; 22 $c. **(m3,3)** 3 Ou. **(m3,21)** 4 Ou.pc. **(n3,3)** 57 $pm; =58 $c. **(n3,5)** 4 Ou Co $ba $bn $hts. **(n3,6)** 6 $pm; =7 $c. **(n3,9)** 17 Oo; 15 $pm; =16 $c. **(n3,15-24)** 35, 38--9: 38--9, 9 Ou Co. **(+n3,15)** 36 $pm $c. **(+n3,18)** 55 Pz; 46 $hts $htv $bn, *ad (3,17)* Ou Co; 47 $pm $c. **(+n3,20)** 54 *ad (3,19)* Co. **(+n3,21)** 58 $pm $c. **(n3,25)** xxii (?) Oo; 14 Ou Co. **(n3,27)** 21 Ou $htv $pm; 23 $c. **(n4,0)** 35 $htv $pm; =36 $c. **(p3,7-8)** 13, 13 Es.ac. **(p3,17)** 15 Ou Co. **(q3,2-5)** 37, 42, 47, 52 Ou Co. **(q3,8)** 8 $km. **(q3,9-10)** 15, 21 Ou Co. **(q3,11)** 25 Eq Xc Es Xg $km. **(q3,12)** =31 $km.O; 38 $km.C. **(q3,13)** 35 Ct.?pc Pa A; 39 Pz; 34 Xa; xxxo Cq.pc; xxx<-> Cq.ac; 36 Ou Co $km. **(q3,16)** 54 Ou Co; 55 Eq Xc. **(q3,17)** 0 Ou Co. **(q3,20)** 16 Ou Co. **(q3,22)** 29 Cq. **(q3,23)** 33 Ou Co. **(q3,26)** 50 Ou Co; *n.l.* A. **(q3,28)** 1 Ou Co. **(q3,29)** 5 $km.

				(Ece)		(Pro)	(Dlo)		(Ear)		(Dpr)		(Sta)		
Tabulae numeri				Aequa tio centri		Prop orti ona lia	Longi tudo lon gior		Aequa tio argu menti		Longi tudo pro pior		Statio Martis prima		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
4	1	7	29	10	17	30	3	55	40	29	4	40	5	16	16
4	2	7	28	10	12	31	3	59	40	37	4	45	5	16	21
4	3	7	27	10	6	32	4	3	40	43	4	50	5	16	26
4	4	7	26	10	0	33	4	7	40	48	4	55	5	16	31
4	5	7	25	9	54	34	4	10	40	53	5	0	5	16	36
4	6	7	24	9	48	35	4	14	40	58	5	5	5	16	41
4	7	7	23	9	41	35	4	17	41	2	5	10	5	16	46
4	8	7	22	9	34	36	4	21	41	6	5	15	5	16	51
4	9	7	21	9	27	37	4	25	41	8	5	21	5	16	56
4	10	7	20	9	20	38	4	28	41	9	5	27	5	17	1
4	11	7	19	9	13	39	4	31	41	9	5	32	5	17	6
4	12	7	18	9	5	40	4	35	41	9	5	38	5	17	11
4	13	7	17	8	57	41	4	38	41	7	5	44	5	17	16
4	14	7	16	8	49	41	4	41	41	4	5	49	5	17	20
4	15	7	15	8	41	42	4	45	41	0	5	55	5	17	24
4	16	7	14	8	32	43	4	48	40	55	6	1	5	17	29
4	17	7	13	8	24	43	4	51	40	50	6	7	5	17	33
4	18	7	12	8	14	44	4	55	40	45	6	14	5	17	37
4	19	7	11	8	5	44	4	59	40	39	6	20	5	17	41
4	20	7	10	7	56	45	5	3	40	31	6	27	5	17	45
4	21	7	9	7	46	46	5	7	40	21	6	32	5	17	49
4	22	7	8	7	37	46	5	11	40	8	6	38	5	17	53
4	23	7	7	7	27	47	5	15	39	53	6	44	5	17	57
4	24	7	6	7	17	48	5	19	39	37	6	51	5	18	1
4	25	7	5	7	7	48	5	22	39	20	6	57	5	18	5
4	26	7	4	6	57	49	5	25	39	1	7	4	5	18	8
4	27	7	3	6	47	49	5	28	38	40	7	11	5	18	11
4	28	7	2	6	37	50	5	30	38	16	7	17	5	18	15
4	29	7	1	6	27	50	5	32	37	51	7	24	5	18	18
5	0	7	0	6	16	51	5	34	37	25	7	30	5	18	21
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(e4,25) 6 Es. **(f4,1-2)** 16,11 $ba. **(f4,6)** 58 Pz. **(f4,8)** 39 Ou Co. **(f4,17)** 23 Ou Co $ba $bn $hts; =24 $c. **(f4,20)** 36 Ct Oo Pz. **(f4,24)** 18 $pm $c. **(f4,27)** 49 $ba; 46 $pm; =47 $c. **(f4,28-5,0)** 36, 20, 14 $ba. **(g4,13)** 40 $ba $bn $hts. **(g4,14)** 42 Ou Co. **(g4,15)** 43 Eq. **(g4,16)** 42 $ba $bn $hts. **(g4,20)** 44 Es.ac. **(g4,23)** 46 Es.ac. **(g4,24-26)** 47(48 Xc.pc), 48, 48 Eq Xc. **(g4,27)** 50 $ba $bn $hts. **(g4,29)** 51 $ba $bn $hts. **(g5,0)** 50 Es. **(h4,18)** 5 Eq. **(h4,19)** 5 Eq. **(j4,3)** 4 $pm; =3 $c. **(j4,4)** 6 Ou Co $ba $hts. **(j4,5)** 11 $bn. **(j4,9)** 24 $pm; =25 $c. **(j4,12-15)** 38, 41, 45, 47 Ou Co. **(j4,16-17)** 51, 55 $c. **(j4,18)** 56 $htv $pm; 59 $c. **(j4,19-20)** (5;)2, 6 $c. **(j4,24)** 18 $pm; 20 $c. **(j4,28)** 39 Eq; 30 *vel* 39 Xc. **(k4,7)** 40 Eq Xc. **(k4,16-19)** 41...41 Co. **(k4,27-28)** 39, 39 Xg. **(L4,2)** 36 Ou Co $bn $hts. **(L4,3)** 42 Ou; 44 $pm; =43 $c. **(L4,6)** 59 $pm $c. **(L4,9)** 7 $pm; =8 $c. **(L4,11)** 10 $hts. **(L4,14)** 7 $c. **(L4,15)** 2 $pm; 3 $c. **(L4,16-17)** 59, 53 $c. **(L4,21)** 16 $pm; 19 $c. **(L4,23)** 55 Eq. **(L4,24)** 57 Pz. **(L4,26)** 0 Es Xg. **(m4,14)** 6 Oo. **(n4,6)** o (=8) Oo. **(n4,10)** 26 Ou Co $ba $bn $hts. **(n4,11)** 27 Ou Co. **(n4,12)** 28 Co; 37 $htv $pm; =38 $c. **(n4,13)** 43 $ba $hts. **(n4,14)** 48 Es Xg. **(n4,20)** 26 Ou Co $ba $bn $hts. **(n4,21)** 22 Pz; 33 $htv; 34 $pm; =32 $c. **(n4,23)** 42 Ou Co. **(n4,24)** 48 Ou Co; 52 $htv $c; 53 $pm. **(n4,27)** 12 $pm; =11 $c. **(n4,29)** 23 Ou Co. **(n5,0)** 31 Ou Co $ba $bn $hts. **(p4,3)** 15 Co. **(p4,8-9)** 17, 17 Eq. **(p4,23)** 18 Ou Co. **(q4,12)** ix Oo. **(q4,13)** 15 Co. **(q4,16)** 28 Ou Co $km. **(q4,17)** 32 $km. **(q4,18)** 38 Oo.ac. **(q4,19-26)** 43, 49, 55, 57, 1, 2, 4, 7 Ou Co. **(+q4,20)** 47 Pz. **(+q4,23)** 7 Pa A. **(+q4,25)** 4 $km. **(q4,28)** 14 $km. **(q5,0)** 20 Pa A.

				(Ece)		(Pro)	(Dlo)		(Ear)		(Dpr)		(Sta)	
Tabulae numeri				Aequa tio centri		Prop orti ona lia	Longi tudo lon gior		Aequa tio argu menti		Longi tudo pro pior		Statio prima Martis	
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
5	1	6	29	6	5	52	5	37	36	57	7	36	5	18	25
5	2	6	28	5	54	52	5	37	36	26	7	41	5	18	28
5	3	6	27	5	43	53	5	38	35	52	7	45	5	18	31
5	4	6	26	5	32	53	5	38	35	15	7	50	5	18	35
5	5	6	25	5	21	54	5	38	34	35	7	54	5	18	38
5	6	6	24	5	9	55	5	38	33	53	7	58	5	18	41
5	7	6	23	4	57	55	5	37	33	7	8	0	5	18	43
5	8	6	22	4	45	56	5	36	32	20	8	2	5	18	45
5	9	6	21	4	32	56	5	34	31	30	8	3	5	18	47
5	10	6	20	4	20	57	5	30	30	36	8	2	5	18	49
5	11	6	19	4	8	57	5	25	29	38	8	1	5	18	51
5	12	6	18	3	55	57	5	18	28	35	7	59	5	18	53
5	13	6	17	3	43	58	5	10	27	28	7	56	5	18	55
5	14	6	16	3	31	58	5	1	26	16	7	52	5	18	57
5	15	6	15	3	18	58	4	52	25	3	7	47	5	18	59
5	16	6	14	3	5	58	4	41	23	45	7	36	5	19	1
5	17	6	13	2	52	58	4	30	22	24	7	23	5	19	3
5	18	6	12	2	39	59	4	18	21	0	7	6	5	19	5
5	19	6	11	2	26	59	4	4	19	33	6	45	5	19	6
5	20	6	10	2	13	59	3	48	18	1	6	22	5	19	7
5	21	6	9	1	59	59	3	32	16	25	5	57	5	19	8
5	22	6	8	1	46	59	3	12	14	45	5	30	5	19	9
5	23	6	7	1	33	59	2	50	13	1	5	0	5	19	10
5	24	6	6	1	20	59	2	27	11	15	4	27	5	19	11
5	25	6	5	1	7	59	2	4	9	27	3	50	5	19	12
5	26	6	4	0	54	59	1	40	7	36	3	9	5	19	13
5	27	6	3	0	40	60	1	16	5	45	2	25	5	19	13
5	28	6	2	0	27	60	0	51	3	52	1	38	5	19	14
5	29	6	1	0	14	60	0	25	1	57	0	50	5	19	14
6	0	6	0	0	0	60	0	0	0	0	0	0	5	19	15
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(b5,20) 23 Co. **(e5,17)** *n.l.* Pa. **(f5,3)** 42 Es Xg. **(f5,5)** 20 Ou Co $bn. **(f5,6)** 10 $ba; 8 $pm; 7 $c. **(f5,7)** 54 Eq. **(f5,9)** 33 $pm; 31 $c. **(f5,13-16)** *n.l.* Pa. **(f5,25)** 8 Oo; 3 Xg. **(f5,26)** 44 Ou Co. **(f5,29)** xo Oo. **(g5,1-18)** 51 52(2) 53(2) 54 55(2) 56(2) 57(3) 58(5) Ou Co. **(+g5,10)** 56 Pz. **(g5,19-6,0)** 59(6), 60(6) Ou Co. **(+g5,26)** 60 $bn. **(h5,23-24)** 3, 3 Es.ac. **(j5,1)** 36 Ct Oo Ou Co Pa A $ba $bn $hts. **(j5,14)** 4 $c. **(j5,15)** 51 Ou Co; 55 $c. **(j5,16)** 47 Pz; 45 $c. **(j5,17)** 33 $c. **(j5,20)** 58 Ou Co. **(j5,23)** 51 $bn. **(j5,24)** 24 Ou Co; 26 $bn; 21 $htv; 29 $c. **(j5,25)** 3 $bn. **(j5,27)** 17 $bn. **(j5,29)** 23 Ou Co; 26 $ba $bn $hts. **(k5,5)** 33 Ou. **(k5,7)** 32 Oo. **(k5,14-15)** 25, 24 $bn. **(L,n)** *ordine (n,L) scribit notisque distinguit* Cq. **(L5,2)** 56 A; 16 Es. **(L5,6)** 13 $ba. **(L5,7)** 50 $ba. **(L5,10-11)** 33, 35 $c. **(L5,13)** 33 Ou Co; 38 A. **(L5,14)** 18 $hts. **(L5,16-17)** 48, 27 $c. **(L5,19)** 0 $bn. **(L5,22)** 5 Ou. **(L5,24-25)** 14, 26 $bn. **(L5,26)** 26 Pz; 37 Ou Co $ba $bn $hts. **(m5,7-11)** 2...2 $ba. **(m5,23)** 4 Ou Co. **(m5,27)** 3 $ba. **(n5,6-7)** (8;)0, 3 $c. **(n5,8)** 3 $ba; 5 $c. **(n5,9)** 6 $c. **(n5,10)** 3 Pa A; 7 $c. **(n5,11)** 0 Ou Co $ba $bn $hts; 6 $c. **(n5,12)** 58 $pm; (8;)3 $c. **(n5,13-29)** *see Appendix*. **(+n5,13)** 52 Pa A. **(+n5,14)** 43 Co; 50 Pa A. **(+n5,22)** 20 Pz. **(+n5,28)** 28 Pa A. **(q5,1)** 24 Ou Co $km; 26 Pa A. **(q5,2)** 27 Ou Co. **(q5,4)** 34 $km. **(q5,6-13)** 42, 46, 49, 52, 54, 56, 56, 56 Ou Co. **(+q5,7-8)** 45, 46 $km. **(q5,11)** 50 $km. **(q5,17)** 4 Pa A. **(q5,18-6,0)** 4, 5, 6, 7, 8, 8, 9, 9, 10, 10, 11, 12, 13 Ou Co. **(+q5,24)** 10 $bn $ba $hts $htv. **(+q5,27-28)** *n.l.* Oo. **(+q5,27)** =13 $km.C; 14 $km.O. **(+q6,0)** 14 $bn $ba $hts $htv.

EA61: Appendix to the apparatus.

```
(n0,11-26)  16 17 18 20 21 22 24 26 28 29 31 32 34 35 37 39:  plerique;
            17 18 20 21 22 24 26 27 29 31 32 34 35 36 38 40   Ou Co $bn $hts, $ba(v.i.);
             . 18  .  .  .  .  . 28  .  .  .  .  . 37  .  .   $pm;
            16 18 20 21 23 25 26 28 29 31 32 34 35 37 38 40   $htv;
            17 18 20 22 23 25 26 28 29 31 32 34 36 37 39 40   $c.
```

```
(q0,7-16)     34 34 35 36 37 38 39 40 42 44:  plerique;
              33 34 34 35 36 36 37 38 40 42   $km.
(+q0,11-16)               36 37 38 39 41 43   Ou Co;
                           - 37  -  - 42  -   $hts $htv;
                           - 37  -  -  -  -   $bn $ba.
```

```
(q0,17-26)    45 47 49 51 52 54 56 59 2 4:  plerique;
              44 46 47 49 51 52 54 56 0 3   $km.
(+q0,24-26)                        58 0 3   Ou Co;
                                   57 - -   $bn $ba $hts $htv.
```

```
(f3,8-26):  23 22 21 20 19 17 15 13 11  9 6 3 0 57 53 49 45 41 37:  plerique, $ba;
             . 24  .  . 21  .  . 16  .  . 9 . . 1  .  . 50  .  .    $c;
            24 23 22 21 20 19 17 15 13 11 9 6 3 0 57 53 49 45 41    $bn $hts $htv;
             - 24  -  - 20  -  - 15  -  - 9 - - 0  -  - 49  -  -    $pm;
            24 23 22 21 20 19 17 16 14 12 9 6 3 0 57 53 49 45 41    Ou Co.
```

```
(n5,13-29)  56 52 47 36 23  6 45 22 57 30  0 27 50  9 25 38 50:  plerique;
            57 53 47 37 23  6 42 22 58 30 45 26 47  3 23 35 48   Ou; Co (v.i.);
            57 53 47 37 23  6 45 22 57 30  0 26 47  7 23 35 48   $bn;
            57 53 47 37 23  6 45 22 57 30  0 26 46  4 20 34 48   $ba;
            57 53 47 37 23  6 45 22 57 30  0 26 47  4 20 35 48   $hts;
            57 53 47 33 23  6 45 22 57 30  0 26 47  4 20 35 48   $htv;
             -  - 47  -  -  6  -  - 59  -  - 26  -  - 20  -  -   $pm;
            59 53 45 35 22  6 47 25  0 31 59 24 46  4 20 35 48   $c.
```

EA71. Equation of Venus.

Toomer 1968, no. 43. – From Albattani, Nallino II p. 126-31, but "statio prima" is like Khw/M, Suter Tab.45-50 p.156-61. Further, sub-table .Ece is the solar equation, analogous to table EA01; see EA41-81 above, and cf. Toomer 1968 p. 65 for parallels and discussion.

Witnesses: **{a0}** Ct,19r-20v; Oo,15r-16v; Pz,122r-123v; Mc,14r-15v; Mb,44r-45r; Ey,46v-49r; Da,201r-202r; Ea,44v-45v. – **{a1}** Xa,24v-26r; Ad,88v-90r; Cq,44-47; Fc,27v-30r; Ps,53v-56r; Sg,137-142; Wd,23v-25r; Fh,38v-41r; Xw,23v-25r. – **{a2}** Cz,72v-75r; Cj,145v-148r; Md,78r-80v; Mp,210r-212v; Vp,127v-130r. – **{aX}** Vo,47v-50r; R,45r-47v; Ov,70v-73r; Cu,69v-72r; Ep,46r-48v. – **{aT}** Lu,53v-56r; Oj,126r-128v; P,107r-109v. – **{k}** Eh,87r-89v; Lw,82r-84v; Ou,60r-62v; Eg,15v-16v; Co,159r-160r; Cn,93r-94v. – **{d}** Op,52v-55r; C,325-330; Lb,22r-24v; Pa,38r-40v; A,217r-219v; Fj,38r-40v; Nc,107r-109v; Pb,29r-31v; Pv,22v-25r; Fd2,39r-41v; Gr3,110r-112v; Ok,45r-47v. – **{e}** Eq,68v-71r; Ek3,95v-98r; Xc,62v-65r; Vj,86r-88v; Ej,69r-71v. – **{x}** Oc,73v-76r; X,150v-153r; Vz,65v-(67v); Mv,85v-88r; Cm,202v-205r; B,142v-145r; T,289v-290v; Lf,90v-93r; Lg,169v-172r; Lh,135v-138r; Xj,273v-276r; Xg,53v-56r; G,58r-60v; Xb,73r-75v; Es,174v-177r; Fb,63v-66r; Pq,182v-185r; Oy,70v-73r; Wa,64v-66r; Ow,153v-156r; Nu,138v-141r. – **{p}** O,68r-70v; Pd,67r-69v; Ch2,167r-169v. – **{?}** Ch,32v-35r (:Savasorda 1); Ch,71r-74r (:Savasorda 2); Pn,42r-44v (:Jo. Lin.). – Duplicates in {?} Ch, in separate collections.

Headings. – General:

- **(1: none)** :: {a0:} Ct Mc Mb Da, {a1:} Sg Fh Xw, {d?} Lb Ok.
- **(2) (Cursus+** Ps Wd**) Veneris** :: {a1:} Ps Wd; {aX} Vo; {p:} Ch2.
- **(3) Aequatio (/-ones** Lu Oj P X**) Veneris** :: {a0:} Oo Ea; {a1:} Xa Ad Cq; {aT:} Lu Oj P; {d:} Pa A Fj Nc Pb Pv Fd2 Gr3; {x:} X Wa; {p:} Pd; {?:} Ch(32v,71r).
- **(4) Tabula aequationis Veneris (+prima** Ov! Vp! Ou Op C O!**)** :: {a0:} Ey; {a1:} Fc!, {a2:} Cz Cj Md Mp Vp; {aX:} Ov R Cu Ep!; {k:} Eh Lw Ou Eg Co; {d?:} Op C; {e:} Eq Ek3 Xc Vj Ej; {x-}; {p:} O; {?:} Pn. – "prima" is variously placed in Vp Ov O.
- **(5: other)** :: Pz ("Tabula Veneris"); Md ("De Venere", then (4) above); Cn.

Entrance columns: normally, **(6) Tabulae numeri** (earlier); **(7) Lineae numeri** (later). — **(8) Lineae numeri communes** :: {d:} Lb Pa A Fj Nc Pb Pv Fd2 Gr3; {p:} O Pd; {x:} Xj Xb. — **(9) Lineae numeri communes centro et argumento** :: {a2:} Mp; {e:} Xc Vj Ej; {x:} Oc Vz Es; {?:} Pn. — **(10: other)** :: Pz ("Lineae n. tabulae n."); Ps Ok Ch (32v,71r).

.Ece: **(11) Aequatio centri** :: normally. — **(12) Aequatio puncti** {a0:} Ct Oo Mb Da, {k:} Ou. — **(13) Aequatio puncti et** (vel Eg) **portionis** {k:} Eh Lw Eg Co. — **(14: other)** :: Pz ("Aequatio centri vel puncti"); Cn ("Aequatio cuspidis"); Ch(32v,71r).

.Pro: normally, **(15) Proportionalia,** with **Minuta** (+partium Pz) before or after. — **(16) Minuta partium** :: {a0:} Pz Da; {k:} Eh Lw Ou Eg Co Cn. — **(17) Partium** :: Mb Oo. — **(18: other)** :: Ct (just the sign "Minuta"); Ch (32v,71r).

.Dlo: **(19) Longitudo longior,** everywhere.

.Ear: **(20) Aequatio argumenti** :: normally. — **(21) Aequatio portionis** :: {a0:} Ct Oo Mb Da; {aT:} Lu Oj P; {k:} Eh Lw Ou Eg Co Cn. — **(22: other)** :: Pz ("Portionis aequatio argumenti"); Ch(32v,71r).

.Dpr: **(23) Longitudo propior** (proprior, occasionally; propinquior Pa A Fj Gr3 Eg) :: everywhere.

.Sta: **(24) Statio Veneris prima** or **Statio prima Veneris** :: normally. — **(25) Statio prima** :: {a0:} Ey; {a2:} Vp; {aX} Ov R Cu; {aT:} Lu; {d:} Lb Pa A Fj Nc Pb Pv Fd2 Gr3; {e:} Xc; {x:} Wa; {p:} O Pd Ch2; {?} Ch(32v,71r). — **(26: other)** :: Eg Ps. — Mb Ps show separate tables; see "Versions".

Versions. Ep interchanges sub-tables .Dlo and .Dpr for signs 0-2; in the tables for signs 3-5 the sub-tables are ordered as shown below. — Ey shows the order "... .Ear .Dlo .Dpr ...", with .Dlo .Dpr under the common heading "Diversitas diametri epicycli". — Mb Ps have .Sta apart from the rest; cf. EB21. In the rest of the witnesses the sub-tables are ordered as indicated.

Values. Parameters: eccentricity of deferent 1;15, radius of epicycle 43;10. — However, sub-table .Ece is the solar equation, for a solar eccentricity of 2;4,45 like table EA01.

Text. For detailed references and summary on coverage, see preface to EA41-81. — Witnesses collated for values, entire table: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** Lu; **{k}** Ou Co; **{d}** Pa A; **{e}** Eq Xc; **{x}** Es Xg. — Headings according to Xa. In Xa, "Aequatio Veneris" heads the first table; there is a general page-heading "Veneris", not reproduced here.

Parallels collated, all sub-tables except .Sta: for all degrees of the argument, **$ba** = Batt., Paris Arsenal 8322, 75v-78r; **$bn** = Batt., Nallino II p. 126-31; **$hts** = Stahlman 1960, table 44 (not collated for .Ece). — Collated for 6°(6)90°(3)180°, and not for .Ece: **$htv** = Handy Tables, Vat. gr. 304, 228v-231r; **$pm** = Almagest XI,11, Toomer p.552.

Parallels collated for .Sta: for all degrees of the argument, **$km** = Khw/M, Suter table 45-50, first stations. — At 6-degree intervals only: **$ba** = *ms.cit.*, 82r; **$bn** = *op.cit.*, p. 139; **$hts** = Stahlman 1960, table 54; **$htv** = *ms.cit.*, 241r. In passages, $hts and $htv may be quoted at 3-degree intervals, but this is not general; see under EA41-81, section (B).

Recomputation: **$c,** for .Dlo .Ear .Dpr, and quoted in selection, mainly where it differs from the adopted text by 3′ or more; see under EA41-81, section (A). For the parameters, see "Values" above. — However, sub-table .Ece has been recomputed as the solar equation like table EA01; the computed values have been rounded to minutes before collation, and all deviations from the adopted values are quoted.

Error. In ms. Ou, at (L3,20) and (L3,24), one may note the error "4" for "53", which looks like a confusion of the Roman numerals "iiii" and "liii".

Aequatio Veneris.

				(Ece)		(Pro)	(Dlo)		(Ear)		(Dpr)		(Sta)		
Tabulae numeri				Aequa tio centri		Prop orti ona lia	Longi tudo lon gior		Aequa tio argu menti		Longi tudo pro pior		Statio Veneris prima		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
0	1	11	29	0	2	-60	0	0	0	26	0	0	5	15	51
0	2	11	28	0	4	60	0	1	0	51	0	1	5	15	51
0	3	11	27	0	6	60	0	1	1	16	0	1	5	15	51
0	4	11	26	0	8	60	0	1	1	41	0	1	5	15	52
0	5	11	25	0	10	60	0	1	2	6	0	2	5	15	52
0	6	11	24	0	12	59	0	1	2	31	0	2	5	15	52
0	7	11	23	0	14	59	0	1	2	56	0	2	5	15	53
0	8	11	22	0	16	59	0	1	3	21	0	3	5	15	53
0	9	11	21	0	18	59	0	2	3	46	0	3	5	15	53
0	10	11	20	0	20	59	0	2	4	11	0	3	5	15	54
0	11	11	19	0	22	59	0	2	4	36	0	4	5	15	54
0	12	11	18	0	24	59	0	3	5	1	0	4	5	15	54
0	13	11	17	0	26	58	0	3	5	26	0	4	5	15	55
0	14	11	16	0	28	58	0	3	5	51	0	5	5	15	55
0	15	11	15	0	30	58	0	4	6	16	0	5	5	15	56
0	16	11	14	0	32	57	0	4	6	41	0	5	5	15	56
0	17	11	13	0	34	57	0	5	7	6	0	6	5	15	56
0	18	11	12	0	36	57	0	5	7	31	0	6	5	15	57
0	19	11	11	0	38	56	0	5	7	56	0	6	5	15	57
0	20	11	10	0	39	56	0	6	8	21	0	7	5	15	57
0	21	11	9	0	41	56	0	6	8	46	0	7	5	15	58
0	22	11	8	0	43	55	0	6	9	11	0	7	5	15	58
0	23	11	7	0	45	55	0	7	9	36	0	8	5	15	58
0	24	11	6	0	47	55	0	7	10	1	0	8	5	15	59
0	25	11	5	0	49	54	0	7	10	26	0	8	5	15	59
0	26	11	4	0	51	54	0	8	10	51	0	9	5	15	59
0	27	11	3	0	52	54	0	8	11	16	0	9	5	16	0
0	28	11	2	0	54	53	0	8	11	41	0	9	5	16	0
0	29	11	1	0	56	52	0	9	12	6	0	10	5	16	0
1	0	11	0	0	58	52	0	9	12	30	0	10	5	16	1
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(f0,10-19) 19, 21, ..., 35, 37 Ou Co $bn. **(f0,20)** 49 Eq.ac. **(f0,22-26)** 42, 44, 46, 48, 50 Oo. **(f0,27-1,0)** 53, 53, 52, 52 A, *cf. col. (g).* **(f0,29-1,0)** 58, 56 $ba. **(g0,6-7)** 60, 60 Ou Co $ba $bn $hts. **(g0,16-1,0)** *see Appendix.* **(+g0,19)** 57 Eq Xc. **(+g0,22)** 56 Eq Xc. **(+g0,27)** 53 Ct.pc Oo Lu Pa A Eq Xc Es Xg. **(+g0,29-1,0)** 57, 58 Oo. **(j0,8)** 2 $bn. **(j0,11)** 3 $bn. **(j0,14)** 4 $bn $hts. **(j0,17-1,0)** 5--9, 9: 4, 5--9 Ou Co. **(k0,7)** 3 Ou Co. **(L0,6)** <->1 Cq; 41 $htv; =31 $c. **(L0,7)** 16 Ou Co. **(L0,13)** 36 Oo. **(L0,15)** 46 Ou. **(L0,16)** 8 Xc. **(L0,23)** 31 Ou Co. **(L0,24)** 2 Es Xg. **(L0,26)** 52 Ou. **(m-n, Inscr.)** proprior Xa, *saepius.* **(n0,16)** 6 Pz. **(n0,25)** 9 $ba. **(p0,27-1,0)** 15...15 Xc. **(q0,1-15)** *see Appendix.* **(q0,16-1,0)** *see Appendix.* **(+q0,16)** 55 Oo. **(+q0,29)** 1 $km. **(+q1,0)** 0 Eq Es Xg; 2 $km.

				(Ece)		(Pro)	(Dlo)		(Ear)		(Dpr)		(Sta)		
Tabulae numeri				Aequatio centri		Proportionalia	Longitudo longior		Aequatio argumenti		Longitudo propior		Statio Veneris prima		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
1	1	10	29	0	59	51	0	9	12	55	0	10	5	16	1
1	2	10	28	1	1	51	0	10	13	20	0	11	5	16	2
1	3	10	27	1	3	50	0	10	13	44	0	11	5	16	3
1	4	10	26	1	5	50	0	10	14	9	0	11	5	16	4
1	5	10	25	1	6	49	0	11	14	34	0	11	5	16	5
1	6	10	24	1	8	49	0	11	14	58	0	12	5	16	6
1	7	10	23	1	10	48	0	11	15	23	0	12	5	16	7
1	8	10	22	1	11	47	0	12	15	48	0	12	5	16	8
1	9	10	21	1	13	47	0	12	16	12	0	12	5	16	9
1	10	10	20	1	15	46	0	12	16	37	0	13	5	16	10
1	11	10	19	1	16	45	0	13	17	1	0	13	5	16	11
1	12	10	18	1	18	45	0	13	17	25	0	13	5	16	12
1	13	10	17	1	19	44	0	13	17	50	0	13	5	16	13
1	14	10	16	1	21	44	0	14	18	14	0	14	5	16	14
1	15	10	15	1	22	43	0	14	18	38	0	14	5	16	15
1	16	10	14	1	23	42	0	14	19	3	0	14	5	16	16
1	17	10	13	1	25	41	0	15	19	27	0	15	5	16	17
1	18	10	12	1	27	40	0	15	19	51	0	15	5	16	18
1	19	10	11	1	28	40	0	15	20	15	0	15	5	16	19
1	20	10	10	1	29	39	0	16	20	39	0	16	5	16	20
1	21	10	9	1	31	38	0	16	21	3	0	16	5	16	21
1	22	10	8	1	32	37	0	16	21	27	0	16	5	16	22
1	23	10	7	1	33	36	0	17	21	51	0	17	5	16	23
1	24	10	6	1	34	35	0	17	22	15	0	17	5	16	24
1	25	10	5	1	36	34	0	17	22	39	0	17	5	16	25
1	26	10	4	1	37	33	0	18	23	3	0	18	5	16	26
1	27	10	3	1	38	32	0	18	23	27	0	18	5	16	27
1	28	10	2	1	39	31	0	18	23	51	0	18	5	16	28
1	29	10	1	1	40	30	0	19	24	15	0	19	5	16	29
2	0	10	0	1	41	30	0	19	24	38	0	19	5	16	30
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(a2,0) 1 Oo. **(e1,1)** 1 $ba. **(f1,1)** 59'35" $c. **(f1,16)** 24 Ou Co $bn $c; 22 $ba *ut vid.* **(f1,18)** 26 Pa A $ba $bn. **(f1,19-24)** 29, 31, 32...35 Ou Co. **(f2,0)** 40 Es Xg. **(g1,1-3)** 52, 51, 51 Ou Co. **(g1,5-6)** 42, 42 Oo. **(g1,8)** 48 Ou Co $ba $bn $hts. **(g1,11)** 46 Ou Co $ba $bn $hts. **(g1,17-2,0)** 42 41 40 40...30 Ou Co $ba $bn $hts. **(j1,5)** 10 Pa A. **(j1,8)** 11 Oo. **(j1,14)** 13 Co. **(j1,24)** 18 $pm; =17 $c. **(j1,29)** 19 Ou Co. **(j2,0)** 20 $pm $c. **(k1,13)** 18 Ou Co $ba, *cf. ad (L1,13).* **(k1,15)** 19 $ba. **(k1,20)** 21 $ba. **(k1,23)** 22 Es.ac. **(k1,29)** 23 Co. **(L1,2)** xo Oo. **(L1,3)** 45 $ba. **(L1,7)** 33 Oo Cq; 28 $ba. **(L1,8)** 44 Lu. **(L1,13)** 7 Ou Co. **(L1,15)** 34 Pa A Es Xg. **(L2,0)** 37 Cq; 28 Eq Xc. **(m)** *om.* Eq. **(n)** *ante col. (k)* Eq. **(n1,2)** 10 Es. **(n1,5-28)** *see Appendix.* **(n1,29-2,0)** 29, 29 Es.ac. **(n2,0)** 20 $htv $pm $c. **(q1,1-15)** *see Appendix.* **(q1,16-2,0)** *see Appendix.*

				(Ece)		(Pro)	(Dlo)		(Ear)		(Dpr)		(Sta)		
Tabulae numeri				Aequa tio centri		Prop orti ona lia	Longi tudo lon gior		Aequa tio argu menti		Longi tudo pro pior		Statio Veneris prima		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
2	1	9	29	1	42	29	0	19	25	2	0	19	5	16	31
2	2	9	28	1	43	28	0	20	25	25	0	20	5	16	32
2	3	9	27	1	44	27	0	20	25	49	0	20	5	16	33
2	4	9	26	1	46	26	0	20	26	11	0	21	5	16	34
2	5	9	25	1	47	25	0	21	26	34	0	21	5	16	35
2	6	9	24	1	48	24	0	21	26	57	0	22	5	16	36
2	7	9	23	1	49	23	0	22	27	20	0	22	5	16	37
2	8	9	22	1	49	22	0	22	27	43	0	23	5	16	38
2	9	9	21	1	50	21	0	23	28	6	0	23	5	16	39
2	10	9	20	1	51	20	0	23	28	29	0	24	5	16	40
2	11	9	19	1	52	19	0	24	28	52	0	24	5	16	41
2	12	9	18	1	53	18	0	24	29	14	0	25	5	16	43
2	13	9	17	1	54	16	0	25	29	37	0	26	5	16	45
2	14	9	16	1	54	15	0	25	29	59	0	26	5	16	47
2	15	9	15	1	55	14	0	25	30	21	0	27	5	16	49
2	16	9	14	1	55	13	0	26	30	43	0	28	5	16	50
2	17	9	13	1	56	12	0	26	31	5	0	29	5	16	52
2	18	9	12	1	56	11	0	26	31	27	0	30	5	16	53
2	19	9	11	1	56	10	0	27	31	49	0	31	5	16	54
2	20	9	10	1	57	9	0	27	32	11	0	31	5	16	56
2	21	9	9	1	57	8	0	28	32	33	0	31	5	16	58
2	22	9	8	1	57	7	0	28	32	55	0	32	5	16	59
2	23	9	7	1	58	6	0	29	33	17	0	32	5	17	0
2	24	9	6	1	58	5	0	30	33	38	0	32	5	17	2
2	25	9	5	1	58	4	0	30	34	0	0	33	5	17	3
2	26	9	4	1	58	3	0	31	34	20	0	33	5	17	5
2	27	9	3	1	58	2	0	32	34	42	0	33	5	17	7
2	28	9	2	1	58	1	0	32	35	3	0	33	5	17	8
2	29	9	1	1	58	+ 1	0	33	35	24	0	34	5	17	10
3	0	9	0	1	59	2	0	33	35	44	0	34	5	17	11
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(a3,0) 2 Oo. **(f2,1-3,0)** *see Appendix.* **(+f2,3)** 4<-> Pz. **(+f2,12)** 52 Oo. **(+f2,16)** 56 Eq Xc. **(+f2,28-29)** 59, 59 $ba. **(f3,0)** 58 Eq Xc. **(g2,4)** 27 Oo. **(g2,13)** 17 Pz. **(g2,27)** t Pz. **(g2,28)** auget (!) *add.* Ct Xa Cq; augetur *add.* Oo; addatur *add.* Lu Ou Co Xg: ad *add.* Eq; *nihil add.* Xc. **(g2,29)** 2 Oo. **(j2,1)** 18 Co. **(j2,4)** 21 Ou Co $bn. **(j2,6)** 22 $htv $pm $c. **(j2,13)** 24 Ou Co $bn $hts. **(j2,16)** 25 Ou Co $bn $hts. **(j2,18)** 27 $htv $pm $c. **(j2,19-23)** 26 27(3) 28 Ou Co. **(j2,24)** 29 Ou Co $htv $pm; =30 $c. **(j2,26-27)** 30 31 Ou Co. **(j2,28)** 33 Eq. **(j3,0)** 34 Ou Co $ba $bn $hts; 32 $htv; 31 $pm; 33'30" $c. **(k2,29)** 34 Xc. **(L2,3)** 48 Oo Pz Ou Co Pa A $ba $bn $hts; 47 $c. **(L2,6)** L<-> Oo. **(L2,7)** 5 Eq Xc. **(L2,9)** 7 Ou Co. **(L2,15)** 23 Es. **(L2,23)** 7 Pz. **(L2,24)** 28 Pz. **(L2,26)** 21 Ct Oo Ou Co Pa A $ba $bn $hts $c. **(n2,1-3,0)** 10, 11, -- 19, 19 Eq Xc, *cf. (n1,1-2,0).* **(+n2,6)** 23 $pm $c. **(n2,9-15)** 24(2) 25 26(2) 27 28 Ou Co $ba $bn; 24 25 26(2) 27 28(2) $hts. **(n2,16-17)** 29 30 $ba; 29 29 $hts. **(+n2,17)** 28 Ct. **(n2,18)** 28 $htv $pm $c. **(n2,19)** 30 Ou Co $bn $hts. **(n2,22)** 31 Ou Co $bn $hts. **(n2,24)** 31 $htv $c; 30 $pm. **(n2,25)** 32 Ou Co $bn $hts. **(n2,26)** *vacat* Oo. **(n2,28)** 34 $ba $bn. **(n3,0)** 35 Ou Co $ba $bn $hts; 33 $pm; =34 $c. **(p2,20-22)** 17--17 Pz. **(p2,22)** 17 Ou Co. **(q2,1-15)** *see Appendix.* **(+q2,1)** 32 $km.O. **(+q2,13)** 44 $km. **(q2,16-3,0)** *see Appendix.* **(+q2,18)** 52 $ba. **(+q2,27)** 4 Eq.

				(Ece)		**(Pro)**	**(Dlo)**		**(Ear)**		**(Dpr)**		**(Sta)**		
Tabulae numeri				Aequa tio centri		Prop orti ona lia	Longi tudo lon gior		Aequa tio argu menti		Longi tudo pro pior		Statio Veneris prima		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
3	1	8	29	1	59	3	0	34	36	4	0	35	5	17	12
3	2	8	28	1	59	4	0	35	36	24	0	36	5	17	13
3	3	8	27	1	59	5	0	35	36	44	0	37	5	17	14
3	4	8	26	1	58	5	0	36	37	4	0	37	5	17	15
3	5	8	25	1	58	6	0	36	37	23	0	38	5	17	16
3	6	8	24	1	58	7	0	37	37	43	0	38	5	17	17
3	7	8	23	1	57	8	0	37	38	2	0	39	5	17	18
3	8	8	22	1	57	9	0	38	38	21	0	40	5	17	19
3	9	8	21	1	57	10	0	38	38	40	0	40	5	17	20
3	10	8	20	1	57	11	0	39	38	59	0	41	5	17	21
3	11	8	19	1	57	12	0	39	39	17	0	42	5	17	22
3	12	8	18	1	57	13	0	40	39	35	0	43	5	17	23
3	13	8	17	1	56	14	0	41	39	53	0	43	5	17	24
3	14	8	16	1	56	15	0	41	40	11	0	44	5	17	25
3	15	8	15	1	56	16	0	42	40	29	0	45	5	17	26
3	16	8	14	1	55	17	0	43	40	46	0	46	5	17	27
3	17	8	13	1	55	18	0	43	41	3	0	47	5	17	28
3	18	8	12	1	54	19	0	44	41	20	0	47	5	17	29
3	19	8	11	1	54	20	0	45	41	37	0	48	5	17	30
3	20	8	10	1	53	21	0	45	41	53	0	49	5	17	32
3	21	8	9	1	53	22	0	46	42	9	0	50	5	17	33
3	22	8	8	1	52	23	0	47	42	24	0	51	5	17	34
3	23	8	7	1	51	24	0	48	42	39	0	52	5	17	36
3	24	8	6	1	51	25	0	49	42	53	0	52	5	17	37
3	25	8	5	1	50	26	0	50	43	7	0	53	5	17	38
3	26	8	4	1	49	27	0	51	43	21	0	54	5	17	39
3	27	8	3	1	48	28	0	52	43	35	0	55	5	17	41
3	28	8	2	1	47	29	0	53	43	48	0	56	5	17	42
3	29	8	1	1	46	30	0	54	44	1	0	56	5	17	43
4	0	8	0	1	45	31	0	55	44	13	0	57	5	17	45
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(a4,0) 3 Oo. **(b)** (1,2), 3, ..., 29, <*>, <*> Cq. **(f3,4-20)** *see Appendix.* **(+f3,16)** 56 Pz. **(+f3,18)** 55 $ba. **(f3,24)** 50 Ou Co $bn $c. **(f4,0)** 46 Pz. **(g3,1-4,0)** 3, 4, 6, 6, 7...18, 18, 20...32 Ou Co. **(j3,1)** 35 Ou Co. **(j3,3)** 33 $htv $pm; =35 $c. **(j3,6)** 36 $htv; 35 $pm; =37 $c. **(j3,7-8)** 3{{6}}, 3{{6}} Xc. **(j3,13)** 40 Ou Co $ba $bn $hts. **(j3,16)** 42 Oo. **(j3,18)** 45 $pm $c. **(j3,19)** 44 Ou Co. **(j3,21)** 47 $pm $c. **(j4,0)** 54 $pm; =55 $c. **(k3,3)** 37 Oo Xa.ac Cq. **(k3,4)** 3{{6}} Xc. **(k3,17)** 40 Eq. **(L3,3)** 40 $pm; 45 $c. **(L3,5)** 24 Ou Co Pa A $ba $bn $hts. **(L3,12)** 25 Ou Co. **(L3,20)** 4 Ou; 13 Xc. **(L3,24)** 4 Ou; 52 Eq Xc; 54 $pm $c. **(L3,27)** 25 Ou Co. **(L4,0)** 12 $pm; =13 $c. **(n3,1)** 36 $bn. **(n3,3)** 36 Ou Co $htv $pm $c. **(n3,15)** 44 Es. **(n3,16-17)** 45, 46 Ou Co $bn $hts. **(n3,19-20)** 47, 48 $bn $hts. **(n3,21-29)** 49...52, 52...56 Ou Co $bn $hts. **(+n3,21)** 49 $htv $c. **(+n3,26)** 53 Ct. **(n4,0)** 56 Ou Co; 58 $htv $pm; =57 $c. **(q3,10-4,0)** *see Appendix.* **(+q3,13-4,0)** *see Appendix.* **(+q3,13-14)** 14, 15 Ct. **(+q3,20)** 33 Ct.ac.

				(Ece)		(Pro)	(Dlo)		(Ear)		(Dpr)		(Sta)		
Tabulae numeri				Aequa tio centri		Prop orti ona lia	Longi tudo lon gior		Aequa tio argu menti		Longi tudo pro pior		Statio Veneris prima		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
4	1	7	29	1	44	31	0	56	44	25	0	58	5	17	46
4	2	7	28	1	43	32	0	57	44	36	0	59	5	17	48
4	3	7	27	1	42	33	0	58	44	47	1	0	5	17	49
4	4	7	26	1	41	33	0	59	44	57	1	1	5	17	50
4	5	7	25	1	40	34	1	0	45	6	1	2	5	17	51
4	6	7	24	1	39	35	1	1	45	14	1	4	5	17	52
4	7	7	23	1	37	36	1	1	45	21	1	5	5	17	53
4	8	7	22	1	36	37	1	2	45	27	1	6	5	17	54
4	9	7	21	1	34	38	1	3	45	33	1	8	5	17	54
4	10	7	20	1	33	39	1	4	45	39	1	9	5	17	55
4	11	7	19	1	32	40	1	5	45	45	1	10	5	17	56
4	12	7	18	1	31	40	1	6	45	50	1	11	5	17	57
4	13	7	17	1	29	41	1	7	45	54	1	12	5	17	57
4	14	7	16	1	28	42	1	9	45	57	1	13	5	17	58
4	15	7	15	1	26	43	1	10	45	59	1	15	5	17	59
4	16	7	14	1	25	44	1	11	45	59	1	16	5	18	0
4	17	7	13	1	23	44	1	12	45	58	1	17	5	18	1
4	18	7	12	1	22	45	1	13	45	57	1	19	5	18	2
4	19	7	11	1	20	46	1	15	45	55	1	20	5	18	3
4	20	7	10	1	18	46	1	17	45	51	1	21	5	18	3
4	21	7	9	1	16	47	1	19	45	46	1	23	5	18	4
4	22	7	8	1	15	48	1	21	45	39	1	24	5	18	5
4	23	7	7	1	13	48	1	23	45	31	1	25	5	18	5
4	24	7	6	1	12	49	1	25	45	21	1	27	5	18	6
4	25	7	5	1	10	50	1	27	45	9	1	28	5	18	7
4	26	7	4	1	9	50	1	28	44	55	1	30	5	18	7
4	27	7	3	1	7	51	1	29	44	39	1	32	5	18	8
4	28	7	2	1	5	51	1	31	44	21	1	34	5	18	9
4	29	7	1	1	3	52	1	32	44	1	1	36	5	18	9
5	0	7	0	1	1	52	1	33	43	39	1	38	5	18	10
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(a5,0) 4 Oo. **(f4,6)** 38 Ou Co $ba $bn $c. **(f4,9)** 35 Ou Co $ba $bn $c. **(f4,15)** 27 Ou Co $bn. **(f4,20)** 19 Pz Ou Co $ba $bn $c. **(f4,21)** 17 Ou Co $ba $bn $c. **(f4,23)** 14 Ou Co $ba $bn $c. **(f4,24)** 14 Oo; 10 $ba. **(f4,28)** 4 Ou Co; 6 $ba. **(g4,1-3)** 32, 33, 34 (33 Co) Ou Co. **(g4,4)** 34 Ou Co. **(g4,10)** 38 $hts. **(g4,11-29)** 39 40, 40 41 42 42 43 44, 44 45 46 46 47 48, 48 49 50 50 51 Ou Co $bn $hts. **(h-j, Inscr.)** longior: longitudo Xa. **(h4,3-4)** 1, 1 Oo. **(j4,1)** 55 $bn. **(j4,3)** 57 $pm; =58 $c. **(j4,6)** 0 $pm; =1 $c. **(j4,7-13)** 2...8 $htv; 2...5, 7...9 $c. **(j4,18)** 14 $pm; 15 $c. **(j4,24)** 24 $pm $c. **(j4,29-5,0)** 33 (34 Co), 35 Ou Co $bn. **(k4,5)** *n.l.* Cq. **(k4,26)** 45 Co. **(k5,0)** 44 Ct Oo Xa Cq Co Pa.ac A; 45 Pa.pc; 48 $ba. **(L4,3)** 77 (!) Ou; 40 $ba; 45 $pm; 46 $c. **(L4,6)** 15 Ou Co $bn $hts $htv $c. **(L4,8)** 30 $c. **(L4,9)** 34 Co; 36 $pm; 37 $c. **(L4,10-11)** 43, 48 $c. **(L4,12)** 51 $pm; 52 $c. **(L4,13)** 44 Eq. **(L4,21)** 45 $pm; =46 $c. **(L4,24)** 20 $pm $c. **(L4,27)** 40 $pm; =39 $c. **(n4,3)** 1 $htv $pm; =0 $c. **(n4,9)** 7 Ou Co. **(n4,18)** 18 $pm; =19 $c. **(n4,21)** 22 $pm; =23 $c. **(o4,29-5,0)** *vacat* Pz. **(p4,16)** 17 Xg. **(q4,1)** 44 Eq; 47 $km. **(q4,2-12)** *see Appendix.* **(+q4,5-12)** *see Appendix.* **(+q4,6)** 51 Pz. **(q4,19)** 2 Ou. **(q4,20)** 4 Co. **(q4,22)** 4 Ou Co. **(q4,23-26)** 6, 7, 7, 8 Lu.

				(Ece)		(Pro)	(Dlo)		(Ear)		(Dpr)		(Sta)		
Tabulae numeri				Aequa tio centri		Prop orti ona lia	Longi tudo lon gior		Aequa tio argu menti		Longi tudo pro pior		Statio Veneris prima		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
5	1	6	29	0	59	53	1	35	43	15	1	40	5	18	11
5	2	6	28	0	58	54	1	36	42	48	1	42	5	18	11
5	3	6	27	0	56	54	1	37	42	18	1	44	5	18	12
5	4	6	26	0	54	55	1	38	41	45	1	46	5	18	12
5	5	6	25	0	52	56	1	38	41	8	1	47	5	18	13
5	6	6	24	0	50	56	1	39	40	28	1	48	5	18	14
5	7	6	23	0	48	56	1	40	39	45	1	49	5	18	14
5	8	6	22	0	46	57	1	40	38	58	1	50	5	18	15
5	9	6	21	0	44	57	1	41	38	7	1	51	5	18	16
5	10	6	20	0	42	57	1	41	37	12	1	51	5	18	16
5	11	6	19	0	40	57	1	42	36	12	1	52	5	18	17
5	12	6	18	0	38	57	1	42	35	7	1	52	5	18	17
5	13	6	17	0	36	58	1	41	33	58	1	52	5	18	17
5	14	6	16	0	34	58	1	40	32	44	1	51	5	18	18
5	15	6	15	0	32	58	1	38	31	24	1	50	5	18	18
5	16	6	14	0	30	58	1	36	29	58	1	49	5	18	18
5	17	6	13	0	28	58	1	34	28	25	1	47	5	18	19
5	18	6	12	0	26	59	1	31	26	46	1	43	5	18	19
5	19	6	11	0	24	59	1	28	25	2	1	38	5	18	19
5	20	6	10	0	22	59	1	*24*	23	12	1	33	5	18	19
5	21	6	9	0	20	59	1	*19*	21	15	1	27	5	18	20
5	22	6	8	0	18	59	1	*12*	19	11	1	21	5	18	20
5	23	6	7	0	16	59	1	4	17	2	1	14	5	18	20
5	24	6	6	0	13	60	0	56	14	47	1	6	5	18	20
5	25	6	5	0	11	60	0	48	12	26	0	57	5	18	21
5	26	6	4	0	8	60	0	40	10	3	0	46	5	18	21
5	27	6	3	0	6	60	0	31	7	38	0	35	5	18	21
5	28	6	2	0	4	60	0	21	5	9	0	24	5	18	21
5	29	6	1	0	2	60	0	11	2	36	0	12	5	18	21
6	0	6	0	0	0	60	0	0	0	0	0	0	5	18	21
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(a6,0) 5 Oo. **(f5,1)** 59'33" $c. **(f5,4-5)** 55, 53 Ou Co $ba. **(f5,6)** 51 Ou Co. **(f5,9)** x'viiii Cq. **(f5,14)** 30 Pz. **(f5,20-21)** 21, 19 $ba $bn $c. **(f5,22-23)** 16, 14 $ba; 17, 15 $bn $c. **(f5,22)** 19 Pz. **(f5,24-25)** 14, 12 Ou Co. **(f5,26)** 9 Ou Co $ba $bn $c. **(f5,28)** viii Oo. **(g5,1-24)** *see Appendix*. **(+g5,12-24)** =A; 58(5), 59(5), 60(3) Pa. **(g5,18)** 58 Xc. **(h24-25)** 1,1 Cq. **(j5,1-6)** 55, 56, 57, 58, 58, 59 Xa Cq. **(+j5,3)** 36 $htv $c. **(+j5,5)** 39 Ct Oo Lu Ou Co Pa A Eq Xc $ba $bn $hts. **(j5,16)** 37 Ou Co. **(j5,17)** 32 $ba. **(j5,19-20)** 38, 36 Pz. **(+j5,20)** 24: Ou $ba $bn $hts; 27 Co; 26 *cett., cf. (k5,18)*. **(j5,21)** 19: Ou Co $ba $bn $hts $htv $pm $c; 20 Eq Xc Es; 25 *cett., cf. (k5,19)*. **(j5,22)** 12: Ou Co $ba $bn $hts; 13 Eq Xc Es Xg $c; 23 *cett., cf. (k5,20)*. **(j5,24)** 58 $pm $c. **(k5,7)** 31 Co. **(k5,23)** 19 $ba. **(k5,28)** 40 (!) $ba. **(L5,3)** 15 Ou Co. **(L5,4)** 15 Ou Co. **(L5,7)** 46 Ou Co $ba $bn $hts. **(L5,9)** 7: Pz *in ras.*, Ou Co Pa A Eq Xc Es $ba $bn $hts $htv $pm; liii Oo; 50 *cett.*; 8 $c. **(L5,11)** 52 Ou Co. **(L5,12)** 8 Oo. **(L5,13)** 54 Es; 17 $ba; 48 $hts, *prave*. **(L5,19)** 22 Pa A. **(L5,24)** 46 Ou Co. **(L5,25)** 27 Ou Co $bn $hts; 29 $c. **(L5,26)** 4 Ou Co $ba $hts; 5 $bn. **(L5,28)** 6 $c. **(n5,3)** 43 $hts $htv $pm $c; 45 $bn. **(n5,8)** 59 Xc. **(n5,16)** 48 Ou Co $bn $hts. **(n5,17)** 45 Ou Co $bn $hts; 46 $ba. **(n5,20)** 37 Lu; 34 Ou Co. **(n5,22)** 31 Xa Cq. **(n5,24)** 7 Ou Co $bn $hts $c; 17 $ba; 16 Xc; 5 $pm. **(n5,26)** 45 $hts. **(q5,1-6,0)** 10, 11, 12(2), 13(2), 14(2), 15(2), 16(2), 17(3), 18(3), 19(3), 20(6), 21(3) Ou Co. **(+q5,11)** 16 $km.

EA71: Appendix to the apparatus.

```
(g0,16-1,0)  58 58 57(3) 56(3) 56 55(2) 54(2) 53 52   Ou Co;
             58 57 57(3) 56(3) 56 55(2) 54(2) 53 52   $hts;
             58 57 57(3) 56(3) 55 55(2) 54(2) 53 52   $ba $bn.

(q0,1-15)    51 51 51 52 52 52 53 53 53 54 54 54 55 55 56:  plerique, $km;
             53 53 53 53 53 53 53 53 53 53 53 53 53 53 53   Ou Co;
              -  -  -  -  - 53  -  -  -  -  - 54  -  -  -   $bn $ba;
              -  - 52  -  - 53  -  - 54  -  - 54  -  - 55   $hts $htv.

(q0,16-1,0)  56 56 57 57 57 58 58 58 59 59 59 0 0 0 1:  plerique, $km fere;
             55 55 55 56 56 57 57 58 58 59 59 1 1 2 2   Ou Co;
              -  - 56  -  -  -  -  - 58  -  - - - - 2   $bn $ba;
              -  - 56  -  - 57  -  - 58  -  - 0 - - 2   $hts $htv.

(n1,5-28)    11 12 12 12 12 13 13 13 13 14 14 14 15 15 15 16 16 16 17 17 17 18 18 18:
                                                             plerique, $hts $ba;
             12 12 12 12 13 13 13 13 14 14 14 15 15 15 16 16 16 17 17 17 18 18 18 19 Ou Co $bn;
             12 12 12 13 13 13 14 14 14 15 15 15 16 16 16 17 17 17 18 18 19 19 19 $htv:
              . 12  .  .  .  .  . 14  .  .  .  .  . 16  .  .  .  .  . 18  .  .  .  . $pm;
              . 11  .  .  .  .  . 13  .  .  .  .  . 16  .  .  .  .  . 18  .  .  .  . $c.

(q1,1-15)    1 2 3 4 5 6 7 8 9 10 11 12 13 14 15:  plerique;
             2 3 3 4 5 6 6 7 7  8  9 10 11 12 13   Ou Co;
             - - - - - 6 - - -  -  - 11  -  -  -   $bn $ba;
             - - 4 - - 6 - - 8  -  - 11  -  - 14   $hts $htv;
             2 3 4 4 5 6 6 7 8  9 10 11 12 13 14   $km.

(q1,16-2,0)  16 17 18 19 20 21 22 23 24 25 26 27 28 29 30:  plerique;
             14 15 16 17 18 19 20 21 22 23 24 25 26 28 30   Ou Co;
              -  - 17  -  -  -  -  - 23  -  -  -  -  - 30   $bn $ba;
              -  - 17  -  - 20  -  - 23  -  - 27  -  - 30   $hts $htv;
             15 16 17 18 19 20 21 22 23 24 25 27 28 29 30   $km.

(f2,1-3,0)   ut textus: $ba, cett., v.i.;
             42...51 51 52, 53 54 55 56 56 56, 57 57 57 58 58 58, 58 59(5)   Ou Co;
             42...51 51 52, 53 54 55 55 56 56, 57 57 58 58 58 59, 59 59(5)   $bn;
             42...51 51 52, 53 53 54 55 55 56, 56 57 57 57 58 58, 58 59(5)   $c.

(q2,1-15)    31 32 33 34 35 36 37 38 39 40 41 43 45 47 49:  plerique, $km fere;
             31 32 34 35 37 38 38 40 42 43 45 46 47 48 49   Ou Co;
              -  -  -  -  - 38  -  -  -  -  - 46  -  -  -   $bn $ba;
              -  - 35  -  - 38  -  - 43  -  - 46  -  - 51   $hts $htv.

(q2,16-3,0)  50 52 53 54 56 58 59 0 2 3 5 7 8 10 11:  plerique, $km;
             51 53 54 55 56 58  0 1 2 3 5 6 8  9 11   Ou Co;
              -  - 54  -  -  -  - - 2 - - - -  - 10   $bn, $ba(v.i.);
              -  - 54  -  - 58  - - 2 - - 7 -  - 11   $hts $htv.

(f3,4-20)    ut textus: $ba, cett.;
             59(4) 58 58(3) 57(2)    56 56 55 55 54 54 53   $bn;
             59(4) 58 58(3) 57(2) 57 56 56 55 55 54 54      Ou Co;
             59(4) 59 58(3) 57(2) 57 56 56 55    54 54 53   $c.

(q3,10-4,0)  21 22 23 24 25 26 27 28 29 30 32 33 34 36 37 38 39 41 42 43 45:  plerique;
             22 23 24 25 26 28 29 31 32 33 34 36 37 38 39 40 41 42 44 45 46   Ou Co;
              -  - 24  -  -  -  -  - 32  -  -  -  -  - 40  -  -  -  -  - 46   $bn $ba;
              -  - 24  -  - 28  -  - 32  -  - 36  -  - 40  -  - 43  -  - 46   $hts $htv.
(+q3,13-4,0)          25 26 27 28 29 30 32 33 34 36 37 38 40 41 42 43 45 46   $km.

(q4,2-12)    48 49 50 51 52 53 54 54 55 56 57:  plerique;
             47 48 49 50 51 51 52 53 54 55 56   Ou Co;
              -  -  -  - 51  -  -  -  -  - 56   $bn $ba;
              - 49  -  - 51  -  - 54  -  - 56   $hts;
              - 48  -  - 51  -  - 54  -  - 56   $htv;
(+q4,5-12)          50 51 52 53 53 54 55 56   $km.

(g5,1-24)    52 53 54 54 55 55, 56 56 56 57(3), 57 58(2) 58(3), 59(3) 59(3)   Ou Co $bn $hts;
             53 53 55 55 55 56, 56 56 57 57(3), 58 58(2) 59(3), 59(3) 60(3)   $ba.
```

EA81. Equation of Mercury.

Toomer 1968, no. 44. – From Albattani, Nallino II p. 132-37, but "statio prima" is like Khw/M, Suter Tab.51-56 p.162-67. See notes to EA41-81.

Witnesses: **{a0}** Ct,21v-22v; Oo,17v-18v; Pz,124v-125v; Mc,16v, 23r-v; Mb,46r-47v; Ey,50v-53r; Da,203r (first table only); Ea,46v-47v. – **{a1}** Xa,27r-28r; Ad,91r-92r; Cq,49-51; Fc,32r-34v; Ps,57v-60r; Sg,146-151; Wd,26r-27r; Fh,43r-45v; Xw,26r-27r. – **{a2}** Cz,76v-79r; Cj,149v-152r; Md,82v-85r; Mp,214r-216v; Vp,131v-134r. – **{aX}** Vo,52r-54v; R,59r-61v; Ov,74v-77r; Cu,72v-75r; Ep,50r-52v. – **{aT}** Lu,57v-60r; Oj,130r-132v; P,118r-120v. – **{k}** Eh,90r-92v; Lw,85r-87v; Ou,63r-65v; Eg,17r-18r; Co,160v-161v; Cn,94v-96r. – **{d}** Op,56v-59r; C,333-338; Lb,(26r)-28v (25v-26r not seen); Pa,42r-44v; A,221r-223v; Fj,42r-44v; Nc,111r-113v; Pb,33r-35v; Pv,27r-29v; Fd2,43r-45v; Gr3,114r-116v; Ok,49v-52r. – **{e}** Eq,71'v-74r; Ek3,98v-101r; Xc,66v-69r; Vj,90r-92v; Ej,73r-75v. – **{x}** Oc,77v-80r; X,154v-157r; Mv,88v-91r; Cm,206v-209r; B,146r-149r; T,291v-292v; Lf,94v-97r; Lg,173v-176r; Lh,139v-142r; Xj,278v,277r-v,279r-280r; Xg,57v-60r; G,62r-64v; Xb,77r-79v; Es,178v-181r; Fb,67v-70r; Pq,186v-189r; Oy,74v-77r; Wa,66v-68v; Ow,157v-160r; Nu,142v-145r. – **{p}** O,72r-74v; Pd,70v-73r; Ch2,170r-172v. – **{?}** Ch,35v-38r (:Savasorda 1); Ch,74v-77r (:Savasorda 2); Pn,45r-47v (:Jo. Lin.). – Duplicates in {?} Ch; lacuna in {x} Vz.

Headings. – General:

(1: none) :: {a0:} Ct Mc Mb Da, {a1:} Sg Fh Xw, {d?} Lb Ok.
(2) (Cursus+ Ps Wd**) Mercurii** :: {a1:} Xa Cq Ps Wd; {aX} Vo; {p:} Ch2. – *Added:* **Aequatio Mercurii** Xa Cq.
(3) Aequatio (/-ones Lu Oj P X**) Mercurii** :: {a0:} Oo Ea; {a1:} Ad; {aT:} Lu Oj P; {d:} Pa A Fj Nc Pb Pv Fd2 Gr3; {x:} X Wa; {p:} Pd; {?:} Ch(35v,74v).
(4) Tabula aequationis Mercurii (+prima Ov! Vp! Ou Op C O!) :: {a0:} Ey; {a1:} Fc!, {a2:} Cz Cj Md Mp Vp; {aX:} Ov R Cu Ep!; {k:} Eh Lw Ou Eg Co; {d?:} Op C; {e:} Eq Ek3 Xc Vj Ej; {x-}; {p:} O; {?:} Pn. – "prima" is variously placed in Vp Ov O.
(5: other) :: Pz ("Tabula Mercurii"); Mb ("Mercurii tadil", gloss only); Md ("De Mercurio", then the above); Cn.

Entrance columns: normally, **(6) Tabulae numeri** (earlier); **(7) Lineae numeri** (later). – **(8) Lineae numeri communes** :: {d:} Lb Pa A Fj Nc Pb Pv Fd2 Gr3; {p:} O; {x:} Xj. – **(9) Lineae numeri communes centro et argumento** :: {a2:} Mp; {e:} Xc Vj Ej; {x:} Oc Xb Es; {?:} Pn. – **(10: other)** :: Ps Ch(35v,74v).

.Ece: **(11) Aequatio centri** :: normally. – **(12) Aequatio puncti** :: {a0:} Ct Oo Da, {k:} Ou. – **(13) Aequatio puncti et portionis** :: {k:} Eh Lw Eg! Co. – **(14: other)** :: Pz ("Aeq. centri id est puncti"); Cn ("Aeq. cuspidis"); Ch(35v,74v).

.Pro: normally, **(15) Proportionalia,** with **Minuta** before or after. – **(16) Minuta partium** :: {a0:} Pz Da; {k:} Eh Lw Ou Eg Co Cn. – **(17) Partium:** Mb Oo. – **(18: other)** :: Ct (just the sign "minuta"); Ch(35v,74v).

.Dlo: **(19) Longitudo longior,** everywhere.

.Ear: **(20) Aequatio argumenti** :: normally. – **(21) Aequatio portionis** :: {a0:} Ct Pz(pc) Da; {aT:} Lu Oj P; {k:} Eh Lw Ou Eg Co Cn. – **(22: other)** :: Oo ("Longitudo proportionis", from conflation with the adjacent sub-headings?); Ch(35v,74v: "Rectitudo portionis").

.Dpr: **(23) Longitudo propior** (proprior, occasionally; propinquior Pa A Fj Gr3 Eg) :: normally. – **(24: other)** :: Mb ("Longitudo brevior").

.Sta: **(25) Statio Mercurii prima** or **Statio prima Mercurii** :: normally. – **(26) Statio prima** {a0:} Ey; {a2:} Vp; {aX} Ov R Cu; {aT:} Lu; {k:} Cn; {d:} Lb Pa A Fj Nc Pb Pv Fd2 Gr3; {x:} Wa; {p:} O Pd Ch2; {?} Ch(35v,74v). – **(27: other)** :: Eg Mb Ps. – Mb Ps show separate tables; see "Versions".

Versions. Ey shows the sub-tables in the order "... .Ear .Dlo .Dpr ...", with .Dlo .Dpr under the common heading "Diversitas diametri epicycli". Mb Ps have .Sta apart from the rest. In the rest of the witnesses the sub-tables are ordered as indicated.

Values. Parameters: eccentricity of deferent 3;0, radius of epicycle 22;30.

Peculiarities. – *Ece:* The values are the same as those of the Almagest where these are present, except for 3 insignificant deviations. Departures from the recomputation do not exceed 2', and all are caused by the Almagest values.

Text. For detailed references and summary on coverage, see preface to EA41-81. – Witnesses collated for values, entire table: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** Lu; **{k}** Ou Co; **{d}** Pa A; **{e}** Eq Xc; **{x}** Es Xg. – Headings according to Xa. In Xa there is a general page-heading "Mercurii", here reproduced once.

Parallels collated, all sub-tables except .Sta: for all degrees of the argument, **$ba** = Batt., Paris Arsenal 8322, 78v-81r; **$bn** = Batt., Nallino II p. 132-137; **$hts** = Stahlman 1960, table 45. – Collated for 6°(6)90°(3)180°: **$htv** = Handy Tables, Vat. gr. 304, 231v-234r; **$pm** = Almagest XI,11, Toomer p.553.

Parallels collated for .Sta: for all degrees of the argument, **$km** = Khw/M, Suter table 51-56, first stations. – At 6-degree intervals only: **$ba** = *ms. cit.*, 82r; **$bn** = *op. cit.*, p. 139; **$hts** = Stahlman 1960, table 55; **$htv** = *ms. cit.*, 241v. In passages, $hts and $htv may be quoted at 3-degree intervals, but this is not general; see under EA41-81, section (B).

Recomputation: **$c,** for .Ece .Dlo .Ear .Dpr only, and quoted in selection, mainly where it differs from the adopted text by 3′ or more; see under EA41-81, section (A). For the parameters, see "Values" above.

Mercurii.

				(Ece)		**(Pro)**	**(Dlo)**		**(Ear)**		**(Dpr)**		**(Sta)**			
						.Minu.										
Aequatio Mercurii				Aequa tio centri		Prop orti ona lia	Longi tudo lon gior		Aequa tio argu menti		Longi tudo pro pior		Statio Mercurii prima			
Tabulae numeri																
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi	
						.Minu.										
0	1	11	29	0	3	-60	0	2	0	17	0	1	4	27	14	
0	2	11	28	0	6	60	0	4	0	33	0	2	4	27	14	
0	3	11	27	0	9	60	0	5	0	49	0	3	4	27	14	
0	4	11	26	0	12	59	0	7	1	5	0	4	4	27	13	
0	5	11	25	0	15	59	0	8	1	22	0	4	4	27	13	
0	6	11	24	0	17	59	0	10	1	38	0	5	4	27	12	
0	7	11	23	0	20	58	0	12	1	55	0	6	4	27	12	
0	8	11	22	0	23	58	0	14	2	11	0	7	4	27	11	
0	9	11	21	0	25	58	0	15	2	27	0	8	4	27	11	
0	10	11	20	0	28	57	0	17	2	44	0	9	4	27	10	
0	11	11	19	0	30	57	0	19	3	0	0	10	4	27	9	
0	12	11	18	0	32	57	0	20	3	16	0	11	4	27	8	
0	13	11	17	0	35	56	0	22	3	32	0	12	4	27	7	
0	14	11	16	0	38	56	0	23	3	48	0	13	4	27	6	
0	15	11	15	0	40	55	0	24	4	5	0	14	4	27	5	
0	16	11	14	0	43	55	0	26	4	21	0	15	4	27	3	
0	17	11	13	0	45	54	0	28	4	37	0	16	4	27	2	
0	18	11	12	0	47	54	0	29	4	53	0	17	4	27	0	
0	19	11	11	0	50	53	0	31	5	9	0	18	4	26	59	
0	20	11	10	0	53	53	0	33	5	25	0	19	4	26	56	
0	21	11	9	0	55	52	0	34	5	41	0	20	4	26	54	
0	22	11	8	0	58	51	0	36	5	57	0	21	4	26	52	
0	23	11	7	1	0	51	0	38	6	13	0	22	4	26	50	
0	24	11	6	1	2	50	0	39	6	29	0	23	4	26	48	
0	25	11	5	1	5	49	0	41	6	45	0	24	4	26	46	
0	26	11	4	1	8	48	0	43	7	1	0	25	4	26	44	
0	27	11	3	1	10	47	0	44	7	17	0	26	4	26	42	
0	28	11	2	1	13	46	0	46	7	33	0	26	4	26	40	
0	29	11	1	1	15	45	0	48	7	49	0	27	4	26	38	
1	0	11	0	1	17	44	0	49	8	4	0	28	4	26	36	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	

(a1,0) *vacat* Oo. **(f0,1)** 4 Ou Co $ba. **(f0,3)** 8 Ou Co. **(f0,6)** 16 $ba. **(f0,10)** 29 Ou. **(f0,12)** 33 Eq Xc $ba. **(f0,13)** 25 Pz. **(f0,18)** 48 $ba. **(f0,29)** xx Oo. **(f1,0)** 18 Ou Co. **(g,Inscr.)** minu *(bis)*: minuantur *bis* Xa; minuatur *(semel)* Ct Oo Pz Ou Co Pa A Xg; mi(ur) *(semel)* Es; mun(ur) *(semel)* Xc. **(j0,1)** 3 Es Xg; 4 $ba. **(j0,2)** 3 Ou Co; 2 $ba. **(j0,5)** 9 Oo Ou Co Pa A $ba $bn $hts. **(j0,18)** 30 $htv; =29 $c. **(j0,21)** 35 Ou Co $bn. **(j0,22)** 37 $bn. **(j0,24)** 40 $htv; =39 $c. **(j0,27)** 45 $bn. **(L0,1)** 27 Oo Pz Cq. **(L0,2)** 37 Pz. **(L0,4)** 6 Ou Co $bn $hts. **(L0,10)** 48 Ou Co. **(L0,14)** 58 Ou Co. **(L0,15)** 4 Ou Co $bn $hts; 50 Oo. **(L0,18)** 4 Ou. **(L0,21)** 14 Pz. **(L0,24)** 25 $ba. **(L0,27-1,0)** 26, 26, 27, 28 *(cf. col. (n))* Oo. **(L1,0)** 5 $bn. **(m-n, Inscr.)** proprior Xa, *saepius*. **(n0,5)** 5 Ou Co $bn. **(n0,10)** 8 Oo Co. **(n0,26-27)** 24, 25 Ou Co $ba $bn $hts. **(p0,19-1,0)** 28...28 Pa A. **(q0,1-8)** *see Appendix*. **(+q0,6)** 33 $ba. **(q0,10)** 9 Pz; 11 $km. **(q0,12)** 9 Oo. **(q0,13-16)** 8 7 6 4 $km. **(+q0,13-14)** 6, 7 Ou. **(q0,17)** 1 Ou Co. **(q0,19)** 58 Ou Co. **(q0,21)** 44 Eq. **(q0,24)** 49 $km $bn $ba $hts $htv. **(q0,25)** 47 $km. **(q0,26)** 45 Ou Co $km. **(q0,27-28)** 43, 41 Ou Co. **(q0,29)** 28 Pz Ou Co. **(q1,0)** 26 Pz Ou.

				(Ece)		(Pro) .Minu.	(Dlo)		(Ear)		(Dpr)		(Sta)		
Aequatio Mercurii Tabulae numeri				Aequa tio centri		Prop orti ona lia	Longi tudo lon gior		Aequa tio argu menti		Longi tudo pro pior		Statio Mercurii prima		
Si	Gr	Si	Gr	Gr	Mi	Mi .Minu.	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
1	1	10	29	1	20	43	0	51	8	20	0	29	4	26	34
1	2	10	28	1	23	42	0	53	8	35	0	30	4	26	32
1	3	10	27	1	25	41	0	54	8	50	0	31	4	26	29
1	4	10	26	1	28	40	0	56	9	6	0	32	4	26	27
1	5	10	25	1	31	39	0	58	9	21	0	33	4	26	24
1	6	10	24	1	33	38	0	59	9	36	0	34	4	26	21
1	7	10	23	1	36	36	1	1	9	51	0	35	4	26	19
1	8	10	22	1	38	35	1	2	10	6	0	36	4	26	17
1	9	10	21	1	40	34	1	4	10	21	0	37	4	26	15
1	10	10	20	1	43	33	1	5	10	36	0	38	4	26	12
1	11	10	19	1	45	32	1	7	10	51	0	39	4	26	9
1	12	10	18	1	47	31	1	8	11	6	0	40	4	26	6
1	13	10	17	1	50	29	1	10	11	21	0	41	4	26	4
1	14	10	16	1	52	28	1	12	11	36	0	42	4	26	1
1	15	10	15	1	54	27	1	13	11	50	0	43	4	25	58
1	16	10	14	1	57	25	1	15	12	5	0	44	4	25	56
1	17	10	13	1	59	24	1	16	12	19	0	45	4	25	53
1	18	10	12	2	1	23	1	18	12	33	0	46	4	25	50
1	19	10	11	2	4	21	1	20	12	48	0	46	4	25	48
1	20	10	10	2	6	20	1	22	13	2	0	47	4	25	45
1	21	10	9	2	8	19	1	23	13	16	0	48	4	25	42
1	22	10	8	2	10	17	1	25	13	30	0	49	4	25	40
1	23	10	7	2	12	16	1	27	13	44	0	49	4	25	37
1	24	10	6	2	14	15	1	28	13	58	0	50	4	25	34
1	25	10	5	2	16	13	1	30	14	12	0	51	4	25	30
1	26	10	4	2	18	12	1	32	14	26	0	52	4	25	27
1	27	10	3	2	19	11	1	34	14	39	0	53	4	25	24
1	28	10	2	2	21	9	1	36	14	52	0	54	4	25	22
1	29	10	1	2	23	8	1	38	15	5	0	55	4	25	20
2	0	10	0	2	25	7	1	39	15	18	0	56	4	25	18
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(f1,2) 24 Oo. **(f1,16)** 58 A. **(f1,29-2,0)** 25, 23 Pz. **(g, Inscr.)** minu *(bis)*: minuantur, -atur Xa; minuatur *(semel)* Ct Oo Pz Cq Ou Co Pa A Xg; mi(ur) *(semel)* Es; min(ur) *(semel)* Xc. **(g1,16)** 26 Ou Co. **(g1,19)** 22 Ou Co. **(g1,21)** 24 Pz. **(g1,29)** 13 Pz. **(j1,1)** 57 Pz. **(j1,9)** 3 Ou Co $ba $bn $hts. **(j1,14-19)** 13, 15, 16, 18, 20, 22 Eq. **(+j1,17)** 17 Ou Co $ba $bn $hts. **(j1,25)** 24 Pz. **(j1,26)** 22 Pz. **(k1,12)** 10 Pz. **(k1,20)** 12 Pz. **(k1,24)** x<-> Oo.ac. **(k1,25)** 13 Co. **(L1,1)** 30 Xa. **(L1,4)** 5 Ou Co $ba $bn. **(L1,5)** 20 Ou Co $bn. **(L1,6)** 16 Co. **(L1,11)** 50 Oo. **(L1,12)** ? $htv.ac. **(L1,13-2,0)** *vacat* $ba. **(+L1,13-17)** =$hts, *cett.;* 20, 35, 49, 4, 18 Ou Co $bn. **(++L1,17)** 21 Pa A. **(+L1,24)** 50 Eq Xc. **(+L1,26)** 36 Pa A, Es.ac. **(+L1,28)** 3 Ou. **(n1,11)** xxxii Oo; 38 Co. **(n1,18)** 45 Ou Co $bn $hts $htv $pm; =46 $c. **(n1,19-26)** 46, 47--52: 47--52, 53 $ba. **(q1,1)** 33 Ou Co. **(q1,2)** 31 Cq Ou Co. **(q1,3)** 30 Eq Xc. **(q1,4)** 26 Ou Co. **(q1,8-11)** 16 (6 Co), 12, 10, 8 Ou. **(+q1,8)** 16 $km.C. **(q1,17)** 54 Co. **(q1,22-23)** 39, 38 Ou Co. **(q1,25-2,0)** 31, 28, 26, 22, 21, 19 (23 Co) Ou Co.

				(Ece)		(Pro) .Minu.	(Dlo)		(Ear)		(Dpr)		(Sta)		
Aequatio Mercurii Tabulae numeri				Aequa tio centri		Prop orti ona lia	Longi tudo lon gior		Aequa tio argu menti		Longi tudo pro pior		Statio Mercurii prima		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
2	1	9	29	2	27	5	1	41	15	31	0	57	4	25	16
2	2	9	28	2	29	4	1	43	15	44	0	58	4	25	14
2	3	9	27	2	31	2	1	44	15	56	1	0	4	25	11
2	4	9	26	2	33	1	1	46	16	9	1	1	4	25	9
2	5	9	25	2	34	+ 1	1	48	16	21	1	2	4	25	7
2	6	9	24	2	36	2	1	49	16	33	1	4	4	25	5
2	7	9	23	2	38	4	1	51	16	45	1	5	4	25	3
2	8	9	22	2	40	6	1	53	16	57	1	6	4	25	1
2	9	9	21	2	41	8	1	54	17	9	1	7	4	25	0
2	10	9	20	2	43	10	1	56	17	21	1	8	4	24	58
2	11	9	19	2	44	12	1	58	17	32	1	9	4	24	56
2	12	9	18	2	45	14	1	59	17	43	1	11	4	24	55
2	13	9	17	2	47	16	2	1	17	54	1	12	4	24	54
2	14	9	16	2	48	18	2	3	18	5	1	13	4	24	53
2	15	9	15	2	49	20	2	4	18	16	1	14	4	24	52
2	16	9	14	2	50	22	2	6	18	27	1	15	4	24	51
2	17	9	13	2	51	24	2	8	18	37	1	16	4	24	50
2	18	9	12	2	52	25	2	9	18	47	1	17	4	24	49
2	19	9	11	2	53	27	2	11	18	57	1	18	4	24	48
2	20	9	10	2	54	29	2	13	19	7	1	19	4	24	47
2	21	9	9	2	55	30	2	14	19	16	1	20	4	24	46
2	22	9	8	2	56	32	2	16	19	25	1	21	4	24	45
2	23	9	7	2	57	34	2	18	19	35	1	22	4	24	44
2	24	9	6	2	57	35	2	19	19	44	1	23	4	24	43
2	25	9	5	2	58	37	2	21	19	53	1	24	4	24	42
2	26	9	4	2	59	38	2	23	20	2	1	25	4	24	41
2	27	9	3	2	59	40	2	24	20	10	1	26	4	24	40
2	28	9	2	3	0	41	2	26	20	18	1	27	4	24	39
2	29	9	1	3	0	43	2	28	20	25	1	28	4	24	38
3	0	9	0	3	1	44	2	29	20	33	1	29	4	24	37
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(a3,0) 2 Oo. **(e2,27)** 3 Ou Co. **(f2,1)** 26 Ou Co. **(f2,5)** 35 Ou Co $bn $hts $c. **(f2,16-17)** *n.l.* Cq. **(f2,22-23)** 55, 56 Eq Xc. **(f2,27)** 0 Ou Co. **(f3,0)** 0 Ou Co Eq Xc. **(g,Inscr.)** minu: minuatur Ct Cq Ou Co Pa A Xg; minuantur Xa; m(ur) Eq; mi(ur) Es. **(g2,5)** "+": addatur Ct Oo Xa Cq Lu Ou Co Es Xg, Pz *(ad 2,6)*; adde Eq Xc; *om.* Pa A. **(g2,7)** 3 $ba. **(g2,9)** 5 Oo. **(g2,12)** 15 $bn. **(g2,19)** 26 $bn. **(j2,2)** 42 Ou Co $bn. **(j2,4)** 49 Co. **(j2,6)** 50 Ou Co. **(L2,2)** 34 A Eq Xc. **(L2,3)** 36 Xc. **(L2,5)** 31 Pz. **(L2,6)** 43 Pa A. **(L2,20)** 4 Co. **(L2,22)** 26 Ct Ou Pa A $ba $bn $hts; 27 Co. **(L2,23)** 25 Co. **(L2,28)** 10 Eq Xc. **(L2,29)** 26 Ou Co $bn $hts. **(m2,1-2)** 1,1 Oo Cq. **(n2,2)** 59 $bn. **(n2,6)** 3 Pa A. **(n2,7-9)** 6, 7, 8 Ou Co. **(q2,3)** 12 Ou Co. **(q2,8)** 2 Ou Co. **(q2,11)** 57 Ou Co. **(q2,29)** 39 $km. **(q3,0)** 38 $km $bn $ba $hts $htv.

				(Ece)		(Pro) .Adda.	(Dlo)		(Ear)		(Dpr)		(Sta)		
Aequatio Mercurii Tabulae numeri				Aequa tio centri		Prop orti ona lia	Longi tudo lon gior		Aequa tio argu menti		Longi tudo pro pior		Statio Mercurii prima		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
3	1	8	29	3	1	46	2	31	20	40	1	30	4	24	37
3	2	8	28	3	1	47	2	33	20	47	1	31	4	24	36
3	3	8	27	3	2	48	2	34	20	54	1	32	4	24	36
3	4	8	26	3	2	49	2	36	21	1	1	33	4	24	35
3	5	8	25	3	2	50	2	38	21	7	1	34	4	24	35
3	6	8	24	3	2	50	2	39	21	13	1	35	4	24	34
3	7	8	23	3	2	51	2	41	21	19	1	36	4	24	34
3	8	8	22	3	1	52	2	43	21	24	1	37	4	24	33
3	9	8	21	3	1	53	2	44	21	29	1	38	4	24	33
3	10	8	20	3	1	54	2	46	21	34	1	39	4	24	32
3	11	8	19	3	0	55	2	48	21	38	1	40	4	24	32
3	12	8	18	3	0	56	2	49	21	42	1	41	4	24	32
3	13	8	17	2	59	56	2	50	21	46	1	42	4	24	31
3	14	8	16	2	59	57	2	52	21	49	1	43	4	24	31
3	15	8	15	2	58	57	2	53	21	52	1	44	4	24	31
3	16	8	14	2	58	58	2	55	21	55	1	45	4	24	30
3	17	8	13	2	57	58	2	57	21	57	1	46	4	24	30
3	18	8	12	2	56	59	2	58	21	59	1	47	4	24	30
3	19	8	11	2	55	59	3	0	22	0	1	48	4	24	30
3	20	8	10	2	54	59	3	1	22	1	1	49	4	24	30
3	21	8	9	2	53	59	3	2	22	2	1	50	4	24	30
3	22	8	8	2	52	59	3	2	22	2	1	51	4	24	30
3	23	8	7	2	51	60	3	3	22	1	1	52	4	24	30
3	24	8	6	2	50	60	3	4	22	0	1	53	4	24	30
3	25	8	5	2	49	60	3	4	21	59	1	54	4	24	29
3	26	8	4	2	48	60	3	5	21	58	1	55	4	24	29
3	27	8	3	2	46	60	3	6	21	56	1	56	4	24	29
3	28	8	2	2	45	60	3	6	21	53	1	56	4	24	29
3	29	8	1	2	43	60	3	7	21	50	1	57	4	24	29
4	0	8	0	2	41	60	3	8	21	47	1	57	4	24	29
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(a4,0) 3 Oo. **(f3,9)** 2 $pm; =1 $c. **(f3,26)** 40 Oo. **(g, Inscr.)** adda: addatur Ct Pz Xa Cq Lu Ou Co Pa A Xg; add() Es; adde Xc. **(g3,18)** 58 Ou Co. **(j/L)** *columnam alteram loco alterius scribit notisque ambas distinguit* Cq. **(j3,12)** 48 $htv $pm $c. **(j3,13)** 51 Ou. **(j3,22)** 3 $ba. **(j3,25)** 5 $bn. **(j3,27)** 5 $ba. **(k3,25-4,0)** 22...22 Eq Xc. **(L3,2)** 41 $ba. **(L3,3)** 55 Ou Co $ba. **(L3,6)** 14 $pm; =13 $c. **(L3,12)** x'n Oo. **(L3,24)** 1 $pm $c. **(L4,0)** 57 Xa. **(n3,8)** 36 Cq. **(n3,17-4,0)** *see Appendix.* **(q3,1-4,0)** 38, 37(2), 36, 35(2), 34(2), 33(3), 32(2), 31(4), 30(8), 29(5) Ou; (*ut ms.* Ou) -- 32(3), 31(4), 30(8), 29(4) Co. **(q3,1)** 36 $km.O. **(q3,6)** 37 $ba. **(q3,7)** 33 Xc.?pc. **(q3,10)** 33 $km. **(q3,13)** 32 $km. **(q3,16-17)** 31, 31 $km. **(q3,23-24)** 29, 29 Pa A. **(q3,25-28)** *n.l.* Oo. **(q3,25)** 30 $km.O. **(q3,29-30)** 39 Oo.

				(Ece)		(Pro)	(Dlo)		(Ear)		(Dpr)		(Sta)		
						.Adda.									
Aequatio Mercurii Tabulae numeri				Aequa tio centri		Prop orti ona lia	Longi tudo lon gior		Aequa tio argu menti		Longi tudo pro pior		Statio Mercurii prima		
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
4	1	7	29	2	39	60	3	8	21	43	1	58	4	24	29
4	2	7	28	2	37	60	3	9	21	38	1	58	4	24	29
4	3	7	27	2	35	60	3	9	21	33	1	59	4	24	29
4	4	7	26	2	34	59	3	9	21	27	1	59	4	24	29
4	5	7	25	2	32	59	3	10	21	21	1	59	4	24	29
4	6	7	24	2	30	59	3	10	21	15	2	0	4	24	29
4	7	7	23	2	28	58	3	11	21	8	2	0	4	24	29
4	8	7	22	2	26	58	3	11	21	*1*	2	0	4	24	29
4	9	7	21	2	24	58	3	12	20	53	2	0	4	24	30
4	10	7	20	2	22	57	3	12	20	44	2	1	4	24	30
4	11	7	19	2	20	57	3	12	20	34	2	1	4	24	30
4	12	7	18	2	18	56	3	12	20	24	2	1	4	24	30
4	13	7	17	2	16	56	3	11	20	13	2	1	4	24	30
4	14	7	16	2	14	56	3	10	20	2	2	1	4	24	30
4	15	7	15	2	11	55	3	9	19	50	2	1	4	24	31
4	16	7	14	2	9	55	3	8	19	37	2	1	4	24	31
4	17	7	13	2	7	55	3	7	19	24	2	0	4	24	31
4	18	7	12	2	4	54	3	6	19	10	2	0	4	24	32
4	19	7	11	2	2	54	3	5	18	55	2	0	4	24	32
4	20	7	10	2	0	53	3	4	18	40	2	0	4	24	32
4	21	7	9	1	57	53	3	3	18	24	2	0	4	24	33
4	22	7	8	1	55	52	3	1	18	7	1	59	4	24	33
4	23	7	7	1	52	51	2	59	17	50	1	59	4	24	33
4	24	7	6	1	49	51	2	57	17	32	1	58	4	24	34
4	25	7	5	1	47	50	2	55	17	14	1	57	4	24	34
4	26	7	4	1	44	50	2	53	16	55	1	55	4	24	34
4	27	7	3	1	41	49	2	51	16	35	1	53	4	24	35
4	28	7	2	1	38	49	2	48	16	14	1	51	4	24	35
4	29	7	1	1	35	48	2	45	15	53	1	49	4	24	35
5	0	7	0	1	32	48	2	42	15	31	1	47	4	24	36
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(a5,0) 4 Oo. **(e4,19-20)** 1, 1 Oo. **(f4,2)** 36 Ou Co. **(f4,21-22)** 59, 57 Ou Co. **(f4,27)** 48 Oo.ac. **(f4,28)** 39 Oo. **(f4,29)** 34 $bn. **(g, Inscr.)** adda: addatur Ct Pz Xa Cq Ou Co Xg; add() Es; adde Xc. **(g4,12-5,0)** *see Appendix*. **(j4,9)** 11 Ou Co. **(j4,12)** 11 Pa A. **(j4,21)** 2 $ba $bn $hts $htv $pm; =3 $c. **(j5,0)** 41 Pa. **(k4,8)** 20 Eq. **(k4,21-5,0)** 17(2), 16(3), 15(3), 14(2) Ou Co. **(L4,1-2)** *ras.* Co.ac. **(L4,1)** 44 Eq. **(L4,2)** 48 Oo. **(L4,8)** 1: Ct Ou Co Pa A $ba $bn $hts $c; 0 Es Xg; 4 *cett.* **(L4,9)** 52 Es Xg. **(L4,11)** 35 Ou Co $ba $bn $hts. **(L4,12)** 25 Ou Co $ba $bn $hts $htv $pm; =24 $c. **(L4,13)** 14 Ou Co $bn $hts; 12 $ba; *ras.* Oo. **(L4,15)** 15 Pa. **(L4,16)** 38 Ou Co. **(L4,21)** 54 Ou Co. **(L4,23)** 51 Pa A. **(L4,26)** 35 $ba. **(L5,0)** 21 A. **(m4,5)** 2 Ou Co $bn. **(n4,3-4)** 58, 58 Oo.ac. **(n4,5)** 0 Ou Co $bn. **(n4,17-19)** 1,1,1 Ou Co $bn. **(n4,23)** 58 $bn. **(n5,0)** 41 Pz. **(q4,1-5,0)** 29(6), 30(6), 31(3), 32(3), 33(3), 34(3), 35(3), 36(3) Ou Co. **(q4,15)** 30 $km. **(q4,18)** 31 $km; =32 $ba $bn $htv. **(q4,23)** 34 $km. **(q4,27)** 34 Pz. **(q4,29)** 36 $km.

Aequatio Mercurii				(Ece) Aequa tio centri		(Pro) .Adda. Prop orti ona lia	(Dlo) Longi tudo lon gior		(Ear) Aequa tio argu menti		(Dpr) Longi tudo pro pior		(Sta) Statio Mercurii prima		
Tabulae numeri															
Si	Gr	Si	Gr	Gr	Mi	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Si	Gr	Mi
5	1	6	29	1	30	48	2	39	15	8	1	45	4	24	36
5	2	6	28	1	27	47	2	36	14	44	1	43	4	24	36
5	3	6	27	1	24	47	2	32	14	20	1	41	4	24	37
5	4	6	26	1	21	46	2	29	13	55	1	39	4	24	37
5	5	6	25	1	18	46	2	25	13	29	1	37	4	24	37
5	6	6	24	1	15	45	2	21	13	3	1	34	4	24	38
5	7	6	23	1	12	45	2	17	12	36	1	32	4	24	38
5	8	6	22	1	9	44	2	13	12	9	1	29	4	24	38
5	9	6	21	1	6	44	2	9	11	41	1	26	4	24	39
5	10	6	20	1	3	43	2	5	11	12	1	23	4	24	39
5	11	6	19	1	0	43	2	0	10	43	1	20	4	24	39
5	12	6	18	0	57	43	1	55	10	13	1	17	4	24	39
5	13	6	17	0	54	42	1	50	9	43	1	14	4	24	39
5	14	6	16	0	51	42	1	44	9	12	1	11	4	24	39
5	15	6	15	0	48	42	1	38	8	40	1	7	4	24	40
5	16	6	14	0	45	42	1	32	8	7	1	4	4	24	40
5	17	6	13	0	42	41	1	26	7	34	1	0	4	24	40
5	18	6	12	0	39	41	1	19	7	1	0	56	4	24	40
5	19	6	11	0	35	41	1	13	6	27	0	52	4	24	40
5	20	6	10	0	32	41	1	7	5	53	0	47	4	24	41
5	21	6	9	0	28	41	1	1	5	19	0	42	4	24	41
5	22	6	8	0	25	41	0	55	4	45	0	38	4	24	41
5	23	6	7	0	22	40	0	48	4	10	0	33	4	24	41
5	24	6	6	0	19	40	0	42	3	35	0	28	4	24	41
5	25	6	5	0	16	40	0	35	3	0	0	24	4	24	41
5	26	6	4	0	13	40	0	28	2	24	0	19	4	24	41
5	27	6	3	0	9	40	0	21	1	48	0	14	4	24	41
5	28	6	2	0	6	40	0	14	1	12	0	10	4	24	42
5	29	6	1	0	3	40	0	7	0	36	0	5	4	24	42
6	0	6	0	0	0	40	0	0	0	0	0	0	4	24	42
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(a6,0) 5 Oo. **(e5,12-13)** 1, 1 Oo. **(f5,5)** 19 Eq Xc. **(f5,6)** 14 $ba. **(f5,12)** 54 Oo.ac. **(f5,15)** 47 $pm $c. **(f5,18)** 49 Pz; 38 $pm $c. **(f5,21)** 33 Ou Co. **(f5,22)** 26 $ba. **(g, Inscr.)** adda: addatur Ct Oo Pz Xa Xg Co Eq Xc; add() Es. **(g5,1)** 49 Pz. **(g5,9-22)** 43(3) 42(3) 41(4) 40(4) $bn. **(+g5,12)** 42 Eq. **(+g5,21-22)** 40, 40 $hts. **(j5,13)** 40 $ba. **(j5,14)** 40 Eq Xc. **(j5,16)** 36 Pz. **(j5,20)** 50 $ba. **(j5,23)** 49 Ou Co $bn $hts. **(k5,20)** 6 Ou Co. **(k5,22-23)** 7, 7 Oo.ac. **(k5,26)** *vacat* Co. **(k5,27-29)** 2, 1, 1 Ou Co. **(L5,1)** 10 Ou Co $bn. **(L5,2)** 45 $bn. **(L5,6)** 4 Ou Co. **(L5,14)** 52 $ba. **(L5,17)** 24 Ou Co. **(L5,19)** 37 Oo. **(L5,20)** 3 Ou Co; 13 $ba; 33 Pa A. **(L5,21)** 59 Ou Co. **(L5,22)** 55 Pz. **(L5,29)** xxxv{{i}} Ct. **(n5,6)** 39 $ba; 35 $bn. **(n5,7)** xxvii Cq, *partim p.c.* **(n5,10)** 33 $ba. **(n5,12)** 27 Pz. **(n5,21)** 43 $pm; =42 $c. **(n5,24)** 33 Co; 23 $ba. **(n5,26)** 24 Co. **(q5,1-15)** *see Appendix.* **(q5,16-6,0)** *see Appendix.* **(+q5,13-5,19)** 40(4), 41(3) Pa A. **(q5,19)** 41 Es.

EA81: Appendix to the apparatus.

```
(q0,1-8)         14 14 14 13 13 12 12 11:  plerique;
                 14 14 14 13 13 13 12 12   $km;
                 18 17 16 15 14 13 13 12   Ou Co;
                  -  -  -  -  - 13  -  -   $bn;
                  -  - 14  -  - 13  -  -   $hts;
                  -  - 13  -  - 14  -  -   $htv.

(n3,17-4,0)      46 47, 48 49 50, 51 52 53, 54 55 56, 56 57 57:  $ba, cett.;
                  - 46,  -  - 49,  -  - 52,  -  - 55,  -  - 57   $htv $pm;
                 45 46, 47 48 49, 50 51 52, 53 54 55, 56 56 57   $bn $hts;
                 47 48, 48 49 50, 51 52 53, 53 54 55, 56 56 57   $c.

(g4,12-5,0)      57, 56(3) 55(3), 54(2) 53 52 51 51, 51 50(2) 49(2) 49   Ou Co;
                 57, 56(3) 55(3), 54(2) 53 53 52 51, 51 50(2) 49(2) 48   $bn $hts.

(q5,1-15)        36 36 37 37 37 38 38 38 39 39 39 39 39 39 40:  plerique, $km;
                 37 37 37 37 37 38 38 38 38 38 38 39 39 39 39   Ou Co;
                  -  -  -  -  - 37  -  -  -  -  - 38  -  -  -   $bn $ba;
                  -  - 37  -  - 37  -  - 38  -  - 38  -  - 39   $hts $htv.

(q5,16-6,0)      40 40 40 40 41 41 41 41 41 41 41 41 42 42 42:  plerique, $km;
                 39 39 39 39 39 39 40 40 40 40 40 40 40 40 40   Ou Co;
                  -  - 39  -  -  -  -  - 40  -  -  -  -  - 40   $bn $ba;
                  -  - 39  -  - 39  -  - 40  -  - 40  -  - 40   $hts $htv.
```

EB. Extracts of planetary equation tables.

EB11. Extract from EA01, and from EA11.Ear. For the eclipse tract "Ut annos Arabum" (CbB).

Belongs to the eclipse tract "Ut annos Arabum"; see CbB02. Contains the values of the solar equation and of the lunar equation of argument, extracted from EA01 and EA11, for the usual set of arguments.

Witnesses: {?} Oq,22r-23r (:Ut Annos); Ox,91r-v,96r (:Ut Annos). – Occurs among eclipse tables. – *Headings:* as reproduced, Oq Ox. – *Sample.* From Oq Ox. Not emended.

Tabula aequationis solis et lunae tempore coniunctionis et oppositionis.

Lineae numeri				Aequatio solis (EA01)			Aequatio argumenti lunae (EA11.Ear)		
Si	Gr	Si	Gr	Gr	Mi	Se	Gr	Mi	Se
0	1	11	29	0	2	2	0	4	50
0	2	11	28	0	4	2	0	9	40
...	...	...	...	...	...	...	...	...	...
3	0	9	0	1	59	4	5	0	2
3	1	8	29	1	59	10	5	0	16
3	2	8	28	1	59	10	5	0	44
3	3	8	27	1	59	8	5	0	55
3	4	8	26	1	59	4	5	0	59
3	5	8	25	1	58	57	5	0	59
3	6	8	24	1	58	50	5	0	57
...	...	...	...	...	...	...	...	...	...
5	29	6	1	0	2	9	0	5	45
6	0	6	0	0	0	0	0	0	0
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)

(g3,0) 14 Ox. **(h3,0)** 4 Ox.

EB2*. Separate tables for planetary stations.

EB21. Values comparable to EA41-EA81.

Mb,48r-51v: "Statio prima Saturni", etc., five tables in succession, each for 0s1°(1°)6s0°. Correspondingly, EA41...81 have no such sub-tables.

Ps,60v-63r: "Tabula stationum planetarum (...; Statio Saturni prima; ...)": five tables in parallel, 1°(1°)180°. Correspondingly, EA41...81 have no such sub-tables.

Da1,128r-130r: "Tabula stationum Saturni", etc., five tables in succession, 0s1°(1°)6s0°. There are no copies of EA41...81 in this part of the manuscript; the copies in Da, 194r+, do show the sub-tables .Sta. – The relevance is slight; the collection Da1 is a small fragment.

EB22. Albatenian.

Pn,56r: "Tabula de stationibus planetarum (...; Statio Saturni prima; Statio secunda; ...)", five tables in parallel, 6°(6°)180°. The argument values and the layout are as in Albattani, Nallino II p. 138-9, and the values are comparable to Nallino's edition, though they often differ by a few minutes.

The copies of EA41...81 in Pn,33r+ show the normal sub-tables for stations. Ms. Pn contains many tables by John of Lignères, but the present table does not seem to belong in this context either, since it is absent from similar collections.

EC. Equation tables, Alkhwarizmian.

These tables accompany the mean motion tables CE40, q.v., in both of the known manuscripts, Da2 and Pz. A discussion of them, based on ms. Pz, is in Mercier 1987 p. 101.

The values are essentially the same as in the tables of Alkhwarizmi / Maslama (Suter Tab. 21 ff.). Our tables appear as a selection from the tables of Suter, comprising:

		(Suter, Tab. 21-26:)
EC11:	Sun, equation	Examinatio solis
	Moon, equation	Examinatio lunae
	Moon, latitude	Latitudo lunae
		(Suter, Tab. 27-56:)
	Planets, "aequatio cuspidis"	Examinatio centri
EC12:	Planets, "aequatio residui"	Examinatio ipsius elheza.

In the Suter tables, the values for sun and moon are given down to seconds, whereas the present values are rounded to minutes. The values for the five planets reproduce their counterparts with few variants.

Testimony: Ibn Almuthanna quotes a 1° value for Mercury as 0;16° (since the value for 7 1/2° was 2;0°: Q30, p.43:16 Goldst.), which fits the present table and also that of Suter. Also, the EC12 values may be compared to Ibn Almuthanna Q32 (cf. Goldstein 1967 p. 197),[1] where the maximum values are quoted as 340′ (=5°40′ against 5°44′ in EC12), then 652′, 2431′, 2831′ and 1290′, all equal to those of EC12. Thus there is no doubt that these values should be attributed to Alkhwarizmi.

EC11. Da2,209v-211r: "Lineae numeri; Aequatio solis; Aeq. lunae; Aeq. latitudinis lunae; Aeq. cuspidis Saturni; Aeq. c. Iovis; Aeq. c. Martis; Aeq. c. Veneris; Aeq. c. Mercurii", all written in parallel; entrances (0s1°, 11s29°) - (6s0°, 6s0°), increment 1°.

EC12. Da2,211r-212r: "Tabulae numeri aequationis residui; Aequatio residui Martis; Aeq. r. Iovis; Aeq. r. Martis; Aeq. r. Veneris; Aeq. r. Mercurii", all written in parallel; entrances (0s1°, 11s29°) - (6s0°, 6s0°), increment 1°.

EC11-12. For purposes of recognition, I quote the maximum values of all the tables, together with the arguments where they assume these maxima.

	(EC11)	**(EC12)**
Sun, equation:	2;14° (for 2s27°-3s5°)	
Moon, equation:	4;56° (for 2s28°-3s3°)	
Moon, latitude:	4;30° (for 2s28°-3s3°)	
	Aequatio cuspidis	Aequatio residui
Saturn:	8;37° (for 3s 0°)	5;44° (for 3s 5°-3s8°)
Jupiter:	5; 6° (for 2s29°-3s1°)	10;52° (for 3s 8°-3s13°)
Mars:	11;13° (for 3s 0°)	40;31° (for 4s 8°-4s9°)
Venus:	2;14° (for 3s 0°)	47;11° (for 4s15°)
Mercury:	4; 2° (for 3s 0°)	21;30° (for 3s22°)

---

1 Some of the tables quoted in Ibn Almuthanna are for "kardagas" of 7 1/2° or 3 3/4° whereas others had interpolations such as to show values at 1° intervals. This complication is ignored here, since the quoted values are valid in either case.

F. Planetary latitudes.

Tables of lunar latitude: see EA11, EC11.

FA11-21. Latitudes, Alkhwarizmian.

Toomer 1968 no. 45-46. – Tables FA11 and FA21 occur together in the witnesses, in this order except for mechanical displacements in Ad and Cm.

They are certainly derived from tables like those of Alkhwarizmi / Maslama, as quoted below. Indeed, the Alkhwarizmian tables have been shown to contain gross errors which have been inherited by FA11; see the note there. As concerns layout, the present tables differ from the Khw/M tables; thus, all our tables are written in parallel whereas each of the Khw/M tables is attached to the equation table for the planet in question. Also, the entrances of the Maslama tables are in signs and degrees, whereas here they are expressed in degrees only. FA21 appears further transformed.

Canons: Cc313-14; Cb165-66; CcB17. The last is the same as Adelard's translation of Alkhwarizmi, Suter ch. 17; the two former ones may have a similar source.

Headings implied by the references in the canons, quoted in the form "table FA11 / table FA21". – Whole table: "tabula binarii (+numeri) / tabula quaternarii" Cc; "tabulae bipartialis numeri / tabulae quadripartialis numeri" Cb. – Table for a single planet: "latitudo prima / latitudo secunda" CcB (=Adelard); "tabula planetae prima / tabula planetae secunda" Cb; "tabula planetae" (in both cases) Cc.

Thus, in the first case, Cc resembles some of the archaic witnesses, whereas Cb reflects the vulgate.

FA11. "Tabula binarii numeri..."

Toomer 1968 no. 45. – The values are the same as in Alkhwarizmi / Maslama, Suter Tab.27-56 p.138-67, columns "Latitudo ... prima" for each planet.

Witnesses: **{a0}** Oo,37v-38v; Cq2,113-115; Pz,126v-127v; Mc,24v-25v; Mb,52v-53v; Ey,56r-58v. – **{a1}** Xa,28v-29v; Ad,92v-93v; Cq,52-54; Fc,35r-37v; Ps,63v-66r; Sg,152-157; Wd,27v-28v; Fh,46r-48v; Xw,27v-28v. – **{a2}** Cz,79v-82r; Cj,152v-155r; Md,87r-89v; Mp,217r-219v; Vp,134v-135v. – **{aX}** Vo,55r-57v; R,106r-107r; Ov,90r-92v; Cu,76r-78r; Fj2,105r-106r. – **{aT}** Lu,60v-63r; Oj,133r-135v; P,121r-123v. – **{k}** Eh,103r-v+,93r-94v(m2). – **{d}** Lb,29v-30r; A,266r-267v(m2), 269r-v(m2); Nc,124v-127r; Ok,52v-55r. – **{e}** Gr,56r-58v; Eq,74v-77r; Ek3,101v-104r; Xc,69v-72r; Vj,93r-95v; Ej,76r-78v. – **{x}** Oc,80v-83r; X,157v-160r; Mv,92r-94v; Cm,209v-212r; B,149v-150v; T,293r-v; Lf,97v-100r; Lg,176v-179r; Lh,142v-145r; Xj,280v-282'r; Xg,60v-63r; G,65r-67v; Xb,80r-82v; Es,181v-184r; Fb,70v-73r; Pq,189v-192r; Oy,77v-80r; Wa,68v-69v; Ow,160v-163r; Nu,145v-148r. – **{p}** O,75v-78r; Pd,33r-35v. – **{?}** Ew1,27r-29v; Da2,212v-213r (:with CE40); Vd2,56v-59r (:?). —— A lacuna in {x} Vz is likely to have contained this table.

Canons: see under FA11-21 above.

Headings. The term "...bipartialis / binarii...", used about the double entrance columns, is likely to have been introduced in contradistiction to the term "quadripartialis / quaternarii" used about FA21. Since the latter may be a coinage proper to the Toledan tables (see preamble to FA21), then so is possibly the term for the present table. – General headings:

- **(1) Tabula bipartialis** (/**binarii** Oo.pc Mc Mb Lb Da2; *om.* Oo.ac) **numeri ad scientiam latitudinum** (-nis Oo; **+5** Lb Lu P) **planetarum** :: {a0:} Oo Mc Mb; {a1:} Xa Ad Cq Fc Sg Fh Xw Wd; {aX:} Fj2; {aT:} Lu P; {d:} Lb Nc; {?:} Da2!. – *Added:* +haesitantium Lb; +sive radix latitudinis Fc.
- **(2) Tabula bipartialis numeri ad sciendum** (-dam Oj Vo A) **latitudines** (-nem Oj Vo A Ok: **+5** Oj Xc Vj Ej Mv T! Xg O Pd) **planetarum** :: {a2:} Cz Cj; {aT:} Oj; {aX:} Vo Cu; {k:} Eh; {d:} A Ok; {e}; {x-}; {p:} O Pd.
- **(3) Tabula bipartialis numeri ad latitudines** (-nem Ps X Ow) **planetarum** (**+5** Oc X Xb Es Wa!) :: {a1:} Ps; {a2:} Md Mp Vp; {aX} Ov R; {x:} Oc X Xb Es Wa Ow. – *Added:* **+ex epicyclo ipsorum** Oc Xb.
- **(4: other)** Ey Pz Cq2 Vd2 Ew1 (all: **Tabula ... binarii ...**, endings different).

Entrance column: **(5) Numerus (+graduum** Fh Ok) :: {a0:} Oo Pz Mc Mb; {a1:} Xa Ad Cq Fc Sg Fh Xw Wd; {aX:} Vo R Fj2; {d:} Nc Ok; {?:} Da2 Ew1. — **(6) Lineae (+bipartialis** Cz Mv B T Xg G Oy) **numeri** :: most of the late witnesses, adding: **+communes** {k:} Eh, {x:} X Cm Lf Lg Xj Es Fb Pq Nu; **++argumenti planetarum** (-ae Oc; *om.* Mp) {a2:} Mp; {x:} Oc X Xb. — **(7: other)** :: Cq2 Ps Md Lb.

Table for Saturn: **(8) Tabula prima** (*om.* Cj Md Mp Vp Lh) **ad Saturnum** :: normally. — **(9) Tabula** (**+prima** Fc Lb O Pd) **Saturni** :: {a0:} Pz Mc Mb; {a1:} Fc; {d:} Lb; {p:} O Pd. — **(10) Latitudo Saturni** :: {x:} Oc X Xb Es Wa. **(11: other)** Ey Ps Sg Vd2 Xj.

Values. The tables have not been recomputed for the present purpose. This could be done according to the findings of Kennedy/Ukashah, Centaurus 14 (1969) p.91 ff., which reveal substantial errors in the Khw/M version. Generally, the values are about half what they should be (*art.cit.* p. 91, 94). This being granted, the first value for Saturn should have been 1;26, but the tables use the value 1;33. Further, the table for Jupiter is piecewise linear, deviating much from the expected function near 0° and 180°. These features also characterize the present table, in all witnesses.

Text. Collated for values: **{a0}** Pz Oo; **{a1}** Xa Cq; **{aT}** Lu; **{e}** Eq Xc; **{x}** Es Xg. — Headings according to Xa.— Also quoted for values: **$km** = Khw/M, Suter *tab.cit.*, quoted for mss. "C and "O"; **$kc** = Khw/M, Oxford CCC 283, 127r-141v, columns "Latitudo ... prima". $kc carries corrections that are meant as additive or subtractive, as observed by Neugebauer 1962 p. 185; these places are listed as "(original reading) (+ *or* -) (correction)".

Readings chosen. I reproduce the majority of Pz Oo Xa Cq Lu, underscoring where the adopted reading differs from the consensus of $km (= Suter's mss. "O" and "C") and the uncorrected readings of $kc.

Variant groups, etc. — Textual variants are not very distinctive: most of them are found at boundaries between arrays of several similar figures, and could be due to slides or run-ons. There is evidence for the error groups *Eq Xc* (e.g., k14-22; g31-54; m61) and *Es Xg* (e.g., h102-111; m128-130). Either may agree with some or all of the sources, by chance or not (d76, d84, f74). So may *Oo* and/or *Pz,* about nondescript readings (d93; k143-144; perhaps d121-142). Once too (g147-150), *Oo Pz* appear to have a non-trivial common error. Generally, the witnesses collated here are homogeneous with each other and with the evidence for Alkhwarizmi / Maslama.

Tabula bipartialis numeri ad scientiam latitudinum planetarum.

Numerus		Tabula prima ad Saturnum		Tabula prima ad Iovem		Tabula prima ad Martem		Tabula prima ad Venerem		Tabula prima ad Mercurium	
Gr	Gr	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi
1	359	1	33	1	36	2	14	2	24	1	44
2	358	1	32	1	35	2	14	2	23	1	44
3	357	1	32	1	35	2	14	2	23	1	44
4	356	1	31	1	35	2	14	2	22	1	44
5	355	1	31	1	34	2	13	2	22	1	44
6	354	1	30	1	34	2	13	2	22	1	44
7	353	1	30	1	34	2	13	2	21	1	43
8	352	1	29	1	34	2	13	2	21	1	43
9	351	1	29	1	33	2	12	2	21	1	43
10	350	1	28	1	33	2	12	2	21	1	43
11	349	1	28	1	33	2	12	2	21	1	43
12	348	1	27	1	33	2	12	2	21	1	43
13	347	1	27	1	32	2	11	2	21	1	43
14	346	1	26	1	32	2	11	2	21	1	43
15	345	1	26	1	32	2	11	2	20	1	42
16	344	1	26	1	32	2	11	2	20	1	42
17	343	1	25	1	31	2	11	2	20	1	42
18	342	1	25	1	31	2	11	2	20	1	42
19	341	1	25	1	31	2	10	2	19	1	42
20	340	1	25	1	31	2	10	2	19	1	42
21	339	1	25	1	30	2	10	2	19	1	42
22	338	1	25	1	30	2	10	2	19	1	42
23	337	1	25	1	30	2	10	2	18	1	41
24	336	1	25	1	30	2	10	2	18	1	41
25	335	1	24	1	29	2	9	2	18	1	41
26	334	1	24	1	29	2	9	2	18	1	41
27	333	1	24	1	29	2	9	2	18	1	41
28	332	1	24	1	29	2	9	2	18	1	41
29	331	1	24	1	28	2	9	2	18	1	41
30	330	1	24	1	28	2	9	2	18	1	41
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)

(d1) 32 $km.O. **(d16)** 25 $km $kc. **(d23-24)** 24 24 $km.O. **(d25)** 25 Es Xg. **(f24)** 29 $kc.pc. **(h25)** 10 $km $kc. **(h26)** 10 $km. **(k14-22)** 21, 20--19: 20--19, 18 Eq Xc. **(+k22)** 18 $kc. **(k27-30)** 17(4) $km $kc.

Tabula bipartialis numeri ad latitudines planetarum.

Numerus		Tabula prima ad Saturnum		Tabula prima ad Iovem		Tabula prima ad Martem		Tabula prima ad Venerem		Tabula prima ad Mercurium	
Gr	Gr	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi
31	329	1	24	1	28	2	8	2	17	1	41
32	328	1	24	1	28	2	8	2	17	1	41
33	327	1	24	1	28	2	8	2	16	1	41
34	326	1	24	1	28	2	7	2	16	1	40
35	325	1	24	1	27	2	7	2	16	1	40
36	324	1	24	1	27	2	7	2	15	1	40
37	323	1	23	1	27	2	6	2	15	1	40
38	322	1	23	1	27	2	6	2	14	1	40
39	321	1	23	1	27	2	6	2	14	1	39
40	320	1	23	1	27	2	5	2	14	1	39
41	319	1	23	1	26	2	5	2	13	1	39
42	318	1	23	1	26	2	5	2	13	1	38
43	317	1	23	1	26	2	4	2	12	1	38
44	316	1	23	1	26	2	4	2	12	1	38
45	315	1	23	1	26	2	4	2	11	1	38
46	314	1	23	1	26	2	3	2	11	1	37
47	313	1	22	1	26	2	3	2	10	1	37
48	312	1	22	1	26	2	3	2	10	1	37
49	311	1	22	1	25	2	2	2	9	1	37
50	310	1	22	1	25	2	2	2	9	1	36
51	309	1	22	1	25	2	1	2	8	1	36
52	308	1	22	1	25	2	1	2	8	1	36
53	307	1	22	1	25	2	0	2	7	1	35
54	306	1	22	1	25	2	0	2	7	1	35
55	305	1	22	1	24	1	59	2	6	1	35
56	304	1	22	1	24	1	59	2	6	1	34
57	303	1	22	1	24	1	58	2	5	1	34
58	302	1	22	1	24	1	57	2	4	1	34
59	301	1	22	1	24	1	56	2	4	1	33
60	300	1	22	1	24	1	55	2	3	1	33
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)

(d31-36) 14(6) $kc. **(+d35-36)** 23 23 $km.C. **(d37-46)** 13...13 $kc. **(+d43-46)** 13...13 $km.O. **(f48)** 25 $kc. **(f54)** 24 Eq Xc. **(g31-54)** 1...1 Eq Xc. **(g55-60)** 2...2 Cq Eq. **(h57)** 57 $kc.ac. **(k31)** 18 Pz. **(k40)** 13 Eq. **(k43-55)** 12--7, 6: 13, 12--7 $kc. **(k44)** 13 Pz. **(k60)** 4 $km.O. **(m39)** 40 Eq.ac. **(m42)** 39 Eq Xc. **(m53)** 36 $kc. **(m56)** 35 $kc. **(m59-60)** 34 34 $kc.

Tabula bipartialis numeri ad latitudines planetarum.

Numerus		Tabula prima ad Saturnum		Tabula prima ad Iovem		Tabula prima ad Martem		Tabula prima ad Venerem		Tabula prima ad Mercurium	
Gr	Gr	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi
61	299	1	21	1	24	1	55	2	3	1	33
62	298	1	21	1	24	1	54	2	2	1	32
63	297	1	21	1	24	1	53	2	1	1	32
64	296	1	21	1	24	1	53	2	1	1	32
65	295	1	21	1	24	1	52	2	0	1	31
66	294	1	21	1	24	1	52	1	59	1	31
67	293	1	21	1	23	1	51	1	59	1	31
68	292	1	21	1	23	1	51	1	58	1	30
69	291	1	20	1	23	1	50	1	57	1	30
70	290	1	20	1	23	1	50	1	57	1	29
71	289	1	20	1	22	1	49	1	56	1	29
72	288	1	20	1	22	1	49	1	55	1	29
73	287	1	20	1	22	1	48	1	55	1	28
74	286	1	20	1	21	1	48	1	54	1	28
75	285	1	20	1	21	1	47	1	53	1	27
76	284	1	20	1	21	1	47	1	52	1	27
77	283	1	19	1	21	1	46	1	52	1	27
78	282	1	19	1	21	1	45	1	51	1	26
79	281	1	19	1	20	1	44	1	50	1	26
80	280	1	19	1	20	1	44	1	49	1	25
81	279	1	19	1	20	1	43	1	49	1	25
82	278	1	19	1	20	1	42	1	48	1	24
83	277	1	19	1	19	1	42	1	47	1	24
84	276	1	19	1	19	1	41	1	46	1	24
85	275	1	18	1	19	1	40	1	45	1	23
86	274	1	18	1	19	1	39	1	45	1	23
87	273	1	18	1	18	1	39	1	44	1	22
88	272	1	18	1	18	1	38	1	43	1	22
89	271	1	18	1	18	1	37	1	42	1	21
90	270	1	18	1	18	1	36	1	41	1	21
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)

(a66-68) 67, 68, 69 Pz.ac. **(d75)** 19 $km.O. **(d76)** 19 Eq Xc $km.O. **(d83)** 18 $km.O. **(d84)** 18 Eq Xc $km.O. **(d85)** 19-1 $kc. **(f70)** 22 $kc. **(f74)** 22 *vel* 21 Xa; 22 Es Xg $km $kc. **(f78)** 20 $kc. **(f82)** 19 $kc. **(f86)** 18 $kc. **(h81)** 42 Oo. **(h87)** 38 Es.ac. **(h90)** 37 Oo. **(j61-65)** 2...2: 1...1 Oo Xa. **(+j65)** 1 $km.O. **(k77-90)** 52, 51--41: 51--41, 40 Eq. **(m61)** 32 Eq Xc. **(m69)** 29 Xc. **(m70)** 30 $km.O. **(m77)** 26 $km $kc. **(m89)** 22 Oo.

Tabula bipartialis numeri ad latitudines planetarum.

Numerus		Tabula prima ad Saturnum		Tabula prima ad Iovem		Tabula prima ad Martem		Tabula prima ad Venerem		Tabula prima ad Mercurium	
Gr	Gr	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi
91	269	1	18	1	17	1	35	1	40	1	20
92	268	1	18	1	17	1	34	1	40	1	20
93	267	1	18	1	17	1	33	1	39	1	19
94	266	1	17	1	17	1	32	1	38	1	19
95	265	1	17	1	16	1	31	1	37	1	19
96	264	1	17	1	16	1	30	1	36	1	18
97	263	1	17	1	16	1	30	1	35	1	18
98	262	1	17	1	16	1	29	1	34	1	17
99	261	1	17	1	15	1	28	1	34	1	17
100	260	1	17	1	15	1	27	1	33	1	16
101	259	1	16	1	15	1	26	1	32	1	16
102	258	1	16	1	15	1	26	1	31	1	15
103	257	1	16	1	14	1	25	1	30	1	15
104	256	1	16	1	14	1	24	1	29	1	14
105	255	1	16	1	14	1	23	1	28	1	14
106	254	1	16	1	14	1	22	1	27	1	13
107	253	1	16	1	13	1	21	1	26	1	13
108	252	1	16	1	13	1	21	1	25	1	12
109	251	1	16	1	13	1	20	1	24	1	12
110	250	1	15	1	13	1	19	1	23	1	11
111	249	1	15	1	12	1	18	1	22	1	11
112	248	1	15	1	12	1	17	1	21	1	10
113	247	1	15	1	12	1	16	1	20	1	10
114	246	1	15	1	12	1	15	1	19	1	10
115	245	1	15	1	11	1	15	1	18	1	9
116	244	1	15	1	11	1	14	1	17	1	9
117	243	1	15	1	11	1	13	1	16	1	8
118	242	1	15	1	11	1	12	1	15	1	8
119	241	1	15	1	10	1	11	1	14	1	7
120	240	1	15	1	10	1	10	1	13	1	7
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)

(d91) 28 $km.C; 18+10 $kc. **(d93)** 17 Oo Pz $km $kc. **(d98)** 16 $km.C; 17-1 $kc. **(d99-100)** 16 16 $km; 17-1, 17-1 $kc. **(d101-102)** 17 17 Pz. **(d107)** 15 $km.C; 16-1 $kc. **(d108-109)** 15 15 $km; 16-1, 16-1 $kc. **(d110)** 16-1 $kc. **(f99)** 16 $kc. **(f107)** 14 $kc. **(f119-120)** 11 11 $kc. **(h98)** 30 Eq.ac. **(h99)** 27 $kc.ac. **(h100)** 29 Xg; 28 $kc. **(h102-111)** 25, 24, 23, 22, 21, 20, 19, 18, 18, 17 Es Xg. **(h108)** 20 Eq Xc. **(m98)** 18 $km.C. **(m113)** 9 $kc.

Tabula bipartialis numeri ad latitudines planetarum.

Numerus		Tabula prima ad Saturnum		Tabula prima ad Iovem		Tabula prima ad Martem		Tabula prima ad Venerem		Tabula prima ad Mercurium	
Gr	Gr	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi
121	239	1	14	1	10	1	9	1	12	1	6
122	238	1	14	1	10	1	8	1	11	1	6
123	237	1	14	1	10	1	7	1	10	1	5
124	236	1	14	1	10	1	6	1	9	1	4
125	235	1	14	1	10	1	6	1	8	1	4
126	234	1	14	1	10	1	5	1	7	1	4
127	233	1	14	1	10	1	4	1	6	1	3
128	232	1	14	1	10	1	3	1	5	1	3
129	231	1	14	1	9	1	2	1	4	1	2
130	230	1	14	1	9	1	1	1	3	1	2
131	229	1	13	1	9	1	0	1	2	1	1
132	228	1	13	1	9	0	59	1	1	1	1
133	227	1	13	1	8	0	59	1	0	1	0
134	226	1	13	1	8	0	58	0	59	1	0
135	225	1	13	1	8	0	57	0	58	1	0
136	224	1	13	1	8	0	56	0	57	0	59
137	223	1	13	1	7	0	55	0	56	0	59
138	222	1	13	1	7	0	54	0	55	0	58
139	221	1	13	1	7	0	53	0	54	0	58
140	220	1	13	1	7	0	52	0	53	0	57
141	219	1	13	1	6	0	51	0	51	0	57
142	218	1	13	1	6	0	50	0	50	0	56
143	217	1	12	1	6	0	50	0	49	0	56
144	216	1	12	1	5	0	49	0	48	0	56
145	215	1	12	1	5	0	48	0	47	0	55
146	214	1	12	1	5	0	48	0	46	0	55
147	213	1	12	1	5	0	47	0	45	0	55
148	212	1	12	1	5	0	46	0	44	0	54
149	211	1	12	1	4	0	45	0	43	0	54
150	210	1	12	1	4	0	44	0	42	0	53
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)

(d121-142) 24(10) 23(12) Pz; 24(14) 23(8) $km.C. **(+d121-124)** (14+10)(4) $kc. **(d143-150)** 22(8) $km.C. **(f121-128)** 10...10: 9...9 Oo. **(f140)** 6 Es Xg. **(f144)** 6 $km $kc. **(g147-150)** 1...1 Oo Pz. **(h121)** 8 Oo Cq Eq. **(h122)** 9 Eq. **(h142)** 1 $km.O. **(h146-148)** 47 46 45 $km $kc. **(k141-142)** 52 51 $km $kc. **(k143-144)** 50 49 Oo $km $kc. **(k146)** 47 $kc. **(m124)** 5 $km $kc. **(m128-130)** 2,2,1 Es Xg. **(m147)** 54 $km $kc. **(m149)** 53 Pz. **(m150)** 54 Oo.

Tabula bipartialis numeri ad latitudines planetarum.

Numerus		Tabula prima ad Saturnum		Tabula prima ad Iovem		Tabula prima ad Martem		Tabula prima ad Venerem		Tabula prima ad Mercurium	
Gr	Gr	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi
151	209	1	12	1	4	0	43	0	41	0	53
152	208	1	12	1	4	0	42	0	40	0	53
153	207	1	12	1	3	0	41	0	39	0	52
154	206	1	12	1	3	0	41	0	38	0	52
155	205	1	11	1	3	0	40	0	37	0	52
156	204	1	11	1	3	0	39	0	36	0	52
157	203	1	11	1	2	0	38	0	35	0	51
158	202	1	11	1	2	0	38	0	34	0	51
159	201	1	11	1	2	0	37	0	34	0	51
160	200	1	11	1	2	0	36	0	33	0	51
161	199	1	11	1	1	0	36	0	32	0	50
162	198	1	11	1	1	0	35	0	31	0	50
163	197	1	11	1	1	0	34	0	30	0	50
164	196	1	11	1	1	0	34	0	29	0	50
165	195	1	11	1	0	0	33	0	28	0	50
166	194	1	11	1	0	0	32	0	28	0	50
167	193	1	11	1	0	0	32	0	27	0	50
168	192	1	11	1	0	0	31	0	26	0	49
169	191	1	11	0	59	0	31	0	26	0	49
170	190	1	11	0	59	0	30	0	25	0	49
171	189	1	11	0	59	0	30	0	25	0	49
172	188	1	11	0	59	0	29	0	24	0	49
173	187	1	10	0	58	0	29	0	24	0	49
174	186	1	10	0	58	0	29	0	23	0	49
175	185	1	10	0	58	0	28	0	23	0	48
176	184	1	10	0	58	0	28	0	23	0	48
177	183	1	10	0	57	0	28	0	22	0	48
178	182	1	10	0	57	0	27	0	22	0	48
179	181	1	10	0	57	0	27	0	22	0	48
180	180	1	10	0	57	0	27	0	22	0	48
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)

(d153-4) 11 11 $km $kc. **(d173)** 11 $kc. **(e169-170)** 1,1 Pz. **(d172)** 10 Eq Xc. **(f160)** 1 $kc. **(f169-180)** 0...0 $kc. **(h155)** 30 Pz. **(h159)** 38 $kc. **(h167)** 22 $km.O. **(h168)** 21 Eq. **(h175)** 29 Cq. **(k151)** 40 $kc. **(k163)** 34 $km. **(k176)** 22 Eq. **(k179)** 23 Oo. **(m174)** xlxi *(sic!)* $kc.

FA21. "Tabula quaternarii numeri..."

Toomer 1968, no. 46. – The values are essentially the same as in Khw/M, Suter Tab.27-56 p.138-67, columns "Latitudo ... secunda" for each planet. These are for arguments 1°-180°; the values include figures for seconds, but they have here been rounded to minutes. Further, the Toledan table has been folded about 90°, and since the entrance has thus become four-fold, the whole table has got the name ("T. quadripartialis (/quaternarii) numeri..."). This is in the whole tradition.

Witnesses: **{a0}** Oo,39r-v; Cq2,116-117; Pz,128r-v; Mc,26r-v; Mb,54r-v; Ey,59r-60r. – **{a1}** Xa,30r-v; Ad,78r-v; Cq,53A-54A; Fc,38r-39r; Ps,66v-67v; Sg,158-160; Wd,29r-v; Fh,49r-50r; Xw,29r-v. – **{a2}** Cz,82v-83v; Cj,155v-156v; Md,90r-91r; Mp,220r-221r; Vp,136r-137r. – **{aX}** Vo,58r-59r; R,107v-108v; Ov,93r-94r; Cu,78v-79v; Fj2,106v-107r. – **{aT}** Lu,63v-64v; Oj,136r-137r; P,124r-125r. – **{k}** Eh,95r-96r(m2). – **{d}** Lb,30v-31r; A,268r-v(m2); Nc,127v-128v; Ok,55v-56v. – **{e}** Gr,59r-60r; Eq,77v-78v; Ek3,104v-105v; Xc,72v-73v; Vj,96r-97r; Ej,79r-80r. – **{x}** Oc,83v-84v; X,160v-161v; Mv,95r-96r; Cm,212v, 141r-v; B,151r-152r; T,294r-v; Lf,100v-101v; Lg,179v-180v; Lh,145v-146v; Xj,282'v-283v; Xg,63v-64v; G,68r-69r; Xb,83r-84r; Es,184v-185v; Fb,73v-74v; Pq,192v-193v; Oy,80v-81v; Wa,69v-70v; Ow,163v-164v; Nu,148v-149v. – **{p}** O,78v-79v; Pd,36r-37r. – **{?}** Ew1,30r-31r; Da2,213v (with CE40); Vd2,59v-60v (:?). — A lacuna in {x} Vz is likely to have contained this table.

Canons: see FA11-21 above.

Headings. – General:

(1) Tabula quadripartialis (/quaternarii {a0}, Ew1) **numeri** (*om.* Ey Pz Mb Xw) **ad latitudines (/-nem** Pz Ps Xw Ew1; **+5** Ey Oj Es!) **planetarum** :: {a0}; {a1:} Xa Ad Cq Fc Ps Wd Fh Xw; {a2:} Md Vp; {aX:} Vo Ov R Fj2; {aT:} Lu Oj P; {d:} A Nc; {x:} Es; {?:} Ew1.

(2) Tabula quadripartialis numeri (*om.* Xc Ej) **ad sciendum** (habendum Mp) **latitudines (/-nem** Cu Ok Ek3) **(+5) planetarum** :: {a2:} Cz Mp; {aX:} Cu; {k:} Eh; {d:} Ok; {e}; {x-}; {p:} O Pd.

(3) Tabula quadripartialis numeri *(Sg Oc X Xb:)* **ad scientiam latitudinum 5** (*om.* Sg) **planetarum** *(Oc X Xb:)* **ex excentricis** :: {a1:} Sg; {a2:} Cj; {x} Oc X Xb Lh Wa.

(4: other) Cq2 ("T. secunda ad latitudines pl.", then like {a0}); Vd2 Lb Da2 (all **Tabula quaternarii...,** ending differently).

Entrance column: **(5) Lineae quadripartialis numeri** (n.q. Cq) :: {a1} and normally. – **(6) Lineae numeri (+quadrati** Oo Da2; **+argumenti** Mp Oc X Xb; **++latitudinis** Mp) :: {a0:} Oo Ey; {a1} Sg; {a2:} Cz Cj Mp Vp; {aX:} Ov Cu; {d:} Lb A; {e}; {x:} Oc X Xb Lh Es Pq Ow; {p:} O Pd; {?:} Da2 Vd2. – **(7) Numerus graduum** (*om.* Ew1) :: {a0:} Pz Mc Mb; {?:} Ew1. – **(8: other)** Cq2 ("Lineae numeri et numerus graduum"); Md & R ("Tabula quadripartialis numeri (/ad numerum R)"); Vo Wa.

Table for Saturn: **(9) Tabula secunda** (t.s.: t. Cj Md Mp Vp Lh Ow; s.t. Cu) **ad Saturnum** :: normally. – **(10) Tabula secunda** (*om.* Pz Mc Mb) **Saturni** :: {a0:} Pz Mc Mb; {a1:} Fc Ps!; {d:} Lb; {p:} O Pd; {?:} Vd2!. – **(11) Latitudo Saturni** :: {x:} Oc X Xb Es Wa. – **(12: other)** :: Ey Cu Xj.

Values. Compared to the Alkhwarizmi / Maslama table, the present values have been rounded to minutes such that 30 seconds are rounded downwards (at k30, o30, o44, o52, o57).

The function can be recomputed as R * sin(argument), where R = 5 for Saturn and Venus, 2;30 for Jupiter, 3;45 for Mars, and 6;15 for Mercury; cf. Neugebauer 1962 p.103 and Kennedy/Ukashah 1969 p. 87.

The adopted text departs from the recomputed values in a few places only (f72, k40, k46, o12; o32 and k44; see "Text" below). In four of these places (f72, k40, k46, o12) all our witnesses depart from $km $kc too, and are thus certainly in error, though the errors are trifling.

Text. Collated for values: **{a0}** Pz Oo; **{a1}** Xa Cq; **{aT}** Lu; **{e}** Eq Xc; **{x}** Es Xg. – Headings according to Xa.

Also quoted: **$km** = Khw/M, Suter p. 138-167 tab. 27-56, cols. "Latitudo ... secunda", mss. "C" and "O" only. **$kc** = Khw/M, Oxford CCC 283, 127r-141v, cols. "Latitudo ... secunda". For $kc, additive or subtractive corrections are listed as described for FA11. **$c** = recomputation; see "Values" above.

The values of $km and $kc have been rounded to minutes, in the manner described under "Values" above, before being compared to the present ones. If such a rounded value disagrees with the adopted one, the unrounded value is quoted; thus, readings that involve minutes are quoted as "minutes, seconds". $km and $kc have only been collated on the interval 1°-90°; the second half of each has been ignored.

Readings chosen. I adopt the majority of Oo Pz Xa Cq Lu, underscoring readings that differ from the consensus of $km $kc (even when these are in error and our text is correct), and readings that differ from the consensus of either with $c.

Variant groups, etc. — Our witnesses, when they agree, have no errors in common with $km $kc. At o56 (and at g54-60, which is banal), they are correct against the consensus of $km $kc. On the whole, then, they may derive from a witness independent of $km $kc, or else any pertinent oddities have been eliminated by correction. Where $km and $kc disagree, our witnesses will join whichever has the correct reading ($km: f37, h73-74, etc.; $kc: o17-18, o30, etc.; $kc and $km.O: f59, f71; neither: h24, m65).

At (o32), *Oo Pz* agree with the source and $c whereas the rest are in error. At (k44), conversely, *Oo Pz Xa Cq* are in error against the source and $c; the rest agree, but the correct reading would be easy to find by interpolation. Error groups are, as usual, *Eq Xc* (m20, o10) and *Es Xg* (k20, f52), though evidence is slight.

Tabula quadripartialis numeri ad latitudines planetarum.

Lineae quadripartialis numeri				Tabula scd'a ad Saturnum		Tabula scd'a ad Iovem		Tabula scd'a ad Martem		Tabula scd'a ad Venerem		Tabula scd'a ad Mercurium	
Gr	Gr	Gr	Gr	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi
1	179	181	359	0	5	0	3	0	4	0	5	0	7
2	178	182	358	0	10	0	5	0	8	0	10	0	13
3	177	183	357	0	16	0	8	0	12	0	16	0	20
4	176	184	356	0	21	0	10	0	16	0	21	0	26
5	175	185	355	0	26	0	13	0	20	0	26	0	33
6	174	186	354	0	31	0	16	0	24	0	31	0	39
7	173	187	353	0	37	0	18	0	27	0	37	0	46
8	172	188	352	0	42	0	21	0	31	0	42	0	52
9	171	189	351	0	47	0	23	0	35	0	47	0	59
10	170	190	350	0	52	0	26	0	39	0	52	1	5
11	169	191	349	0	57	0	29	0	43	0	57	1	12
12	168	192	348	1	2	0	31	0	47	1	2	1	19
13	167	193	347	1	7	0	34	0	51	1	7	1	24
14	166	194	346	1	13	0	36	0	54	1	13	1	31
15	165	195	345	1	18	0	39	0	58	1	18	1	37
16	164	196	344	1	23	0	41	1	2	1	23	1	43
17	163	197	343	1	28	0	44	1	6	1	28	1	50
18	162	198	342	1	33	0	46	1	10	1	33	1	56
19	161	199	341	1	38	0	49	1	13	1	38	2	2
20	160	200	340	1	43	0	51	1	17	1	43	2	8
21	159	201	339	1	48	0	54	1	21	1	48	2	14
22	158	202	338	1	52	0	56	1	24	1	52	2	20
23	157	203	337	1	57	0	59	1	28	1	57	2	27
24	156	204	336	2	2	1	1	1	32	2	2	2	33
25	155	205	335	2	7	1	3	1	35	2	7	2	38
26	154	206	334	2	12	1	6	1	39	2	12	2	44
27	153	207	333	2	16	1	8	1	42	2	16	2	50
28	152	208	332	2	21	1	10	1	46	2	21	2	56
29	151	209	331	2	25	1	13	1	49	2	25	3	2
30	150	210	330	2	30	1	15	1	52	2	30	3	7
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)

(c18-19) 108, 109 Pz. **(e10-11)** 1,1 Oo. **(e24-30)** 1...1 Xc $km.O. **(e24-27)** *ras.* Oo. **(f2)** 15 Pz. **(f6)** 29,21 $kc. **(f7)** (26+10),33 $kc. **(f17)** 28 *vel* 29 Cq; (17+10),43 $kc. **(f21)** 46,31 $km.O. **(f22)** 55,23 $kc. **(f24)** 2,50 $kc. **(f29)** 35 Oo. **(g24-30)** 0...0 $km.C $kc.pc. **(h3)** =7,51 $kc.ac $c; 7,11 $km $kc.pc. **(h7)** 18,(17+30) $kc. **(h10)** 25,3 $kc. **(h11)** 39 Eq. **(h14)** 36,47\31/ $kc. **(h22)** 56,40\11/ $kc. **(h24)** 1,41 $km; 1,50\41/ $kc; =1,0 $c. **(h25)** 4,24 $km.O. **(h27)** 18 Pz. **(k20)** 16 Es Xg. **(L24-30)** 1...1 $kc. **(m18)** 32 Eq. **(m20)** 42 Eq Xc. **(n8-30)** 0, 0, 1--2, 3, 3: 1--2, 2, 2, 2, 2 Oo. **(o5)** 37 Oo; 27 Pz. **(o6)** 31 Pz. **(o10)** 2 Eq Xc; 0,7 $km.C. **(o12)** 17,18 $km; 17,48 $kc; 17,58 $c. **(o17-18)** 49,18 / 55,13 $km. **(o21)** 12 Oo. **(o27)** 56,15 (!) $km; =50,15 $kc. **(o30)** 50,30 $km.

Tabula quadripartialis numeri ad latitudines planetarum.

Lineae quadripartialis numeri				Tabula scd'a ad Saturnum		Tabula scd'a ad Iovem		Tabula scd'a ad Martem		Tabula scd'a ad Venerem		Tabula scd'a ad Mercurium	
Gr	Gr	Gr	Gr	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi
31	149	211	329	2	35	1	17	1	56	2	35	3	13
32	148	212	328	2	39	1	19	1	59	2	39	3	18
33	147	213	327	2	43	1	22	2	3	2	43	3	24
34	146	214	326	2	48	1	24	2	6	2	48	3	30
35	145	215	325	2	52	1	26	2	9	2	52	3	35
36	144	216	324	2	56	1	28	2	12	2	56	3	40
37	143	217	323	3	1	1	30	2	15	3	1	3	46
38	142	218	322	3	5	1	32	2	19	3	5	3	51
39	141	219	321	3	9	1	34	2	22	3	9	3	56
40	140	220	320	3	13	1	36	2	24	3	13	4	1
41	139	221	319	3	17	1	38	2	28	3	17	4	6
42	138	222	318	3	21	1	40	2	31	3	21	4	11
43	137	223	317	3	25	1	42	2	33	3	25	4	16
44	136	224	316	3	28	1	44	2	34	3	28	4	20
45	135	225	315	3	32	1	46	2	39	3	32	4	25
46	134	226	314	3	36	1	48	2	41	3	36	4	30
47	133	227	313	3	39	1	50	2	45	3	39	4	34
48	132	228	312	3	43	1	51	2	47	3	43	4	39
49	131	229	311	3	46	1	53	2	50	3	46	4	43
50	130	230	310	3	50	1	55	2	52	3	50	4	47
51	129	231	309	3	53	1	57	2	55	3	53	4	51
52	128	232	308	3	56	1	58	2	57	3	56	4	55
53	127	233	307	4	0	2	0	3	0	4	0	4	59
54	126	234	306	4	3	2	1	3	2	4	3	5	3
55	125	235	305	4	6	2	3	3	4	4	6	5	7
56	124	236	304	4	9	2	4	3	7	4	9	5	11
57	123	237	303	4	12	2	6	3	9	4	12	5	14
58	122	238	302	4	14	2	7	3	11	4	14	5	18
59	121	239	301	4	17	2	9	3	13	4	17	5	21
60	120	240	300	4	20	2	10	3	15	4	20	5	25
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)

(f33) 47,23 $km.O; 46,23 $km.C. **(f36)** 57,20 $km; =(56+1),20 $kc. **(f37)** =0,33 $km; 0,(24+10-1) $kc. **(f38)** 3 Es. **(f45)** =32,8 $km; (22+10),8 $kc. **(f52)** 57 Es Xg. **(f58)** 15,22 $km; (14+1),(25-3) $kc. **(f59)** 18,9 $km.C; (17+1),9 $kc; =17,9 $km.O. **(g54-60)** 1...1 $km $kc. **(h41)** 37,22 $km.O. **(h49)** 52 Xa. **(h55)** *ras.?* Lu. **(j32)** 2 $kc. **(k34)** 5,19 $km.O; 5,30 $km.C; 5,39 $kc; 5,49 $c. **(k40)** 24,38 $km $kc; 25 $c. **(k44)** 36 Lu Eq Xc Es Xg $c; 36,18 $km; 35,18 $kc. **(k46)** 41,51 $km $kc; 42 $c. **(m34)** 48,45 $kc. **(m38)** 15 Pz. **(m40)** 22,50 $km.O. **(m55-58)** *n.l.* Oo. **(m58)** 14,35 $km.O. **(m59-60)** 13, 15 Pz *(cf. col. k)*; *n.l.* Oo. **(n40)** 3 Pz.ac. **(n52-55)** *n.l.* Oo. **(n54)** 4 $kc. **(o32)** 19 Oo Pz; 18,43 $km $kc $c. **(o36)** 42,24 $kc. **(o37)** 45 Pz. **(o45)** 35,10 $km.C. **(o49-53)** *n.l.* Oo. **(+o49)** 43,50 $kc. **(o50)** 46,16 $kc. **(o56)** 12 Pz; 10,23 $km $kc; =10,53 $c. **(o58)** 14 Pz.

Tabula quadripartialis numeri ad latitudines planetarum.

Lineae quadripartialis numeri				Tabula scd'a ad Saturnum		Tabula scd'a ad Iovem		Tabula scd'a ad Martem		Tabula scd'a ad Venerem		Tabula scd'a ad Mercurium	
Gr	Gr	Gr	Gr	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi
61	119	241	299	4	22	2	11	3	17	4	22	5	28
62	118	242	298	4	25	2	12	3	19	4	25	5	31
63	117	243	297	4	27	2	14	3	20	4	27	5	34
64	116	244	296	4	30	2	15	3	22	4	30	5	37
65	115	245	295	4	32	2	16	3	24	4	32	5	40
66	114	246	294	4	34	2	17	3	26	4	34	5	43
67	113	247	293	4	36	2	18	3	27	4	36	5	45
68	112	248	292	4	38	2	19	3	29	4	38	5	48
69	111	249	291	4	40	2	20	3	30	4	40	5	50
70	110	250	290	4	42	2	21	3	31	4	42	5	52
71	109	251	289	4	44	2	22	3	33	4	44	5	55
72	108	252	288	4	46	2	23	3	34	4	45	5	57
73	107	253	287	4	47	2	23	3	35	4	47	5	59
74	106	254	286	4	48	2	24	3	36	4	48	6	0
75	105	255	285	4	50	2	25	3	37	4	50	6	2
76	104	256	284	4	51	2	26	3	38	4	51	6	4
77	103	257	283	4	52	2	26	3	39	4	52	6	5
78	102	258	282	4	53	2	27	3	40	4	53	6	7
79	101	259	281	4	54	2	27	3	41	4	54	6	8
80	100	260	280	4	55	2	28	3	42	4	55	6	9
81	99	261	279	4	56	2	28	3	42	4	56	6	10
82	98	262	278	4	57	2	29	3	43	4	57	6	11
83	97	263	277	4	58	2	29	3	43	4	58	6	12
84	96	264	276	4	58	2	29	3	44	4	58	6	13
85	95	265	275	4	59	2	29	3	44	4	59	6	14
86	94	266	274	4	59	2	30	3	44	4	59	6	14
87	93	267	273	5	0	2	30	3	45	5	0	6	14
88	92	268	272	5	0	2	30	3	45	5	0	6	15
89	91	269	271	5	0	2	30	3	45	5	0	6	15
90	90	270	270	5	0	2	30	3	45	5	0	6	15
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)

(b61-90) 1, 2, ..., 29, 0 Pz. **(c61-90)** 249, 248, ..., 261, 270 Pz, *serie unitatum ex (d) tralata.* **(d61-90)** 29, 28, ..., 1, 0 Pz. **(e90)** 4(;0,0) $km $kc. **(f63)** xx[[-]] $kc. **(f67)** 35 Pz. **(f70)** 43 Oo.pc. **(f71)** =43,39 $km.O; 43,29 $km.C; 43,(39-10) $kc. **(f72)** 45 $c; 45,19 $km $kc. **(h70)** 20,17 $kc. **(h71)** 21,7 $km.C. **(h72)** 22 Pz. **(h73-74)** 22,26 / 23,11 $kc. **(h75)** 24 Oo. **(k63)** 10,29 $km.O. **(L90)** 4(,0,0) $kc. **(m65)** 31,13 $km; 39,53 $kc; =31,53 $c. **(m66)** 33,4 $km.O. **(m68)** 39 Cq; 37,9 $kc. **(m73)** 46,13 $km. **(o69)** 5 Oo.

FB. Latitudes, Albattani.

FB11.

Toomer 1968, no. 47 and 48. — From Albattani, Nallino II p. 140-141.

Witnesses. For the asterisks, see "Versions" below. — **{a0}** Ct,23v-24r; Oo,24v; Cq2,87; Pz,126r; Mc,24r; Ey,77v/78r*. — **{a1}** Fc,62v. — **{aX}** Xr,82v/83r**; R,62r/62v**; Ov,89r/89v**; Vd,21v-22r (see "Versions"). — **{aT}** Lu,65r-v; Oj,154r-155v; P,113v-114r. — **{k}** Eh,97r/97v*; Lw,88r/88v*; Ou,66r/66v**; Eg,18v/18v*; Co,162r/162r*; Cn,96v/96v*. — **{d}** Op,60r/60v*; C,341/342*; Lb,29r; Pa,71r; A,236v; Fj,48r; Gr3,120r. — **{x}** Es,190r; Wa,71r. — **{p}** Pd,73v/74r**; Ch2,153v. — **{?}** Pn,24v (:Jo. Lin.); Fc2,108r (:Jo. Lin.).

Versions. In all cases the table has an upper and a lower half, with entrances 6°(6°)90° and 96°(6°)180°. In Ey Op C the entrance values are in signs and degrees.

Like its counterpart in Albattani (cf. canons Ca116), this table was no doubt meant to show all planets in one series, containing an entrance column, a sub-table for each of the five planets, and a sub-table (=.Par) with a title like "partes latitudinum..." or "argumenta latitudinis...", common to the five planets.

(*) Some witnesses show the table in two parts, one for the upper and one for the lower planets (Toomer's no. 47 and 48), each with its proper heading: these witnesses were asterisked in the list above.

(**) In addition to this, some witnesses show a duplicate of sub-table .Par attached to the table for the upper planets; these witnesses were marked with two asterisks.

Vd, alone, splits the table into one for Saturn and Jupiter and another one for the rest, with separate headings, and duplicating sub-table .Par.

Canons: Ca116-118 and Cc221-224, each quite close to Albattani ch. 47. The implied headings are generally like the sub-headings below. A distinction such as

(.Ver:) "tabula reflexus" Ca; "tabula reflexionis" Cc

is the same as between Ct {aT k} and the majority, but it is trifling and not repeated. — Separate canons for this table are numerous. Some are reproduced or cited in the appendix to canons Cb, under CbA.F.

Headings. — Main headings for tables that show all 5 planets together (witnesses that have no asterisk in the "Witnesses" list):

Tabula latitudinum 5 planetarum (pl. 5 Pz Mc Oo; **+erraticorum** (-cum Ct; errantium Lu) Ct Oo Lu) **quae est longitudo eorum a (+via solis in** Ct Lu Oj P! Pn**) cingulo (/circulo** Ct Lu Oj P Pn**) signorum** :: {a0:} Ct Oo Cq2! Pz Mc; {aT:} Lu Oj P; {?:} Pn.

Tabula latitudinis 5 planetarum erraticarum (*sic; om.* Fc A) **et est elongatio eorum** *(Pa A:)* **a via solis** *(Fc Fj Gr3:)* **a cingulo** (circulo Fc) **signorum** :: {a1} Fc; {d:} Pa A Fj Gr3.

Tabula latitudinis 5 planetarum :: {d:} Lb; {?:} Fc2.

Tabula latitudinis (-num Wa) **5 planetarum, cuius** (quarum Wa) **lineae crescunt per additionem 6 graduum** :: {x:} Es Wa.

(other) :: Vd (split up peculiarly, cf. "Versions" above; two headings "... et est elongatio eorum a via solis", cf. Pa A); Ch2.

Main headings for tables that show the upper and lower planets separately (witnesses that are asterisked in the "Witnesses" list):

Upper planets: **Tabula latitudinum** (-nis Cn Op C) **3 planetarum superiorum quod est longitudo eorum a cingulo** (circulo Lw Op C) **signorum** :: {aX:} Ov!; {k:} Lw Ou Eg! Co Cn!; {d?:} Op C. — **(other)** :: Ey ("T. lat-um 3 sup. pl. secundum Ptolomaeum"); Pd (as for whole table, much like Fc Fj Gr3 above); Xr R Eh.

Lower planets: **Tabula latitudinum 2 planetarum inferiorum, quod est longitudo eorum a cingulo signorum** (a c.s.: ab ecliptica Ov) :: {aX} Ov; {k:} Eh Lw Ou Eg! Co Cn. — **Tabula latitudinum** (-nis Op C) **Veneris et Mercurii** *(Ey:)* **secundum Ptolomaeum** :: {a0:} Ey; {d:} Op C. — **(other)** Xr R Pd.

Sub-headings, all tables:

The sub-headings containing terms like "effregion" occur in the tables for each of the upper planets. I list them for Saturn only, and I do not attempt to reproduce the spellings in the manuscripts. — Ct consistently spells "effengion / effrengion", and Cq2 seems to show a parallel distinction "effengion / estrengion". This should correspond to "afîjiyûn / ferîjiyûn" (= Greek "apogeion / perigeion"); compare, e.g., the gloss in Albattani, Nallino II p. 140, cf. I p. 282. These terms are no doubt transmitted through an Arabic source, perhaps through copies of Albattani, *pace* Toomer p.72. — In the rest of the witnesses the distinction seems eliminated. The normal spellings are "effregion" (P Ov Eg Co Cn Fc2), also "effengion" (Oo Cq2 Oj), "effrengion" (Lu Pn), "efeng(ri)na" (Pa Fj Gr3), "effigio / effegeon / effegion / effigion" (Ey Mc Ou Eh).

Where the table is split up, there is an entrance column for the second table and (in the witnesses that were double-asterisked above) a copy of sub-table .Par appended to the first table. The headings of these tables are not recorded.

Entrance column (first one if there are more than one, but for second table in Eh, since the first one is illegible).
— **Linea numeri quae augmentatur per 6 gradus** :: {a0:} Ct; {aT:} Lu Oj P!; {?:} Pn. — **Lineae numeri quae augmentantur** (q.a.: **/augmentatae** Oo Cq2; q. augentur Ov; q. crescunt Cn) **per 6 gradus** (+tabula augmentata per senarium Cq2) :: {a0:} Oo Cq2; {aX:} Ov; {k:} Eh Lw Ou Eg! Co Cn; {d?:} Op C; {?:} Fc2. — **Tabula numeri augmentati per 6 gradus** (+latitudo prima Pz) :: {a0:} Pz Mc. — **Lineae numeri addentes (+per** Lb Es Wa**) 6 partes (/gradus** Lb Es Wa; *om.* Pd**)** :: {a1:} Fc; {d:} Lb Pa A; {x:} Es Wa; {p:} Pd. — **Lineae numeri communes** :: {aX:} Vd; {d:} Fj Gr3. — **Lineae numeri** (*om.* R) :: {a0:} Ey; {aX:} Xr R; {p:} Ch2.

.Sas, .Sam: Saturn. The "effregion" items for Saturn are recorded below; the analogous items for the other planets are ignored.

Latitudo Saturni per augmentationem (/-ntum) 50 (+gra) super cuspidem (s.c.: s. centrum Ov Oj; *om.* Eh Lw) **[Effregion septentrionalis (/-onis); Effregion meridionalis (/-diana)]** :: {a0:} Ct Oo Cq2 Pz Mc Ey; {aT:} Lu Oj! P; {aX:} Ov; {k:} Eh Lw! Ou Eg Co Cn; {?:} Pn Fc2.
Latitudo Saturni cum augmento 50 gra :: {d?} Op C.
Latitudo Saturni, additio 50 super centrum [efeng()na septentrionalis; efeng()na meridionalis] :: {d:} Lb! Pa A Fj Gr3.
Latitudo Saturni, eff()gioma [septentrionalis; meridionalis], additio 50 gr super centrum :: {x:} Es Wa!.
Saturni [Septentrionalis; Meridionalis] :: {aX} Xr R; {p:} Pd! Ch2.
(other) :: Fc Vd.

.Ius, .Ium: Jupiter. — **Latitudo Iovis per diminutionem 20 (+gra) a cuspide** (a c.: de c. Oo Cq2 Mc; *om.* Lw Op C; a centro Oj) :: {a0:} Ct Oo Cq2 Mc Ey; {aT:} Lu Oj P; {k:} Lw Ou Co; {d?:} Op C; {?:} Pn Fc2. — **Latitudo Iovis, diminutio 20 a centro** :: {d:} Lb Pa A Fj Gr3; {x:} Es Wa!. — **Iovis** :: {aX:} Xr R; {p:} Pd Ch2. — **(other)** :: Ov & Eg (like {a0} etc., but ending "20 gr super centrum" (Ov); "20 gr super cuspidem" (Eg); Pz Fc Vd Eh Cn.

.Mas, ,Mam: Mars. — **Latitudo Martis ((et) est) absque augmento** (-tatione Ct; -te Lw; aug<-> P) **vel (/et)** (+absque Lw Ou) **diminutione** :: {a0:} Ct; {aT:} Lu Oj! P; {k:} Eh Lw Eg Ou Co Cn; {?:} Pn! Fc2!. — **Latitudo Martis quemadmodum (/ut** Pz Mc**) fuerit sine** (*om.* Oo Pz.pc; **/in** Pz.ac Mc) **augmento** (-tum Pz) **vel diminutione** (-nem Pz) :: {a0:} Oo Cq2 Pz Mc! Ey. — **Latitudo Martis sine augmento et** (/vel Ov) **diminutione** :: {aX:} Ov; {d?:} Op C. — **Latitudo Martis secundum quod** (s.q.: **/prout** Es Wa) **est sine additione et diminutione** (minu- Lb Wa) :: {d:} Lb Pa A Fj Gr3; {x:} Es Wa. — **(Latitudo+** Fc Vd**) Martis** :: {a1:} Fc; {aX:} Xr R Vd; {p:} Pd Ch2.

.Ved, .Ver: Venus. — **Latitudo** (*om.* Xr R Pd Ch2) **Veneris (+Venus** Ct Lu Oj P Pn) :: all.
— Sub-headings: **[Declinatio; Reflexus]** :: {a0:} Ct; {aT:} Lu Oj P; {aX:} Ov; {k:} Eh Lw Ou Eg Co Cn; {?:} Pn Fc2. — **[Declinatio; Reflexio]** :: {a0:} Oo Cq2 Pz Mc Ey; {aX:} Xr R; {d?} Op C; {p:} Pd Ch2. — **[Inclinatio; Reflexio]** :: {aX:} Vd; {d:} Lb Pa A Fj Gr3; {x:} Es Wa. — **(other)** Fc ("[Pars septentrionalis; Pars meridionalis]").

.Med, .Mer: Mercury. — As above, with Mercury in place of Venus.

.Par: Minutes of proportion.
Portiones (/partes Ct Lu Oj P Pn Fc2) **latitudinum** (-nis Fc2; *om.* Co) **5 planetarum (+erraticorum** Ct Lw) :: {a0:} Ct Oo Pz! Mc Ey; {aX:} Ov!; {aT:} Lu Oj P; {k:} Eh Lw Eg Co Cn; {d?:} Op C!; {?:} Pn Fc2!.
Argumentum (-ta Pa A Gr3 Es) **latitudinis planetarum 5** (p.5: p. Pa; 5 p. Vd Es) **haesitantium** (=Fj Gr3; *om.* Vd Es Wa; *varie cett.*) :: {a1:} Fc; {aX} Vd; {d:} Lb Pa A Fj Gr3; {x:} Es Wa!.
Proportiones (portiones Ch2; proportionalia Xr) :: {aX:} Xr R; {p:} Pd Ch2. — In each of Xr R Pd the two instances are equal.
(other) :: Cq2 ("Portiones latitudinis"); Ou ("Portiones latitudinum 3 planetarum superiorum; Por. lat. 2 pl. inferiorum", special headings for the two parts of the table); Ov ("Proportiones" for first part; second part noted above); Fc2 ("minuta proportionalia" added to the above).

Note for upper half of table:

"Septentrio; cum fuerit cuspis (centrum Oj) planetae cum augmentatione sua nota in medietate superiori, erit septentrionalis ex tribus superioribus planetis (*om.* Oj)" :: {a0:} Ct; {aT:} Lu Oj P; {?:} Pn.

"Septentrio (s-onalis latitudo regula Cq2); cum fuerit cuspis planetae ex tribus superioribus cum augmentatione sua nota in medietate superiori, erit septentrionalis (planeta meridianus Cq2)" :: {a0:} Oo Cq2 Pz Mc Ey.

Note for lower half of table:

"Meridies (m-onalis latitudo regula Cq2); cum fuerit cuspis planetae ex tribus superioribus (s.t. Oo) cum augmentatione sua (+nota Ey) in medietate inferiori, erit (+planeta Cq2) meridianus (-ionalis Ey Pz)" :: {a0:} Oo Cq2 Pz Mc Ey.

Parallel tables. The values are the same as in Batt., Nallino II p.140-141. This table is from Almagest XIII,5 (cf. Nallino II p. 247; Toomer 1968 p.72), but the Almagest table has more entries for arguments between 90° and 180°. The term "effregion" used in the present table is probably a loan from Albattani; see the section on sub-headings.

Ibn al-Kammad (Madrid 10023, 45r-v) shows the present values for Saturn, Jupiter, Mars, and for sub-table .Par, whereas the values for Venus and Mercury are from the Handy Tables; see Chabás & Goldstein 1994 p. 31-32.

Values. The values have not been recomputed. Those of .Par can be obtained as 12 times the lunar latitude corresponding to (90°-the argument), Almag. XIII,4; cf. Nallino II p. 254 top.

Text. Collated for values: **{a0}** Ct Oo Pz Cq2; **{aT}** Lu; **{k}** Ou Co; **{d}** Pa A; **{x}** Es. – Headings according to Ct. – Parallels quoted for values: **$ba** = Batt., Paris Arsenal 8322, 82v-83r; **$bn** = Batt., Nallino II p. 140-141 (p. 247 ff., no comment on whether the numbers have been altered); **$pm** = Almagest XIII,5, text from Toomer 1984 p. 632-33.

Co divides the table between the superior and inferior planets, which is a normal feature; further, in both of the resulting partial tables, the upper and lower halves are united such as to cover the range 6°(6°) 360°. – Pa A Es divide the table as shown, but the lower half has no separate headings except for the phrase "Pars inferior" in Es.

Variant groups. In several instances (notably p-q 174, p180, from Abjad numerals), the whole of our tradition seems to be in error against the consensus of $bn $pm; $ba, however, joins the Toledan witnesses in all these instances except at (o6). I do not know whether Nallino has assimilated $bn to the Almagest in some of these places.

Ou Co (Es) may join $bn $pm (and now mostly $ba, too) against all the rest (e.g., at q126, o168, o180), or they may be in error against all the rest (e.g., d174, o30). No doubt, as usual, Ou Co present an independent Albatenian text. *Es* may or may not join Ou Co; in any case the present table is not common in Class {x}, and may be a stray loan into Es from a source like Ou Co.

Pa A normally joins the majority in errors, and have some of their own, e.g., o168, from Abjad numerals.

Ct Pz Cq2 Lu have one error in common (m6), and elsewhere (d96, f6, o114, u66, w18, w156, x162), varying subsets of them are in error, including also *Oo* and *$ba.* The latter may, however, also join Ou or Co (q.v. above, and cf. k84, x54, y120).

Readings chosen. There is no proper vulgate text for this table, since most of groups {a1, e, x} are absent. I reproduce the readings of the majority among Ct Oo Pz Cq2 Lu, underscoring where such a majority (plus any other witnesses) differs from the Almagest and Albattani (as represented by $bn $pm, at a minimum). Italics are used where gross errors have been corrected against the majority, and where the majority does not exist.

Tabula latitudinum quinque planetarum erratic<or>um,
quae est longitudo eorum a via solis in circulo signorum.

		(Sas)		**(Sam)**		**(Ius)**		**(Ium)**		**(Mas)**		**(Mam)**		**(Ved)**		**(Ver)**		**(Med)**		**(Mer)**		**(Par)**	
Li nea num eri que aug men ta tur per sex gra dus	Li nea num eri que mi nu it ur per sex gra dus	Latitudo Saturni per augmentum L graduum super cuspidem				Latitudo Iovis per diminutionem XX graduum a cuspide				Latitudo Martis est absque augmentatione vel diminutione				Latitudo Veneris Venus				Latitudo Mercurii Mercurius				Partes latitudinum quinque planetarum erratic<or>um	
		Effe ngion sept entri onis		Effre ngion meri diana		Effe ngion sept entri onis		Effre ngion meri diana		Effe ngion sept entri onis		Effre ngion meri diana		Decli natio		Refle xus		Decli natio		Refle xus			
Septentrio: cum fuerit cuspis planetae cum augmentatione sua nota in medietate superiori, erit septentrionalis ex tribus superioribus planetis.																							
		Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Mi	Se
6	354	2	4	2	2	1	7	1	5	0	2	0	3	1	2	0	8	1	45	0	11	59	36
12	348	2	5	2	3	1	8	1	6	0	9	0	4	1	1	0	16	1	44	0	22	58	36
18	342	2	6	2	4	1	8	1	6	0	11	0	5	1	0	0	24	1	43	0	33	57	0
24	336	2	7	2	4	1	9	1	7	0	13	0	6	0	59	0	33	1	40	0	44	54	36
30	330	2	8	2	5	1	10	1	8	0	14	0	7	0	57	0	41	1	36	0	55	52	0
36	324	2	10	2	7	1	11	1	9	0	16	0	9	0	55	0	49	1	30	1	6	48	24
42	318	2	11	2	8	1	12	1	10	0	18	0	12	0	51	0	57	1	23	1	17	44	24
48	312	2	12	2	10	1	13	1	11	0	21	0	15	0	46	1	5	1	16	1	27	40	0
54	306	2	14	2	13	1	14	1	13	0	24	0	18	0	41	1	13	1	8	1	35	35	12
60	300	2	16	2	15	1	16	1	16	0	28	0	22	0	36	1	20	0	59	1	44	30	0
66	294	2	18	2	18	1	18	1	18	0	32	0	26	0	29	1	28	0	49	1	52	24	24
72	288	2	21	2	21	1	21	1	21	0	36	0	30	0	23	1	35	0	38	2	0	18	24
78	282	2	24	2	24	1	24	1	24	0	41	0	36	0	16	1	43	0	26	2	7	12	24
84	276	2	27	2	27	1	27	1	27	0	46	0	42	0	8	1	50	0	16	2	14	6	24
90	270	2	30	2	30	1	30	1	30	0	52	0	49	0	0	1	57	0	0	2	20	0	0
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(coll. (x-y)): Ou1 = Ou,66r; Ou2 = Ou,66v.

(a6-90) 6, 12, 18, 24--90: 6+12+18, 24--90, *vac., vac.* Oo. **(b)** 354+347(!)+342, 336--270, *vac., vac. (ut (a))* Oo. **(f6)** 3 Cq2 $ba. **(f12)** 4 Cq2. **(f18)** 3 Ou Co Es $ba $bn $pm. **(f54)** 12 Ou Co Es $ba $bn $pm. **(f66)** 28 Oo. **(f84)** 26 $ba. **(h84)** 29 Ou Es; 28 Co; 26 $ba. **(k84)** 26 Ou Es $ba. **(m6)** 2: Ct Pz Cq2 Lu; 4 Ou Co; 7 Oo Pa A Es $ba; 8 $bn $pm. **(m36)** 15 $bn $pm. **(m60)** 29 Lu Ou Co Es. **(m66)** 31 Oo. **(m78)** 40 Co. **(o6)** 4 $ba $bn $pm. **(o30)** 6 Ou Co. **(o60)** 21 Pz. **(q6-12)** 1, 2 Oo. **(q30)** 58 Lu. **(q60)** 35 Ou Co Es $ba $bn $pm. **(q78)** 14 $ba. **(r6-90)** *=(p6-90)* Cq2. **(+r48-90)** 0(8) Oo.ac. **(s18)** 25 $bn $pm. **(s78)** 42 Ou Co $ba $bn $pm. **(u6)** 55 Pa A. **(u12)** 43 Co.ac. **(u42)** 24 Lu; 32 Ou Co; 28 $ba. **(u66)** 59 Pz Cq2. **(w12)** 23 Cq2. **(w18)** 23 Pz $ba. **(w24)** 24 $ba. **(w42)** 16 Ou Co Es $ba $bn $pm. **(w48)** 26 Ou Co Es $ba $bn $pm. **(w66)** 55 Pz. **(w90)** 2 A. **(x36)** 42 Ou1. **(x54)** 38 Co $ba. **(x84)** 16 Cq2. **(x90)** 18 Co. **(y42-54)** 0, 12, 0 Co. **(y84)** 34 $ba; *n.l.* Pz.

		(Sas)		(Sam)		(Ius)		(Ium)		(Mas)		(Mam)		(Ved)		(Ver)		(Med)		(Mer)		(Par)	
Li nea num eri que aug men ta tur per VI gra dus	Li nea num eri que mi nu it ur per VI gra dus	Latitudo Saturni per augmentum L graduum super cuspidem				Latitudo Iovis per diminutionem XX graduum a cuspide				Latitudo Martis est absque aug mento et diminutione				Latitudo Veneris Venus				Latitudo Mercurii Mercurius				Partes latitu dinum quin que plane tarum erra tic<o r>um	
		Effe ngion sept entri onis		Effre ngion meri diana		Effe ngion sept entri onis		Effre ngion meri diana		Effe ngion sept entri onis		Effre ngion meri diana		Decli natio		Refle xus		Decli natio		Refle xus			
		Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Mi	Se
96	264	2	*33*	2	33	1	33	1	33	0	59	0	56	0	10	2	3	0	15	2	25	6	24
102	258	2	36	2	36	1	36	1	36	1	6	1	4	0	20	2	9	0	31	2	28	12	24
108	252	2	39	2	39	1	39	1	39	1	14	1	13	0	32	2	15	0	48	2	29	18	24
114	246	2	42	2	42	1	42	1	42	1	23	1	23	0	45	2	20	1	6	2	30	24	24
120	240	2	45	2	45	1	45	1	45	1	34	1	37	0	59	2	25	1	25	2	29	30	0
126	234	2	47	2	48	1	47	1	48	1	47	1	51	1	*18*	2	28	1	45	2	26	35	12
132	228	2	50	2	51	1	50	1	51	2	1	2	10	1	38	2	30	2	6	2	20	40	0
138	222	2	53	2	54	1	52	1	54	2	16	2	33	1	59	2	30	2	26	2	11	44	24
144	216	2	55	2	56	1	55	1	57	2	34	2	56	2	23	2	28	2	47	2	0	48	24
150	210	2	57	2	58	1	58	2	0	2	55	3	29	3	3	2	22	3	7	1	45	52	0
156	204	2	59	3	0	2	0	2	3	3	16	4	9	3	43	2	12	3	26	1	*29*	54	36
162	198	3	0	3	2	2	2	2	5	3	38	4	55	4	26	1	55	3	42	1	10	57	0
168	192	3	1	3	3	2	3	2	6	4	0	5	*53*	5	13	1	27	3	54	0	48	58	36
174	186	3	2	3	4	2	4	2	7	4	14	6	36	*5*	*52*	0	48	4	2	0	24	59	36
180	180	3	2	3	5	2	5	2	8	4	21	7	7	*6*	22	0	0	4	5	0	0	60	0
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(coll. (x-y)): Ou1 = Ou,66r; Ou2 = Ou,66v.

(b162-180) 298, 292, 286, 118 Pz. **(d96)** 34 Ct Lu; 32 Cq2. **(d108)** 36 Cq2. **(d126)** 48 Pz. **(d150)** 58 Ou Co. **(d174)** 1 Ou Co Es. **(d180)** 3 Pa A. **(e156)** 2 Cq2. **(f126)** 47 Cq2. **(f132)** 50 Pa A. **(f144)** 55 Lu. **(f180)** 8 Lu. **(h126-138)** 48, 51, 54 Lu, *cf. col. (f).* **(+h126)** 50 $ba. **(h138)** 54 $ba. **(h162)** 1 Cq2. **(h180)** 4 $bn $pm. **(j150)** 1 Cq2. **(k162)** 6 Ou Co. **(L132)** 1 Ou. **(L168-180)** 3(3) Oo. **(m126)** 49 Ou Co Es; 48 $ba $bn $pm. **(m132-180)** 50 52 55 58 0 2 3 4 5 *(=h132-180)* Cq2. **(+m132)** 50 Ou. **(+m150)** 54 $pm. **(+m156)** 15 Oo. **(n144)** 3 Oo. **(n180)** 6 Es. **(o96)** 57 Pz. **(o114)** 23: Ct Pz Cq2; 24 Oo Lu Co Pa A Es $ba $bn $pm; 34 Ou. **(o132)** 13 Oo. **(o138)** 30 Oo; 32 Ou Co $ba $bn $pm. **(o144)** 57 Pz. **(o168)** 53: Ou Co $ba $pm; 33 Pa A; 52 $bn; 43 *cett.* **(o174)** 26 Lu. **(o180)** 7: Ou Co $ba $bn $pm; 30 *cett.* **(p174, 180)** 5, 6: $bn $pm; 6, 7 $ba, *omnes.* **(q108)** 12 Oo. **(q114)** 35 A; 44 $bn $pm. **(q120)** 58 Cq2. **(q126)** 18: Ou Co Es $bn $pm; 13 *cett.* **(q138)** 58 Cq2; 29 $ba. **(q156)** 44 Ou Co Es $ba $bn $pm. **(q168)** 14 Lu. **(q174)** 52: $bn $pm; 12 $ba, *omnes.* **(r174)** 1 Pa A. **(r180)** 1 A. **(s114)** 22 Pa A. **(s120)** 24 $bn $pm. **(s126)** 27 Ou Co Es $bn $pm. **(s150)** 25 Pa A. **(t156)** 4 Pz. **(u120)** 15 Oo. **(u126)** 46 Ou Co. **(u138)** 27 Ou Co $ba $bn $pm. **(u144)** 46 Cq2. **(u156)** 25 Cq2. **(w114)** 20 Co. **(w126)** 25 Pa A. **(w150)** 46 $bn $pm. **(w156)** 59 Oo Pz Cq2. **(w168)** 47 Co.ac. **(w174)** 28 Lu. **(x96-156)** 6, 12, 18, 24--54: 24--54, 57, 58, 59 Co. **(x120)** 34 Es.ac. **(x126)** 34 Pz; 36 Cq2. **(x162)** 56 Oo Lu. **(y120)** 24 Co $ba. **(y126)** 0 Co. **(y132)** 24 Co.

G. Mean syzygy.

GA. Syzygy tables for Toledo.

Toomer 1968, no. 52-55 (p. 78-81, with examples and discussion). – The present tables are based on the solar and lunar parameters of the CA* tables. No parallel tables are known. – Sub-tables:

.Tps: "days...", time of mean syzygy
.Mot: mean longitude of sun and moon
.Alu: argument of moon
.Ala: argument of latitude.

This layout is common, cf. Khw/M, Suter Tab. 69-72 p.183-86; Batt., Nallino II p. 84-87; ?Maslama, Nallino II p. 306-7, cf. 308.

Canons. The canons (Ca126, Cc237, Cb170) all seem related to Albattani ch. 42; indeed, canon Cc ascribes itself to Albattani (Cc244) and locates the time of the syzygy to Aracca in the first place (Cc242-243), only secondarily to Toledo.

As usual, the terms employed as references in the canons cannot be cleanly correlated with certain manuscripts. Thus, for 'opposition', Cc Cb show "impletio", only found in the table-headings of mss. Mc Mb and in GB12; Ca has the common "praeventio". "Oppositio", frequent in the table headings, does not occur in any of the canons except for late intrusions. – For the sub-tables .Alu and .Ala ("portio lunae", "motus latitudinis" in Ca Cc), Cb alone has "argumentum lunae", "argumentum latitudinis", as is most common in the late tradition of the tables.

The canon Cb167 has the terms "praeventio" and "motus latitudinis", like Ca but unlike the context in Cb. It is an addition to Cb, and has a parallel in the tract "Diversi astrologi"; see CbA(5).

Values. Toomer (1968 p. 79-81) has shown that both the radices and the velocity constants essentially agree with the Toledan mean motion tables CA01-31. Here I shall only summarize an estimation of the velocity constants.

In GA11-12 the difference in time between two successive entries is 360 mean lunations, or about 30 lunar years. In sub-table .Tps the apparent tabular difference is 30 lunar years + 20m = 10631;0,50 days. This is probably meant as exact, in which case it is equivalent to the standard mean lunation of 29;31,50,8,20 days (Toomer p. 80).

To make this plausible, and to determine the velocity constants, I have tried to guess at the real tabular differences in sub-tables .Mot, .Alu and .Ala, in the way explained under GA11, "Values", q.v. for details. The estimated differences are listed under **(a)** below; they are such as seem to satisfy both GA11 and GA12. I also recapitulate the three analogous 30-year differences in CA01-31 **(c)**; the value listed under the argument of latitude is the sum of the likely tabular differences for CA11 and CA31. For the motion of the sun, one gets

```
(value in (a)) / (value in (c)) * 10631 = 10631;0,49,59...
```

and correspondingly for the two other motions listed. Thus no doubt the standard mean lunation is the one intended. The corresponding motions during 1 day, listed as **(b)** and **(d)**, agree tolerably well with each other.

		(a) GA11-12 (for 360 lunations = 10631;0,50 days)	(b) GA11-12 (for 1 day)
Sun, motion	.Mot:	10478; 1,10,20°	0;59, 8,11,28,27,27°
Moon, argument	.Alu:	138894; 0,51,30°	13; 3,53,56,17,56,32°
Moon, arg't of lat.	.Ala:	140641;23,59, 7°	13;13,45,39,31,19,24°

		(c) CA01-31 (for 30 lunar years = 10631 days)	(d) CA01-31 (for 1 day)
Sun, motion	CA01:	10478; 0,21, 3,20°	0;59, 8,11,28,27,30°
Moon, argument	CA21:	138893;49,58,20°	13; 3,53,56,17,58,12°
Moon, arg't of lat.	CA11+31:	140641;12,57,42°	13;13,45,39,31,20,26°

To assess the mean lunar motion presupposed by .Ala, one has to subtract the motion of the node, though this can only be obtained from CA31, thus:

argument of latitude for 1 day (from .Ala):	13;13,45,39,31,19,24
motion of node (from CA31; see under CA*)	- 0; 3,10,46,42,33,17
motion of moon for 1 day:	13;10,34,52,48,46, 7

This estimate of the motion of the moon turns out to be a little too small to fit comfortably as a mean motion parameter of CA11. However, the error only amounts to about 1 second in 600 years, which could have come about for a variety of reasons, not least the irregular variation of .Ala mentioned under GA11. The velocity parameters, then, are practically the same here as in CA01-31.

Any sub-table in GA11 should show constant differences to its counterpart in GA12, corresponding to the motion in question during half a lunation. In fact the apparent differences fluctuate a little, suggesting that the tables have been computed independently. However, some errors or revisions seem to have left traces in both tables, such as those in sub-tables .Alu (q.v.) for AH 571-601; so perhaps the tables were, at least, corrected against each other. I will refrain from discussing this possibility.

There are other intriguing cases of unevenness in the tables, most distinctly perhaps in GA14.Alu; cf. the commentary there.

GA11. Conjunctions, collected years, Toledo.

Toomer 1968, no. 52.

Witnesses: **{a0}** Ct,27r; Oo,23v; Cq2,85; Pz,129v; Mc,27v; Mb,56v; Ey,61r; Ea,54v. – **{a1}** Xa,31r; Ad,79r; Cq,55; Fc,43v; Ps,68r; Sg,162; Wd,30r; Fh,51r; Xw,30r. – **{a2}** Cz,84r; Cj,157r; Md,91v; Mp,221v. – **{aX}** Vo,60r; Xr,81v; R,63r; Ov,95r; S,101r; Vd,11r. – **{aT}** P,132r (:Toledan). – **{k}** Eh,98r; Lw,97r-v; Ou,67v; Eg,20r; Co,162v; Cn,98r. – **{d}** Op,73v; C,368; Lb,32v; Pa,46r; A,225r; Fj,45r; Nc,118r; Pb,34r; Pv,32r; Fd2,48r; Gr3,117r; Ok,57r. – **{e}** Gr,61r; Eq,79v; Ek3,106v; Xc,74r; Vj,97v; Ej,80v; Vm,12v. – **{x}** Oc,85r; X,162r; Vz,68r; Mv,96v; Cm,142r; B,152v; T,294v; Lf,102r; Lg,181r; Lh,147r; Xj,284r; Xg,65r; G,69v; Xb,84v; Es,190v; Fb,75r; Pq,194r; Oy,82r; Wa,70v; Ow,165r; Nu,150r. – **{p}** O,80r; Pd,74v; Ch2,176v. – **{?}** Ef,65r; Ew2,35v (:Ut Annos); Ox,89v (:Ut Annos); Oq,19r (:Ut Annos); Ut,129v (:?).

Headings. – General:

(1) Tabula (-ae Co) **coniunctionis** (-num Ct) **per medium cursum solis et lunae in annis Arabum collectis ad mediam** (-um Ct) **diem** (m.d.: meridiem Ou Eg) **civitatis** (*om.* Eg Cn) **Toleti** :: {a0:} Ct; {k:} Eh Lw Ou Eg Co Cn.

(2) Tabula (/-ae Oo Cq2 Mc Cq Fc Vo) **coniunctionum** (/-nis) **solis et lunae per medium cursum** (p.m.c.: *om.* Pz Mc) **in annis Arabum collectis** :: {a0:} Oo Cq2 Pz Mc Ea; {a1:} Xa Ad! Cq Fc Ps Fh Xw Wd; {a2:} Md; {aX:} Vo! Xr R; {aT:} P; {d:} Ok; {x:} Ow; {p:} O! Pd; {?:} Ef. – *Added:* (nothing) Pz Mc; **+ad medium** (-am Xw Ow) **diem** (m.d.: **/meridiem** Ea Ps Xr R O Pd) **civitatis** (*om.* Ea Ps Wd P R Ef Pd) **Toleti** *cett.*

(3) Tabula (-ae Pa) **coniunctionis** (+solis et lunae Vd) **in annis lunaribus coniunctis ad medium** (-am Lb) **diem** (+civitatis Lb) **Toleti** :: {aX:} Vd; {d:} Lb Pa Fj Pv Gr3.

(4) Tabula coniunctionis solis et lunae ad meridiem Toleti (+latitudo eius 39 (+gr) 54 (+m'a) A Fd2) :: {d:} A Nc Pb Fd2.

(5) Tabula coniunctionis solis et lunae secundum medios motus ad annos Arabum collectos (c.a. Xc Vj Ej) :: {e:} Gr Eq Ek3 Xc Vj! Ej; {?:} Ox.

(6) Tabula mediae (*om.* Ch2) **coniunctionis solis et lunae in annis Arabum** (*om.* Nu) **collectis** :: {a0:} Ey; {a2:} Mp; {d?:} Op C; {x-}; {p:} Ch2. — *Added:* **+ad meridiem (+civitatis** Ey) **Toleti** Ey B Lf Nu; **+ad Toletum** Mp Oc X T Xb Oy; **+ad civitatem Toleti** Vz Mv Cm Lg Xj Xg G Es Pq Wa Ch2; **+pro meridie Toleti** Op C.

(7: other) Mb (no hdg.); Cq2 ("Alhestima", then (2) above); S ("T. c-onis s. et l."); Sg Cz Cj Ov Vm Lh Fb Ew2 Ut Oq.

Entrance column: mostly **(8) Anni (+Arabum) collecti** or **(9) Annorum collectorum (+numerus).**

Sub-headings:

.Tps: **(10) Dies et horae** :: {a0:} Ct; {aX:} Vd; {k:} Eh Lw Ou Eg Co Cn; {d:} Op C Lb Pa A Fj Nc Pb Pv Fd2 Gr3. — **(11) Dies et** (*om.* Fc Ps Xw) **horae atque (/et) horarum minuta** (m.h. Pz Mc Mb Fc Ps Fh Xw P Ok Ow) :: {a0:} Oo Cq2 Pz Mc Mb; {a1:} Xa Ad Cq Fc Ps Sg Wd Fh Xw; {aX:} Vo; {aT:} P; {d:} Ok; {x:} Ow. — **(12) Tempus mediae** (*om.* Ey Ov) **coniunctionis** :: {a0:} Ey Ea; {a2:} Cz Cj Mp; {aX:} Ov; {e}; {x-}; {?:} Ew2 Ox Oq. — **(13) Medium tempus coniunctionis** :: {p:} Ch2; {?:} Ut. — **(14) Medius motus in diebus** :: {p:} O Pd. — **(15: none)** Md Xr R S Ef.

.Mot: **(16) Medius cursus solis et lunae** (l.e.s. Cq) :: normally. — **(17) Medius motus solis et lunae** :: {a2:} Mp; {d?:} Op C; {e:} Gr Eq Ek3; {x}; {?:} Ut. — **(18) Medius** (-um Lb) **solis et lunae** :: {aX} Xr; {d:} Lb; {?:} Ew2. — **(19: other)** :: Ov.

.Alu: **(20) Argumentum lunae** :: normally. — **(21) Portio lunae** :: {a0:} Ct Oo Cq2; {aT:} P; {k}; {?:} Ew2. — **(22) Argumentum lunae ad horam coniunctionis** :: {aX:} Ov; {p:} Ch2. — **(23) Argumentum lunae medium** (m.a.l. X Ut) :: {x:} Oc X Xb; {?:} Ut. — **(24) Argumentum lunae sive portio** (s.p.l. O) :: {d:} Ok; {e:} Xc Vj Ej; {p:} O. — **(25) Portio sive argumentum lunae** :: {d?:} Op C. — **(26) Medius motus argumenti lunae** (+argumentum lunae Wa) :: {a2:} Mp; {x:} Es Wa. — **(27: other)** Ps ("Arg. vel portio lunae").

.Ala: **(28) Motus latitudinis** (+lunae Cq2 Cz Ow) :: normally. — **(29) Argumentum latitudinis** :: {a0:} Ey; {a2:} Md; {d:} A Nc Fd2; {?:} Ew2. — **(30) Argumentum latitudinis lunae** :: {a0:} Pz Mc Mb; {a2:} Cj Mp; {aX:} S; {d?:} Op C; {e}; {x-}; {?:} Ox Oq. — **(31: other)** Ps ("Motus vel argumentum lat."); Ch2 X Ut.

Ranges. Ignoring entries where the values are blank.

1-601:	{a0:} Ct Oo Cq2 Pz Mc Mb; {a1:} Xa Ad Cq Ps Wd; {k:} Co.
1-631:	{a1:} Sg Xw; {aX:} Ov; {k:} Eh Lw.
1-661:	{a1:} Fh; {aX:} Vo; {k:} Ou Eg Cn.
1-691:	{aT:} P; {d:} Lb Pa A Pb.
1-721:	{d:} Nc Fd2.
1-841:	{d:} Fj Pv Gr3; {e:} Gr Eq Xc Vj Ej Vm.
1-871:	{a0:} Ey; {a2:} Cz Cj Md; {aX:} Vd; {d:} Ok; {e:} Ek3; {x:} Oc X Lh Xb Es Wa; {p:} O. — The entrances of Xb X end in "870"; the tabular values are the same as elsewhere.
1-901:	{a1:} Fc; {x:} Xg Ow.
1-931:	{x:} Mv Lf; {?:} Ox.
1-961:	{a2:} Mp; {x:} Vz Cm B T Lg Xj G Fb Pq Oy Nu.
Other:	S (1, 571-601); Ea (1, 451-631); Xr (571-631); Ef (481-631); R (1-31, 571-691); Ch2 (601-721); Ew2 (631-841); Ut (1, 661-841); Pd (571-871); Op & C (691-871); Oq (601-901);

Values of GA11-12. When checking suggested parameters against the tabular values, I treat the radix values as if they had no hidden sexagesimals; in the other values, hidden sexagesimals are taken to be discarded without rounding. This is not obvious from the present tables but conforms to the treatment of CA01-31.

Sub-table .*Tps* and general remarks: see under GA above.

Sub-table .*Mot:* The apparent tabular differences are 38;1,10/11, and the second-values show the period "10,10,11". Irregularities: GA11.Mot:h91 ought to read "41" (though it does so nowhere); and GA12.Mot starts with the difference "11", perhaps because the radix has hidden sexagesimals. In any case, no doubt the intended tabular difference in both instances is 29 revolutions + 38;1,10,20°. When using this, both tables are reproduced to within 1" up to AH 601. From AH 631 on, the accepted values are lower than the expected ones by up to 4 or 5 seconds.

Sub-table *.Alu:* On the intervals AH 1-541 (GA11) or AH 1-421 (GA12) the tabular differences vary between 294;0,48° and 294;0,54°, typically around 294;0,51-52. The values do not seem to show any period. Thus I have had to use the average difference over the time intervals mentioned; this is 385 revolutions + 294;0,51,30°. In either case the accepted tabular values differ from expectation by 2" or less.

In GA12 the values for AH 451-511 are corrupt in the early witnesses. In both tables, the values for AH 571-601 are no doubt mistaken except for likely restorations in some later witnesses (Eq Xc, see "Variant groups" below); and in the additional part from AH 631 on, the accepted values may deviate by up to 10" from expectation. This looks like a consequence of the error at AH 601, which is also about 10", rather than an intended revision.

Sub-table *.Ala:* The case is much the same as for .Alu. Until AH 601, the tabular differences vary between 241;23,58° and 241;24,0, in no apparent period. For an average tabular difference, the best choice seems to be 390 revolutions + 241;23,59,7°, which looks a trifle too great for GA11 and a trifle too small for GA12. If this is used, the accepted tabular values will deviate from expectation by 2" or less in GA11 as a whole. In GA12 the same is the case until AH 601; after that, most tabular differences in the vulgate version are of 241;23,58°, so that the table increases more slowly than expected.

Text. Collated for values: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** P; **{k}** Ou Co; **{d}** Pa A; **{e}** Eq Xc; **{x}** Es Xg Lg. — Headings according to Xa. — Coverage:

AH 1-601:		Ct	Oo	Pz	Xa	Cq	P	Ou	Co	Pa	A	Eq	Xc	Es	Xg	Lg
AH 631-661	(asterisked):						P	Ou		Pa	A	Eq	Xc	Es	Xg	Lg
AH 691	(same):						P			Pa	A	Eq	Xc	Es	Xg	Lg
AH 721-841	(same):											Eq	Xc	Es	Xg	Lg
AH 871	(same):													Es	Xg	Lg
AH 901	(same):														Xg	Lg
AH 931-961	(same):															Lg

In Pa, the entry for AH 691 is incomplete, and there is a trace of an entry for AH 721. In A, the value for AH 691 "motus latitudinis" may be secondary too. In Eq and in Xc, at AH 871, only the time-value has been filled in; this entry is disregarded.

Listed in selection: **$c** = values recomputed from the apparent radix values and from the tabular differences found under "Values" above. They are only quoted for the additional parts of .Mot, .Alu and .Ala where values are much off the expected ones. In the part until AH 601, deviations do not exceed 2".

Readings chosen. I adopt the readings of the majority of Ct Oo Pz Xa Cq, italicizing where I depart from it in order to correct gross errors. Lesser irregularities in second-values are left untouched, even where other witnesses appear to offer better readings.

In the additional part (AH 631 and following), where Ct Oo Pz Xa Cq are absent, I italicize where I depart from the current majority. The values in .Mot are slightly off the recomputed ones, and those of .Alu are some 10" off; cf. "Values" above. Both these sets of unexpected values are underscored.

Ms. P shows variant values for AH 631-691 in .Mot and .Ala; cf. the apparatus. In .Alu, P supplies its own set of second-values, increasing by 51" exactly. These are secondary: indeed, at AH 241 and 451 P shows the usual minute-values, which do not fit the seconds.

Variant groups, tables GA11-12. The early witnesses *Ct Oo Pz Xa Cq* are in error in a dozen places, corrected and italicized in the text. In these places Eq Xc show plausible readings, Es Xg Lg usually so, whereas P, Ou Co, Pa A may show either. It is likely that the plausible readings are secondary; cf. below for Eq Xc.

Of the usual error groups, *Ou Co* are in error at GA12:f361,m0. They have plausible readings, e.g., at GA11:q121,q241; but the errors they share with the early witnesses (e.g., GA11:L391, m571) indicate that they do not constitute an independent group. In a few cases they share errors with *Oo* (GA11:k121;

GA12:d131,k181), which may or may not be significant. There are many errors in *Pa A*, e.g., GA11:h331, GA12:j301,m361, and the Abjad error GA11:p331.

Eq Xc have significant common errors at GA11:p0, GA12:f91-181, GA12:k151,p361, and at GA12:p0, which may or may not be an Abjad error. Again, they have plausible readings at GA11:m571-600 (subtable .Alu) against all others. They may be due to conjecture, though this leaves unexplained why Eq Xc share the faulty continuation at GA11:m630+ with the late witnesses; indeed, this seems to be caused by the incorrect readings at m571-600. It cannot then be excluded that Eq Xc have adduced independent sources.

Es Xg Lg are in error at GA11:h121,o331,p121,q361. At GA11:m571 they share one error with Pa A, perhaps by accident. Where the early witnesses are in error, Es Xg Lg may be correct (several instances) or in error (GA11:n331,p181). They are probably mixed and emended.

Tabula coniunctionum solis et lunae per medium cursum in annis Arabum collectis ad medium diem civitatis Toleti.

	(Tps)			**(Mot)**				**(Alu)**				**(Ala)**			
Anno rum col lect orum Nume rus	Dies et horae atque horarum minuta			Medius cursus solis et lunae				Argu mentum lunae				Motus latitudinis			
	Di	Ho	Mi	Si	Gr	Mi	Se	Si	Gr	Mi	Se	Si	Gr	Mi	Se
Radix	28	22	23	4	22	12	10	4	6	9	10	0	17	54	6
31	28	22	43	6	0	13	20	2	0	10	2	8	19	18	4
61	28	23	3	7	8	14	30	11	24	10	52	4	20	42	3
91	28	23	23	8	16	15	40	9	18	11	46	0	22	6	2
121	28	23	43	9	24	16	51	7	12	12	37	8	23	30	2
151	29	0	3	11	2	18	1	5	6	13	27	4	24	54	0
181	29	0	23	0	10	19	12	3	0	14	17	0	26	*17*	59
211	29	0	43	1	18	20	22	0	24	15	11	8	27	41	58
241	29	1	3	2	26	21	32	10	18	16	1	4	29	5	56
271	29	1	23	4	4	22	43	8	12	16	55	1	0	29	56
301	29	1	43	5	12	23	53	6	6	17	46	9	1	53	54
331	29	2	3	6	20	25	3	4	0	18	35	*5*	3	17	54
361	29	2	23	7	28	26	14	1	24	19	27	1	4	41	54
391	29	2	43	9	6	27	24	11	18	*20*	20	9	6	5	52
421	29	3	3	10	14	28	34	9	12	21	10	5	7	29	51
451	29	3	23	11	22	29	45	7	6	22	3	1	8	53	51
481	29	3	43	1	0	30	55	5	0	22	55	9	10	17	50
511	29	4	3	2	8	32	5	2	24	23	45	5	11	41	48
541	29	4	23	3	16	33	16	0	18	24	37	1	13	5	48
571	29	4	43	4	24	34	26	10	12	25	*28*	9	14	29	47
601	29	5	3	6	2	35	37	8	6	26	*20*	5	15	53	47
631 *	29	5	23	7	10	36	*47*	6	0	27	21	1	17	17	45
661 *	29	5	43	8	18	37	*57*	3	24	28	12	9	18	41	45
691 *	29	6	3	9	26	39	*8*	1	18	29	2	5	20	5	43
721 *	29	6	23	11	4	40	17	11	12	29	55	1	21	29	43
751 *	29	6	43	0	12	41	*26*	9	6	30	46	9	22	53	42
781 *	29	7	3	1	20	42	37	7	0	31	35	5	24	17	42
811 *	29	7	23	2	28	43	46	4	24	32	27	1	25	41	41
841 *	29	7	43	4	6	44	55	2	18	33	20	9	27	5	41
871 *	29	8	3	5	14	46	5	0	12	34	10	5	28	29	39
901 *	29	8	23	6	22	47	17	10	6	35	0	1	29	53	39
931 *	29	8	43	8	0	48	26	8	0	35	55	*10*	1	17	37
961 *	29	9	3	9	8	49	35	5	24	36	47	*6*	2	41	37
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(b151-241) 28(4) Oo. **(d0)** 13 Oo. **(d31)** 23 Pa. **(d91)** 13 Oo. **(e31)** 5 Co. **(e271)** 3 Ou. **(e361)** 6 Co. **(e451)** 10 Pa A. **(f121)** 28 A. **(f301)** 21 Oo. **(f421)** 15 Oo. **(f751)** 10 Eq Xc. **(g361)** 16 Pa. **(h91)** 40: *omnes.* **(h121)** 50 Es Xg Lg. **(h241)** 33 P. **(h301)** 52 Pa A. **(h331)** 30 Pa A. **(h631-691)** 47, 57, 8: P, *recte;* 46, 55, 5 *cett.* **(h721-961)** 18 28 38 49 59 9 20 30 40 $c. **(h751)** 26: Eq Xc; 20 Es Xg Lg. **(k91)** 23 Co. **(k121)** 22 Oo Co. **(k271)** 22 Es.ac. **(k571-871)** 12--18, 12: 18, 12--18 Es.ac. **(L0)** 0 Xc. **(L391)** 21 Ct Pz Xa Cq Ou Co. **(L661-691)** 27, 28 P. **(m0-691)** 11, 2, 53, ... *(incremento 51")* ... 11, 2, 53, 44 P. **(m61)** 25 A. **(m571)** 28: Eq Xc, *recte;* 38 Ct Oo Pz Xa Ou Co; xxxq Cq; 33 Pa A Es Xg Lg; *alia* P. **(m601)** 20: Xc, *recte;* 28 Eq; 30 *cett.* **(m631-961)** 11 3 54 46 37 29 20 12 3 55 46 38 $c. **(n331)** 5: P Ou Co Pa A Eq Xc; 6 *cett.* **(n691)** *vacat* Pa; *m2* A. **(n931-61)** 10,6: *scripsi;* 9,5 Lg. **(o331)** 2 Es Xg Lg. **(o691)** *vacat* Pa; *m2* A. **(p0)** 58 Eq Xc. **(p121)** 20 Es Xg Lg. **(p181)** 17: P Ou Co Pa A Eq Xc; 16 *cett.* **(p301)** 45 Oo. **(p331)** 47 Oo; 57 Pa A. **(p421)** 19 Oo. **(p451)** 57 (?) Oo.ac; 54 Oo.pc. **(p481)** 16 Pz. **(p691)** *vacat* Pa; *m2* A. **(p841)** 2 Eq. **(q0)** 5 P, *fort. recte.* **(q91)** 3 Pa A. **(q121)** 1 Ou Co. **(q241)** 57 Ou Co. **(q271)** 55 P Eq Xc. **(q301)** 54: *omnes;* 56 *melius.* **(q361)** 53 P Ou Co; 52 Es Xg Lg. **(q511)** 49 P. **(q631)** 46 P; 55 Pa A. **(q661)** 43 Ou; 53 Pa A. **(q691)** 44 P; *vacat* Pa; 11 A*(m2).*

GA12. Oppositions, collected years, Toledo.

Toomer 1968, no. 53.

Witnesses: **{a0}** Ct,27r; Oo,23v; Cq2,85; Pz,129v; Mc,27v; Mb,57r; Ey,61v; Ea,54v. — **{a1}** Xa,31r; Ad,79r; Cq,55; Fc,44r; Ps,68v; Sg,163; Wd,30r; Fh,51v; Xw,30r. — **{a2}** Cz,84v; Cj,157v; Md,92r; Mp,222r. — **{aX}** Vo,60v; Xr,81v; R,63r; Ov,95v; S,101r; Vd,11v. — **{aT}** P,132v (:Toledan). — **{k}** Eh,98v; Lw,98r-v; Ou,68r; Eg,20r; Co,162v; Cn,98r. — **{d}** Op,73v; C,368; Lb,33r; Pa,46v; A,225v; Fj,45v; Nc,118v; Pb,34v; Pv,32v; Fd2,48v; Gr3,117v; Ok,57v. — **{e}** Gr,61v; Eq,80r; Ek3,107r; Xc,74v; Vj,98r; Ej,81r; Vm,12v. — **{x}** Oc,85v; X,162v; Vz,68v; Mv,97r; Cm,142v; B,153r; T,295r; Lf,102v; Lg,181v; Lh,147v; Xj,284v; Xg,65v; G,70r; Xb,85r; Es,191r; Fb,75v; Pq,194v; Oy,82v; Wa,71v; Ow,165v; Nu,150v. — **{p}** O,80v; Pd,74v; Ch2,176v. — **{?}** Ef,65r; Ew2,35v (:Ut Annos); Ox,89v (:Ut Annos); Oq,19r (:Ut Annos); Ut,129v (:?).

Headings. — General:

(1) **Tabula praeventionum ad** (per Ct) **medium cursum solis et lunae in annis Arabum collectis ad medium** (-am Co) **diem** (m.d.: meridiem Eg) **civitatis** (*om.* Eg) **Toleti** :: {a0:} Ct; {k:} Lw Ou Eg Co Cn.

(2) **Tabula** (/-ae Oo Cq) **praeventionis solis et lunae per medium cursum in annis** (**+Arabum** Ea Ps Sg Wd Md Xr R P Ow O Pd Ef) **collectis** :: {a0:} Oo Cq2 Pz.pc Ea!; {a1:} Xa Ad Cq Fc Ps Sg Fh Xw Wd; {a2:} Md; {aX:} Vo Xr R; {aT:} P; {d:} Ok; {x:} Ow; {p:} O Pd; {?:} Ef!. — *Added:* (nothing) Sg Ow; **+ad medium diem** (m.d.: m. Xw; **/meridiem** Ea Ps Xr R O Pd) **civitatis** (*om.* Ea Ps Wd R Pd Ef; *n.l.* Ad) **Toleti** *cett.*

(3) **Tabula praeventionis in annis Arabum collectis super meridiem** (+civitatis C) **Toleti** :: {d?:} Op C.

(4) **Tabulae impletionum lunae** :: {a0:} Mc Mb.

(5) **Tabula** (-ae Pa) **oppositionis in annis lunaribus coniunctis ad medium diem** (m.d.: meridiem Pa) **Toleti** :: {aX:} Vd; {d:} Lb Pa Fj Pv Gr3.

(6) **Tabula oppositionis solis et lunae ad meridiem Toleti** :: {d:} A Nc Pb Fd2.

(7) **Tabula mediae oppositionis** (t.m.o.: m-a o-o X) **solis et lunae ad annos Arabum collectos** (**+ad Toletum** Mp Oc X Xb) :: {a2:} Cj Mp; {e:} Gr Eq Ek3 Xc Vj Ej; {x:} Oc X Xb; {?:} Ew2 Oq.

(8) **Tabula mediae oppositionis solis et lunae in annis Arabum collectis** :: {a0:} Ey; {x-}. — *Added:* **+ad meridiem** (**+civitatis** Ey) **Toleti** Ey Vz Cm B Lf Lg Xj G Nu; **+ad Toletum** T Es Fb Pq Oy; **+ad civitatem Toleti** Mv Xg.

(9: **other**) Pz.ac (no hdg.); Cq2 ("Icztibel", then (2) above); S ("T. oppositionis s. et l."); Cz Ov Eh Vm Lh Wa Ch2 Ox Ut.

Sub-headings are distributed much as in GA11. I only quote a few that differ characteristically from GA11.

.Tps: (10) **Tempus mediae** (*om.* Ey) **oppositionis** (+in diebus O; +solis Xb; +solis et lunae Wa) :: {a0:} Ey Ea; {a2:} Cz Cj Mp; {e}; {x:} Oc Vz Mv Cm B T Lg Lh Xj Xg G Xb Es Fb Pq Oy Wa Nu; {p:} O; {?:} Ew2 Ox Oq. — (11: **other**) e.g.: Ov & Ch2 & Lf ("... praeventionis ..."); Md & X ("... coniunctionis(!) ..."); Ut.

.Alu: (12) **Argumentum sive pars lunae** :: {a1:} Fh Xw; {d:} Ok. — (13: **other**) e.g.: Ea ("Anomalia lunae").

.Ala: (14) **Motus latitudinis** *(Ek3 Xc Vj Ej Vm Ow:)* **lunae** (+argumentum Ow) :: {a2:} Md; {e}; {x:} Ow. — (15: **other**) e.g.: Ch2 ("Portio sive argumentum lunae".)

Ranges.

1-601:	{a0:} Ct Oo Cq2 Pz Mc Mb; {a1:} Xa Ad Cq Ps Wd; {k:} Co.
1-631:	{a1:} Ov Sg Xw; {k:} Eh Lw Ou.
1-661:	{a: Fh Vo; k: Eg Cn.
1-691:	{aT:} P; {d:} Lb Pa A Pb.
1-721:	{d:} Nc.
1-841:	{aX:} Vd; {d:} Fj Pv Gr3 Ok; {e:} Gr Eq Xc Vj Ej Vm.
1-871:	{a0}: Ey; {a2:} Cz Cj Md; {d:} Ek3; {x:} Oc X Lh Xb Es. — X Xb end in "870"; the tabular values are the normal ones.
1-901:	{x:} Xg Ow.
1-931:	{x:} Mv Lf.
1-961:	{a2:} Mp; {x:} B Pq Wa Nu.
1-991:	{x:} Vz Cm T Lg Xj G Fb Oy.
Other:	S (1, 571-601); Ea (1, 451-631); Ef (481-631); Xr (571-631); R (1-31, 571-691); Ch2 (601-721); Fd2 (1-751); Fc (1-781); Ew2 (631-841); Ut (661-841); O & Pd (571-871); Oq (601-871); Op & C (691-901); Ox (601-931).

Values: see GA11.

Text. Collated for values: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** P; **{k}** Ou Co; **{d}** Pa A; **{e}** Eq Xc; **{x}** Es Xg Lg. – Headings according to Xa. – Coverage:

AH 1-601:		Ct	Oo	Pz	Xa	Cq	P	Ou	Co	Pa	A	Eq	Xc	Es	Xg	Lg
AH 631	(asterisked):						P	Ou		Pa	A	Eq	Xc	Es	Xg	Lg
AH 631-691	(same):						P			Pa	A	Eq	Xc	Es	Xg	Lg
AH 721-841	(same):											Eq	Xc	Es	Xg	Lg
AH 871	(same):													Es	Xg	Lg
AH 901	(same):														Xg	Lg
AH 931-991	(same):															Lg

In Pa, the entry for AH 691 is incomplete, and there is a trace of an entry for AH 721. In A, at AH 691, the values for the lunar argument and for the argument of latitude seem secondarily entered, though perhaps by the main hand. In Eq, at AH 871, only the time-value has been filled in; this entry is disregarded.

Listed in selection: **$c** = values recomputed as indicated under GA11. They are only quoted for the additional parts, i.e., from AH 631 on. Until AH 601, the adopted values do not differ from the recomputed ones by more than 2".

Readings chosen. In the main part (Radix until AH 601) I adopt the readings of the majority of Ct Oo Pz Xa Cq, treating them like those of GA11, q.v.

In the additional part (AH 631 and following), where Ct Oo Pz Xa Cq are absent, I italicize where I depart from the current majority. The values in .Mot are slightly off expectation, and those of .Alu are some 10" off. The values of .Ala are faulty, deviating by up to 10", unlike their counterparts in GA11. See GA11, "Values...". These sets are underscored.

Ms. P shows its own variant values for AH 631-691 in .Ala and, less distinctly, in .Mot, cf. the apparatus; in .Alu it agrees with the majority of the later witnesses.

Variant groups: see GA11.

Tabula praeventionis solis et lunae per medium cursum
in annis collectis ad medium diem civitatis Toleti.

	(Tps)			(Mot)				(Alu)				(Ala)			
Anno rum col lect orum Nume rus	Dies et horae atque minuta horarum			Medius cursus solis et lunae				Argu mentum lunae				Motus latitudinis			
	Di	Ho	Mi	Si	Gr	Mi	Se	Si	Gr	Mi	Se	Si	Gr	Mi	Se
Radix	14	4	1	4	7	38	59	9	23	14	39	6	2	33	57
31	14	4	21	5	15	40	10	7	17	15	31	2	3	57	57
61	14	4	41	6	23	41	20	5	11	16	22	10	5	21	55
91	14	5	1	8	1	42	30	3	5	17	15	6	6	45	54
121	14	5	21	9	9	43	41	0	29	18	6	2	8	9	54
151	14	5	41	10	17	44	51	10	23	18	58	10	9	33	52
181	14	6	1	11	25	46	1	8	17	19	46	6	10	57	51
211	14	6	21	1	3	47	12	6	11	20	40	2	12	21	51
241	14	6	41	2	11	48	22	4	5	21	31	10	13	45	50
271	14	7	1	3	19	49	32	1	29	22	23	6	15	9	49
301	14	7	21	4	27	50	43	11	23	23	14	2	16	33	48
331	14	7	41	6	5	51	53	9	17	24	6	10	17	57	47
361	14	8	1	7	13	53	3	7	11	24	56	6	19	21	47
391	14	8	21	8	21	54	14	5	5	25	49	2	20	45	46
421	14	8	41	9	29	55	24	2	29	26	40	10	22	9	45
451	14	9	1	11	7	56	34	0	23	*27*	*31*	6	23	33	44
481	14	9	21	0	15	57	45	10	17	*28*	*23*	2	24	57	43
511	14	9	41	1	23	58	*55*	8	11	*29*	*14*	10	26	21	42
541	14	10	1	3	2	0	5	6	5	30	5	6	27	45	41
571	14	10	21	4	10	1	16	3	29	*30*	*57*	2	29	9	40
601	14	10	41	5	18	2	26	1	23	31	*48*	11	0	33	39
631 *	14	11	1	6	26	3	35	11	17	32	49	7	1	57	*38*
661 *	14	11	21	8	4	4	44	9	11	33	40	3	3	21	*37*
691 *	14	11	41	9	12	5	53	7	5	34	31	11	4	45	*36*
721 *	14	12	1	10	20	7	2	4	29	35	22	7	6	9	31
751 *	14	12	21	11	28	8	14	2	23	36	14	3	7	33	*29*
781 *	14	12	41	1	6	9	24	0	17	37	7	11	8	57	27
811 *	14	13	1	2	14	10	35	10	11	37	59	7	10	21	25
841 *	14	13	21	3	22	11	45	8	5	38	47	3	11	45	23
871 *	14	13	41	5	0	12	55	5	29	39	32	11	13	9	22
901 *	14	14	1	6	8	14	5	3	23	40	25	7	14	33	20
931 *	14	14	21	7	16	15	16	1	17	41	17	3	15	57	18
961 *	14	14	41	8	24	16	26	11	11	42	7	11	17	21	16
991 *	14	15	1	10	2	17	37	9	5	42	57	7	18	45	14
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(d31) 20 Oo.?pc Ou Co. **(d181)** 0 Pa A. **(e0)** 3 Ou. **(e91)** 4 Pa A. **(e331)** 5 Ou. **(e391)** 7 Ou. **(f0)** 6 Pz. **(f61)** 24 Co. **(f91-181)** 10 (1 Xc.pc), 11, 1, 2 Eq Xc, *cf. col. (e).* **(f361)** 14 Ou Co. **(f571)** 20 Co. **(f841)** 32 Es.ac. **(g0)** 28 Oo. **(g31)** 41 Ou. **(g91)** 43 Oo. **(g541)** 1 Pa A. **(g841)** 22 Es.ac. **(h271)** 33 P Ou. **(h301)** 44 P. **(h421)** 14 Oo. **(h511)** 59 Ct Oo Pz Xa Cq Co Pa A. **(h631-991)** 36 46 56 7 17 27 38 48 58 9 19 29 40 $c. **(+h691)** 55 P. **(j181)** 7 Ou. **(j301)** 1 Pa A. **(j691)** *vacat* Pa; *m2?* A. **(k0)** 22 Eq. **(k91)** 10 Co. **(k151)** 33 Eq Xc. **(k181)** 13 Oo; 18 Ou Co. **(k691)** *vacat* Pa; *m2?* A. **(L451-571)** 27 28 29 30 30: Eq Xc Es Xg Lg; 26 27 28 30 31 Ct Oo Pz Xa Cq P Ou Co Pa A. **(L691)** *vacat* Pa; *m2?* A. **(L721)** 25 Eq. **(m0)** 29 Ou Co. **(m61)** 32 Ou. **(m151)** 57 P. **(m301)** 21 P; 18 Ou. **(m361)** 46 Pa A. **(m391)** 19 Oo. **(m451-511)** 31 23 14: Eq Xc Es Xg Lg; 50, 43 (53 A), 35 Ct Oo Pz Xa Cq P Ou Co Pa A. **(m571-601)** 57, 48: Eq Xc Es Xg Lg, *fort. recte;* 8, 58 Ct Oo Pz Xa Cq P Ou Co Pa A. **(m631-991)** 40 32 23 15 6 58 49 41 32 24 15 7 58 $c. **(m631)** 49: P Ou Pa A Eq Xc; 39 Es Xg Lg. **(m661)** 40: P Pa A Eq Xc Es; 33 Xg Lg. **(m691)** 31: P A*(m2?)* Eq Xc; 21 Es; 28 Xg Lg; *vacat* Pa. **(m721)** 22: Eq Es; 32 Xc; 20 Xg Lg. **(m871)** 42 Es.ac. **(n91)** 5 Oo. **(n631)** 6 Es. **(n691)** *vacat* Pa; *m2?* A. **(o211)** 11 Ou. **(o481)** 23 Pa A. **(o691)** *vacat* Pa; *m2?* A. **(p0)** 13 Eq Xc. **(p61)** 51 A. **(p121-151)** 59, 32 Oo. **(p301)** 32 Oo. **(p361)** 41 Eq Xc. **(p451)** 32 Oo Ou. **(p541)** 41 Xc. **(p601)** *n.l.* Oo. **(p691)** *vacat* Pa; 44 A*(m2?)*. **(q31)** 55 Pz. **(q91)** 44 Eq. **(q121)** 52 Pa. **(q631-691)** 38 37 36: P, *recte;* 37 35 33 *cett. fere.* **(+q691)** *vacat* Pa; 53 A*(m2?)*. **(q721-991)** 35 34 34 33 32 31 30 29 28 27 $c. **(q751)** 30 Eq Xc.

GA13. Expanded years.

Toomer 1968, no. 54.

Witnesses: **{a0}** Ct,27v; Oo,24r; Cq2,86; Pz,130r; Mc,28r; Mb,57r; Ey,62r; Ea,55r. — **{a1}** Xa,31v; Ad,79v; Cq,56; Fc,44v; Ps,69r; Sg,164; Wd,30v; Fh,52r; Xw,30v. — **{a2}** Cz,85r; Cj,158r; Md,92v; Mp,222v. — **{aX}** Vo,61r; Xr,82r; R,63v; Ov,96r; S,101r; Vd,12r. — **{aT}** P,133r (:Toledan). — **{k}** Eh,99r; Lw,99r-v; Ou,68v; Eg,20v; Co,163r; Cn,98v. — **{d}** Op,74r; C,369; Lb,33v; Pa,47r; A,226r; Fj,46r; Nc,119r; Pb,35r; Pv,33r; Fd2,49r; Gr3,118r; Ok,58r. — **{e}** Gr,62r; Eq,80v; Ek3,107v; Xc,75r; Vj,98v; Ej,81v; Vm,13r. — **{x}** Oc,86r; X,163r; Vz,69r; Mv,97v; Cm,143r; B,153v; T,295r; Lf,103r; Lg,182r; Lh,148r; Xj,285r; Xg,66r; G,70v; Xb,85v; Es,191v; Fb,76r; Pq,195r; Oy,83r; Wa,71v-72r; Ow,166r; Nu,151r. — **{p}** O,81r; Pd,75r; Ch2,176v. — **{?}** Ef,65v; Ew2,36r (:Ut Annos); Ox,90r (:Ut Annos); Oq,19v (:Ut Annos); Ut,130r (:?).

Headings. — General:

(1) Tabula (**/-ae** Oo Cq2 Ad Cq Fc) **coniunctionum (/-nis) et (/ac) praeventionum (/-nis; /impletionum** Mc Mb) **solis et lunae (+per medium cursum** R O Pd) **in annis Arabum** (*om.* Ct Cn) **expansis** (/sparsis Ea; +per medium cursum Xr) :: {a0:} Ct Oo Cq2! Pz Mc Mb Ea; {a1:} Xa Ad Cq Fc Ps Wd Fh Xw; {a2:} Md!; {aX:} Vo Xr R; {k:} Eh Lw Ou Eg Co Cn; {d:} Op C Ok; {p:} O Pd Ch2.
— *Added:* (nothing) Pz Mc Mb; **+ad medium** (-am Xr Eh Lw Ou Co) **diem** (*om.* Oo Cq2) **civitatis** (*om.* Wd) **Toleti** Ct Oo Cq2, Xa Ad! Cq Fc Wd Fh Xw, Md, Vo Xr, Eh Lw Ou Co Cn, Ok; **+ad meridiem** (+civitatis O) **Toleti** Ea Ps R Eg O Pd Ch2; **+in Toleto** Op C.

(2) Tabula (tempus Xc) **coniunctionis et praeventionis solis et lunae ad annos Arabum** (*om.* Gr Eq) **expansos** :: {e:} Gr Eq Ek3 Xc Vj Ej.

(3) Tabula (/-ae Pa) **coniunctionis et oppositionis** (praeventioni (!) Ov) :: {aX:} S Ov Vd; {d:} Lb Pa A! Fj Nc Pb Pv Fd2 Gr3.
— *Added:* **+solis et lunae** S A Nc Pb Fd2; **++in annis lunaribus** (*om.* S Lb) **expansis** S Ov Vd Lb Pa Fj Pv Gr3; **+++ad meridiem Toleti** Vd! A Fd2.

(4) Tabula mediae (*om.* Cj Oq; communis Ox) **coniunctionis et oppositionis solis et lunae** :: {a0:} Ey; {a2:} Cj Mp; {x-}; {?:} Ew2 Ox.
— *Added:* **+ad annos Arabum** (*om.* Ew2) **expansos** Cj Mp, Oc X Lh Xb Es, Ew2 Ox; **+in annis Arabum expansis** (+ad meridiem Toleti B; +ad Toletum Lf; +ad civitatem Toleti Wa) Ey, Vz Mv Cm B T Lf Lg Xj Xg G Fb Pq Oy Wa Nu.

(5: other) Sg Cz P Vm Ow Ef Ut.

Sub-headings are distributed much as in GA11. I only quote a few that differ characteristically from GA11. Some ("portio lunae", "motus latitudinis") look more archaic than those of GA11: perhaps, in some cases, the present table has escaped innovation because it is less conspicuous. Lesser variants concerning particles and word-order are ignored.

.Tps: **(6)** *(Ey {e}:)* **Tempus coniunctionis** *(Ey Xc Vj Ej Vm:)* **et oppositionis** *{Ek3 Xc Vj Ej Vm:}* **solis et lunae** :: Ey {e}. — **(7) Tempus mediae coniunctionis et oppositionis** *(Cj Lh:)* **solis et lunae** :: {a2:} Cz Cj Mp; {x:} Oc X Vz Mv Cm B T Lf Lg Lh Xg G Xb Es Fb Pq Oy Wa Nu; {?:} Oq. — **(8: other)** Ea & Ew2 (no heading); Ov & Ch2 ("... et praeventionis ..."); Xj Ut.

.Mot: **(9) Medius cursus solis et lunae** :: {x:} Vz Cm B Lf Lg Lh Xj Xg Fb Pq Oy Nu. — **(10) Medius motus solis et lunae** :: {e:} Vj Ej Vm; {x:} Ow.

.Alu: **(11) Portio lunae** :: {a1:} Xa Ad Cq Sg Wd; {aX:} Vo. — **(12) Argumentum sive portio lunae** :: {a1:} Fh Xw; {d:} Ok. — **(13: other)** e.g., P ("Portio vel argumentum lunae").

.Ala: **(14) Motus latitudinis lunae** :: {e:} Gr Eq Ek3 Xc Vj Ej. — **(15) Argumentum latitudinis** *(Cz:)* **lunae** :: {a2:} Cz; {d:} Lb.

Values. The time interval between two successive entries should be 12 standard mean lunations = 10631;0,50 days / 30 = 354 days 8;48,40 hours; cf. notes to GA11-12. Table *.Tps* shows the multiples of this value, always subtracting the number of days up to and including the year in question; where the subtrahend is 1 greater than the integer part of the multiple subtracted from, the figures for hours and minutes are kept, but a figure "1" appears in the days' place. The adopted values in .Tps are correct, assuming normal rounding, except that one would expect 59" and 25" at years 16 and 19; these readings are not, however, found in any witness.

Sub-tables *.Mot* and *.Ala* are slightly uneven, with tabular differences that vary irregularly within a few seconds. The 30-year values are 1" off the tabular differences in GA11-12. Recomputation based on the 30-year values (discarding extra sexagesimals in the results) yields values that do not differ by more than 2" from the adopted values, except a single deviation of 5" (for .Ala:q19, where the expected second-value is 10"; the erroneous value, underscored, is in all witnesses). Recomputation from the 30-year value expected from GA11-12, or from either 30-year value using normal rounding, gives worse results.

Sub-table *.Alu,* while correct down to minutes, has irregular second-values, too small by up to 5" in the middle part of the table. One may suspect a slide, but still the apparent values vary too irregularly to fix its position. It does not give a better fit if one tries to reconstruct the values on the basis of CA21. Thus it is uncertain how this sub-table was made.

Text. Collated for values: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** P; **{k}** Ou Co; **{d}** Pa A; **{e}** Eq Xc; **{x}** Es Xg Lg. – Headings according to Xa. – Recomputed values are not quoted.

Readings chosen. The majority of Ct Oo Pz Xa Cq is adopted. In .Alu:m7, almost all witnesses have the uneven-looking reading "9", which is surely an old flaw. It is corrected into "10" in some late witnesses. The reading should properly be "11" or "12"; cf. the discussion of .Alu above.

Variant groups. There are traces of most of the error groups noted for GA11-12, except that the early witnesses do not show striking oddities; one may note the garbled correction in *Xa Cq,* .Alu:m7. Variant readings are mostly shown by *Ou Co* and by *Es Xg Lg (Eq, Xc),* but neither set is significantly like the recomputation, and both may constitute perfunctory attempts at smoothing where the tabular differences look particularly odd.

Tabula coniunctionum ac praeventionum solis et lunae in annis Arabum expansis ad medium diem civitatis Toleti.

	(Tps)			**(Mot)**				**(Alu)**				**(Ala)**			
Anni ex pansi Numerus	Dies horae atque minuta horarum			Medius cursus solis et lunae				Portio lunae				Motus latitudinis			
	Di	Ho	Mi	Si	Gr	Mi	Se	Si	Gr	Mi	Se	Si	Gr	Mi	Se
1	0	8	49	11	19	16	2	10	9	48	0	0	8	2	48
2	1	17	37	11	8	32	4	8	19	36	0	0	16	5	34
3	0	2	26	10	27	48	7	6	29	24	3	0	24	8	23
4	0	11	15	10	17	4	8	5	9	12	5	1	2	11	9
5	1	20	3	10	6	20	11	3	19	0	6	1	10	13	58
6	0	4	52	9	25	36	13	1	28	48	10	1	18	16	48
7	1	13	41	9	14	52	15	0	8	36	*10*	1	26	19	34
8	1	22	29	9	4	8	17	10	18	24	10	2	4	22	22
9	0	7	18	8	23	24	20	8	28	12	14	2	12	25	11
10	1	16	7	8	12	40	22	7	8	0	14	2	20	27	58
11	0	0	55	8	1	56	24	5	17	48	15	2	28	30	46
12	0	9	44	7	21	12	26	3	27	36	17	3	6	33	34
13	1	18	33	7	10	28	29	2	7	24	17	3	14	36	21
14	0	3	21	6	29	44	32	0	17	12	22	3	22	39	11
15	0	12	10	6	19	0	33	10	27	0	22	4	0	41	57
16	1	20	58	6	8	16	35	9	6	48	22	4	8	44	45
17	0	5	47	5	27	32	38	7	16	36	26	4	16	47	34
18	1	14	36	5	16	48	41	5	26	24	26	4	24	50	23
19	1	23	24	5	6	4	42	4	6	12	27	5	2	53	15
20	0	8	13	4	25	20	44	2	16	0	29	5	10	55	58
21	1	17	2	4	14	36	47	0	25	48	31	5	18	58	46
22	0	1	51	4	3	52	49	11	5	36	36	5	27	1	35
23	0	10	39	3	23	8	52	9	15	24	36	6	5	4	24
24	1	19	28	3	12	24	56	7	25	12	40	6	13	7	13
25	0	4	17	3	1	40	58	6	5	0	41	6	21	10	0
26	1	13	5	2	20	57	1	4	14	48	45	6	29	12	48
27	1	21	54	2	10	13	2	2	24	36	45	7	7	15	35
28	0	6	43	1	29	29	5	1	4	24	48	7	15	18	24
29	1	15	31	1	18	45	7	11	14	12	48	7	23	21	10
30	0	0	20	1	8	1	9	9	24	0	51	8	1	23	58
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(b15) 1 Es Xg.ac Lg. **(b18)** 0 Eq. **(d2)** 38 Ou Co. **(d3)** 25 Ou Co; in alio libro 26 Co.mg. **(d6)** 52: A*v.l., cett.*; 32 Pa A. **(d15)** 20 Ou Co. **(f13)** 20 Co. **(f15)** 18 Co; 17 Xc. **(f16-17)** 4, 26 Xc. **(f20)** 26 Oo. **(f25)** 3 A. **(g2)** 33 Xc. **(g3)** 44 Co; 48 Co.pc. **(g13)** 24 Xc. **(g23)** 4 Xc. **(g29)** 15 Ou Co. **(h4)** 9 Ou Co Xc. **(h6)** 12 Es Xg Lg. **(h14)** 31 Ou Co Xc Xg Lg. **(h19)** 43 Eq Es Xg Lg. **(h20)** 45 Xa Eq Es Xg Lg. **(h21)** 49 Eq. **(h23)** 53 P Es Xg. **(h24)** 55 Ou Co. **(h27)** 3 Xg Lg. **(j10)** 6 Es. **(k6)** 29 Ou Co; 18 A. **(k16)** 7 Eq.ac. **(L9)** 2 Ou Co. **(L11)** 44 Xc. **(L16)** 44 Xc. **(L21)** 44 Xc. **(L23)** 24\22/ Ou; 22 Co; 14 Xc. **(L26)** 44 Xc. **(m3)** 4 Eq Xc Lg, Oo *(in ras.?)*. **(m7)** 10: Es Xg Lg; 9 Ct Oo Pz P Ou Co Pa A Eq Xc; 19 Xa Cq. **(m14)** 27 Oo.ac. **(m16)** 24 Eq Xc Xg Lg. **(m20)** <.>xn Oo. **(m28-29)** 49, 49 Ou Co; 40, 40 Xc. **(m29)** 41 Xc. **(n15)** 3 Co. **(n30)** 7 Xc. **(o2)** 12 Eq. **(o12)** 26 Xa. **(o13)** 4 Xc. **(o14)** 22 *aut* 23 P. **(p7)** 17 Eq. **(p8)** 20 A. **(p19)** 52 Es Xg. **(p24)** 8 Oo. **(p28)** 14 Oo. **(q8)** 20 A. **(q10)** 18 A. **(q15)** 27 A. **(q18)** 22 Es; 21 Xc. **(q20)** 18 A; 54 Xc. **(q24)** 14 Ou Co; 18 Pa A; 12 Eq Xc. **(q26)** 49 Ou Co. **(q30)** 18 A; 50 A*v.l.*

GA14. Months.

Toomer 1968, no. 55.

Witnesses: **{a0}** Ct,27v; Oo,24r; Cq2,86; Pz,130r; Mc,28r; Mb,57v; Ey,62v; Ea,55r. — **{a1}** Xa,31v; Ad,79v; Cq,56; Fc,45r; Ps,69v; Sg,165; Wd,30v; Fh,52v; Xw,30v. — **{a2}** Cz,85v; Cj,158v; Md,93r; Mp,223r. — **{aX}** Vo,61v; Xr,81v; R,64r; Ov,96v; S,101r; Vd,12v. — **{aT}** P,133v (:Toledan). — **{k}** Eh,99v; Lw,100r-v; Ou,69r; Eg,20v; Co,163r; Cn,98v. — **{d}** Op,74v; C,370; Lb,34r; Pa,47v; A,226v; Fj,46v; Nc,119v; Pb,35v; Pv,33v; Fd2,49v; Gr3,118v; Ok,58v. — **{e}** Gr,62v; Eq,81r; Ek3,108r; Xc,75v; Vj,99r; Ej,82r; Vm,13r. — **{x}** Oc,86v; X,163v; Vz,69v; Mv,98r; Cm,143v; B,154r; T,295v; Lf,103v; Lg,182v; Lh,148v; Xj,285v; Xg,66v; G,71r; Xb,86r; Es,192r; Fb,76v; Pq,195v; Oy,83v; Wa,72r; Ow,166v; Nu,151v. — **{p}** O,81v; Pd,75v; Ch2,176v. — **{?}** Ef,66r; Ew2,41v (:Ut Annos); Ox,90v (:Ut Annos); Oq,19r (:Ut Annos); Oq,19v (:Ut Annos); Ut,130v (:?). — Duplicate in {?} Oq.

Headings. — General:

- **(1) Coniunctiones et** (ac Ea) **praeventiones solis et lunae in mensibus Arabum** :: {a0:} Oo Cq2 Ea; {a1:} Xa Ad Cq Fc Wd Fh Xw; {a2:} Md; {aX:} Vo; {d:} Ok.
- **(2) Tabula coniunctionum et praeventionum** (c.e.p.: **/c-onis et p-onis** Ps Sg Op C O Ch2 Ef) **solis et lunae** (s.e.l.: *om.* Ct Op C Ef; +per medium cursum R) **in mensibus Arabum** (lunaribus a. Ou; /lunaribus Ch2) :: {a0:} Ct; {a1:} Ps Sg; {a2:} Cz; {aT:} P; {aX:} R!; {k:} Eh Lw Ou Eg Co Cn; {d?} Op C; {p:} O Pd Ch2; {?:} Ef. — *Added:* (nothing) Ct Ps Sg Cz P Ef; **+ad mediam** (-um Eh Cn) **diem civitatis Toleti** Eh Lw Ou Co Cn; **+ad meridiem** (+civitatis O) **Toleti** R Eg O Pd Ch2; **+super meridiem civitatis Toleti** Op C.
- **(3) Tabulae coniunctionum et impletionum** (praeventionum Pz) **solis et lunae in mensibus lunaribus** :: {a0:} Pz Mc Mb.
- **(4) Tabula** (+mediae Cj) **coniunctionis et praeventionis** (**/oppositionis** Cj Xc Vj Ej) **solis et lunae ad menses Arabum** :: {a2:} Cj; {e:} Gr Eq Ek3 Xc Vj Ej.
- **(5) Tabula coniunctionis et oppositionis** (e.o.: *om.* Pa Nc) **solis et lunae** (s.e.l.: *om.* Lb Pa Fj Pv Gr3) :: {aX:} S Vd; {d:} Lb Pa A Fj Nc Pb Pv Fd2 Gr3. — *Added:* (nothing) Pb; **+in mensibus** (+lunaribus Vd) S Vd Lb Pa Fj Pv Gr3; **+ad meridiem Toleti** A Nc Fd2.
- **(6) Tabula mediae coniunctionis et** (c.e. *om.* Oc) **oppositionis solis et lunae in mensibus Arabum** (*om.* Mp) :: {a0:} Ey; {a2:} Mp; {x-}; {?:} Oq(19r). — *Added:* **+ad meridiem Toleti** B Lf; **+sive lunaribus** Oc; **+lunaribus** (*om.* Lh) **ad Toletum** Mp X Lh Xb.
- **(7: other)** Ox & Oq(19v) ("T. communis c-oni et o-oni s. et l. ad menses A."); Ov ("T. c-onis et praeventionis in m. lunaribus"); Xr Vm Wa Ew2 Ut.

The sub-headings are generally similar to those of GA13: there are several minor deviations (including much vacillation in "medius cursus / medius motus"), but none that looks systematic. I refrain from giving details.

Versions. The entrance column may contain names of months, numbers of months, or both. This has only been recorded for the witnesses collated for the text; see below.

Values. The time interval between two successive entries should be 1 standard lunation of 29;31,50,8,20 days = 29 days 12;44,3,20 hours; cf. notes to GA11-12. Table *.Tps* shows the multiples by 0...11 of 1 lunation (apparently rounded to 29 days 12;44,3 hours), always subtracting the appropriate number of days contained in 0 months up to 11 months; where the subtrahend is 1 greater than the integer part of the multiple subtracted from, the figures for hours and minutes are kept, but a figure "1" appears in the days' position.

All three remaining sub-tables vary slightly irregularly. For comparison I recompute the values pertaining to 12 and to 1 lunation on two different assumptions: **(a)** that the underlying velocity parameters are those which can be found from GA11-12; **(b)** that they are equal to the 1-year values shown by GA13, without extra sexagesimals. Entire revolutions are ignored. Thus the 12-lunation value should be the item corresponding to "1 year", not apparent here but only in GA13; and the 1-lunation value should be the tabular difference in this table.

	(a) From GA11-12, q.v.:		**(b)** From first value in GA13:	
	12 lunations	1 lunation	12 lunations	1 lunation
.Mot	11s 19;16, 2,21°	0s 29; 6,20,12°	11s 19;16, 2°	0s 29; 6,20,10°
.Alu	10s 9;48, 1,43°	0s 25;49, 0, 9°	10s 9;48, 0°	0s 25;49, 0, 0°
.Ala	0s 8; 2,47,58°	1s 0;40,14, 0°	0s 8; 2,48°	1s 0;40,14, 0°

For sub-tables *.Mot* and *.Ala* it makes no great difference which kind of parameter is assumed: in either case .Mot and .Ala are reproduced to within 2" when assuming that extra sexagesimals are just discarded, .Mot perhaps slightly worse when assuming normal rounding.

Sub-table *.Alu,* on the other hand, cannot presuppose the first kind of parameter. The second kind is probably the one intended, as appears from the values for months 1 and 12; but on this assumption all seconds should be zero, whereas in fact the values show slight deficits, in an irregular manner. I do not know why this should be so if the table is as trivial as it appears to be. As was said under GA13, the explanation need not be that the values have been derived from table CA21 independently.

Text. Collated for values: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** P; **{k}** Ou Co; **{d}** Pa A; **{e}** Eq Xc; **{x}** Es Xg Lg. — Headings according to Xa.

Layout: Ct has both of columns (a) and (b); so has Es but in reverse order; Oo Xa Cq Ou Co Xc have (a) only (but Oo adds (b) in the margin); Pa A Xg have (b) only; Eq has (b) but spells out the numerals as "primus ... duodecimus".

I choose the majority readings of Ct Oo Px Xa Cq. In this way, no gross errors emerge; but all witnesses show a set of lesser ones, as noted in "Values", above. There are some apparent attempts at emendation, notably in Ou Co; as often as not, these make matters worse.

Coniunctiones et praeventiones solis et lunae in mensibus Arabum.

		(Tps)			**(Mot)**				**(Alu)**				**(Ala)**			
Menses Arabum		Dies et horae atque minuta horarum			Medius cursus solis et lunae				Portio lunae				Motus latitudinis			
Nomina mensium		Di	Ho	Mi	Si	Gr	Mi	Se	Si	Gr	Mi	Se	Si	Gr	Mi	Se
Almu.	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safar	2	1	12	44	0	29	6	20	0	25	49	0	1	0	40	13
Rabe	3	0	1	28	1	28	12	39	1	21	37	58	2	1	20	27
Rabe	4	1	14	12	2	27	18	59	2	17	26	58	3	2	0	40
Gume.	5	0	2	56	3	26	25	21	3	13	15	59	4	2	40	57
Gume.	6	1	15	40	4	25	31	40	4	9	4	58	5	3	21	8
Rageb	7	0	4	24	5	24	37	59	5	4	53	57	6	4	1	22
Saab.	8	1	17	8	6	23	44	20	6	0	42	59	7	4	41	36
Rama.	9	0	5	52	7	22	50	41	6	26	32	0	8	5	21	52
Sauel	10	1	18	36	8	21	57	1	7	22	20	59	9	6	2	5
Dulc.	11	0	7	20	9	21	3	21	8	18	9	59	10	6	42	20
Dulh.	12	1	20	5	10	20	9	42	9	13	59	0	11	7	22	*32*
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)

(a/b) *invertit* Es. **(a)** *om.* Pa A Eq Xg Lg Pz.ac. **(a10)** scoriether Xc. **(a11)** dulh Xa. **(a12)** dulhin(?) Xa. **(b)** *om.* P Oo.ac Xa Cq Ou Co Xc; *habent* Ct *sine titulo suo,* Pz *sub tit.* <<Numerus>> mensium numerus, Xg Lg *sub titulo* Numerus mensium Arabum; primus ... duodecimus Eq, *titulo* menses. **(e5)** 57 Pz. **(e9)** 56 Pa. **(e11)** 25 Pz. **(e12)** 4 Ou Co. **(f)** 0, 29...21, 21, 20 Co, *cf. col. (g).* **(g8)** 22 Es. **(h6)** 21 Cq. **(h7)** 26 Cq. **(h8)** 34 A. **(j2)** 29 A. **(j3)** xxx<-> Cq; 28 Ou Co. **(j4)** 58 Ou Co. **(j5)** 20 Eq Xc Lg. **(j7)** 58 Ou.ac Co. **(j12)** 43 Xc Es. **(m2)** 29 Co. **(m3)** 34 Es. **(m8)** 43 A. **(n5)** 58 Xc. **(n8)** 56 Ou. **(n11)** 50 Lg. **(r2)** 14 Co. **(r5)** 17 Ou Co; in alio libro 57 Co.mg. **(r7)** 21 (?) Oo. **(r8)** 32 Pz. **(r10)** 50 Lg. **(r12)** 33 Ct Oo Ou Co Pa A Xc.

GB. Syzygy tables for Toulouse.

For general remarks on the Toulouse tables, see Section CC. The present tables, for finding mean syzygies, have been printed by Poulle (1994, table 9-11, p. 76-80). A list of manuscripts of the Toulouse tables of mean motions and syzygies is in Pedersen 1998. As in the case of the mean motion tables (CC*), I reproduce some samples useful for identification purposes, without much emendation. I have not found any significant differences between the witnesses collated. – The structure of the tables is not quite obvious, so the following comments are somewhat fuller than usual.

Canons. Rules for these tables are listed in the appendix to canons Cb, as CbA.G31-32. They are rare and short.

Rationale. The sub-tables are of the same kinds as in the Toledan mean syzygy tables (GA*), q.v. Thus, there are partial tables for collected years (**GB11-12**), expanded years (**GB13**) and "months" (**GB14**), and each of these have sub-tables for times (**.Tps**) and for motion values (**.Mot, .Alu, .Ala**) as in GA*. The standard mean lunation of 29d;31,50,8,20 (=29d 12h;44,3,20) is used.

Notation: In the columns for times (".Tps") of GB11-13, a value of, say, "0 months 8 days" means 8 days elapsed. A value of "11 months 22 days" is to be taken as a negative day-value, modulo 30, so it means that 8 days should be subtracted. In practice, when adding time values, one may add the day-values as they appear, and then subtract 30 days from the sum for each "11" that occurs in the months' place.

To obtain valid times for syzygies, one always has to add an entry from GB11 or GB12 (for conjunctions or oppositions, as appropriate) to an entry from GB13. According to circumstances, an entry from GB14 (months) may be added too.[1] The entrance values are to be taken as elapsed years. For instance, if the entry for 600 years in GB11 is added to the entry for 3 years in GB13, item by item, the sum will show the time and the motion values for a conjunction close to AD 603 elapsed, i.e., generally, in February AD 603 (if the day-value is negative) or in March AD 604 (if the day-value is zero or positive). Note that February 603 is bissextile; for such a reason, years 3, 7, ..., 23 in GB13 are treated as leap-years.

Values in GB11-14. In **GB13,** for 1 year, the time value is "9 days 2h;30,1" (elapsed). The motion values (.Mot, .Alu, .Ala) are those corresponding to a time interval of 12 standard mean lunations.[2] So the motion values were zero at a time that is 12 lunations (=354 days 8h;48,40) earlier than the time value for 1 year, that is, for 19 days 17h;41,21 elapsed after the beginning of the preceding year (="0 years").[3] In other words, if GB13 had an entry for 0 years, this would show the time value of 19 days 17h;41,21, and zero for the three motion values.

The entries in GB13 have been developed from this origin, by successively adding either 12 lunations (=354 days 8h;48,40) or 13 lunations (=383 days 21h;32,43,20) and the corresponding values for the motions. Also, between successive time values, either 365 or 366 days are subtracted, the latter from the values for 3, 7, ..., 23 years. Negative day-values are represented as indicated above. The day-values range between -14 and +15; this near-symmetry may be intentional, and may have governed the choice between applying the increment of 12 lunations and that of 13. The last entry, for 24 years, represents a time that is 296 lunations later than 0 years 19 days 17h;41,21.

---

1 The entry in GB14 that is marked with a month-name is not always appropriate for that month, as is also noted by the canons cited above. For instance, if one is looking for a mean conjunction in March, and the sum of the values from GB11/12 and from GB13 contains a positive number of days, then the conjunction found is already in March, and no month-value should be added (except, if needed, to check whether the next conjunction is still in March).

2 They are the same as in GA13, q.v.

3 Year 0 has 365 days; indeed, year 3 was a leap-year, so year 0 is not.

In the collected-year tables **GB11** and **GB12,** each entry represents the time and the motion values for a syzygy that occurs in March or April after the year listed in the entrance; for instance, the GB12 entry for "624" years is valid for the mean opposition on March 29, AD 625 current. However, 19 days 17h;41,21 have been subtracted from all the time values. This was the constant added to the time values in GB13, as was just seen; so when one of the GB13 time values is added to a time value from GB11 or GB12, the constant cancels itself out, and a valid lunation time is obtained.

The entries in GB11 or GB12 can be developed by successively adding either 297 lunations (approximated as 8770 days 14h; 4,29) or 296 lunations (approximated as 8741 days 1h;20,26), and the corresponding motion values. Further, between successive time values, 8766 days are to be subtracted, corresponding to 24 Julian years. Negative day-values are represented as indicated above. The day-values range between -12 and +17. So, when they are added to the GB13 values, the sums will be between about -26 and +32 days, counting from the beginning of March; in other words, the corresponding syzygies will fall within February or (largely) within March. This choice of range is no doubt intentional, and it is likely to have governed the choice of syzygies for GB11 and GB12. However, I do not understand the details of this choice, nor how it interacts with the constant subtracted from the time values, nor why this very constant was chosen.

In the "month"-table **GB14,** the time values are just multiples of a standard mean lunation, subtracting, for each month, the number of days in the preceding months (thus nothing for March). There are no negative day-numbers; so, e.g., the value "11 months 17 days" for February reflects the 11 months from March to January (=337 days) plus 17 days, i.e., the 354 days contained in 12 standard lunations. The motion values are those expected from the time values, and are basically the same as those of the analogous Toledan table GA14.

In GB11, the values of the solar mean motion (".Mot")[1] are 1 degree too low until AD 480; from AD 504 on they agree with those found from the Toulouse mean motion tables. In GB12, the value of the solar mean motion for 360 years is valid for 1 lunation later than indicated by the time value; I do not know which value is intended.

Check of two oppositions from the mean motion tables. As an illustration and for a rough check, I shall compute the mean oppositions in March AD 625 and in March AD 1225[2] from the present tables GB12-14, and check the results from the Toulouse and Toledan mean motion tables. It will be seen that the values basically agree; thus the parameters are the same in all cases.

The *opposition during March, AD 625* is found from the syzygy tables by addition of the entries for 600 years (GB12), for 24 years (GB13), and for March (GB14), observing the rules above. This yields,

Time (.Tps)	Sun, mean motion (.Mot)	Moon, mean motion	Moon, argument (.Alu)	Node, mean motion	Argt. of latitude (.Ala)
28d 17h; 2,24	**0s 8°; 8, 7**	(same + 6s)	**2s 5°;11,44**	(absent)	**3s 24°;14,45**

Thus the opposition in question is on AD 625 March 29 (current) = AH 3 Shawwal 14 (current), at about 17h;2 in Toulouse.

1 I have checked the .Mot values throughout GB11-12, but not .Alu and .Ala. For these, see the examples further below.

2 These times are arbitrary, but they involve the use of the first and the last authentic value in the Toledan mean motion tables for collected years, namely, the radix value and the value for 600 lunar years.

When computing the same opposition from the mean motion tables for Toledo (CA*)[1] and from those for Toulouse (CC*),[2] one gets,[3]

Toledan:	(CA01)	(CA11)	(CA21)	(CA31)	(CA11+CA31)
... 16h;15	**0s 8°; 8, 4**	**6s 8°; 8, 1**	**2s 5°;11,35**	9s 16°;33,34	<3s 24°;41,35>
Toulouse:	(CC01)	(CC11)	(CC21)	(CC31)	(CC11+CC31)
... 17h; 3	**0s 8°; 8, 7**	**6s 8°; 7,59**	**2s 5°;11,36**	9s 16°; 6,46	**<3s 24°;14,45>**

Generally, the values of the syzygy tables agree well with these. The time difference between Toulouse and Toledo is about 48 minutes, as observed by Poulle. The argument of latitude in the syzygy tables is derived from the Toulouse mean motion tables; here, indeed, the motion of the node is about 27′ less than in the Toledan tables,[4] an adjustment which is reflected in the argument of latitude.

The *opposition during March, AD 1225* is found from the syzygy tables by addition of the entries for 1200 years (GB12), for 24 years (GB13), and for March (GB14), in the manner indicated above. This yields,

Time (.Tps)	Sun, mean motion (.Mot)	Moon, mean motion	Moon, argument (.Alu)	Node, mean motion	Argt. of latitude (.Ala)
25d 5h;58,17	**0s 0°;51,53**	(same + 6s)	**4s 10°;58,32**	(absent)	**6s 20°;25,59**

Thus the opposition in question is on AD 1225 March 26 (current) = AH 622 Rabi I, 15 (current), at about 5h;58 in Toulouse.

When computing the same opposition from the mean motion tables,[5] one gets,

Toledan:	(CA01)	(CA11)	(CA21)	(CA31)	
... 5h;11	**0s 0°;51,53**	**6s 0°;51,42**	**4s 10°;58, 8**	0s 20°; 1, 0	<6s 20°;52,42>
Toulouse:	(CC01)	(CC11)	(CC21)	(CC31)	
... 6h; 0	**0s 0°;51,55**	**6s 0°;52, 5**	**4s 10°;58,42**	0s 19°;33,58	**<6s 20°;26, 3>**

This, again, shows good agreement with the syzygy tables. The adjusted values of the motion of the node and the argument of latitude, peculiar to the Toulouse tables, are in evidence here too.

In short, the Toulouse syzygy tables are derived from the Toulouse mean motion tables, incorporating their revised radix value for the node. The rest of the parameters are as in the Toledan tables.

---

1 The arguments to be used in the sub-tables for mean motion are elapsed times of the Hijra era, as follows: Radix + 2 expanded years + 9 months + 13 days + 16 hours + 15 minutes.

2 The arguments to be used in the sub-tables are elapsed times of the Christian era, thus: 624 (collected) years + 28 days + 17 hours + 3 minutes. In fact, the only Toulouse sub-table needed for this computation is the collected-year table; the values for days, hours and minutes have been taken from the pertinent Toledan sub-tables. This makes no difference to the result.

3 I have computed the times of mean oppositions to the nearest minute of an hour, with the result that the motion values derived from them are not quite exact; but this precision should suffice for the present purpose.

The argument of latitude does not appear as a value in the mean motion tables. For the present purpose, it is formed as the mean motion of the moon (from table CA11 or CC11) plus the mean motion of the node (from table CA31 or CC31).

4 See CC*, "Values", with note.

5 Arguments for the Toledan mean motion tables: 600 (collected) years + 21 expanded years + 2 months + 14 days + 5 hours + 11 minutes. For the Toulouse tables: 1224 (collected) years + 25 days + 6 hours.

GB11. Conjunctions, collected years, Toulouse.

Witnesses: **{aT}** Lu,66r (AD 600-1320), 88r (AD 0-600, 1320-1488); Oj,137v-138r; P,79r-v; A1,193v; G2,92v; **{k}** Lw,91r-92v. – Tables GB11-14 are also in mss. Du,30r-32v and Ek,127r-128v; cf. Pedersen 1998. These copies are ignored here.

Headings, e.g.: as shown below: Lu(66r,88r). – Lu,88r adds, "qui locus distat ab Arin in occidente 49 gradibus et 45 minutis". This longitude value is only found in Lu; the usual value is 50°, cf. CC01. Headings vary in the other witnesses. – Sub-headings: Lu(66r), see transcription below. There are different sub-headings in the other witnesses, but the characteristic sub-heading "Mediata (medietas G2) mensium..." is general.

Ranges: AD **0(24)1416** (1488 Lu) Lu Oj P Lw; 1200(24)1416 A1; 1008(24)1320 G2 (numbers incomplete).

Sample. From Lu P Lw. Headings from Lu(66r).

Tabula coniunctionis solis et lunae per medium cursum ad annos domini nostri Ihesu Christi solares ad medium diem civitatis Tolosae.

	(Tps)					(Mot)				(Alu)				(Ala)			
Anni d.n. I.Ch. coll ecti	Mediata mensium, dierum et horarum					Medius cursus solis et lunae				Portio sive argumentum lunae				Motus latitudinis			
	Me	Di	Ho	Mi	Se	Si	Gr	Mi	Se	Si	Gr	Mi	Se	Si	Gr	Mi	Se
Radix	11	23	1	58	48	11	25	29	17	1	28	56	46	2	23	34	9
24	11	27	16	3	17	11	29	51	15	5	16	30	29	6	12	43	26
.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
600	11	19	14	54	41	11	19	13	2	4	4	43	33	5	19	45	22
624	11	24	4	59	10	11	23	34	59	7	22	17	16	9	8	54	38
.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1200	0	15	16	34	37	0	11	3	7	7	6	19	20	9	16	36	47
1224	11	20	17	55	3	11	16	18	44	9	28	4	2	0	5	5	51
.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1392	11	23	7	42	23	11	17	46	9	10	5	11	1	0	18	30	37
1416	11	27	21	46	52	11	22	8	7	1	22	44	44	4	7	39	54
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)

(a-f Rad) *praemittit* Lu *lineam* "<*>, 0 12 19 40 9". **(f600)** 48 Lw. **(m600)** 14 Lw. **(q1392)** 8 Lw.

GB12. Oppositions, collected years, Toulouse.

Witnesses: **{aT}** Lu,66v (AD 600-1320), 88v (AD 0-600, 1320-1488); Oj,138v-139r; P,80r-v; A1,193v; **{k}** Lw,93r-94v. – Also in Du Ek; see GB11. – *Headings, e.g.:* As shown below: Lu(66v). Headings vary in the other witnesses. – Sub-headings: Lu(66v), see transcription below. There are different sub-headings in the other witnesses, much as in GB11, but the characteristic sub-heading "Mediata mensium..." is general. – *Ranges:* AD **0(24)1416** (1488 Lu) Lu Oj P Lw; 1200(24)1416 A1; 1008(24)1320 G2 (numbers incomplete). – *Sample.* From Lu P Lw. Headings from Lu(66v).

Tabula praeventionis sive impletionis lunae per medium cursum solis et lunae ad annos domini nostri Ihesu Christi solares ad medium diem civitatis Tolosae.

	(Tps)					(Mot)				(Alu)				(Ala)			
Anni d.n. I.Ch. collecti	Mediata mensium, dierum et horarum					Medius cursus solis et lunae				Portio sive argumentum lunae				Motus latitudinis			
	Me	Di	Ho	Mi	Se	Si	Gr	Mi	Se	Si	Gr	Mi	Se	Si	Gr	Mi	Se
Radix	0	7	20	20	39	0	11	2	25	8	11	51	15	9	8	54	14
24	0	12	10	25	8	0	15	24	23	11	29	24	58	0	28	3	31
.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
600	0	4	9	16	32	0	3	46	10	10	17	38	2	0	5	5	27
624	0	8	23	21	1	0	8	8	8	2	5	11	46	3	24	14	45
.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1200	0	0	22	12	25	11	26	29	56	0	23	24	50	3	1	16	41
1224	0	5	12	16	54	0	0	51	53	4	10	58	32	6	20	25	58
.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1392	0	8	2	4	14	0	2	19	18	4	18	5	31	7	3	50	44
1416	0	12	16	8	43	0	6	41	16	8	5	39	14	10	23	0	1
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)

(a-f Rad) *praemittit* Lu *lineam* "<*>, 0 27 14 2 2". **(d624)** 29 Lw. **(g600)** 11 Lw. **(k Rad)** 26 Lw. **(L1416)** 1 Lw. **(o624)** 56 Lw.

GB13. Expanded years, Toulouse tables.

Witnesses: **{aT}** Lu,67r; Oj,139v; P,81r; A1,194r; **{k}** Lw,95r-v. — *Headings, e.g.:* As shown below: Lu(67r). Headings vary in the other witnesses. — Sub-headings: Lu, see transcription below. There are different sub-headings in the other witnesses, but the characteristic sub-heading "Mediata mensium..." is general. — *Sample.* From Lu P Lw. Headings from Lu.

Tabula coniunctionis et praeventionis per medium cursum solis et lunae in annis expansis.

	(Tps)					(Mot)				(Alu)				(Ala)			
Anni expansi	Mediata mensium, dierum et horarum					Medius cursus solis et lunae				Portio lunae				Motus latitudinis			
	Me	Di	Ho	Mi	Se	Si	Gr	Mi	Se	Si	Gr	Mi	Se	Si	Gr	Mi	Se
1	0	9	2	30	1	11	19	16	2	10	9	48	2	0	8	2	48
2	11	28	11	18	41	11	8	32	4	8	19	36	4	0	16	5	35
....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
b 23	0	5	10	13	8	11	15	59	33	4	11	56	40	2	10	26	16
24	11	24	19	1	49	11	5	15	37	2	21	44	42	2	18	29	5
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)

(c24) 14 Lw.

GB14. Months, Toulouse tables.

Witnesses: **{aT}** Lu,67v; Oj,140r; P,81v; A1,194r; **{k}** Lw,96r-v. — *Headings, e.g.:* As shown below: Lu(67v). Headings vary in the other witnesses. — Sub-headings: Lu, see transcription below. There are different sub-headings in the other witnesses, but the characteristic sub-heading "Mediata mensium..." is general. — *Text.* Values from Lu P Lw. Headings from Lu.

Tabula coniunctionis et praeventionis per medium cursum solis et lunae ad menses solares.

	(Tps)					**(Mot)**				**(Alu)**				**(Ala)**			
Nomina mensium Latinorum	Mediata mensium, dierum et horarum					Medius cursus solis et lunae				Portio lunae				Motus latitudinis			
	Me	Di	Ho	Mi	Se	Si	Gr	Mi	Se	Si	Gr	Mi	Se	Si	Gr	Mi	Se
Mar	0	29	12	44	3	0	29	6	20	0	25	49	0	1	0	40	13
Apr	1	28	1	28	6	1	28	12	39	1	21	38	0	2	1	20	27
Mai	2	27	14	12	10	2	27	18	59	2	17	27	1	3	2	0	41
Iun	3	26	2	56	13	3	26	25	21	3	13	16	1	4	2	40	55
Iul	4	25	15	40	16	4	25	31	40	4	9	5	1	5	3	21	9
Aug	5	24	4	24	20	5	24	37	59	5	4	54	1	6	4	1	23
Sep	6	22	17	8	23	6	23	44	20	6	0	43	1	7	4	41	37
Oct	7	22	5	52	26	7	22	50	41	6	26	32	2	8	5	21	51
Nov	8	20	18	36	30	8	21	57	1	7	22	21	2	9	6	2	5
Dec	9	20	7	20	33	9	21	3	21	8	18	10	2	10	6	42	20
Ian	10	18	20	4	36	10	20	9	42	9	13	59	2	11	7	22	33
Feb	11	17	8	48	40	11	19	16	2	10	9	48	2	0	8	2	48
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)

(c Mai) 26 Lw. **(e Ian)** 40 Lw. **(r Mar)** 4 Lw. **(r Iun)** 41 Lw.

GC. Syzygy tables for Novara, by Campanus.

A set of four syzygy tables for Novara, analogous to the preceding sets, is in R Fd Ey2 Ej2. The two tables for collected years have the range AD 1(76)1597, and the month-table begins in March. The range and collected-year increment is different from those of the Novarese tables of planetary mean motion and of trepidation (cf. the preface to the former, section CD), and the origins might well be different. In ms. Fd, the conjunction table is accompanied by a canon "Ego *Campanus* composui hanc praesentem tabulam...", so the syzygy tables, at least, are likely to be from the late 13th century.

Witnesses: {?} R,89v-91v (:Novara); Ey2,99v-100r (collected-year tables only); Fd,14v-16v (:Novara); Ej2,93v-96r (:Novara).[1]

R Fd Ej2 has the normal layout, with 4 sub-tables in parallel. Ey only shows the "Tempus" sub-tables, writing the conjunction and the opposition tables for collected years in parallel, with values rounded to minutes. They are followed by the lesser-denomination "Tempus" tables, after the fashion of planetary mean motion tables.

A copy that shows essentially the same values, but with more significant digits, is in ms. Par. lat. 7411, 13r-14v. It accompanies the Novarese mean motion tables; cf. CD*.

Headings, e.g.: "Tabula mediae coniunctionis solis et lunae ad annos Christi collectos ad meridiem Novariae, latitudo eius 45 gradus" Fd, varying in the other witnesses; Ey2 gives a longitude "ab occidente" of 30°50′ (the normal one is 30°15′, cf. MA11), and a latitude of 45°.

Values. In the sample from .Tps below, the time difference between the first conjunctions in AD 1141 and in AD 1217 is 76 years minus 5h;47,47. For comparison, 940 standard lunations of 29d;31,50,8,20 yield 76 years minus 5h;47,46,40. Thus no doubt the standard lunation has been used.

The entry in .Tps for AD 1217 is counted from 1217 March 1 current = AH 613, month 11, day 22 current. From the Toledan tables GA*, the mean conjunction in AH 613, month 11, occurs on day 29, 22;7 hours = March 8, 22;7 hours, at Toledo. The difference to the Novara time in .Tps is 78 minutes, in agreement with the common difference in longitude between Novara and Toledo; cf. notes to CD* above. The values found from GA* for .Mot., .Alu and .Ala are all within 9" of those listed below. — I have not checked the present table in other ways.

Samples of conjunction table and expanded-year table. From R Fd Ej2. Not emended.

	(Tps)					(Mot)				(Alu)				(Ala)			
	Me	Di	Ho	Mi	2a	Si	Gr	Mi	2a	Si	Gr	Mi	2a	Si	Gr	Mi	2a
1y:	0	12	20	9	0	11	26	29	8	1	28	56	55	2	24	1	2
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1141y:	0	9	5	12	20	11	15	35	3	3	24	30	24	5	28	50	26
1217y:	0	8	23	24	33	11	14	51	27	8	22	12	37	6	29	9	43
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1597y:	0	7	18	25	40	11	11	13	25	9	10	43	47	0	0	46	11
1y:	11	17	8	49		11	19	16	2	10	9	48	2	0	8	2	48
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
76y:	11	27	18	12		11	29	16	24	4	27	42	14	1	0	19	18
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)

(e76) secunda 13 *add.* Ej2 *(m1).* **(j1)** 6 R. **(k1217)** 37 R. **(m76)** 22 R. **(r-s 1141, 1217, 1597)** *vacat* R.

---

1 Further copies, ignored here, are in Ek,213v-216v; Lh,60ra-61r; Xc,85r-88r; Ul,247r-257v. The Campanus canon, or similar canons, are in Ek Lh Xc.

GD. Mean syzygy tables, late or in single witnesses.

This section comprises all sets that contain at least a table of mean conjunctions for collected years. Like the Toledan tables and others, each set generally contains tables for mean conjunctions and oppositions in collected years, plus one table for expanded years and one for months. This reproduction is only for reference: details are not given, the values are imperfectly emended, and parameters and extra witnesses have not been investigated. — Some single values, presumably for Cremona, are listed under CF11(F).

GD10. Ea,48r-v, 53v-54r: "Tabula coniunctionum solis et lunae ad annos domini (+nostri Ihesu Ea(53v)) Christi collectos". — Two copies of the same set of tables. Range AD 880(24)1264; the month-table begins in January. Glosses on 53v, probably in the text hand: "Hinc subtracte sunt hore distantie *Sicilie* a Ro(m)a", and "Hic (!) equate sunt tabule super *Siciliam*". — Sample, from Ea(53v+), collated with Ea(48r+):

	(Tps)			(Mot)				(Alu)				(Ala)			
	Di	Ho	Mi	Si	Gr	Mi	2a	Si	Gr	Mi	2a	Si	Gr	Mi	2a
880y:	14	12	36	11	27	7	39	9	28	3	41	5	24	17	21
.....	....			....				....				....			
1192y:	15	0	36	11	29	41	8	6	24	44	0	3	1	57	38
1216y:	19	14	48	0	4	25	16	10	12	17	49	6	21	6	55
.....	....			....				....				....			
1264y:	28	18	48	0	13	55	2	5	17	25	9	1	29	25	30
1y:	18	21	32	0	18	23	20	11	5	37	2	1	8	43	3
.....	....			....				....				....			
24y:	4	14	4	0	4	54	18	3	17	33	43	3	19	9	17
(a)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)

(e880) 44 Ea(48r). **(e1)** 24 Ea(48v). **(e24)** 0 Ea(48v). **(g24)** 14 Ea(48v). **(h24)** 44 Ea(48v).

GD15. Mv,103r-v: "Tabula mediae coniunctionis solis et lunae in annis Christi collectis". — No location. Range AD 1256(20)1356. Unexpectedly, the month-table shows Arab months, and has essentially the same values as GA14. — Sample:

	(Tps)			(Mot)				(Alu)				(Ala)			
	Di	Ho	Mi	Si	Gr	Mi	2a	Si	Gr	Mi	2a	Si	Gr	Mi	2a
1256y:	352	1	38	10	23	1	45	1	25	40	8	8	0	25	0
1276y:	341	2	59	10	12	6	50	10	12	23	38	8	16	2	34
.....	....			....				....				....			
1356y:	356	9	51	10	26	39	50	10	10	55	31	0	19	53	16
1y:	354	8	49	11	19	16	2	10	9	48	0	0	8	2	48
.....	....			....				....				....			
20y:	354	1	21	11	19	5	5	8	16	43	29	0	15	37	34
(a)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)

Another copy of the expanded-year table is in ms. Bodl. Laud.misc. 594, 160vb.

GD20. Fc2,111v-112r; Pn,48r-v: "Tabula mediae coniunctionis solis et lunae in annis Christi collectis super meridianum *Parisius* (-siensem Pn)". — Range AD 1321(24)1609; month-table begins in January. This table belongs to *John of Lignères'* tables for trigonometry and eclipses. The pertinent canons have the dating 1322; cf. their titles in Fc2(102r) and Pn(41r). — Sample, from Fc2 Pn:

	(Tps)				**(Mot)**					**(Alu)**				**(Ala)**			
	Di	Ho	Mi	2a	Si	Gr	Mi	2a	3a	Si	Gr	Mi	2a	Si	Gr	Mi	2a
1321y:	28	18	2	6	10	16	21	14	29	10	17	5	20	0	20	38	41
1345y:	3	19	21	9	9	21	56	35	51	1	8	52	13	3	9	6	37
.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1609y:	24	17	11	9	10	14	29	32	56	3	26	37	55	6	8	53	4
1y:	10	15	11	23	11	19	16	50	20	10	9	48	7	0	8	2	45
.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23y:	13	7	29	34	11	16	18	31	3	4	11	58	45	2	10	25	10
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)

(r1609) 56 Pn.

GD25. P,132r-v, in an appendix, together with Toledan tables: "Ad medium diem *Parisius*". — Short collected-year tables added to GA11 and GA12, and sharing GA13-14 with them. Range AH 571(30)691.

The time values, erased, seem to have been 58 minutes greater than their Toledan counterparts. The values of the argument of latitude are 0;31,57° less, corresponding to a longitude difference of about 59 minutes of time. The values of the two remaining tables are the Toledan ones.

I do not understand how this configuration comes about, nor how the time difference coheres with CE50, which accompanies the present tables in ms. P and shows a time difference (34 minutes) that is in fact plausible for Paris. — Values of conjunction table:

	(Tps)			**(Mot)**				**(Alu)**				**(Ala)**			
	Di	Ho	Mi	Si	Gr	Mi	2a	Si	Gr	Mi	2a	Si	Gr	Mi	2a
571	29	5	*	4	24	34	26	10	12	25	38	9	13	57	50
601	29	6	*	6	2	35	37	8	6	26	11	5	15	21	50
631	29	6	*	7	10	36	47	6	0	27	2	1	16	45	49
661	29	6	*	8	18	37	57	3	24	27	53	9	18	9	48
691	29	7	*	9	26	39	8	1	18	28	44	5	19	33	47
(a)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)

(e571-691) *eras.* P; *fortasse* 41, 1, 21, 41, 1.

GD30. Ew2,35r (with tables like those of "Ut Annos"; see CbB): "Tabula coniunctionis solis et lunae ad annos Arabum super *Parisius*". – Short collected-year tables preceding GA11-12, and meant to share GA13 with them. At GA14's place there is a month-table with months 1-11 equal to months 2-12 of GA14, with an extra month 12, and with sightly different values. The normal GA14 is on 41v. – Full text of conjunction table:

	(Tps)			(Mot)				(Alu)				(Ala)			
	Di	Ho	Mi	Si	Gr	Mi	2a	Si	Gr	Mi	2a	Si	Gr	Mi	2a
Radix	28	17	51	7	19	31	36	2	28	38	50	8	18	1	27
30	28	18	11	8	27	32	45	0	22	39	41	4	19	25	25
60	28	18	31	10	5	33	55	10	16	40	32	0	20	49	23
90	28	18	51	11	13	35	5	8	10	41	23	8	22	13	21

I do not know what calendar is reflected by the entrance values, nor what relation the tabular values have to the Toledan ones.

GD35. Ch,55v-57r (:Savasorda 2): "Tabula coniunctionis solis et lunae in annis Aegyptiis collectis et in annis mundi collectis per 19 ante medium diem Mercurii". – No location. Range 0(19)266 in "Egyptian" years; months are numbered 1-12. Ascribable to Abraham bar Hiyya; see AC42.

The single-year table (excerpted for 1 and 19 Egyptian years below) has the same values as that reproduced from Abraham bar Hiyya's Luhot ha-Nasi by Millás (1959 p. 123, cf. p. 114) – Sample:

	(Tps)					(Mot)				(Alu)				(Ala)			
	Me	Di	Ho	Pc	Se	Si	Gr	Pc	Se	Si	Gr	Pc	Se	Si	Gr	Pc	Se
0y:	0	0	0	13	24	6	6	59	27	11	21	10	19	6	*19*	31	0
19y:	0	4	16	9	40	6	6	59	37	9	28	5	52	6	27	6	14
.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
266y:	2	5	12	49	26	6	7	44	50	10	28	8	7	10	4	27	0
1y:	11	24	8	48	40	11	19	16	36	10	9	48	2	0	18	46	13
.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
19y:	0	4	16	33	3	0	0	0	*10*	10	6	55	33	0	7	35	13
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)

(a1) 1,2: 0,1 Ch. **(h266)** 5 Ch. **(k19)** 0 Ch. **(q0)** 17 Ch.

H. Parallax.

The tables to be reproduced in this section comprise: **(HC11-71:)** a series of parallax tables for climates, originally from the Handy Tables, but transmitted through Albattani; **(HA11, HB21-61:)** parallax tables, also for climates but with other values than HC*, only known from the Toledan tables; **(HA21-22:)** rare local tables on the same principle.

All these tables are of the same apparent type, designed for finding parallax in longitude and latitude. A table contains 12 sub-tables. Each sub-table is labelled with a sign of the ecliptic, and pertains to syzygies where the sun and moon are at the beginning of that sign. It contains an entrance column showing arguments that denote times from sunrise (first entry) through noon (labelled "meridies" or "recessus") until sunset (last entry). The times are counted from noon, backwards or forwards. Thus the first and the last of the arguments are equal to half the length of daylight when the sun is at the beginning of the sign in question; they will be termed "half-day values". For each argument there is a pair of tabular values, namely, the parallax in longitude and latitude, each expressed as integer minutes of arc. For each sub-table, the first and the last such pair will be termed "sunrise values" and "sunset values", respectively.

Some other types of parallax tables are listed under **(HD*)**; all of these are ultimately from the Almagest, interpolated in non-central parts of the tradition of our tables.

The following notes concern the tables HA11 and HB*-HC*. All full witnesses contain selections comprising one or more of these tables; the selections, which are very disparate, are listed in T:05(8.5). On the face of it, canons of the Albatenian type are applicable to all such tables, since they have the same structure.

Canons. The rules for parallax and solar eclipses in Ca (Ca158-169, Ca170-183) are verbatim from Albattani ch. 39 and Ch. 44. They ascribe the tables to Theon (i.e., to the Handy Tables; cf. the HC* series) and imply that the whole series is present (as the HC* series happens to be in Class {k} and in Ey).

The corresponding rules in Cc and Cb (parallax: Cc298-306 ~ Cb179a-185; Cc247-49 = Cc295-97; solar eclipse: Cc250-262 (for Cordoba) ~ Cb186-192) are for the same type of tables, so they are generally like the Albatenian ones. Unlike these, they assume that the moon is at mean distance in the epicycle (Cb182a-b ~ Cc302-3; Cc248). There are traces of this in the headings of HA11 and HB61, though these headings are hardly original.

The terms employed in the canons are few and uniform, and do not serve to distinguish between different types of tables: normal phrases are "tabula diversitatis aspectus (+lunae)" for the table (Ca161, Cc247, Cb188c, etc.) and "minuta longitudinis / latitudinis" for the values.

Values. For the purpose of checking the values of a particular table (for which the ecliptical obliquity and the terrestrial latitude are given), the following summary procedure has been used:[1]

(1) Find the zenith distance (**z**) of the sun and moon, and the angle from the altitude circle to the ecliptic (**v**), in a way that will yield values like those of Almagest II,13 (cf. table HD17).

(2) For the distance D of the moon from the earth, measured in earth-radii, find the lunar parallax in altitude as

```
pa = Arc tan([k * sin(z)] / [1 - k * cos(z)])
```

1 The basis for constructing at least the Handy Table parallaxes, which are the same as in HC*, may have been the parallax table of Almagest V,18 (Rome 1931, cited by Toomer 1968 p. 97). I have not tried this method, nor those described in Kennedy 1956a.

where k = 1/D.[1] The only value of D which need be taken into account here is 64;10, thus assuming that the epicycle centre is in the apogee of the deferent (distance 59;0: Almagest V,17), and that the moon is in the apogee of the epicycle (radius 5;10: *ibid.*).

(3) If applicable, find the solar parallax in altitude from (2) above, using the distance D = 1210 (Almagest V,17), and subtract it from the lunar parallax.

(4) From the parallax in altitude (**pa**), found from (2) and perhaps (3), find the parallax in longitude (plo) and the parallax in latitude (pla) as

```
plo = -(pa * cos(v))
pla =  (pa * sin(v)).
```

Thus a parallax in longitude by which the sun and moon are displaced in the direction of the signs will be counted as positive, and vice versa.

It is thus assumed that all tables can be reproduced from principles derived from the Almagest (cf. Toomer 1968 p. 97). Indeed, for suitable choices of terrestrial latitudes (different, to be sure, from those stated in the table headings, and some admittedly opportunistic), the tabular values can generally be approximated to within 1′ or 2′. This has been considered satisfactory for the present purpose. However, in the case of HA11 and the series HB* it should not be taken as proof that the tables were made in this way; at least, as will be seen, HA11 has probably not been calculated independently. I have not tried to optimize the parameters systematically, but under each table I list the possibilities I have tried.

A Ptolemaic type of obliquity of, say, 23;51° must be assumed for HC* and fits well with the values. For HB* too, this value turns out to yield better approximations than other reasonable obliquities; so it has been used for recomputing all tables. It is not exact: cf. the footnote to section HC. The obliquity of 23;51,20°, attested as that of the Almagest, yields practically the same results.

The latitudes of the relevant climates from the Almagest and the Handy Tables are assumed to be valid both for HB* and HC* (whatever may be stated in the table headings), thus:

Cli mate	(Longest day)	Lati tude	Latitude applied to	
1	(13h)	16;27°		HC11
2	(13h;30)	23;51°	HB21	HC21
3	(14h)	30;22°	HB31	HC31
4	(14h;30)	36; 0°	HB41	HC41
5	(15h)	40;56°	HB51	HC51
6	(15h;30)	45; 1°	HB61	HC61
7	(16h)	48;32°		HC71

The tables ought to be symmetrical so that the values of Gemini are like those of Leo in reverse; Cancer should be like itself in reverse; etc. In fact there are many cases where two symmetrical values differ between themselves though both are plausible, making it likely that they have been computed independently; cf. Toomer 1968 p. 100. In general, however, I have freely corrected from symmetry, especially where one of the values agrees badly with the recomputed one.

Also (Toomer p. 100) some signs have values for sunrise and sunset that are pairwise the same, or else the same but such that sunrise and sunset values are interchanged, as follows:

```
Ari,     interchanged in  Lib;
Tau Psc, interchanged in  Vir Sco;
Gem Aqr, interchanged in  Leo Sgr;
Cnc Cap.
```

The cases where sunrise and sunset values are interchanged are due to the symmetry noted above. In the present case too, such equivalent pairs quite often do not agree perfectly. Still, the relation may be

1 Cf., e.g., Nallino II p. 235.

put to use where there is a suspicion that some of the outer rows of a table have disappeared, as is the case for HB41-61.

The *headings and entrances* are generally inconsistent with the tabular values. Indeed, the HC series is from the Handy Tables, and the Ptolemaic latitudes (above) plus a Ptolemaic obliquity have surely been used for deriving both the tabular values and the half-day values in the entrances; but the ostensible latitudes in the headings are those of Albattani, made to suit his own value for the obliquity. In the HB series, both the headings and the half-day values in the entrances fit the tabular values badly, and are sometimes inconsistent with each other; cf. the discussion under HB*. In other words, the headings and entrances of a table have to be treated independently of the values in the body of the table.

Readings chosen, and notation. See remarks under HB* and HC*, and under each of the HA* tables.

In any column for parallax in longitude, values near the top (i.e., for times near sunrise) stand for displacement in the direction of the signs; for values near the bottom (near sunset), the opposite is the case. The first of the values for which the direction has changed is here marked with "-". As far as I know, there is no such notation in the manuscripts.

References to table cells. For any table, the reference "Ari:q-5" denotes a cell in the sub-table for Aries, in column (q), at the argument "hour 5 before noon" (i.e., in the upper half of the sub-table). Correspondingly, "Ari:q+5" refers to a cell at the argument "hour 5 after noon" (i.e., in the lower half of the sub-table); and "Ari:(q Rec)" or Ari:(q Mer)", to a cell at the argument "noon", normally labelled "rec(essus)" or "mer(idies)". In the apparatus, short references like "(q-5)", "(q+5)", and "(q Rec)" / "(q Mer)" are used.

HA. Parallax tables for special locations or latitudes.

HA11. Parallax for Toledo.

Toomer 1968, no. 63 (printed in full, with discussion). — No parallels known.

Witnesses: **{a0}** Ct,28v-29r; Oo,26v; Cq2,91; Ey,66v; Ea,49v; Lo,78v-79r. — **{a1}** Xa,33r; Ad,81r; Cq,58; Fc,72r; Ps,70v; Sg,170-171; Wd,33r; Fh,55r-v; Xw,32r. — **{a2}** Cz,86v-87r; Md,95v-96r; Mp,226r (entrances and values blank). — **{aX}** Vo,63'r-v; Xr,86r; R,65r; Ov,100r-v; S,101v. — **{aT}** Lu,74r; Oj,143r-v; P,137r (:Toledan). — **{d}** Lb,46v; Pa,53r; A,232r; Fj,54r; Nc,133v; Fd2,55r; Gr3,126r; Ok,60v. — **{e}** Gr,64r; Eq,82v; Ek3,109r; Xc,77r; Vj,100v; Ej,83v; Vm,13v. — **{x}** Oc,91r; X,168r; Mv,108v; B,160v; T,298r; Lf,110r; Lg,188r; Lh,155r; Xj,291v; Xg,73r; G,77r; Xb,90v; Es,198r; Fb,83r; Pq,202r; Oy,89v; Wa,77v; Ow,169r; Nu,157v. — **{p}** O,85v-86r; Pd,76v-77r. — {?} Ew1,31v-32r; Ox,95v (:Ut Annos); Oq,21r (:Ut Annos); Ut,133r (:?).

Canons. See H* above. A dedicated canon is in ms. Lo, 85va-86rb; it partly agrees with Cb182a-185.

Headings. — General. The headings collected in the first paragraph below include phrasings that are alternatives, such as "...ad latitudinem Toleti quae est..." and "... ad civitatem Toleti cuius latitudo est ...". There may be different types, but they are mixed and cannot be distinguished.

The phrase "in longitudine media" (see headings 1,4,5,6) is loosely attached in some non-central witnesses, and is likely to be a late addition; see "Tabular values" below.

The list takes no account of detailed variation in particles and order of words, nor of numerical variants that occur only once.

(1) Tabula diversitatis (t.d.: diversitas Lo O Pd) **aspectus lunae** (*om.* S Ov Vo O Pd Ew1; /signorum R; **+in longitudine media** R S Vj Ej O Pd Ew1) **ad latitudinem** (**+civitatis** Ct Md Ok Ox Oq; **/civitatem** Cz Oj P Xc T Es Fb) **Toleti (+quae est) (/+cuius latitudo (est))** Ct Cz Oj P Ov Vo T Es Fb Ox! Oq) **39** (30 Vj Ej Ox) **gr (+et) 54 mi** (54 m.: *om.* T) :: {a0:} Ct Oo Cq2 Lo Ey; {a1:} Xa Ad Cq Ps Sg Fh Xw Wd; {a2:} Cz Md; {aT:} Oj P; {aX:} Ov Vo Xr R S; {d:} Ok; {e:} Xc Vj Ej Vm!; {x:} T Es Fb; {p:} O Pd; {?:} Ew1 Ox! Oq.
— *Added:*
+et dies eius (*om.* Oj) **longior 14 horarum aequalium** (*om.* Oj) **et 51 mi** :: Cz Oj P;
+((et) eius) horae (e.h.: **/h.e.** Ov R S O Pd Ew1; **+aequales** Ct Md Ox Oq) **14 et 51** (**/7** Xc Vj Ej Vm; *vacat* Vo; *om.* Ox Oq) **mi** (*om.* Ct Fb; **+secundum Azarchel** R O Pd Ew1) :: *cett.*

(2) Tabula diversitatis aspectus lunae ad civitatem Toleti, 39 gr existentem et 54 mi, et eius horae sunt 14 et 51 mi (et 51 mi: **/et 27 mi** Mv.ac B Xj Pq Ow.pc Nu; *om.* G) :: {x:} Mv B Lf Lg Lh Xj Xg G Pq Ow Nu.

(3) Diversitas (**/Tabulae div-tis** Lb! Fj Gr3) **aspectus** (*om.* Lb; +lunae Nc) **in** (+civitate Lb) **Toleto, latitudo eius 39 54** (*om.* Lb) **horae eius** (*om.* Pa Nc) **14 51 (+mi)** :: {d:} Lb Pa A Fj Nc Fd2 Gr3.

(4) Tabula diversitatis aspectus lunae, prout est in longitudine media, ad Toletum :: {e:} Gr Eq.

(5) Tabula diversitatis aspectus lunae ad Toletum, cuius latitudo 39 gr 54 mi, horae 14 51 mi, luna in longitudine media :: {x:} Oc Xb.

(6: other) Ek3 ("T. d. a. l. ad lat. Toleti prout est in longitudine media", cf. Gr Eq); Oy (like Mv etc., ending "... hore 14 et 51 m'a, longitudo longior"); Wa (day-length 14;27, cf. Mv); Ut ("... secundum Arzachel"); Ea Fc Mp X.

Sub-headings for Cancer:

(7) Horae cancri; (Cancer+ Fh Xw) **Diversitas aspectus** (*om.* Oj Ut) **[Longitudo; Latitudo]** :: {a0:} Ct Oo Cq2 Lo Ey Ea; {a1:} Xa Ad Cq Fc Wd Fh Xw; {a2:} Cz; {aX:} Ov Xr; {aT:} Lu Oj P; {d:} Lb Pa A Fj Fd2 Gr3 Ok; {?:} Ut.

(8) Cancer, horae; Diversitas aspectus [Longitudo; Latitudo] :: {aX} R S; {p:} O Pd; {?:} Ew1.

(9) Diversitas aspectus (+lunae Ps) **[Horae cancri; Longitudo; Latitudo]** :: {a1:} Ps Sg; {a2:} Md.

(10) Horae cancri; Longitudo; Latitudo :: {a2:} Mp; {e:} Eq Ek3 Xc Ej; {x-}.

(11) Horae cancri; Minuta longitudinis; Minuta latitudinis :: {d:} Nc; {e:} Gr.

(12: other) (or deficient:) Vo Vj Vm Mv Xg Ox Oq.

Values in heading and entrances. Latitude of Toledo: 39;54°, as stated by the heading and confirmed from elsewhere. This may indeed be the basis of the half-day values of the entrances. I reproduce this series as found in the manuscripts, adding the main variants, and comparing the series to recomputations for obliquities 23;33,30° and 23;51°.

	Cnc	Leo	Vir	Lib	Sco	Sgr	Cap	Aqr	Psc	Ari	Tau	Gem
Vulgate:	7;27	7;13	6;40	6	5; $\underline{4}$	4;47	4;33	4;$\underline{46}$	5; $\underline{4}$	6	6;40	7;13
Pa A...:	7;$\underline{26}$				5;$\overline{20}$				5;$\overline{20}$			
23;51°:	7;27	7;13	6;40	6; 0	5;20	4;47	4;33	4;47	5;20	6; 0	6;40	7;13
23;33,30°:	7;26	7;12	6;39	6; 0	5;21	4;48	4;34	4;48	5;21	6; 0	6;39	7;12

Thus the series is reproduced perfectly from the Ptolemaic-type obliquity of 23;51°, only correcting the values (underscored above) that are in any case inconsistent with the rest. The obliquity of 23;33,30°, elsewhere ascribed to Azarchel, makes for a poorer fit; it would yield the present values if one assumed a latitude of about 40;21°, but this is an unlikely value. On the other hand this obliquity, given the latitude of 39;54°, implies a maximum day-length of 14;51,3, which corresponds to the value 14;51 of the heading of the table. Thus the entrances and the heading are not computed on the same basis.

Tabular values. In this section, the tabular values are assumed to be independently computed, as this makes no difference for the present rough estimates. In fact the values may have been derived from other tables, as shown in the next section.

The horizontal parallax in altitude, estimated from the outer pair of tabular values in each sub-table,[1] is about 54′, as in the tables of series HB. Thus the computation is likely to have assumed that the moon is at the apogee of the epicycle (at distance 64;10: see under H* above), and that the solar parallax is not to be subtracted; cf. Toomer 1968 p. 97. This would yield a horizontal parallax of 53.6′, quite a good correspondence. – However, phrases such as "luna in longitudine media" are found repeatedly among the table-headings listed above. The canons (Cb182a-b; Cc248, Cc302-3), meant to be valid for some tables of the present type, also assume the moon to be at mean distance (though, for other reasons, this makes for paradoxical results; see note to Cc248). In this case the solar parallax would have to be subtracted (Toomer p. 100). Assuming, then, the solar and lunar distances of 1210 and 59, one gets a maximum horizontal parallax of 55.5′, and the recomputed values are too large, barely but consistently. So these testimonies appear unfounded.

---

1 Simply as: parallax_in_altitude =
[(parallax_in_longitude)**2 + (parallax_in_latitude)**2]**(1/2),
which appears adequate for this purpose.

Derivation of the tabular values from HB41 and HB51. When recomputing table HA11 on the basis of latitude 39;54°, one finds that the largest deviations from expectation occur at about the same places as they do in HB51. I show a comparison of places where some of HB41, HA11, or HB51 show unexpected values, listing, in each case, both of the values that are symmetrical according to the notes under H* above. The readings are compared to the recomputed ones, and the values that appear faulty are underscored. I add a few examples where asymmetries in HA11 are coupled with asymmetries in HB41 or HB51; however, these are less significant, being selected among many irregular cases. All values are those of the manuscripts, whether or not they have been corrected in the edition.

	Found			Recomputed		
	HB41	HA11	HB51	HB41	HA11	HB51
Leo:g+3	25	20	17	26	24	23
Gem:x-3	25	20	17			
Vir:m+2	28	31	33	30	32	33
Tau:u-2	29	32	33			
Vir:L+5	28	28	28	29	26	25
Tau:t-5	28	28	28			
Lib:pRec	19	16	14	13	14	14
Ari:pRec	12	13	14			
Sco:t+2	8	7	6	7	5	4
Psc:L-2	8	6	5			
Sgr:x-3	35	34	34	39	38	37
Aqr:g+3	35	35	34			
Cap:c-2	23	19	17	22	21	20
Cap:c+2	23	19	17			

This accounts for the unexpected values in HA11 that are well attested, apart from one or two; I also ignore some values near sunrise or sunset, where the recomputation may be imprecise because of faults in the latitude values employed. On the whole, the correlation of errors is quite conspicuous.

It appears that a value in HA11 may be constructed as a weighted mean between the corresponding ones in HB41 and HB51, such that the distances to either side have the proportion 2:1 or as close as possible to 2:1 (this includes the distances 0,0 and 1,0). Where this rule is broken, there is almost always an asymmetry in one of the three tables, such that the rule would be fulfilled by insertion of the symmetrical value. I do not list these instances, which are numerous; one is Sgr:x-3 and Aqr:g+3, above. An exception is,

Vir:L-6+	51	51	50
Tau:t+6+	51	51	50.

All told, it is plausible[1] that HA11 has been made according to the rule just suggested, rather than being computed independently.

---

1 In the sub-tables of HA11 for Gem, Cnc and Leo there is also some uncertainty about the values for sunrise and -7h, and for +7h and sunset; indeed, only one of each pair can correspond to anything in HB41 and HB51, since the counterparts to the other one are absent. Evidence is conflicting. In HA11:Cnc the sunrise/sunset values agree with the outer values in HB41 and HB51 whereas the 7-hour values do not agree with anything; the same may be the case for Leo, sunset and Gem, sunrise; whereas the case is mixed in Leo, sunrise and Gem, sunset. It is possible that the maker of HA11 possessed undamaged copies of HB41 and HB51 where the sunrise/sunset values were the same as the present outer values; but as I shall try to argue below, the values in HB41-51 that are now the outer ones are more likely to be the original values for 7 hours. If our table-maker saw HB41 and HB51 as they are now, he may have taken their outer values for sunrise/sunset values, and made up an extra set of values for HA11, to go with the argument of 7 hours. The problem can only be solved if the tables are recomputed in a more precise way, or if complete copies are found of HB41 and HB51.

By chance or not, the proportion of 2:1 corresponds to the ostensible latitude values in the headings of the three tables. Indeed, the latitude in HA11 (39;54°) is the well-known one for Toledo; and its distances to the two others (36;24° and 41;44°, of obscure origin) are 210′ and 110′, thus approximately in the proportion 2:1. Incidentally, this may support a conjecture that the last two latitudes are, if not original, then at least the same as those known to the table-maker of HA11. Still, it does not explain their genesis, and in fact the latitude stated for HB51 is hard to explain and probably inconsistent with the tabular values; see the notes to HB*.

I still list values from the recomputation for latitude 39;54°, since they constitute fair approximations, useful for distinguishing between readings. If the latitude values here used for recomputing HB41 and HB51 (36° and 40°56′) are realistic, a practicable latitude for HA11 would be about 39°18′, and in fact this gives a fit that is markedly better in detail. It does not, however, make much difference for identifying gross errors, so I have not introduced it.

Text. Collated for values: **{a0}** Ct Oo; **{a1}** Xa Cq; **{aT}** Lu; **{d}** Pa A; **{e}** Eq Xc; **{x}** Es Xg. – Headings according to Xa. – Layout: Oo Xa Cq Lu Pa A Eq Es Xg have six sub-tables across the page, Ct four across the page. I follow the layout of Xa etc.

Also quoted for values: **$c:** value recomputed from latitude 39;54° and obliquity 23;51°. All values that differ by 2′ or more from the adopted value are quoted, plus an arbitrary selection of values that serve to distinguish between readings. – **$d:** weighted mean of counterparts in HB41 and HB51, according to the rule suggested under "Derivation", above. Quoted for the values that differ from the adopted reading, and for values used as evidence for correcting a reading. Not quoted for the rows for 7h and for sunrise/sunset in the signs Gem, Cnc and Leo.

Eq omits all values for minutes of time (cols. (b, f, k, ...)). This has not been noted in the apparatus.

Readings chosen. I generally adopt the readings of Ct Oo Xa Cq, but I correct them freely according to $d, or to $c when supported by a symmetrical value.

I use underscoring where the text is kept though it differs from $c (by 2′ or more) or from $d, and italics where the text has been corrected according to $d, or according to the symmetrical value supported by $c.

Variant groups. There are several errors common to all witnesses, e.g., at Cnc:d-7, Vir:L-1, Gem:x-6,x-5, Leo:g+3. Often, some grouping including *Ct Oo* and/or *Xa Cq* is in error against one including *Pa A Es,* e.g., in the minute values at Sco:s-5;20,+5;20, Psc:k-5;20,+5;20, and at Sgr:y-3, Psc:m+2 (Oo with Pa A), Gem:x-2,x-1, Cnc:c-5,cRec, Lib:p-1, Aqr:g+1, Ari:o+6. The rest are vacillating in these cases. The correct readings may, as always, be due to scribal emendation.

Pa A, when alone, form a well-defined error group, and never seem to be correct against the rest. Errors are at Leo:h+3, Lib:p-4, Sgr:x-1, Cap:d-4;33, Psc:L+4,m+3. Other error groups are much less distinct. *Eq Xc Xg (Es)* have peculiar readings at Gem:x-3,x+6, Psc:m-1, of doubtful significance. *Xg,* however, most often agrees with the majority; it also has a number of alternative readings inserted by the text-hand, and some of these agree with correct readings in Pa A Es.

Generally, Ct Oo Xa Cq may represent a vulgate that contains old errors. It seems possible to assume that Pa A (Es) constitute an independent group, but the part played by Es is doubtful.

Tabula diversitatis aspectus lunae ad latitudinem Toleti, 39 gr et 54 mi, et horae eius 14 et 51 mi.

Horae cancri		Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi	Horae leonis		Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi	Horae virginis		Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi	Horae librae		Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi	Horae scorpionis		Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi	Horae sagittarii		Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi
7	27	40	36	7	13	47	28	6	40	51	18	6	0	51	15	5	*20*	51	18	4	47	46	29
7		41	*35*	7		48	26	6		51	17	5		51	15	5		50	19	4		44	31
6		42	31	6		49	22	5		49	16	4		47	17	4		47	22	3		34	*35*
5		41	27	5		46	19	4		44	15	3		41	19	3		41	26	2		30	40
4		37	23	4		41	17	3		38	15	2		32	23	2		34	30	1		20	43
3		30	19	3		33	15	2		29	17	1		*23*	28	1		24	35	.		.	.
2		21	17	2		24	15	1		*20*	20	.		.	.	.		.	.	.		.	.
1		11	16	1		15	15	.		.	.	.		.	.	.		.	.	.		.	.
Rec		*0*	15	Rec		5	17	Rec		9	*24*	Rec		16	31	Rec		15	40	Rec		10	45
1		-11	16	1		- 6	20	.		.	.	.		.	.	.		.	.	.		.	.
2		21	17	2		16	24	1		- 1	28	.		.	.	.		.	.	.		.	.
3		30	19	3		20	28	2		9	31	1		3	36	1		4	43	.		.	.
4		37	23	4		30	32	3		18	37	2		- 6	40	2		- 7	46	1		- 1	48
5		41	27	5		33	37	4		24	41	3		13	43	3		13	48	2		11	48
6		42	31	6		33	40	5		28	44	4		20	46	4		20	48	3		20	48
7		41	35	7		33	41	6		28	46	5		23	48	5		24	48	4		27	46
7	27	40	36	7	13	33	42	6	40	26	47	6	0	24	49	5	*20*	27	47	4	47	29	45
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(a Rec) azawel id est recessio Ct, *ubique;* recessio Oo Xa Cq Lu, *ubique;* rec() Es Xg, *ubique;* r() Eq, *ubique;* reces() Xc, *ubique;* remotio Pa A, *ubique.* **(b)** *hanc columnam et omnes ei similes om.* Eq. **(b-7;27, b+7;27)** 26 Pa A Es; 2\6/7 Xg. **(c-7;27)** 38 $c. **(c-5)** 20 Ct Oo. **(c-2)** 31 Cq. **(c Rec)** 0: $c $d, *cett.;* 9 Ct Xa Cq Lu; 8 Oo. **(c+4)** 32 Xa. **(c+7;27)** 38 $c. **(d-7;27)** 38 $c. **(d-7)** 35: *cf. Cnc:d+7;* 33 *omnes;* 36 $c; *def.* $d. **(d-1)** 1 Xc. **(d+7)** 33 Eq Es. **(d+7;27)** 38 $c. **(g-6)** 47 $c. **(g+3)** 24 $c. **(g+7;0)** 31 $c. **(g+7;13)** 30 $c. **(h-5)** 29 Lu. **(h-3)** 14 Pa A. **(h+3)** 38 Pa A. **(h+7)** 44 $c. **(h+7;13)** 44 $c. **(L-6;40)** 50 $d. **(L-2)** 39 Oo. **(L-1)** 20: *cf. Tau:t+1;* 22 *omnes;* 19 $c. **(L+3)** 19 Oo. **(L+5, L+6)** 26, 26 $c. **(m-6;40)** 48 Oo. **(m Rec)** 24: $c $d, *cf. Tau:uRec;* 33 Es.ac; 23 *omnes.* **(m+3)** 17 Oo. **(m+6)** 45 Oo; 40 Xc. **(m+6;40)** 17 Oo. **(o-6, o+6)** Eq Es Xg; *om. cett.* **(p-4)** 17 Pa A. **(p-1)** 23: *cf. Ari:p+1;* 24 $c; 4 Ct Oo Cq; 3 Xa Lu. **(p Rec)** 16: $d, *cett.;* 13 Eq, *cf. Ari:pRec;* 14 $c. **(q-2)** 13 Es. **(s-5;20)** 20: Pa A Eq Es $c; 2\4/0 Xg; 4 *cett.* **(s+5;20)** 20: Pa A Eq Es Xg $c; 4 *cett.* **(t-4)** 48 Ct. **(t-3)** 40 Oo. **(t+2)** 5 $c. **(t+5;20)** 25 $c. **(x-3)** 43 Xc; 38 $c. **(x-1)** 4 Pa A. **(y-4;47)** 27 $c. **(y-3)** 35: Pa A Es Xg $c, *cf. Aqr:h+3;* 36 Lu; 30 *cett.*

Horae capri corni		Lo ng it ud Mi	La ti tu do Mi
4	33	39	38
4		36	40
3		30	43
2		19	46
1		10	48
.		.	.
.		.	.
.		.	.
Rec		0	49
.		.	.
.		.	.
.		.	.
1		-10	48
2		19	46
3		30	43
4		36	40
4	33	39	38
(a)	(b)	(c)	(d)

Horae aqua rii		Lo ng it ud Mi	La ti tu do Mi
4	46	29	45
4		27	46
3		20	48
2		11	48
1		1	48
.		.	.
.		.	.
.		.	.
Rec		-10	45
.		.	.
.		.	.
.		.	.
1		20	43
2		30	40
3		*34*	35
4		44	31
4	46	46	29
(e)	(f)	(g)	(h)

Horae pis cis		Lo ng it ud Mi	La ti tu do Mi
5	*20*	27	47
5		24	48
4		20	48
3		13	48
2		6	46
1		- 4	43
.		.	.
.		.	.
Rec		15	*40*
.		.	.
.		.	.
1		24	35
2		34	*30*
3		41	26
4		47	22
5		*50*	19
5	*20*	51	18
(j)	(k)	(L)	(m)

Horae arie tis		Lo ng it ud Mi	La ti tu do Mi
6	0	24	49
5		23	48
4		20	46
3		13	43
2		6	40
1		- 3	36
.		.	.
.		.	.
Rec		13	31
.		.	.
.		.	.
1		23	28
2		32	23
3		41	19
4		47	17
5		51	15
6	0	51	15
(n)	(o)	(p)	(q)

Horae tau ri		Lo ng it ud Mi	La ti tu do Mi
6	40	26	47
6		28	46
5		28	44
4		24	41
3		18	37
2		9	32
1		1	28
.		.	.
Rec		- 9	24
.		.	.
1		20	*20*
2		29	17
3		38	15
4		44	15
5		49	16
6		51	17
6	40	51	18
(r)	(s)	(t)	(u)

Horae gemi norum		Lo ng it ud Mi	La ti tu do Mi
7	13	33	42
7		33	42
6		*33*	40
5		*33*	37
4		30	32
3		20	*28*
2		*16*	24
1		*6*	20
Rec		- 5	17
1		15	15
2		*24*	15
3		*33*	15
4		41	*17*
5		46	19
6		49	22
7		48	26
7	13	47	27
(v)	(w)	(x)	(y)

(c-2,c+2) 21, 21 $c. **(d-4;33)** 33 Pa A; 28 Xc. **(d+4;33)** 28 Oo. **(f-4;46)** 16 Oo; 47 $c. **(f+4;46)** 47 $c. **(g+1)** *duplicant* Xa Cq. **(g+3)** 34: $d, *cf. Sgr:x-3;* 35 *omnes;* 38 $c. **(h+4;46)** 27 $c. **(k-5;20, k+5;20)** 20, 20: Pa A Eq Es Xg; 4, 4 *cett.* **(L-5;20)** 25 $c. **(L+4)** 27 Pa A. **(L+5)** 50: Pa A $c $d, *cf. Sco:t-5;* 51 *cett.* **(m-5)** x'x (=?) Oo. **(m-1)** 42 Eq Xc Es Xg. **(m Rec)** 40: $d, *cf. Sco:uRec;* 3\4/9 Xg; 39 *cett.* **(m+2)** 30: Oo Lu Pa A Es, *cf. Sco:u-2;* 31 $c; 35 Ct Xa Cq Eq Xc; 35\0/ Xg. **(m+3)** 40 Pa A. **(m+5)** 18 Ct. **(n+6)** 5 Xa Cq. **(o-6)** Eq Es Xg; *om. cett.* **(o+6)** 0: Eq Es Xg; 20 Xa Cq; x Oo; *om. cett.* **(p-5)** 27 Oo. **(t-6;40)** 36 Eq. **(t-6, t-5)** 26, 26 $c. **(t+3)** 28 Oo. **(t+6;40)** 50 $d. **(u+1)** 20: $c $d, *cf. Vir:m-1;* 21 *omnes.* **(u+6)** 17: 16 Xa Lu Eq Xc. **(x-7;13)** 30 $c. **(x-7)** 31 $c. **(x-6)** 33: $c, *cf. Leo:g+6;* 30 *omnes.* **(x-5)** 33: $c, *cf. Leo:g+5;* 30 *omnes.* **(x-3)** 30 Eq Xc; 30\2/ Xg; 24 $c. **(x-2)** 16: Lu Pa A Es $c, *cf. Leo:g+2;* 2\1/6 Xg; 26 *cett.* **(x-1)** 6: Lu Pa A Es, *cf. Leo:g+1;* 7 $c; 20\6/ Xg; 20 *cett.* **(x+2)** 24: $d, *cf. Leo:g-2;* 25 $c, *omnes.* **(x+3)** 33: $d, *cf. Leo:g-3;* 24 (?) Oo; 34 *cett.* **(x+6)** 46 Eq Xc; 46\9/ Xg; 47 $c; *om.* Cq. **(y-7;13, y-7)** 44, 44 $c. **(y-3)** 28: Lu $c, *cf. Leo:h+3;* 30 Eq.?pc; 20 *cett.* **(y-2)** 34 Eq.?pc. **(y+4)** 17: $c $d, *cf. Leo:h-4;* 16 *omnes.* **(y+6)** 29 Oo.

HA21. Parallax for latitude 52;50°, <Northampton>.

Toomer 1968, no. 75.

Witnesses: **{k}** Cn,105r. – **{d}** Op,73r; C,367. – One more witness, ignored here: Cg,359v.

A further copy is in Ch,205r, with the same values, headed "Diversitas aspectus lunae ad castrum *Norhamtone,* cuius latitudo est 52 gradus et 50 mi, horae 16 et 40 minuta". Toomer (1968 p.112) had guessed at Northampton from the latitude; cf. note to MA11a.

Heading: **Tabula diversitatis aspectus lunae in latitudine 52 graduum et 50 minutorum** Op C. No heading in Cn. – Sub-heading: "Cancer [Horae cancri; Minuta longitudinis; Minuta latitudinis]; Leo..." Op C. Cn shows another, secondary, sub-heading.

Values. When assuming the stated latitude of 52°50′ and an obliquity of, e.g., 23°35′, the quoted half-day values and tabular values may be reproduced to within 1′, except for a pair of deviations of 2′, marked below. An obliquity of 23°51′ fits the half-day values less well. I have not tried with other obliquities.[1] For the parameters, compare table BE60, which also occurs in mss. Ch Cn.

The horizontal parallax in altitude is about 51′. Thus probably the solar parallax has been taken into account, as in the tables HC below.

Sample. From Op Cn.

Cnc				Leo				Vir				Lib				Sco				Sgr			
h	m	Lo	La	h	m	Lo	La	h	m	Lo	La	h	m	Lo	La	h	m	Lo	La	h	m	Lo	La
8	20	25	44	7	56	35	36	7	2	42	28	6		44	25	4	58	42	28	4	4	35	36
Mer		0	25	Mer		6	27	Mer		12	31	Mer		16	36	Mer		16	43	Mer		10	47
8	20	25	44	7	56	19	47	7	2	13	49	6		12	49	4	58	13	49	4	4	17	48
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(a Mer) merid(ies) Cn Op, *ubique.* **(g+8;20)** 17 *calculando.* **(v-4;4)** (4;4, 4) Cn. **(v+4;4)** (4, 4;4) Cn.

Cap				Aqr				Psc				Ari				Tau				Gem			
h	m	Lo	La	h	m	Lo	La	h	m	Lo	La	h	m	Lo	La	h	m	Lo	La	h	m	Lo	La
3	40	25	44	4	4	17	48	4	58	13	49	6		12	49	7	2	13	49	7	56	19	47
Mer		0	49	Mer		10	47	Mer		16	43	Mer		16	36	Mer		12	31	Mer		6	27
3	40	25	44	4	4	35	36	4	58	42	28	6		44	25	7	2	42	28	7	56	35	36
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(f+4;4) *om.* Cn. **(x-3;40)** 17 *calculando.*

1 Toomer (1968 p. 112) derived an obliquity of 23°30′ from the day-lengths and the stated latitude.

HA22. Parallax for ?London.

Witness: Ek3,118v: "Tabula diversitatis aspectus ad civitatem Lond()".

Sample. Some vacant entrance values have been supplemented; sub-headings are not reproduced.

One current latitude value for London was about 51;40° (table MA11 in ms. Ch2; actual value 51;30°). The half-day values rather point to a latitude of about 50;50° (for obliquity 23;35°) or of 50;30° (for obliquity 23;51°). For the parallax values, estimating the horizontal parallax at 50.1′,[1] I have tried the pairs (51;40, 23;35) and (50;30, 23;51), of which the latter fits the values better.

Thus, opportunistically, the values have been recomputed for latitude 50;30° and obliquity 23;51°. Readings that deviate by 2′ or more from expectation are underscored, and the computed value is quoted as "**$c**". However, if a reading can safely be corrected from the expected value, plus perhaps from symmetry, the corrected reading is adopted and italicized. In two illegible places, in Sgr and Gem, I merely suggest some likely values.

Cnc	Leo	Vir	Lib	Sco	Sgr
h m Lo La	h m Lo La	h m Lo La	h m Lo La	h m Lo La	h m Lo La
8 *10 27* 43	7 48 37 34	6 58 43 26	6 0 45 23	5 2 43 24	4 12 *37* 3<4>
Rec. 0 22	Rec. 6 25	Rec. 11 30	Rec. 15 33	Rec. 17 41	Rec. 10<47>
8 *10 27* 43	7 48 20 46	6 58 14 48	6 0 14 48	5 2 15 48	4 12 20 4<6>
(a) (b) (c) (d)	(e) (f) (g) (h)	(j) (k) (L) (m)	(n) (o) (p) (q)	(r) (s) (t) (u)	(v) (w) (x) (y)

(b-8;10, b+8;10) 10,10: $c; 0,0 Ek3. **(c-8;10, c+8;10)** 27,27: $c; 37,37 Ek3. **(j+6;58)** 0 Ek3. **(q Rec)** 35 $c. **(u-5;2)** 26 $c. **(x-4;12)** 37: $c; 30 Ek3.

Cap	Aqr	Psc	Ari	Tau	Gem
h m Lo La	h m Lo La	h m Lo La	h m Lo La	h m Lo La	h m Lo La
3 50 28 43	4 12 20 46	5 2 14 48	6 0 14 48	6 57 15 *48*	7 48 20 4<6>
Rec. 0 *48*	Rec. 10 47	Rec. 17 42	Rec. 15 33	Rec. 11 30	Rec. 5 2<5>
3 50 28 43	4 12 37 32	5 2 43 24	6 0 45 23	6 57 *43* 26	7 48 37 3<4>
(a) (b) (c) (d)	(e) (f) (g) (h)	(j) (k) (L) (m)	(n) (o) (p) (q)	(r) (s) (t) (u)	(v) (w) (x) (y)

(d Rec) 48: $c; 0 Ek3. **(h+3;50)** 34 $c. **(m+5;2)** 26 $c. **(q Rec)** 35 $c. **(t+6;57)** 43: $c; 45 Ek3. **(u-6;57)** 48: $c; 46 Ek3.

---

1 See note to HA11, "Tabular values".

HB. Parallax tables for climates. No parallels known.

Toomer 1968, no. 64-68.

The tables for climates collected under this heading are those which are fairly common and are not by Theon/Albattani (for these, cf. section HC). They were discussed by Toomer 1968 p. 97, 100-01, 105; I have little to add except what follows from the distribution in the manuscripts, for which see also T:05(8.5).

Together, our tables cover all of climates 2-6; and apart from these and the HC* tables, no others are found that purport to be valid for climates. Thus one might expect the present tables to have a common origin. It is true that they do not form a coherent series in any witness. Their distribution, apart from apparent stray copies, is

```
HB51     {p} {e} {a0 a1 aT}
HB41         {e} {a0 a1 aT} {d} Lb {x}
HB61                        {d} Lb {x}
HB21-31                         Lb {x}
```

The longest series, consisting of HB21-41 and HB61, occurs in ms. Lb and class {x}; but these, plus class {d}, use HC52 for the fifth climate instead of HB51. On the whole, the pattern of occurrence does not make it obvious that these tables are meant to form a series.

They do have one common feature, since they presuppose a horizontal parallax in altitude of about 54′ as against the 50.8′ of the Albatenian tables (see notes to section HC). This is the case for HA11 too, q.v. for discussion. Some other common features (such as the distorted entrance values and the apparent loss of the outer rows in HB41-61) will be discussed later.

Values in headings and entrances. These are summarized in the list below; letters such as "(a)" refer to this.

The table headings purport to show the latitude (m) and maximum daylight (a) for each climate posited; and in the sub-table entrances, the half-day values for Cancer (b) and for Capricorn (c) should once more reflect the maximum and minimum length of daylight, respectively. The sets of half-day values are not attested elsewhere, and, as observed by Toomer (p. 105), they are largely incoherent.

To each set, i.e., the set of hour values (a-c) and the set of latitudes (m), I append the values expected from the other set on the basis of three likely values for the obliquity, i.e., the values (e-g) and (n-p), respectively. These do not suggest any evident possibilities of correction.

One might expect the climates in question to be defined on the basis of maximum day-lengths that are multiples of a half hour (d). This appears to be true, e.g., for the oblique ascension tables BG11-17, and these show their own latitude values; but it is not obvious that these have anything to do with the latitude values found here. In any case I add some values derived from such "ideal" day-lengths (q-s).

		HB21	HB31	HB41	HB51	HB61
a:	Hours (heading)	**13;28**	**14; 0**	14;27	**15; 0**	15;28
a1:	Half day from (a)	**6;44**	**7; 0**	7;14?	**7;30**	7;44
b:	Half day (entrance, Cnc)	**6;44**	**7; 0**	7;14	**7;30**	7;48
c:	Half day (entrance, Cap)	5;14	**5; 0**	**4;45**	**4;30**	4;20
d:	Ideal hours	13;30	**14; 0**	**14;30**	**15; 0**	15;30
e:	Hours from (m), obl=23;33	13;30	14; 0	14;30	15; 3	15;34
f:	Hours from (m), obl=23;33,30	13;30	14; 1	14;30	15; 3	15;34
g:	Hours from (m), obl=23;51	13;31	14; 2	14;32	15; 6	15;37
m:	Latitudes in headings of HB*	24; 0	30;48	**36;24**	41;44	45;53
n:	Lat. from (a), obl=23;33	23;39	30;42	35;53	41;17	45;10
o:	Lat. from (a), obl=23;33,30	23;38	30;42	35;52	41;16	45; 9
p:	Lat. from (a), obl=23;51	23;21	30;21	35;29	40;53	44;45
q:	Lat. from (d), obl=23;33	24; 7	same	36;25	same	45;25
r:	Lat. from (d), obl=23;33,30	24; 6		**36;24**		45;25
s:	Lat. from (d), obl=23;51	23;49		36; 1		45; 1
t:	Lat., HC*, obl=23;35	24; 5	30;40	36;22	41;14	45;22
u:	Lat., Almagest, obl=23;51,20	23;51	30;22	36; 0	40;56	45; 1

This comparison does not reveal much. The hours of daylight (a) are fairly consistent with the half-day values (b-c), except in HB61 where (b-c) must be faulty. On the other hand, they are inconsistent with the latitudes encountered (m), regardless of the obliquity. This, then, does not explain why the values (a) in HB21, HB41 and HB61 have been distorted from their expected half-hour values. The latitude (m) in HB41 is, however, consistent with the ideal length of daylight (d) and an obliquity of, most closely, 23;33°, as seen from (e). The same is roughly the case for HB21 and HB31, whereas the latitudes (m) of HB51-61 appear to be faulty. However, the latitude in HB51 could be coupled with that of HB41 and with the latitude of Toledo, as observed under HA11. This still does not explain the rationale behind it.

The half-day values (b-c) in each table belong to a system of values, one for each sign, as listed under the single tables. These systems are largely incoherent within themselves, as will be shown, so they do not furnish much confirmation for (b-c). Moreover, there are rows missing in HB41-61, making it dubious that all the half-day values are those intended. The one fairly realistic set is that of HB31: it is very similar to that of Albattani in HC31, but it is not clear which obliquity it rests on.

The only obliquity value capable of somehow explaining the headings and entrances is thus one close to 23;33°, perhaps "Azarchel"'s 23;33,30°; these possibilities are practically indistinguishable. For the values in the body of the tables, I shall still choose 23;51° as parameter, for the reasons to be given.

Tabular values. For the same reasons as in the case of HA11, the tabular values will be recomputed (for the procedure, see H*) under the assumption that the moon is in apogee, and that the solar parallax is not to be subtracted. The alternative assumption (moon in mean distance, subtraction of solar apogee) yields values that are consistently too great, though the table headings show sparse remarks to either effect. The obliquity used will be 23°51′ as for HA11 and HC*, since this mostly gives a better fit than does 23°33′; the difference is, however, slight in view of the low precision with which the values are listed.

The Ptolemaic latitudes (H* above) fit the tabular values tolerably well, so I have used these latitudes for recomputation. The latitudes that are apparent from the table headings have been tested against the tabular values too, using obliquities of both 23;33° and 23;51°, as reported under each table. In most cases,[1] the Ptolemaic values give the best fit. It has not generally been tested whether other sets of values are still more suitable.

Readings chosen. The text is normally chosen according to the majority of witnesses collated, assisted by recomputation, symmetry and extra sources. Wherever a tabular value differs from the recomputation by 2′ or more, and plausible alternatives cannot be obtained by symmetry or in other ways, the reading is kept but is underscored. If there is a plausible alternative of either sort, I introduce it, using italics.

---

1 Except HB21 (lat. 24;0) and HB51 (the latitude when corrected to 41;14). The stated latitudes of HB51-61 are palpably erroneous.

HB21. Parallax, Climate 2.

Toomer 1968, no. 64.

Witnesses: **{d}** Lb,43v. — **{x}** Oc,89v; X,166v; Mv,105v; Cm,147r; B,157v; T,296v; Lf,107r; Lg,185v; Lh,152v; Xj,288v; Xg,70r; G,74r; Xb,89r; Es,195r; Fb,80r; Pq,199r; Oy,86v; Wa,74v; Nu,154v.

Headings: **(1) Tabula diversitatis aspectus lunae in secundo climate, cuius latitudo est** (*om.* Cm Fb) **24 gr, et eius horae** (+sunt Oc Cm Xb) **13 et 28** (e.28: 28 Lh Es; e.24 Cm T; 24 Oy) **mi.** Some singular variants ignored. — **(2: other)** Lb ("Tabula d. a. in c. s., latitudo eius 24, horae eius 13 28"); X("Diversitas a. l. in s. c.").

Sub-heading for Cancer, mostly **Horae cancri; Longitudo; Latitudo.** — Lb has the type "Horae cancri; Diversitas aspectus [Longitudo; Latitudo]" corresponding to the old heading of HA11. Other forms in Mv Xg.

Tabular values. Recomputed for latitude 23;51° and obliquity 23;51°. These values are chosen for ease of comparison with the rest of the tables.

Of other possibilities tried, either (lat=24°, obl=23;51°) or (24°, 23;33°) fit the adopted readings marginally better, judging from a rough count of deviations; but these normally keep within 1′-2′ in all cases.

Values in heading and entrances. The half-day values given by the witnesses are 6;44, 6;40, 6;20 for Cnc, Leo, Vir, and the corresponding ones. The value for Cnc disagrees with the value for Cap, but it fits the day-length given by the heading. For the latitude of 24°, and for an obliquity of either 23;33° or of 23;51°, one would expect the values 6;45, 6;38, 6;21, etc.; this series does not agree too well with the one found, so the values of the witnesses are not useful for determining the parameters precisely.

Text. Collated for values: **{d}** Lb; **{x}** Es Xg. — Headings from Xg. — Also quoted on occasion: **$c:** recomputation of parallax values; for the parameters, see "Tabular values" above. Only quoted where the recomputed value differs by 2′ or more from the parallax value adopted.

Readings chosen, italicized readings, etc.: see remarks to HB*. For the inconsistency of the entrance values, see above; these values are not marked.

Variant readings: Some of the underscored or italicized tabular values are probably errors, notably Tau:t-3; Leo:g+1 / Gem:x-1; they occur in all three witnesses. Note especially the Abjad-type error Aqr:g5-5;20, which suggests that the table is not a Latin construct, even if the witnesses are late. This error is not in Xg, but one may assume Xg to be corrected. On the whole, Lb Es Xg are uniform.

Tabula diversitatis aspectus lunae in 2'o climate,
cuius latitudo est 24 gr, et eius horae 13 et 28 mi.

Can cer		Lo ng it ud	La ti tu do	Leo		Lo ng it ud	La ti tu do	Virgo		Lo ng it ud	La ti tu do	Libra		Lo ng it ud	La ti tu do	Scor pius		Lo ng it ud	La ti tu do	Sagit tar ius		Lo ng it ud	La ti tu do
Ho re	Mi	Mi	Mi	Ho re	Mi	Mi	Mi	Ho re	Mi	Mi	Mi	Ho re	Mi	Mi	Mi	Ho re	Mi	Mi	Mi	Ho re	Mi	Mi	Mi
6	44	50	21	6	40	52	14	6	20	53	4	6	0	53	1	5	40	53	4	5	20	52	13
6		50	20	6		53	12	6		53	4	5		52	2	5		53	6	5		52	14
5		49	15	5		50	6	5		*52*	2	4		49	4	4		50	9	4		49	19
4		43	10	4		44	3	4		46	1	3		41	6	3		42	14	3		41	24
3		35	6	3		37	*2*	3		38	2	2		32	10	2		36	20	2		*32*	29
2		24	4	2		25	1	2		28	4	1		20	15	1		22	24	1		21	33
1		13	2	1		13	2	1		16	6	.		.	.	.		.	.	.		.	.
Rec		0	1	Rec		2	4	Rec		5	11	Rec		8	20	Rec		10	30	Rec		10	38
1		-13	2	1		- 6	6	1		- 8	15	.		.	.	.		.	.	.		.	.
2		24	4	2		23	11	2		19	21	1		- 2	25	1		- 1	32	1		- 5	40
3		35	6	3		32	15	3		29	26	2		14	31	2		13	37	2		16	41
4		43	10	4		40	21	4		34	31	3		23	36	3		23	40	3		27	40
5		49	15	5		43	26	5		38	35	4		*30*	38	4		30	41	4		35	38
6		50	20	6		44	31	6		39	38	5		34	39	5		36	40	5		41	35
6	44	50	21	6	40	43	33	6	20	38	39	6	0	36	42	5	40	38	38	5	20	42	33
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(a Rec) rem(oti)o Lb, *ubique;* rec() Xg Es, *ubique.* **(c-6;44)** 48 $c. **(c-2)** 34 Xg. **(c+4)** 46 Lb. **(c+6;44)** 48 $c. **(d-6;44)** 24 $c. **(d+6;44)** 24 $c. **(f-6;40)** *vel* 44 ? Lb. **(g+1)** 12 $c. **(g+6)** 49 Xg. **(h-6;40)** 12 $c. **(h-6)** 9 $c. **(h-3)** 2: *cf. Gem:y+3;* 3 *omnes;* 0 $c. **(L-5)** 52: *cf. Tau:t+5;* 53 *omnes;* 51 $c. **(m-6)** 2 $c. **(m-5)** 0 $c. **(o-6, o+6)** *om.* Lb. **(p+4)** 30: $c, *cf. Ari:p-4;* 32 *omnes.* **(q+1)** 21 Lb. **(q+3)** 34 $c. **(q+6)** 40 $c. **(t-2)** 34 $c. **(u+1)** 34 $c. **(v-w +1...+5;20)** *inverso ordine* Lb. **(x-2)** 32: $c, *cf. Aqr:g+2;* 34 *omnes.* **(x Rec)** 8 $c.

Capri cor nus		Lo ng it ud	La ti tu do	Aqua rius		Lo ng it ud	La ti tu do	Pis ces		Lo ng it ud	La ti tu do	Aries		Lo ng it ud	La ti tu do	Tau rus		Lo ng it ud	La ti tu do	Gem ini		Lo ng it ud	La ti tu do
Ho re	Mi	Mi	Mi	Ho re	Mi	Mi	Mi	Ho re	Mi	Mi	Mi	Ho re	Mi	Mi	Mi	Ho re	Mi	Mi	Mi	Ho re	Mi	Mi	Mi
5	14	49	24	5	20	42	33	5	40	38	38	6	0	36	42	6	20	38	39	6	40	43	33
5		48	25	5		41	35	5		36	40	5		34	39	6		39	38	6		44	31
4		44	31	4		35	38	4		30	41	4		30	38	5		38	35	5		43	26
3		35	33	3		27	40	3		23	40	3		23	36	4		34	31	4		40	21
2		24	38	2		16	41	2		13	37	2		14	31	3		*29*	26	3		32	15
1		13	40	1		5	40	1		1	32	1		3	25	2		19	21	2		23	10
.		.	.	.		.	.	.		.	.	.		.	.	1		8	15	1		6	6
Rec		0	41	Rec		-10	38	Rec		-11	30	Rec		- 8	20	Rec		- 5	11	Rec		- 2	4
.		.	.	.		.	.	.		.	.	.		.	.	1		16	6	1		13	2
1		-13	40	1		21	33	1		22	24	1		20	15	2		28	4	2		25	1
2		24	38	2		32	29	2		36	20	2		32	10	3		38	2	3		37	2
3		35	33	3		41	24	3		42	14	3		41	6	4		46	1	4		44	3
4		*44*	31	4		49	19	4		50	9	4		49	4	5		52	2	5		50	6
5		48	25	5		52	14	5		53	6	5		52	2	6		53	4	6		53	12
5	14	49	24	5	20	52	13	5	40	53	4	6	0	53	1	6	20	53	4	6	40	52	14
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(c+4) 44: *cf. Cap:c-4;* 46 *omnes;* 43 $c. **(g Rec)** 8 $c. **(g+5, g+5;20)** 12, 12 Lb Es. **(h+2)** 24 Xg.ac. **(L+2)** 34 $c. **(m-1)** 34 $c. **(o-6, o+6)** *om.* Lb. **(q-6)** 40 $c. **(q-3)** 34 $c. **(q-2)** 21 Xg. **(t-3)** 29: *cf. Vir:L+3;* 28 $c; 34 *omnes.* **(u+5)** 0 $c. **(u+6)** 2 $c. **(x-4)** 40: Lb; 43 Xg Es. **(x-1)** 12 $c. **(y+3)** 0 $c. **(y+6)** 9 $c. **(y+6;40)** 12 $c.

HB31. Parallax, Climate 3.

Toomer 1968, no. 65.

Witnesses: **{d}** Lb,44r. — **{x}** Oc,90r; X,167r; Mv,106r; Cm,147v; B,158r; T,297r; Lf,107v; Lg,186r; Lh,153r; Xj,289r; Xg,70v; G,74v; Xb,89v; Es,195v; Fb,80v; Pq,199v; Oy,87r; Wa,75r; Nu,155r.

Headings: **(1) Tabula diversitatis aspectus lunae (+ad solem** Mv B Lf Xj Xg G Pq Nu) **in tertio climate, cuius latitudo est** (*om.* Oc Cm T Xb Es Fb Oy) **30 gr 48 mi, horae eius 14.** Single variants ignored. — **(2: other)** Lb ("Tabula d. a. in c. t., latitudo eius 30 48, horae 14"); X("Diversitas a. l. in t. c.").

Sub-heading for Cancer, mostly **Horae cancri; Longitudo; Latitudo.** Lb has the type "Horae cancri; Diversitas aspectus [Longitudo; Latitudo]; Horae leonis...", like the old heading of HA11. Other forms in Mv Xg.

Tabular values. Recomputed for latitude 30;22° and obliquity 23;51°. This fits notably better than (30;48, 23;51), and still better than (30;48, 23;33), to judge from a rough count of deviations from the adopted values.

Values in entrances. The half-day values for Cnc, Leo, Vir (7;0, 6;52, 6;28) are consistent with their counterparts. The set resembles the corresponding one in Albattani (7;0, 6;51, 6;28: cf. HC31). The latter set can be derived, e.g., for obliquity 23;33° (e.g., with latitude 30;48 as in the heading of this table), or for 23;51° (e.g., with latitude 30;22, as used here for checking the body of the table). See also the notes under HB* above.

Text. Collated for values: **{d}** Lb; **{x}** Es Xg. — Headings from Xg. — Also noted: **$c:** re-computation; for the parameters, see "Tabular values" above. Only quoted for variants in parallax values, and only where the expected value differs by 2′ or more from the one adopted.

Readings chosen, italicized readings, etc.: see remarks to HB*.

Variant groups. There are several errors common to Lb Es Xg, e.g., Leo:g+4 / Gem:x-4; Lib:p+4 / Ari:p-4; Aqr:g-1. Note the Abjad-type error at Lib:p-2, in all of Lb Es Xg. At Cap:cRec and Vir:m-1, *Es Xg* have errors in common against Lb, but otherwise the witnesses rarely differ; at Cnc:c+2, Xg may be corrected, as it often seems to be.

Tabula diversitatis aspectus lunae ad solem in 3'o climate,
cuius latitudo est 30 gr 48 mi, horae eius 14.

Can cer Ho re	Mi	Lo ng it ud Mi	La ti tu do Mi	Leo Ho re	Mi	Lo ng it ud Mi	La ti tu do Mi	Virgo Ho re	Mi	Lo ng it ud Mi	La ti tu do Mi	Libra Ho re	Mi	Lo ng it ud Mi	La ti tu do Mi	Scor pius Ho re	Mi	Lo ng it ud Mi	La ti tu do Mi	Sagit tar ius Ho re	Mi	Lo ng it ud Mi	La ti tu do Mi
7	0	44	31	6	52	50	19	6	28	53	9	6	0	53	6	5	32	53	9	5	8	50	18
6		44	30	6		*51*	15	6		53	8	5		52	6	5		52	11	5		50	19
5		47	20	5		51	11	5		51	7	4		49	9	4		50	14	4		47	24
4		41	16	4		42	8	4		45	7	3		41	12	3		43	19	3		41	29
3		32	12	3		35	7	3		38	7	2		*32*	16	2		34	24	2		32	33
2		23	9	2		25	7	2		29	9	1		23	20	1		24	29	1		*20*	38
1		12	7	1		14	7	1		17	13	.		.	.	.		.	.	.		.	.
Rec		0	7	Rec		3	9	Rec		6	16	Rec		12	25	Rec		13	33	Rec		9	41
1		-12	7	1		- 9	12	1		- 5	20	.		.	.	.		.	.	.		.	.
2		23	9	2		21	16	2		15	26	1		0	30	1		1	38	1		- 3	43
3		32	12	3		30	20	3		23	31	2		-10	34	2		- 9	41	2		14	44
4		41	16	4		41	26	4		34	35	3		20	38	3		18	43	3		23	43
5		47	20	5		40	31	5		32	39	4		32	41	4		27	44	4		32	41
6		44	30	6		40	35	6		33	42	5		31	43	5		32	43	5		37	40
7	0	44	31	6	52	38	39	6	28	33	42	6	0	*32*	44	5	32	33	42	5	8	39	38
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(a Rec) rem(oti)o Lb, *ubique;* rec() Xg Es, *ubique.* **(b-7, b+7)** *om.* Lb. **(c-6, c-5)** 46, 45 $c. **(c-2)** 33 Lb Es. **(c+5, c+6)** 45, 46 $c. **(d-6, d+6)** 25, 25 $c. **(f+6;52)** *om.* Xg. **(g-6)** 51: $c, *cf. Gem:x+6;* 41 *omnes.* **(g-5)** 48 $c. **(g+4)** 36 $c. **(L+4)** 30 $c. **(m-1)** 23 Xg Es. **(o-6, o+6)** *om.* Lb. **(p-2)** 32: $c, *cf. Ari:p+2;* 52 *omnes.* **(p+4)** 26 $c. **(p+6)** 32: *cf. Ari:p-6;* 31 $c; 34 *omnes.* **(u+1 ... +5;32)** 1, 9, 18, 27, 32, 33 Lb, *cf. (t).* **(x-1)** 20: *cf. Aqr:g+1;* 21 $c; 25 *omnes.*

Capri cor nus Ho re	Mi	Lo ng it ud Mi	La ti tu do Mi	Aqua rius Ho re	Mi	Lo ng it ud Mi	La ti tu do Mi	Pis ces Ho re	Mi	Lo ng it ud Mi	La ti tu do Mi	Aries Ho re	Mi	Lo ng it ud Mi	La ti tu do Mi	Tau rus Ho re	Mi	Lo ng it ud Mi	La ti tu do Mi	Gem ini Ho re	Mi	Lo ng it ud Mi	La ti tu do Mi
5	0	45	30	5	8	39	38	5	32	33	42	6	0	32	44	6	28	33	42	6	52	38	39
4		41	35	5		37	40	5		32	43	5		31	43	6		33	42	6		40	35
3		32	39	4		32	41	4		27	44	4		32	41	5		32	39	5		40	31
2		23	41	3		23	43	3		*18*	43	3		20	38	4		34	35	4		41	26
1		12	43	2		14	44	2		9	41	2		10	34	3		*23*	31	3		30	20
.		.	.	1		*3*	43	1		- 1	38	1		0	30	2		15	26	2		21	16
.		.	.	.		.	.	.		.	.	.		.	.	1		5	20	1		9	12
Rec		0	44	Rec		- 9	41	Rec		13	34	Rec		-12	25	Rec		- 6	16	Rec		- 3	9
.		.	.	.		.	.	.		.	.	.		.	.	1		17	13	1		14	7
.		.	.	1		20	38	1		24	29	1		23	20	2		29	9	2		25	7
1		-12	43	2		32	33	2		34	24	2		32	16	3		38	7	3		35	7
2		23	41	3		41	29	3		43	19	3		41	12	4		45	7	4		42	8
3		32	39	4		47	24	4		50	14	4		49	9	5		51	7	5		51	11
4		41	35	5		50	19	5		52	11	5		52	6	6		53	8	6		51	15
5	0	45	30	5	8	50	18	5	32	53	9	6	0	53	6	6	28	53	9	6	52	50	19
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(b-5, b+5) *om.* Lb. **(c Rec)** 0: Lb $c; 9 Es Xg. **(g-1)** 3: $c, *cf. Sgr:x+1;* 20 *omnes.* **(L-3)** 18: *cf. Sco:t+3;* 19 $c; 4 *omnes.* **(o-6, o+6)** *om.* Lb. **(p-4)** 26 $c. **(t-4)** 30 $c. **(t-3)** 23: *cf. Vir:L+3;* 24 $c; 20 *omnes.* **(x-6)** 40: Lb; 49 Xg; 39 Es. **(x-4)** 36 $c. **(x-3)** 40 Es. **(x+5)** 48 $c.

HB41. Parallax, Climate 4.

Toomer 1968, no. 66.

Witnesses: **{a0}** Ct,28r-v; Oo,26r; Cq2,90. – **{a1}** Xa,32v; Ad,80v; Cq,58; Ps,71r; Sg,168-169; Wd,32v; Fh,54r-v; Xw,31v. – **{a2}** Md,94v-95r; Mp,225v. – **{aX}** Vo,63r-v; Xr,85v; Ov,99r-v. – **{aT}** Lu,73v; Oj,142v-143r; P,84r. – **{d}** Lb,44v; Pa,51r; A,230r; Fj,52r; Nc,132r; Fd2,53v; Gr3,124r; Ok,60r. – **{e}** Xc,76v; Vj,100r; Ej,83r; Vm,13v. – **{x}** Oc,90v; X,167v; Mv,106v; Cm,148r; B,158v; T,297r; Lf,108r; Lg,186v; Lh,153v; Xj,289v; Xg,71r; G,75r; Xb,90r; Es,196r; Fb,81r; Pq,200r; Oy,87v; Wa,75v; Nu,155v. – **{p}** Pd,46v.

Headings. – General. Essentially there is one heading, but there are many minor variants. I only quote the witnesses for a few of the more specific ones.

(1) Tabula diversitatis aspectus (+lunae) (+in longitudine longiori Vj Ej; +ad solem Mv Xg) **in climate quarto (/q.c.;** /c. Ov.ac Vm**) cuius latitudo (+est) 36 gr (+et) 24 (/45** Xc Vj Ej Vm; 4 Sg; 27 Wd) **mi** (et 24 mi: *om.* P, Oc Mv Cm B T Lf Lg Lh Xj Xg G Xb Es Pq Oy Wa Nu) **(+et) (+eius) horae (/h.e.) (+aequales** Ct Wd Md Lu P Ok Fb**) 14** (4 Nu; **+gra**(!) Wd Md Fb T) **(+et) 27** (7 Oc Cm Xb) **(+mi)** (et 27 mi: *om.* Cq2 Ov Ok) :: {a0:} Ct Oo Cq2; {a1:} Xa Ad Cq! Ps Sg Wd Fh Xw; {a2:} Md; {aX:} Ov! Vo Xr!; {aT:} Lu P; {d:} Ok!; {e:} Xc Vj Ej Vm!; {x-}.

(2) Tabula diversitatis aspectus in climate quarto, latitudo eius 36 24, horae eius (*om.* Lb Nc) **14, 27 mi** (*om.* Lb) :: {d:} Lb A Fj Nc Fd2! Gr3.

(3) Tabula diversitatis aspectus lunae in climate quarto, cuius latitudo est 36 gr et 24 mi, et dies eius longior 14 horarum aequalium (*om.* Pd) **et 27 mi** :: {aT:} Oj; {p:} Pd.

(4: other) :: Mp ("... in longitudine longiori"); Pa (5th climate, by mistake); X.

Sub-headings for Cancer:

(5) Horae cancri; (Cancer+ Fh Xw) **Diversitas aspectus** (*om.* Oj) **[Longitudo; Latitudo]** :: {a0:} Ct Oo Cq2; {a1:} Xa Ad Cq Wd Fh Xw; {aX:} Ov Xr; {aT:} Lu Oj P; {d:} Lb Pa A Fj Fd2 Gr3 Ok; {p:} Pd.

(6) Diversitas aspectus [Horae cancri; Longitudo; Latitudo] :: {a1:} Ps Sg; {a2:} Md.

(7) Horae cancri; Longitudo; Latitudo :: {a2:} Mp; {e:} Xc Ej; {x-}.

(8: other) :: Vo (much like Ps); Nc Vj Vm Mv Xg.

Tabular values. Recomputed for latitude 36;0° and obliquity 23;51°. This reproduces the parallax values markedly better than does the latitude of 36;24° from the table heading, whether this is combined with the obliquity of 23;51° or of 23;33°.

At Vir:m+2 and at Lib:pRec, the readings used for constructing HA11 (q.v.) were no doubt "28" and "16", as found in all witnesses. They have nevertheless been corrected in the text.

In the sub-table for Cancer, the entrances "7 a.m." and "7 p.m." are missing. The proper values for entrance "7h;14" should be about (41,34) (recomputed for 7;14h, and corroborated from (41,35), the outermost values for Capricorn; see H* above); the present values look more like those recomputed for 7 hours (=(42,33)). So probably the outermost values have disappeared, and the label "7,14" has been attached to those for 7 hours. I have marked the text correspondingly, though without moving the label "7;14". – In Leo and Gemini, the half-day values expected are 7;3 or 7;4, cf. "Entrance values" below; but neither these labels nor the corresponding entries are present. I have marked the text as if they were missing. A guess at the proper values is (49,24) and (33,42), the outermost values for Sagittarius and Aquarius. These may not seem significantly different from the 7-hour values that are now the outermost ones in Leo and Gemini.

Entrance values. Below, the series of half-day values in the present table (="HB41") is compared to:

`A:` the series found from latitude 36;24° (as in the heading) and obliquity 23;33°; cf. preamble HB*. It is the same as the series found from latitude 36;0° and obliquity 23;51°, used for recomputing the body of the table.

`HB42:` the series shown by ms. Ea, uncorrected; see section HB42 for refs. It is the same as in the Albatenian table HC41, which is for latitude 36° and obliquity 23;51°. Thus it should be the same as (A); in fact it differs from it by showing the values 7;4 / 4;56, as does Albattani.

`B:` the series found from latitude 36;24° and obliquity 23;51°.

	Cnc	Leo	Vir	Lib	Sco	Sgr	Cap	Aqr	Psc	Ari	Tau	Gem
HB41:	7;14	7<*>	6;36	6	5;16	5	4;45	5	5;28	6	6;36	7<*>
A:	7;15	7; 3	6;35	6; 0	5;25	4;57	4;45	4;57	5;25	6; 0	6;35	7; 3
HB42:	7;15	7; 4	6;35	6	5;25	4;56	4;45	4;56	5;25	6	6;35	4; 4
B:	7;16	7; 4	6;35	6; 0	5;25	4;56	4;44	4;56	5;25	6; 0	6;35	7; 4

At Sco and Psc one should read "5;24" to match Vir and Tau. The value for Cnc, probably misplaced, disagrees with that for Cap, and is perhaps altered to suit the day-length value in the heading.

The hour values "7" and "5" (Leo Sgr Aqr Gem) are false but agree with each other, so they cannot be repaired. Perhaps there were extra entries for the expected "7;3" or "7;4", now gone like the outer entries for Cnc, see "Tabular values" above; if so, "5" is a false adaptation to "7". On the whole, the series is so corrupt that it is unwise to guess at parameters.

Text. Collated for values: **{a0}** Ct Oo; **{a1}** Xa Cq; **{aT}** Lu; **{d}** Pa A; **{d?}** Lb; **{e}** Xc; **{x}** Es Xg. – Headings according to Xa. – Layout: Xa Oo Cq Lu Pa A Es Xg have six sub-tables across the page; Ct has four across the page. I follow the layout of Xa etc. – Also noted on occasion: **$c:** re-computation; for the parameters, see "Tabular values". Only quoted for variants in parallax values, and only where the value differs by 2′ or more from the one adopted.

Readings chosen, italicized readings, etc.: see notes to HB*. The entrance values are corrupt, as was seen above. I reproduce the uncorrected values.

Variant groups. There are several errors common to the whole tradition, e.g., at Lib:pRec and in several of the places marked in the text below. None of these happen to be typical Abjad errors.

A well-defined group is *Pa A Lb Es Xg* (errors, e.g., at Aqr:h+4, Gem:x+3, and at Lib:p-4, with attempt at correction in *Xg*?). Abjad-type errors are found at Psc:L+5, Ari:p+5, Tau:t+6. In these and other places (e.g., Tau:t-4, Tau:t+2), *Pa* may leave the group; this is often due to corrections which are recognizable as such. Sub-groups are *Pa A* (Ari:p-6, p-5; Ari:q-6) and perhaps *Lb Es Xg* (Leo:g-7 only); Es Xg are not observed to form a group alone.

At Leo:g+1 there is an Abjad error in *Ct Oo Xa Cq Xc,* and in *Lu,* if the reading "10" in Lu is an attempted correction for the error "50". At Vir:(L-5)--(L-3), *Ct Oo Xa Cq* show a corrupt sequence, and *Xc* has tried to correct it.

Thus *Ct Oo Xa Cq Xc (Lu)* and *Pa A Lb Es Xg* seem to form independent error groups, each with at least one Abjad error against the other. It is true that Ct Oo Xa Cq Xc only have two clear errors, and that these are conspicuous enough to be liable to correction from symmetry. In this way, indeed, the reading "48" shown by Pa A Lb Es Xg (and by Lu) at Vir:L-5, which is imprecise but not as plainly wrong as in Ct and others, could be a copy from Tau:t+5 where it is general. If the likely readings shown by Pa A Lb Es Xg in these places are not due to such corrections, then the two groups are independent transcriptions from the Arabic, in part or in whole.

Peculiarly enough, Es Xg, of Group {x}, seem entirely dependent on Lb and on Pa A (Group {d}) rather than on the vulgate. As usual, the status of Lu is indeterminate; its errors are mainly the same as the general ones, though it seems to share the error Leo:g+1 with the vulgate.

Tabula diversitatis aspectus in climate quarto,
cuius latitudo est 36 gr et 24 mi, et eius horae 14 et 27 mi.

		Diversitas aspectus				Diversitas aspectus				Diversitas aspectus				Diversitas aspectus				Diversitas aspectus				Diversitas aspectus	
Horae cancri		Longitud Mi	Latitudo Mi	Horae leonis		Longitud Mi	Latitudo Mi	Horae virginis		Longitud Mi	Latitudo Mi	Horae librae		Longitud Mi	Latitudo Mi	Horae scorpionis		Longitud Mi	Latitudo Mi	Horae sagittarii		Longitud Mi	Latitudo Mi
<*	*	*	*>	<*	*	*	*>																
7	14	42	33	7		49	23	6	36	51	14	6		52	12	5	16	52	14	5		49	24
6		43	28	6		50	19	6		52	14	5		51	12	5		51	16	4		45	28
5		42	24	5		47	15	5		*48*	13	4		47	14	4		45	19	3		35	32
4		38	20	4		41	14	4		*44*	12	3		42	15	3		41	23	2		30	37
3		31	16	3		34	12	3		*38*	12	2		32	20	2		33	27	1		20	41
2		23	14	2		25	12	2		29	14	1		21	27	1		22	32	.		.	.
1		12	12	1		15	12	1		19	16	.		.	.	.		.	.	.		.	.
Rec		0	12	Rec		4	14	Rec		8	21	Rec		*12*	29	Rec		14	37	Rec		10	43
1		-12	12	1		- 7	16	1		- 2	25	.		.	.	.		.	.	.		.	.
2		23	14	2		17	21	2		11	*29*	1		0	33	1		3	41	.		.	.
3		31	16	3		25	25	3		21	34	2		-10	38	2		- 8	44	1		- 2	47
4		38	20	4		32	29	4		25	41	3		16	41	3		16	45	2		13	47
5		42	24	5		35	35	5		28	43	4		23	43	4		23	46	3		22	46
6		43	28	6		36	39	6		29	44	5		26	46	5		27	46	4		29	44
7	14	42	33	7		34	41	6	36	30	45	6		27	47	5	16	30	45	5		33	42
<*	*	*	*>	<*	*	*	*>																
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(a Rec) azawel id est recessio Ct, *ubique;* recessio Oo Xa Cq Lu, *ubique;* reces() Xc, *ubique;* rec() Es Xg, *ubique;* remotio Pa A Lb, *ubique.* **(a+2)** 1 A. **(c-2)** 33 Cq. **(c+5)** 43 Es.ac. **(c+7;14)** 44 A. **(d-7;14)** 23 Lu. m(eridies) *add.* Lu. **(d+7;14)** *n.l.* Oo. **(f-7, f+7)** 0, 0 Es Xg. **(+f-7)** 4 (?) Es.?ac. **(g-7)** 59 Lb Es Xg. **(g+1)** 50 Ct Oo Xa Cq Xc; 10 Lu; 8 $c. **(h-7)** m(eridies) *add.* Lu. **(k-6;36)** 26 Oo. **(L-6;36)** 50 Oo. **(L-6)** 5 Xc. **(L-5--L-3)** 48, 44, 38: Lu, *cett.;* 50, 45, 38 $c; 8, *(vacat)*, 44 Ct Oo Xa Cq; 52, 8, 44 Xc. **(m+2)** 29: *cf. Tau:u-2;* 30 $c; 28 *omnes.* **(m+3)** 30 Xc. **(m+4, m+5)** *vacat,* (41,43) Cq. **(+m+4)** 38 $c. **(o-6, o+6)** 0, 0 Es Xg. **(p-4)** 40 Lb Pa A Es; 50 Xg. **(p-1)** 23 $c. **(p Rec)** 12: *cf. Ari:pRec;* 13 $c; 19 *omnes.* **(p+1, p+2)** 3, 7 $c. **(q-3)** 17 $c. **(q-1)** 25 $c. **(t-5;16)** 55 Xc. **(t-1)** 32 Es; 25 $c. **(t-4)** 48 $c. **(w-5, w+5)** 0, 0 Es Xg. **(x-3)** 39 $c. **(x+4)** 22 Oo. **(x+5)** 23 Xg.

Horae capri corni		Lo ng it ud Mi	La ti tu do Mi	Horae aqua rii		Lo ng it ud Mi	La ti tu do Mi	Horae pis cis		Lo ng it ud Mi	La ti tu do Mi	Horae arie tis		Lo ng it ud Mi	La ti tu do Mi	Horae tau ri		Lo ng it ud Mi	La ti tu do Mi	Horae gemi norum		Lo ng it ud Mi	La ti tu do Mi
																				<*	*	*	*>
4	45	41	35	5		33	42	5	28	30	45	6		27	47	6	36	30	45	7		34	41
4		39	38	4		29	44	5		27	46	5		26	46	6		29	44	6		36	39
3		31	41	3		22	46	4		23	46	4		23	43	5		28	43	5		35	35
2		23	44	2		13	47	3		16	45	3		16	41	4		25	41	4		32	29
1		11	45	1		2	47	2		8	44	2		10	38	3		21	34	3		25	25
.		.	.	.		.	.	1		- 3	41	1		- 0	33	2		11	29	2		17	21
.		.	.	.		.	.	.		.	.	.		.	.	1		2	25	1		7	16
Rec		0	47	Rec		-10	43	Rec		14	37	Rec		12	29	Rec		- 8	21	Rec		- 4	14
.		.	.	.		.	.	.		.	.	.		.	.	1		19	16	1		15	12
.		.	.	.		.	.	1		22	32	1		21	27	2		29	14	2		25	12
1		-11	45	1		20	41	2		33	27	2		32	20	3		38	12	3		34	12
2		23	44	2		30	37	3		41	23	3		42	15	4		44	12	4		41	14
3		31	41	3		35	33	4		45	19	4		47	14	5		48	13	5		47	15
4		39	38	4		45	28	5		51	16	5		51	12	6		52	14	6		50	19
4	45	41	35	5		49	24	5	28	52	14	6		52	12	6	36	51	14	7		49	23
																				<*	*	*	*>
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(c-4) 29 Oo. **(c-2)** 29 Xc. **(c+2)** 24 Lb Pa A Es Xg. **(f-5, f+5)** 0, 0 Es Xg. **(g+3)** 30 Lb Pa.ac? A Es Xg; 39 $c. **(g+4)** 42 Xc. **(g+5)** 41 Lb A Es Xg. **(h-5)** 43 Lb Pa A Es Xg. **(h-4)** 42 Lb Pa A Es Xg. **(h+2)** 47 Xc. **(h+4)** 58 Lb Pa A Es Xg. **(j+5)** *vacat* A. **(L+1)** 25 $c. **(L+2)** 23 Pa. **(L+4)** 48 $c. **(L+5)** 51: Pa, *cett.;* 11 Lb A Es Xg. **(o-6, o+6)** 0, 0 Es Xg. **(p-6, p-5)** 27, 26: 26, 27 Pa A. **((p-2)--(p+4))** 8, 3, 14, 22, 33, 41, 45 Oo, *cf. col. (L).* **(+p-2, p-1)** 7, 3 $c. **(p+1)** 31 Xc; 23 $c. **(p+3)** 32 Xc. **(p+5)** 11 Lb A Es Xg. **(q-6)** 45 Pa A. **(q+1)** 25 $c. **(q+3)** 17 $c. **(s-6;36, s+6;36)** *n.l.* Oo. **(t-4)** 25: Pa.pc, *cett.;* 45 Lb A Es Xg; <-> Pa.ac. **(t+2)** 29: Pa.pc, *cett.;* 14 Lb A Es Xg; <--> Pa.ac. **(t+5)** 50 $c; *n.l.* Oo. **(t+6)** 12 Lb A Es Xg, Pa.ac?. **(u-4)** 38 $c. **(v-7, v+7)** 6, 6 Xg. **(w-7, w+7)** 0, 0 Es Xg. **(x-3)** 35 A. **(x+3)** 39 Lb Pa A Es Xg. **(y-4)** 24 A. **(y+4)** 14 *vel* 18 Xa; 18 Xc.

HB42. Parallax, Climate 4, variant.

Ea,49r: "Clima quartum cuius latitudo est 36, horae 14 30". The half-day values in the "Horae" columns are the same as in table HC41; cf. notes to HB41, section "Entrance values".

The values in the body of the table are essentially the same as in HB41: thus, here too, the outer entries expected for Cnc, and perhaps for Leo and Gem, are missing. At Vir:L-5...L-3 the text has a corruption much as in the vulgate, but at Leo:g+1 it correctly reads "7" against the vulgate. I have not checked any other readings.

Since the text of ms. Ea has been observed to be archaic in other respects (cf. T:06(20)), the half-day values cannot be dismissed as a late contamination. I have not, however, seen these values in other copies of HB41.

HB51. Parallax, Climate 5.

Toomer 1968, no. 67.

Witnesses: **{a0}** Ct,29v-30r; Oo,27r; Cq2,92; Pz,130v; Mc,28v; Mb,58r-v; Ea,50r. – **{a1}** Xa,33v; Ad,81v; Cq,59; Ps,71v; Sg,172; Wd,33v; Fh,56r-v; Xw,32v. – **{a2}** Md,96v-97r; Mp,226v (see below). – **{aX}** Vo,64r-v; Xr,86v; R,65v; Ov,101r-v. – **{aT}** Lu,74v; Oj,143v-144r; P,84v. – **{d}** Mh,10v. – **{e}** Xc,77v; Vj,101r; Ej,84r; Vm,14r. – **{p}** O,86v-87r; Pd,77v-78r; Ch2,177r. – **{?}** Ew1,32v-33r; Pn,49v (:Jo. Lin.). —— Mp,226v has a table with blank entrances and values; it is likely to be intended as HC52, q.v.

Headings. – General. A number of lesser variants have been ignored.

(1) Tabula diversitatis (t.d.: **/Diversitas** Ov R O Pd Ew1) **aspectus** (-torum *(sic!)* Vo Xr; *om.* Cq2; **+lunae** Ct Ea Cq2 Ov Sg Md Lu P Xc Vj; **+in longitudine longiori** R Vj Ej O Pd Pn) **in climate quinto, cuius latitudo est 41** (40 Ch2 Ew1) **gra (+et) 44** (et 44: *om.* Xw) **mi, (+et) (+eius) horae (/h.e.) (+aequales** Ct Ea Lu P; **+diei** O Pd) **15** (+gradus Ct; **+secundum Theun Alexandrinum** R Xc) **(et) 0** (/9 Xa Ad Sg Fh Xw Vo.pc; /d' Cq2; /70 Vo.ac) **(+mi)** (et 0 mi: *om.* Ea Oo Ov Ps Wd Md R Lu P Xc Vj O Pd Ch2 Pn Ew1; *n.l.* Ct) :: {a0:} Ct Oo Cq2 Ea {a1:} Xa Ad Cq! Ov Ps! Sg! Wd Fh Xw; {a2:} Md; {aX:} Vo Xr! R; {aT:} Lu P!; {e:} Xc Vj Ej; {p:} O Pd Ch2: {?:} Pn Ew1!.
(2) Tabula diversitatis aspectus in climate quinto ad latitudinem 41 gr et 44 (41 Pz) **mi** :: {a0:} Pz Mc.
(3: other) :: Mb ("Tabula diversitatis aspectus"); Oj; Mh & Vm (blank).

Sub-headings for Cancer:

(4) Horae cancri; (Cancer+ Fh Xw) **Diversitas aspectus** (*om.* Oj) **[Longitudo; Latitudo]** :: {a0:} Ct Oo Cq2 Pz Mc Mb Ea; {a1:} Xa Ad Cq Wd Fh Xw; {aX:} Ov Xr R; {aT:} Lu Oj P; {p:} O Pd Ch2; {?:} Ew1.
(5) Diversitas aspectus [Horae cancri; Longitudo; Latitudo] :: {a1:} Ps Sg; {a2:} Md; {e:} Ej.
(6) Horae cancri; Longitudo; Latitudo :: {e:} Xc; {?:} Pn.
(7: other) (or deficient) :: Vo & Vj (much like Ps); Wd; Mh & Vm (blank).

Tabular values. Recomputed for latitude 40;56° and obliquity 23;51°. – Of the possibilities for latitude / obliquity I have tried, this one gives a decidedly better fit to the tabular values than does the latitude of 41;44 from the table heading (whether with obliquity 23;33° or 23;51°). However, with a latitude such as 41;16° (suggested by the preamble to HB*) and obliquity 23;51°, the fit is still better. Nevertheless I shall keep to the Almagest latitude, for uniformity with the rest of the tables. Compared to the recomputation using 41;16°, the present one adds 3 pairs of instances where the tabular values differ from expectation by 2′ or more, whereas 1 pair disappears; thus it does not make much difference for deciding between variants.

In each of the sub-tables for Gem, Leo and Cnc, one row is missing. A comparison with the expected values (and with the outermost values in Sgr, Aqr and Cap; cf. H*), makes it likely that the missing rows are the outer ones, so that the half-day entrance values have been re-used as labels for what are in fact the tabular values for 7 hours. I have put omission marks accordingly, though without moving the half-day values.

Entrance values. The half-day values for Sgr and Aqr should be corrected into 4;42 to make the set consistent. When this is done, the series is about as in HC51, though it still cannot be exactly derived from any reasonable parameter values.

Text. Collated for values: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** Lu; **{e}** Xc. – Headings according to Xa. – Layout: Oo Xa Cq Xg have six sub-tables across the page; Ct, four across the page. I follow the layout of Xa etc. – Also noted on occasion: **$c:** recomputation; for the parameters, see "Tabular values". Only quoted for variants in parallax values, and only where the value differs by 2′ or more from the one adopted.

Readings chosen, italicized readings, etc.: see notes to HB*. Since the recomputation is not optimal, some of the underscored values may in fact be sound.

At Sco:t+2, the reading used for constructing HA11 (q.v.) was no doubt "6", as found in all witnesses. It has nevertheless been corrected in the text below.

Variant groups. There are a few general errors, of which the most striking ones are Leo:g+3 + Gem:x-3; Vir:L+5 + Tau:t-5; Sgr:x-3 + Aqr:g+3; Cap:c-2 + c+2. The two coupled errors at Cnc:(d-5), (d+5) do not give the same grouping; only Lu is correct in both places, but Lu is not correct against the rest elsewhere. At Sco:s+5;19 Xa Cq show what may be a Roman-numeral error. In general, however, the tradition seems homogeneous.

Tabula diversitatis aspectus in climate quinto,
cuius latitudo est 41 gr et 44 mi, et eius horae 15 et +9+ mi.

		Diversitas aspectus				Diversitas aspectus	
Horae cancri		Longitudo Mi	Latitudo Mi	Horae leonis		Longitudo Mi	Latitudo Mi
<*	*	*	*>	<*	*	*	*>
7	30	39	38	7	18	46	28
6		41	32	6		48	23
5		40	*29*	5		45	21
4		36	24	4		41	19
3		29	21	3		33	17
2		20	19	2		24	17
1		10	18	1		15	17
Rec		0	17	Rec		5	19
1		-10	18	1		- 6	22
2		20	19	2		15	26
3		29	21	3		17	29
4		36	24	4		29	33
5		40	*29*	5		32	38
6		41	32	6		32	41
7	30	39	38	7	18	32	42
<*	*	*	*>	<*	*	*	*>
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

		Diversitas aspectus				Diversitas aspectus	
Horae virginis		Longitudo Mi	Latitudo Mi	Horae librae		Longitudo Mi	Latitudo Mi
6	41	50	20	6		51	17
6		50	18	5		51	17
5		49	17	4		47	18
4		44	17	3		40	21
3		38	17	2		32	24
2		29	19	1		24	28
1		20	22	.		.	.
Rec		9	25	Rec		14	32
1		0	29	.		.	.
2		- 8	33	1		5	37
3		16	38	2		- 4	41
4		23	41	3		12	44
5		28	44	4		18	47
6		27	47	5		22	49
6	41	24	48	6		23	50
(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

		Diversitas aspectus				Diversitas aspectus	
Horae scorpionis		Longitudo Mi	Latitudo Mi	Horae sagittarii		Longitudo Mi	Latitudo Mi
5	19	51	20	4	52	44	31
5		50	21	4		43	32
4		48	24	3		34	36
3		41	28	2		30	41
2		34	32	1		20	44
1		25	37	.		.	.
.		.	.	.		.	.
Rec		15	41	Rec		10	47
.		.	.	.		.	.
1		5	44	.		.	.
2		- *5*	47	1		0	49
3		12	49	2		-10	49
4		19	49	3		19	49
5		23	49	4		26	47
5	19	25	48	4	52	27	47
(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(a Rec) azawel id est recessio Ct, *ubique;* recessio Pz Xa Cq Lu, *ubique;* reces(us) Xc, *ubique.* **(b-7;30)** *om.* Xc. **(b+7;30)** 0 Cq; *om.* Xa Xc. **(c-7;30)** 29 Xc. **(c-5)** 41 Oo. **(c-4)** 30 Xc. **(c+7;30)** 29 Xc. **(d-7;30)** 36 $c. **(d-5)** 29: Pz Xa Cq Lu; 28 $c; 39 Ct; 33 Oo; 20 Xc. **(d+5)** 29: Lu Xc; 28 $c; 39 Ct Oo Pz Xa Cq. **(d+7;30)** 36 $c. **(e,f +7;18)** (17,8) Xa *ut vid.* **(f+7;18)** 48 Oo. **(g Rec)** 15 Xc. **(g+3)** 23 $c. **(g+7;18)** 30 $c. **(h-6)** 29 Xc. **(h+6)** 40 Cq. **(h+7;18)** 44 $c. **(L-6;41)** 50 *vel* 51 Cq. **(L-6)** 51 Cq. **(L-4)** 47 Xc. **(L+4)** 24 Ct. **(L+5)** 25 $c. **(L+6)** 20 Xc. **(p-6, p-5)** 15, 15 Xc. **(q-6)** 16 Ct. **(q-3)** 20 Ct. **(q+1)** 47 Xc. **(q+6)** 48 $c. **(s+5;19)** 49 Xa Cq. **(t+2)** 5: *cf. Psc:L-2;* 4 $c; 6 *omnes.* **(t+3)** 17 Xc. **(v,w -4;52, -4)** 4, (2, 50, 4) (!) Xc. **(v,w +4;52)** (2, 4, 50) (!) Xc. **(x-3)** 44 Pz; 37 $c. **(x+3)** 10 Xc. **(x+4;52)** 29 $c. **(y-4;52)** 28 $c. **(y+4;52)** 45 $c.

Horae capri corni		Lo ng it ud Mi	La ti tu do Mi	Horae aqua rii		Lo ng it ud Mi	La ti tu do Mi	Horae pis cis		Lo ng it ud Mi	La ti tu do Mi	Horae arie tis		Lo ng it ud Mi	La ti tu do Mi	Horae tau ri		Lo ng it ud Mi	La ti tu do Mi	Horae gemi norum		Lo ng it ud Mi	La ti tu do Mi
																				<*	*	*	*>
4	30	38	39	4	52	27	47	5	19	25	48	6		23	50	6	41	24	48	7	18	32	42
4		35	41	4		26	47	5		23	49	5		22	49	6		27	47	6		32	41
3		29	44	3		19	49	4		19	49	4		18	47	5		28	44	5		32	38
2		17	47	2		10	49	3		12	49	3		12	44	4		23	41	4		29	33
1		9	49	1		0	49	2		5	47	2		4	41	3		16	38	3		17	29
.		.	.	.		.	.	1		- 5	44	1		- 5	37	2		8	33	2		15	26
.		.	.	.		.	.	.		.	.	.		.	.	1		0	29	1		6	22
Rec		0	50	Rec		-10	47	Rec		15	41	Rec		14	32	Rec		- 9	25	Rec		- 5	19
.		.	.	.		.	.	.		.	.	.		.	.	1		20	22	1		15	17
.		.	.	.		.	.	1		25	37	1		24	28	2		29	19	2		24	17
1		- 9	49	1		20	44	2		34	32	2		32	24	3		38	17	3		33	17
2		17	47	2		30	41	3		41	28	3		40	21	4		44	17	4		41	19
3		29	44	3		34	36	4		48	24	4		47	18	5		49	17	5		45	21
4		35	41	4		43	32	5		50	21	5		51	17	6		50	18	6		48	23
4	30	38	39	4	52	44	31	5	19	51	20	6		51	16	6	41	50	20	7	18	46	28
																				<*	*	*	*>
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(c-4) 37 Oo. **(c-2)** 20 $c. **(c-1)** 11 $c. **(c+1)** 11 $c. **(c+2)** 20 $c. **(c+3)** 20 Xc. **(c+4)** 25 Xc. **(d-4)** 47 Xc. **(d-2)** 41 Xc. **(e,f -4;52, -4, -3, -2)** 50, (2,4), 4, (3,2) (!) Xc. **(e,f +4;52)** (2, 50) Xc. **(g-4;52)** 29 $c. **(g-3)** 29 Xc. **(g+3)** 44 Pz; 37 $c. **(h-4;52)** 45 $c. **(h+4;52)** 28 $c. **(k+5;19)** 18 Ct; 19 Xa *sed partim in ras.* **(m-5;19)** xo *vel* xq Cq. **(q-6)** 48 $c. **(q-5)** 59 Xa. **(q+4)** 28 Oo. **(t-6;41)** 23 Ct. **(t-5)** 25 $c. **(u-4)** <->1 Xa. **(u+6;41)** 2 Lu. **(x-7;18)** 30 $c. **(x-3)** 23 $c. **(x+3)** 33 *vel* 32 Cq. **(x+6)** *n.l.* Oo. **(y-7;18)** 44 $c. **(y-6)** 40 Xc. **(y+5)** 20 Xc. **(y+6)** 33 Pz.

HB61. Parallax, Climate 6.

Toomer 1968, no. 68.

Witnesses: **{a1}** Fc,49v; Ps,72r (secondary). – **{a2}** Mp,227r (entrances and values blank). – **{aX}** S,102r. – **{aT}** Ek1,40v. – **{d}** Lb,45v; Pa,52r; A,231r; Fj,53r; Nc,133r; Fd2,54v; Gr3,125r. – **{x}** Oc,92r; X,169r; Mv,107v; B,159v; T,297v; Lf,109r; Lg,188v; Lh,154v; Xj,290v; Xg,72r; G,76r; Xb,91v; Es,197r; Fb,82r; Pq,201r; Oy,88v; Wa,76v; Ow,169v; Nu,156v. – **{?}** Pn,50r (:Jo. Lin.); Fc2,115r (:Jo. Lin.).

Headings. – General: The intended (though incorrect) values for latitude and day-length appear to be 45°53′ and 15h;28, but certain witnesses introduce values like 45°22′ and 15h;30, from HC61 and Albattani, partly or wholly. A common, and apparently early, variant for the latitude is 48°53′. This does not agree with the day-length in this climate, nor have I seen it as a value for the seventh climate, where it would be better suited.

(1) Diversitas (/Tabula (-ae Ps) **diversitatis** Ps Lb**) aspectus in climate sexto** (+in longitudine media Nc) **latitudo eius 45** (48 Lb; +gr Ps) **53** (43 Nc; 52 Fd2; +mi Ps) **horae (+eius** Fj Fd2) **15** (+et Ps) **28 mi** (*om.* Lb) :: {a1:} Ps; {d:} Lb A Fj Nc! Fd2 Gr3.

(2) Tabula diversitatis aspectus lunae in climate sexto (/s.c.) cuius latitudo est (*om.* Mp Oc Xb Pn) **45** (=Mp Oc Xb Lf Es Wa Pn Fc2; **/48** *cett.*) **(+gr) 53** (24 Mp Pn Fc2; 12 Oc; 22 Es Xb) **mi (+et) horae (+eius) 15 (+et) 28** (30 Mp Xb Es; 13 Oc; 38 Wa) **mi** (+horae Pn Fc2) :: {a2:} Mp!; {x:} Oc Xb Es Mv B Lf Lg Lh Xj Xg G Pq Wa! Ow! Nu; {?:} Pn Fc2. – *Added:* +ad longitudinem <--> Mp; +supponens lunam in longitudine longiori Oc; +supponens lunam in lo(n) <*> Xb.

(3: other) Fc ("T. diversi asp. in cl. 6 cuius lat. est 45 graduum et 27 minut() et dies eius maior 16 horarum et 36 minut()"); S ("T. div. asp. ad latitudinem <**> climatis quae est 48 gra 53 m'a horae 15 28 m'a"); Pa (45°53′, 15h;28, in a secondary hand); X (no numbers); T (numbers gone); Fb (44°53′, 15h); Oy (48°53′, 15h, "...luna in longitudine longiori"); Ek1 (48°59′, 15h).

Sub-heading for Cancer:

(4) Horae cancri; Diversitas aspectus [Longitudo; Latitudo] :: {a1:} Fc; {d:} Lb Pa A Fj Fd2 Gr3.
(5) Horae cancri; Longitudo; Latitudo :: {a2:} Mp; {x-}; {?:} Pn.
(6: other) :: Ps; S (like Fc but with "cancer, horae" for "horae cancri", etc.); Nc Mv Xg Fc2 Ek1.

Tabular values. Recomputed for latitude 45;1° and obliquity 23;51°. – The Ptolemaic latitude here employed fits the tabular values markedly better than does the latitude 45;53° stated in the heading (whether with obliquity 23;33° or 23;51°) and also somewhat better than does latitude 45;25° (for this possibility, see the preamble to HB*, and cf. the heading of ms. Fc above) with obliquity 23;51°. I have not tried any other parameters.

In each of the sub-tables for Gem and Leo, one row is missing (though not in the sub-table for Cnc, perhaps by an accident of layout). A comparison with the expected values, and with the outermost values for Sgr and Aqr (cf. H*), makes it likely that the missing rows are the outer ones, so that the half-day labels "7;28" are attached to what are in fact the values for 7 hours.[1] I have put omission marks accordingly, though without moving the half-day labels.

Entrance values. The half-day values are corrupt.[2] Below, they are compared to **(HC61:)** the values from HC61, which may be obtained from latitude 45;1° and obliquity 23;51°; and to **(a:)** a set found from latitude 45;53°, as the table heading reads, and obliquity 23;33°. Other series with realistic parameters agree with these within 1 minute.

---

1 Toomer (1968 p.105) recognizes that some entries have been omitted, but takes them to be those for 1 hour before noon and 1 hour after noon. This is unlikely, since these values, and the neighbouring ones, are all within 1′ of the recomputed values.

2 Seen by Toomer 1968, p.105. He guesses at 7;44 for Cancer (=half the day-length in the headings), and does not try to correct the rest of the values.

	Cnc	Leo	Vir	Lib	Sco	Sgr	Cap	Aqr	Psc	Ari	Tau	Gem
Vulgate:	7;48	7;28	6;28	6	5;16	4;30	4;20	4;30	5;16	6	6;28	7;28
ms. Fc:	7;46											7;30
HC61:	7;45	7;28	6;48	6; 0	5;12	4;32	4;15	4;32	5;12	6; 0	6;48	7;28
(a):	7;47	7;29	6;49	6; 0	5;11	4;31	4;13	4;31	5;11	6; 0	6;49	7;29

If the gross errors in Vir and Tau are corrected into 6;48, the series is comparable to that of HC61. It is still largely incoherent, and the half-day values for Cnc and Cap do not agree with each other nor with the value in the heading.

Text. Collated for values: **{a1}** Fc; **{d}** Pa A; **{d?}** Lb; **{x}** Es Xg. — Headings according to A. — Also noted on occasion: **$c:** re-computation; for the parameters, see "Tabular values". Only quoted for variants in parallax values, and only where the value differs by 2′ or more from the one adopted.

Readings chosen, italicized readings, etc.: see remarks to HB*.

Variant groups, etc. There are errors common to all witnesses, e.g., Sco:tRec / Psc:LRec; Sgr:x+2 / Aqr:g-2, and several others. There are no clear Abjad-type errors except one in Fc, to be mentioned shortly.

Ms. *Fc* often preserves symmetry where the rest destroy it and have less plausible readings, thus at Leo:g-4; Leo:h+1; Vir:m-6; Aqr:g+3; Cnc:d-4 (with Es); Psc:m-3 (majority reading as plausible as Sco:u+3). This is possibly due to correction from symmetry alone: indeed, Fc does not show good readings where the majority shows symmetrical values that are both in error. On the other hand, no plainly false readings have been replicated by mistake. At Cap:c-3 + Cap:c+3, and at Sco:t-3 (where the symmetrical reading Psc:L+3 is faulty in Fc as in the rest), Fc shows plausible values that happen to be the mean between their neighbours, but if this is due to interpolation, at least it does not seem to be applied elsewhere. Fc is often in error alone so that it destroys symmetry, thus at Psc:L+2 (inexplicably), Sco:s-5;16 (entrance value, Abjad-type error). On the whole, then, it is not clear whether Fc is independent of the rest, or partially corrected, or both. I choose not to trust Fc even where the reading is plausible, unless it has some support from the recomputation and the symmetrical value, which is the case as often as not.

Of the usual error groups, *Es Xg* is instanced at Leo:g+7;28, Cap:c-3, Aqr:g+3, Psc:L+4, Gem:y+5, *Lb Es Xg* perhaps at Ari:p+4.

Diversitas aspectus lunae in climate 6,
latitudo eius 45 53, horae 15 28 mi.

Horae cancri		Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi	Horae leonis		Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi
				<*	*	*	*>
7	48	34	42	7	28	44	31
7		37	40	6		46	27
6		40	35	5		44	23
5		37	33	4		*40*	21
4		33	27	3		32	20
3		28	24	2		23	20
2		20	22	1		14	20
1		10	20	.		.	.
Rec		0	20	Rec		5	23
1		10	20	.		.	.
2		20	22	1		5	*24*
3		28	24	2		13	28
4		33	27	3		22	32
5		37	33	4		26	35
6		40	35	5		30	40
7		37	40	6		30	43
7	48	34	42	7	28	28	46
				<*	*	*	*>
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

Horae virginis		Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi	Horae librae		Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi
6	28	50	23	6		51	20
6		50	*22*	5		50	20
5		47	*20*	4		46	22
4		43	20	3		41	24
3		36	20	2		33	27
2		29	22	1		24	31
1		20	24	.		.	.
.		.	.	.		.	.
Rec		10	28	Rec		15	35
.		.	.	.		.	.
1		1	32	.		.	.
2		7	35	1		4	39
3		14	40	2		3	42
4		20	43	3		10	46
5		23	44	4		15	48
6		24	49	5		19	50
6	28	22	50	6		19	51
(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

Horae scorpionis		Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi	Horae sagittarii		Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi
5	16	49	23	4	30	43	32
5		48	24	4		41	35
4		46	27	3		36	39
3		31	31	2		29	42
2		32	35	1		20	45
1		24	38	.		.	.
.		.	.	.		.	.
.		.	.	.		.	.
Rec		12	42	Rec		11	48
.		.	.	.		.	.
.		.	.	.		.	.
1		5	46	.		.	.
2		3	48	1		0	50
3		11	50	2		11	51
4		15	51	3		16	50
5		21	50	4		24	49
5	16	22	50	4	30	25	48
(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(a Rec) recessio Fc, *ubique;* rem(oti)o Lb Pa A, *ubique;* rec() Es Xg, *ubique.* **(b-7;48, b+7;48)** 46, 46 Fc. **(c-6)** 38 $c. **(c+6)** 38 $c. **(d-5)** 32 Fc; 31 $c. **(d-4)** 27: Fc Es $c, *cf. Cnc:d+4;* 37 Lb Pa A Xg. **(d+5)** 31 $c. **(g-4)** 40: Fc, *cf. Gem:x+4;* 39 $c; 41 *cett.* **(g-2)** 24 A; 33 Es.ac. **(g+7;28)** 38 Es Xg. **(h+1)** 24: Fc, *cf. Gem:y-1;* 25 $c; 23 *cett.* **(L-6;28)** 48 $c. **(L-5)** 46 Fc. **(L+5)** 24 Fc. **(L+6)** 22 $c. **(m-6)** 22: Fc, *cf. Tau:u+6;* 21 $c; 23 *cett.* **(m-5)** 20: $c, *cf. Tau:u+5;* 22 *omnes.* **(m Rec)** 33 Fc; (28,0) Es. **(m+5)** 46 $c. **(m+6)** 45 Fc. **(o-6, o+6)** 0 Es Xg. **(p-6)** 5 A. **(p-2)** 32 Fc. **(p+1)** 6 $c. **(p+2)** 6 Fc. **(q-6)** 15 Fc. **(q+1)** 29 Fc. **(q+5, q+6)** 51, 50 Pa. **(s-5;16)** 56 Fc. **(t-3)** 39 Fc; 40 $c. **(t-2)** 34 $c. **(t Rec)** 16 $c. **(t+1)** 7 $c. **(x+2)** 8 $c.

Horae capricorni		Diversitas aspectus Longitudo Mi	Latitudo Mi	Horae aquarii		Diversitas aspectus Longitudo Mi	Latitudo Mi	Horae piscium		Diversitas aspectus Longitudo Mi	Latitudo Mi	Horae arietis		Diversitas aspectus Longitudo Mi	Latitudo Mi	Horae tauri		Diversitas aspectus Longitudo Mi	Latitudo Mi	Horae geminorum		Diversitas aspectus Longitudo Mi	Latitudo Mi
																				<*	*	*	*>
4	20	35	41	4	30	25	48	5	16	22	50	6		19	51	6	28	22	50	7	28	28	46
4		33	41	4		24	49	5		21	50	5		19	50	6		24	49	6		30	43
3		27	46	3		16	50	4		15	51	4		15	48	5		23	44	5		30	40
2		19	49	2		11	51	3		11	51	3		10	46	4		20	43	4		26	35
1		12	50	1		0	50	2		3	48	2		3	42	3		14	40	3		22	32
.		.	.	.		.	.	1		5	46	1		4	39	2		7	35	2		13	28
.		.	.	.		.	.	.		.	.	.		.	.	1		1	32	1		5	24
.		.	.	.		.	.	.		.	.	.		.	.	.		.	.	.		.	.
Rec		0	51	Rec		11	48	Rec		12	42	Rec		15	35	Rec		10	28	Rec		5	23
.		.	.	.		.	.	.		.	.	.		.	.	.		.	.	.		.	.
.		.	.	.		.	.	.		.	.	.		.	.	1		20	24	1		14	20
.		.	.	.		.	.	1		24	38	1		24	31	2		29	22	2		23	20
1		12	50	1		20	45	2		32	35	2		33	27	3		36	20	3		32	20
2		19	49	2		29	42	3		31	31	3		41	24	4		43	20	4		40	21
3		*27*	46	3		*36*	39	4		46	27	4		46	22	5		47	20	5		44	23
4		33	41	4		41	35	5		48	24	5		50	20	6		50	22	6		46	27
4	20	35	41	4	30	43	32	5	16	49	23	6		51	20	6	28	50	23	7	28	44	31
																				<*	*	*	*>
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(c-3) 27: Pa A Lb $c; 26 Fc; 37 Es Xg. **(c-1, c+1)** 10, 10 $c. **(c+3)** 27: $c, *cf. Cap:c-3;* 26 Fc; 23 *cett.* **(c+4;20)** 23 Lb. **(g-2)** 8 $c. **(g+3)** 36: Fc $c, *cf. Sgr:x-3;* 30 Lb Pa A; 39 Es Xg. **(h-4)** *gem.* A. **(j+5)** *vacat* Fc. **(L-1)** 7 $c. **(L Rec)** 16 $c. **(L+2)** 26 Fc; 34 $c. **(L+3)** 31: Lb, *cett.;* 40 $c. **(L+4)** 36 Es Xg. **(L+5)** *vacat* Fc. **(m-3)** 50 Fc. **(m-2)** 44 A. **(o-6, o+6)** 0 Es Xg. **(p-1)** 6 $c. **(p+4)** 40 Lb Es Xg. **(p+5)** 40 Xg. **(t-6)** 22 $c. **(t-2)** 6 Fc. **(t+1)** 29 Fc. **(t+2)** 22 Fc. **(t+6;28)** 48 $c. **(u-5)** 46 $c. **(w-7;28, w+7;28)** 30 Fc. **(x-2)** 12 Fc. **(y+5)** 13 Es Xg. **(y+6)** 37 Fc.

HC. Parallax tables for climates, Albatenian.

Toomer 1968, no. 69-74. – All these tables are from Albattani (Nallino II p. 95-101). The values are essentially the same as in the Handy Tables (Stahlman no. 28-34; cf. Toomer 1968 p.97 and 110).

Canons. See generally under H*. Dedicated canons are Ca158-169, which are excerpts from Albattani, including the express assignment of the tables to Theon of Alexandria (i.e., to the Handy Tables). The canons presuppose that tables are present for all seven climates, as is the case in Albattani and in ms. Ey and group {k}.

Tabular values. I have tried to recompute the tables according to the procedure described under H* above, with the following parameters:

> Obliquity of ecliptic: 23;51°; see H*. This is taken as Ptolemaic, and gives practically the same results as the Almagest value of 23;51,20°.
>
> Latitudes of climates: as in Almagest II,8, listed under H*.
> – The latitudes shown in the table headings are in fact the Albatenian latitudes of climates; cf. BG21. These latitudes are based on obliquity 23;35° and are thus unrelated to the tabular values; cf. Nallino II p. 237.
>
> Solar distance: 1210 earth-radii, cf. Almagest V,17.
>
> Lunar distance: 64;10 earth-radii, thus assuming that the epicycle centre is in the apogee of the deferent (distance 59;0: Almagest, ibid.), and that the moon is in the apogee of the epicycle (radius 5;10).

The solar parallax is to be subtracted from the lunar parallax. This yields a horizontal parallax of about 50.8′. The horizontal parallax in altitude that can be estimated from the tabular values for sunrise and sunset is about 51′ for all the tables, in good agreement with this.[1]

The parallax values recomputed on these premisses, according to the procedure in H* above, generally reproduce the manuscript values to within 2′. Deviations of 1′ are frequent but do not look systematic.

Entrance values. The half-day entrance values, used as labels for the outermost values in each partial table, are based on an obliquity of 23;51...° and on the Ptolemaic latitudes of climates. Thus the parameters are Ptolemaic, and probably the same as for the tabular values. Half-day values are, however, absent from the witnesses here used for the Handy Tables.

Text. The only witnesses that contain this series in its entirety are Ey and some members of {k}. Ey, rather than the {k} witnesses, shows a layout and headings that are similar to HA11 and HB; so, for practical reasons, Ey is used as standard in these respects. For extra witnesses I use Co, from group {k}, plus either Xb from group {x}, or, if this is absent, Lu from group {aT}.

$c: tabular values recomputed as described above, and rounded in the normal manner. Deviations of 2′ or more from the adopted values are quoted. Deviations of 1′ are only quoted if there are other variants. Thus, if there is a note in the apparatus, and this does not quote $c, then $c reads like the adopted text. If there is no note at all, then $c reads within 1′ of the adopted text.

---

1 Estimating the horizontal parallax: see notes to HA11, "Tabular values". – Note that the parameters chosen for recomputation are the same for the HB* and the HC* tables; thus the recomputed values only differ by the current amount of the solar parallax, so their proportion should be practically constant. This is an over-simplification, as is easily seen from the fact that the actual values in the HB* and HC* tables do not show the concurrent variation that would follow from this.

Values of $c that show .5 in the first decimal are quoted with the decimal, the rest are quoted as rounded.

$bn: Albattani, ed. Nallino. – Nallino comments (II p. 237): "It was easy to emend the faulty numbers of the manuscript, for the same parallaxes are always found twice in each climate; comparison with Theon" (in Halma's edition) "made emendation even more certain." Thus Nallino's text is a reconstruction, and can be used only when corroborated by other means.[1] It has only been collated where it is quoted explicitly.

$ba = Castilian version of Albattani, Paris Arsenal 8322. This mostly agrees with the other sources listed here, though quite often it leaves them, showing readings peculiar to all or some of the Toledan-table witnesses currently present. Thus the text is likely to be mixed. It has been collated for all values.

$htv: As an experiment, a manuscript of the Handy Tables (Vat. gr. 304) has been collated for the apparatus. It generally agrees well with the majority of the Toledan witnesses and with the recomputation. It does not comprise the half-day values. It has mainly been used for guessing at the original text where the Albattani manuscript is in error, whether or not followed by the Toledan-table witnesses. A common error in Vat. gr. 304 is a mix-up of alpha and delta ("1" and "4"). I have not seen any other persistent errors. The readings differ little from Stahlman's edition, to be described. The text has been collated for all the values it contains.

$hts: Stahlman's edition of the Handy Tables (tables 28-34), eclectic, made on the basis of three manuscripts (Vat.gr. 1291 (=V); Par.gr. 2493 (=B); Par.gr. 2399(=A)) plus Albattani and Halma's edition (=H); cf. Stahlman's description p. 131-133. Does not comprise the half-day values. $hts is cited where Stahlman has adopted a reading different from that adopted here, and not elsewhere, not even where some of Stahlman's witnesses differ from the present readings or agree with rejected readings. When $hts is cited, "$hts!" means that Stahlman does not quote any variants, whereas, e.g., "$hts(VB)" means Stahlman's manuscripts V and B.

Readings chosen. I generally adopt the text I believe to be original, judging from the majority of the Toledan witnesses present, aided by the recomputation and the sources listed above, as described in the section for each table. The adopted text is underscored if it is believed to be in error, e.g., where slides are left uncorrected or where the tabular values are 2′ or more off the recomputation. Italics are used where a significant part, perhaps all, of the Toledan-table witnesses disagree with the adopted text, such that this constitutes a correction.

---

1 Nallino (II p. 237) quotes the following readings as from his manuscript: climate 1, latitude 16°32′ (should be 16°39′); climate 2, latitude 24° (should be 24°5′); climate 7, latitude 48°13′ (should be 48°53′). At HC31:Cnc:(c+2) one may presume that the reading was "21".

HC11. Parallax, Climate 1, Albatenian.

Toomer 1968 no. 69. — Same as Albattani, Nallino II p. 95, from Handy Tables (Stahlman table 28).

Witnesses: **{a0}** Ey,67r. — **{aX}** Vd,17r. — **{aT}** Lu,72r; Oj,141r-v. — **{k}** Eh,112r-v; Lw,103r-104v; Ou,71r-v; Co,167v; Cn,103r. — **{d}** Lb,43r. — **{x}** Oc,89r; X,166r; Mv,105r; Cm,146v; B,157r; T,296v; Lf,106v; Lg,185r; Lh,152r; Xj,288r; Xg,69v; G,73v; Xb,88v; Es,194v; Fb,79v; Pq,198v; Oy,86r; Wa,74r; Nu,154r.

Headings. — General. The values 16°32′ and 13h are the Albatenian ones; for their validity see HC* above.

(1) Tabula diversitatis aspectus lunae (*om.* Cn Xg) **in climate primo (/p.c.** {x-}) **cuius latitudo est** (*om.* Oc Xb Es T) **16 (+gr) (+et) 32** (=Ey {k} Oc Xb Es; 3 T; **/39** {x--}) **mi** (*om.* {k}) **et** (*om.* Ey {k} Oc Xb Oy) **horae (+vero** Ey {k}) **eius** (*om.* Lw; +aequales Oc Xb) **13 (/14** Co Cn Oc Xb Es; /19 Lw; **+et 0** Eh Ou Co) :: {a0:} Ey; {k:} Eh Lw! Ou Co Cn!; {x-}.
(2: other) Vd (16°22′); Lu (16°32′, 13h;0); Oj (16°32′, 13h); Lb (16°39′, 13h); X (no numbers): all much like the preceding.

Sub-headings for Cancer:

(3) Horae cancri; Diversitas aspectus [Longitudo; Latitudo] :: {a0:} Ey; {aX:} Vd; {aT:} Lu Oj; {d:} Lb; {k:} Eh Cn.
(4) Horae cancri; Diversitas aspectus lunae [Minuta longitudinis; Minuta latitudinis] :: {k:} Lw Ou Co.
(5) Horae cancri; Longitudo; Latitudo :: {x-}.
(6: other) :: Mv & Xg (headings including "Cancer [Horae ante meridiem et post; Longitudo; Latitudo]").

Values. Recomputed for latitude 16;27° and obliquity 23;51°; see notes to H* and HC*.

Text. Collated for values: **{a0}** Ey; **{aT}** Lu; **{k}** Ou Co; **{x}** Es Xg. — Headings according to Ey. — Layout: Ey Lu Es Xg have 2 sections, 6 sub-tables across the page. This layout is used here. Co Ou show the table in 4 sections, 3 sub-tables across the page. — Also quoted for values: **$bn** = Batt., Nallino II p. 95 (ignored unless quoted). **$ba** = Batt., Paris Arsenal 8322, 60r. **$htv** = Handy Tables, Vat. gr. 304, 205v-206r (not for entrance values). **$hts** = Handy Tables, Stahlman 1960, Table 28 (not for entrance values). **$c** = recomputed values; see "Values" above. In selection, see HC*.

In the columns for latitude, Lu Ou Co $ba $htv add the labels "meridies" and "septentrio" ("no(tios), bo(reios)", $htv) in various abridgments. Such labels are at the tops of all columns, except for accidental omissions. When placed elsewhere, the labels seem to be meant as separators between series of numbers with opposite signs; I have taken this to be the case everywhere, ignoring some ambiguity. They are here represented as "m" and "s", appended to the first item of the series they are valid for. They are present in $bn, but this has not been collated; and they are absent from Ey Es Xg.

Readings chosen: see HC*. *Italics* are used if the adopted text has support from just one of the sets (Ey), (Es Xg), (Lu Ou Co), or from none of them.

Variant groups. The Toledan-table witnesses are certainly closer to Albattani than to the Handy Tables; cf., e.g. Sgr(L-1) below. Together they have slight errors even against Albattani (e.g., Cap(c-5); Psc(m-5;46); Ari(p-6))). There seem to be the groups *(Es Xg)* and *(Ey (Lu Ou Co))*, either of which may join the sources against the other one. — Lu Ou Co may be correct against Ey Es Xg (e.g., Vir(m-1)), but this is rare; Ey is occasionally correct against Es Xg Lu Ou Co (e.g., Lib(q-3, q-2)). Some of the correct readings may, as usual, be due to correction from symmetrical counterparts.

Tabula diversitatis aspectus lunae in climate primo,
cuius latitudo est 16 gr et 32 mi, horae vero eius 13.

Horae cancri	Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi	Horae leonis	Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi	Horae virginis	Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi	Horae librae	Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi	Horae scorpii	Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi	Horae sagittarii	Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi
6 30	49	16m	6 25	51	5m	6 14	51	4s	6 *0*	51	6s	5 46	51	4s	5 35	51	5m
6	50	13	6	51	3	6	51	5	5	49	6	5	49	2	5	51	7
5	49	8	5	48	2*s*	5	*49*	6	4	45	4	4	47	3*m*	4	46	12
4	42	4	4	43	5	4	43	6	3	35	*1*	3	40	8	3	39	18
3	35	1*s*	3	34	6	3	34	6	2	28	3*m*	2	31	12	2	31	23
2	25	4	2	24	7	2	25	4	1	17	8	1	20	19	1	19	27
1	13	6	1	12	6	1	*14*	*0*	.	.	.	.	.	.	.	.	.
Mer	0	7	Mer	1	4	Mer	2	4m	Mer	6	13	Mer	9	22	Mer	7	30
1	-13	6	1	-13	*0*	1	-10	9	.	.	.	.	.	.	.	.	.
2	25	4	2	25	4*m*	2	21	14	1	- 6	18	1	- 3	27	1	- 6	32
3	35	*1*	3	34	9	3	29	19	2	17	23	2	15	30	2	18	34
4	42	4*m*	4	41	*14*	4	36	24	3	26	27	3	25	32	3	28	33
5	49	8	5	44	18	5	40	28	4	33	30	4	33	33	4	37	31
6	50	13	6	45	24	6	41	30	5	37	32	5	37	32	5	42	28
6 30	49	16	6 25	44	25	6 14	40	31	6 *0*	39	*32*	5 46	40	31	5 35	44	25
(a)	(b) (c)	(d)	(e)	(f) (g)	(h)	(j)	(k) (L)	(m)	(n)	(o) (p)	(q)	(r)	(s) (t)	(u)	(v)	(w) (x)	(y)

(a Mer) meridies Ey Ou, *ubique;* recessio Lu, *ubique;* media dies Co, *ubique;* rec() Es Xg, *ubique.* **(b-6, b+6)** 0 Ou, *saepius.* **(c-5)** 47 $c. **(c+5)** 47 $c. **(c+6)** 13 Xg; 49 $c. **(c+6;30)** 25 Xg. **(d-3)** s: *hic* $c; *ad (d-2)* Ou Co $ba; *om.* Lu $htv. **(d Mer)** 30 $ba. **(d+3)** 2 Ey Lu Ou Co. **(d+4)** m: *ad (d+3)* Ou Co. **(d+6;30)** 1 Es. **(f-6;25, f+6;25)** 35, 35 Co. **(g-6;25)** 54 $htv; 50.5 $c. **(g-3)** 35 Es Xg. **(g-2)** 23 Lu; 22 Es Xg. **(g+3)** 31 $htv. **(g+4)** 31 $htv; 40 $c. **(g+6;25)** 43 Es Xg. **(h-6;25)** 4 Es Xg. **(h-6)** 5 Es Xg. **(h-5)** s: *hic* $c, ?$htv; *ad (h-4)* Lu Ou Co; *om.* $ba. **(h-2)** 4 Es Xg. **(h-1)** 7 Es Xg. **(h+1)** 0: $htv $c; 6 Ey Lu Ou Co $ba; 7 Es Xg. **(h+2)** m: *hic* $ba $htv $c; *ad (h+3)* Lu Ou Co. **(h+3)** 20 $ba. **(h+4)** 14: $htv $c; 15 $ba, *omnes.* **(k-6;14, k+6;14)** 54,54 Co; 15,15 $bn. **(L-5)** 48 Ey Lu Ou Co $c. **(L-3)** 35 Es Xg $c. **(L-2)** 35 Co. **(L-1)** 14: $htv $c; 51 $ba; 11 *omnes.* **(m-6;14)** "30 b" $htv. **(m-5)** 4 Es Xg. **(m-1)** 5 $ba; 4 Ey Es Xg. **(m Mer)** m: *om.* $htv. **(m+3)** 54 $ba; 9 $htv. **(m+4)** 14 Es Xg. **(m+6)** 37 Ou; 31 $c. **(o-6, o+6)** *om.* Ey Lu Co $ba. **(p-3)** 35: $bn $hts!, *cett.;* 48 $htv; 38 $c. **(p Mer)** 4 $htv; 9 $bn $hts(A); =6 $hts(V); 19 $hts(HB). **(p+2, p+3)** 16, 27 Es Xg. **(q-5)** 5 Lu. **(q-3)** 4 Co; 3 Lu Ou Es Xg $ba. **(q-2)** 3: Ey $htv $hts(VA) $c; 6 $ba $bn $hts(HB), *cett.* m: *hic* $ba $c; *ad (q-3)* Lu Ou Co; *om.* $htv. **(q+1 ... q+6)** 8, 6, 3, 4, 6, 6 Lu Ou Co, *cf. (q-6 ... q-1).* **(+q+6)** 32: Es Xg; 33 $c; 31 Ey; *alia* Lu Ou Co. **(s-5;46,s+5;46)** 45,45 $bn. **(t-5)** 44 Es Xg; 50 $c. **(t+2)** 13 Lu. **(t+3)** 29 Lu Co; 39 Ou. **(t+4)** 53 $ba. **(t+5)** 36 Lu Ou Co; 38 $c. **(u-5)** 4 $bn $hts(HB); =2 $hts(V); 5 $hts(A). **(u-4)** 4 Ou. m: *hic* $ba $c; *ad (u-3)* Lu Ou Co; *om.* $htv. **(u-2)** 32 Es Xg; 13 $c. **(u+2)** 5 $ba. **(u+5;46)** 34 $htv, *in ras.?* **(x-5;35)** 50 $htv; 50.5 $c. **(x-1)** 59 $ba. **(x Mer)** 30 $ba. **(x+2)** 16 Es Xg. **(x+4)** 33 Es Xg; 30 $ba. **(x+5)** 45 Es Xg. **(y-2)** 24 Es Xg. **(y+3)** 36 Lu Ou Co.

Horae capricorni		Diversitas aspectus Longitudo Mi	Latitudo Mi
5	30	49	16m
5		*47*	18
4		42	23
3		35	27
2		24	30
1		13	33
.		.	.
Mer		0	33
.		.	.
1		-13	33
2		24	30
3		35	27
4		42	23
5		*47*	18
5	30	49	16
(a)	(b)	(c)	(d)

Horae aquarii		Diversitas aspectus Longitudo Mi	Latitudo Mi
5	35	44	25m
5		42	28
4		37	31
3		28	33
2		18	34
1		6	32
.		.	.
Mer		- 7	30
.		.	.
1		19	27
2		31	23
3		39	18
4		46	12
5		51	7
5	35	*51*	5
(e)	(f)	(g)	(h)

Horae piscium		Diversitas aspectus Longitudo Mi	Latitudo Mi
5	46	40	*31*m
5		37	32
4		33	33
3		25	32
2		15	30
1		3	27
.		.	.
Mer		- 9	22
.		.	.
1		20	19
2		31	12
3		40	8
4		47	3
5		49	2*s*
5	46	51	4
(j)	(k)	(L)	(m)

Horae arietis		Diversitas aspectus Longitudo Mi	Latitudo Mi
6	*0*	*39*	*32*m
5		37	32
4		33	30
3		26	27
2		17	23
1		6	18
.		.	.
Mer		- 6	13
.		.	.
1		17	8
2		28	3
3		*38*	1*s*
4		45	4
5		49	6
6	*0*	51	6
(n)	(o)	(p)	(q)

Horae tauri		Diversitas aspectus Longitudo Mi	Latitudo Mi
6	14	40	31m
6		41	30
5		40	28
4		36	24
3		29	19
2		21	14
1		10	9
Mer		- 2	4
1		14	0
2		25	4*s*
3		34	6
4		43	6
5		49	*6*
6		51	5
6	14	51	4
(r)	(s)	(t)	(u)

Horae geminorum		Diversitas aspectus Longitudo Mi	Latitudo Mi
6	25	44	25m
6		45	24
5		44	18
4		41	14
3		34	9
2		25	4
1		13	0
Mer		- 1	4s
1		12	6
2		24	7
3		34	6
4		43	5
5		48	2
6		51	3*m*
6	25	51	5
(v)	(w)	(x)	(y)

(b5;30) *om.* Xg. **(c-5)** 47: $ba $htv $c; 46 *omnes.* **(c-2)** 23 Lu; 34 Ou; 21 $htv; 25 $c. **(c+2)** 23 Lu; 25 Es Xg $c; 14 $htv. **(c+5)** 46 Ey Lu Ou Co. **(d Mer)** 53 $ba. **(d+5;30)** 36 $ba. **(g-5;35)** 41 $htv. **(g-4)** 34 $ba. **(g-3)** 23 Es Xg. **(g+2)** 36 $htv; 30 $c. **(g+5;35)** 51: Es $htv; 50.5 $c; 52 *cett.* **(h-5;35)** 29 $ba. **(h+1)** 26 Es Xg. **(h+2)** 22 Ey; 28 $htv; 22.5 $c. **(k-5;46)** 45 $bn. **(k+5;46)** 4 $ba; 45 $bn. **(L-5)** 47 Es; 38 $c. **(L-2)** 14 Es Xg. **(L-1)** 13 $htv. **(m-5;46)** 31: $ba $bn $htv $c; 30 Ey Lu Ou Co; 39 Es Xg. **(m-4)** 3 Es Xg. **(m-3)** 52 $ba. **(m-1)** 26 Es Xg. **(m+5)** 4 $bn. **(+m+5)** s: *hic* $c; *ad (m+4)* Lu Ou Co; "m" *ad (m+5;46)* $ba; "b" *ad (m+5;46)* $htv; *def. cett.* **(m+5;46)** "30 b" $htv. **(o-6, o+6)** *om.* Ey Lu Co $ba. **(p-6)** 39: $ba $htv $hts! $c; 30 Xg; 40 *cett.* **(p-1)** 20 $ba; 3 $htv. **(p Mer)** 9 Es Xg $ba $bn $hts!. **(p+3)** 33 Ey Lu Ou Co; 35 $bn $hts(HAB); =38 $hts(V). **(q-6, q-5)** *vacat* Lu. **(+q-6)** 32: Es Xg; 33 $c; 31 Ey Ou Co. **(q-4)** 26 $htv. **(q-3)** 28 Lu; 34 Ou Co; 26 $ba; 37 $htv. **(q-2)** 28 Es Xg $htv; 20 $ba. **(q Mer...q+6)** 13, 8--6: 8--6, 6 $htv. **(+q Mer)** 9 Es Xg. **(+q+1)** 18 Ou. **(+q+2)** 6 $bn $hts(HAB); =3 $hts(V). **(+q+3)** s: *hic* $ba $c, $htv *(ad (q+2))*; *om.* Lu Ou Co. **(q+4)** 3 $ba. **(r-2)** 42 $ba. **(s-6;14, s+6;14)** 54, 54 Co, Ou.?ac; 34, 34 $ba; 15,15 $bn. **(t-6;14)** 41 $htv. **(t+1)** 11 $htv. **(t+4)** 44 Co. **(t+6;14)** 5 $ba. **(u+1)** 0: *gem.* Co; 9 Es.ac; 9 *add.* Xg; 4 $ba. **(u+2)** s: *hic* Lu Ou $ba; *ad (u+1)* $c, Co *ut vid.*; *om.* $htv. **(u+3)** 5 Lu. **(u+5)** 7 Ey Lu Ou Co. **(v-6;25)** 7 $ba. **(x-5)** 41 $htv. **(x-3)** 32 Es Xg; 44 $htv. **(x+2)** 23 Lu; 25 Es Xg. **(x+4)** 42 Lu; 40 Es Xg. **(x+6;25)** 54 $htv; 50.5 $c. **(y-6;25)** 26 Ou. **(y-2)** 7 Es Xg. **(y Mer)** s: *ad (y-1)* $c. **(y-1)** 6 Ey. **(y Mer)** s: 7 Lu*(mg.); ad (y+1)* $ba. **(y+2)** 30 $ba. **(y+6)** m: $c; *om.* $htv, *cett.*

HC21. Parallax, Climate 2, Albatenian.

Toomer 1968 no. 73. – Same as Albattani, Nallino II p. 96, from Handy Tables (Stahlman Table 29).

Witnesses: **{a0}** Ey,67v; Ea,52r. – **{aX}** Vd,17v. – **{aT}** Lu,72v; Oj,141v-142r. – **{k}** Eh,113r-v; Lw,105r-106v; Ou,72r-v; Co,168r; Cn,103r.

Headings. – General:

> **(1) Tabula** (-ae Co) **diversitatis aspectus lunae** (*om.* Lw) **in climate secundo** (**/s.c.** Co Vd) **cuius latitudo est** (*om.* Cn) **24** (23 Co) **(+gr) (+et) 5 (+mi)** (et 5 m.: *om.* Vd Oj) :: {a0:} Ey; {aT:} Oj; {aX:} Vd; {k:} Lw Ou Co Cn. – *Added:* **+horae vero eius** (v.e.: *om.* Lw) **13 (+et) 30 (+mi)** :: Ey Lw Ou Co Cn; **+dies eius est 13 horarum et 30** Vd; **+et dies eius longior 30** (!) **horarum aequalium et 30 mi** Oj.
> **(2: other)** Ea (24°15′, 13h;30); Lu (24°5′, 13h;30); Eh (no numbers).

Sub-headings for Cancer:

> **(3) Horae cancri; Diversitas aspectus** (*om.* Oj; +lunae Eh) **[Longitudo; Latitudo]** :: {a0:} Ey Ea; {aT:} Lu Oj; {k:} Eh.
> **(4) Horae cancri; Diversitas aspectus lunae [Minuta longitudinis; Minuta latitudinis]** :: {k:} Lw Ou Co.
> **(5: other)** :: Vd (blank); Cn (secondary).

Values: Recomputed for latitude 23;51° and obliquity 23;51°; see H* and HC*.

Text. Collated for values: **{a0}** Ey; **{aT}** Lu; **{k}** Ou Co. – Headings according to Ey. – Layout: Ey Lu have 2 sections, 6 sub-tables across the page. This layout is used here. Ou Co show the table in 4 sections, 3 sub-tables across the page. – Also quoted for values: **$bn** = Batt., Nallino II p. 96 (ignored unless quoted). **$ba** = Batt., Paris Arsenal 8322, 60v. **$htv** = Handy Tables, Vat. gr. 304, 206v-207r (not for entrance values). **$hts** = Handy Tables, Stahlman 1960, Table 29 (not for entrance values). **$c** = recomputed values; see "Values" above. In selection; see under HC*.

In the columns for latitude, Ou Co Lu add the labels "meridies" and "septentrio": "meridies" normally at tops of sub-tables, "septentrio" to mark latitudinal parallaxes as northerly. $ba has some of the "septentrio" markings too (for Cancer-Virgo), though slightly shifted; $bn seems to lack them. In any case, since the terrestrial latitude is equal or about equal to the obliquity, the sign "septentrio" should only be taken as valid for the single value it pertains to. This may in fact be a zero in all cases; however, I reproduce the position of the "septentrio" markings uncritically.

Readings chosen: see HC* above. Italics are used where all of Lu Ou Co depart from the adopted text.

Variant groups. – *Ey (Lu (Ou Co))* have errors in common with $ba (Tau(u-5)), perhaps because the text of $ba is mixed; and they have errors in common against Albattani as confirmed from $htv or $c, e.g., at Vir(m-2, m-1). *Lu Ou Co* form a sub-group, and so do *Ou Co.* Occasionally (Lib(q+5); Aqr(g-1, h-5;22)), $ba Lu Ou Co may be in error where Ey $htv are correct; these cases might be due to secondary corrections in Ey, as is no doubt the case in Cnc(d+6;45), which has been altered into a non-source reading by Ey alone.

Tabula diversitatis aspectus lunae in climate secundo,
cuius latitudo est 24 gr et 5 mi, horae vero eius 13 et 30 mi.

Horae cancri		Diversitas aspectus: Longitudo Mi	Latitudo Mi	Horae leonis		Diversitas aspectus: Longitudo Mi	Latitudo Mi
6	45	46	*23*m	6	38	50	11*m*
6		46	19	6		49	10
5		*45*	14	5		46	5
4		41	9	4		42	2
3		33	7	3		34	1
2		24	*3*	2		24	0s
1		12	1	1		13	1
Mer		0	0s	Mer		1	3
1		-12	1	1		-11	6
2		24	*3*	2		22	10
3		33	7	3		31	15
4		41	9	4		37	20
5		45	14	5		40	24
6		46	19	6		40	29
6	45	46	23	6	38	40	31
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

Horae virginis		Diversitas aspectus: Longitudo Mi	Latitudo Mi	Horae librae		Diversitas aspectus: Longitudo Mi	Latitudo Mi
6	21	51	3m	6	*0*	51	0m
6		51	2	5		49	1
5		48	1	4		45	2
4		43	0s	3		38	6
3		36	1	2		29	10
2		26	*3*	1		19	14
1		16	*6*	.		.	.
Mer		4	11	Mer		8	19
1		- 8	15	.		.	.
2		17	20	1		- *3*	24
3		26	25	2		13	28
4		32	29	3		22	32
5		35	32	4		29	35
6		36	36	5		33	*37*
6	21	<u>37</u>	36	6	*0*	34	37
(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

Horae scorpii		Diversitas aspectus: Longitudo Mi	Latitudo Mi	Horae sagittarii		Diversitas aspectus: Longitudo Mi	Latitudo Mi
5	*39*	51	3m	5	22	50	11m
5		50	5	5		49	14
4		46	9	4		45	18
3		41	14	3		39	23
2		32	18	2		30	27
1		22	23	1		19	31
.		.	.	.		.	.
Mer		11	28	Mer		8	35
.		.	.	.		.	.
1		- 1	32	1		- 4	37
2		11	35	2		15	38
3		21	37	3		25	37
4		28	38	4		33	36
5		34	37	5		39	33
5	*39*	36	36	5	22	40	31
(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(a Mer) meridies Ey Ou, *ubique;* recessio Lu, *ubique;* med(ia) d(ies) Co, *ubique.* **(c-5)** 41 Lu Ou Co; 46 $htv. **(c-3)** 34 Lu Ou. **(c-2)** 34 Ou. **(d-6;45)** 23: $ba $htv; 22 $c, *omnes.* m: *om.* $ba. **(d-2)** 3: $ba $htv; 2.5 $c; 8 Co; 4 *cett.* **(d Mer)** 0: *om.* $ba. s: Ou Co $ba; *ad (d-1)* Lu; *om. cett.* **(d+2)** 3: $ba $htv; 2.5 $c; 4 *omnes.* **(d+6;45)** 22 Ey $c. **(g-6;38)** 7 $ba; 49 $c. **(g-6)** 48 Co; 50 $c. **(g-4)** 47 Lu. **(g-3)** 31 $htv. **(g-1)** 12 Lu. **(g Mer)** 4 $htv. **(g+2)** 24 Co. **(g+3)** 11 $ba. **(g+5 ... g+6;38)** (40,40) Lu. **(+g+5, g+6)** 41,41 $c. **(h-6;38)** m: *om.* $ba, *omnes.* **(h-4)** 3 $htv. **(h-2)** s: *ad (h-1)* $ba; *om.* $htv. **(h-1...h+6)** 1, 3--29: 3--29, 30 $htv. **(+h+2)** 9 Lu. **(+h+3)** 19 $ba. **(j+6;21)** 5 $ba. **(L-6;21)** 54 $htv. **(L-4)** *vacat* Co; d() 46 vel 43 vel 47 Co *mg.* **(L-2)** 16 Ou Co. **(L Mer)** 3 Lu Ou; 2 $bn $hts!. **(L+2)** 18 Lu $c. **(L+6, L+6;21)** 37, 36 $bn $htv $hts!; 36, 36 $c. **(m-6;21)** m: *om.* $ba. **(m-4)** s: *ad (m-3)* $ba; *om.* $htv. **(m-2, m-1)** 3, 6: $ba $htv $c; 4, 7 *omnes.* **(m+4)** 22 $htv. **(m+5)** 36 Ey; 39 $htv; 33 $c. **(m+6, m+6;21)** 36 *(semel)* Lu; 35, 36 $c. **(o-6, o+6)** *om.* Ey Lu Co $ba. **(p-6)** 4 $ba. **(p-1)** 20 Lu $c. **(p+1)** 4 Lu Ou Co. **(q-1)** 34 $ba. **(q+1)** 21 $htv. **(q+5)** 36 Lu Ou Co $ba. **(q+6)** 36 $bn $htv $hts!; 37.5 $c. **(s-5;39)** 38 Lu Ou Co. **(s+5;39)** 38 Lu Ou; 28 Co. **(t+5)** 24 $ba. **(u-5;39)** 4 Lu. **(u-3)** 11 $htv; 13 $c. **(u+2)** 25 $ba. **(u+3)** 34 $ba. **(u+4)** 28 $htv. **(v-5;22)** 55 $ba. **(x-3)** 35 $ba. **(x-1)** 29 Lu. **(y-5;22)** 12 Ey; 11.5 $c. **(y-2)** 28 Lu $c.

	Diversitas aspectus				Diversitas aspectus				Diversitas aspectus				Diversitas aspectus				Diversitas aspectus				Diversitas aspectus	
Horae capricorni		Longitudo Mi	Latitudo Mi	Horae aquarii		Longitudo Mi	Latitudo Mi	Horae piscium		Longitudo Mi	Latitudo Mi	Horae arietis		Longitudo Mi	Latitudo Mi	Horae tauri		Longitudo Mi	Latitudo Mi	Horae geminorum		Longitudo Mi	Latitudo Mi
5	15	46	23m	5	22	40	*31*m	5	39	36	36m	6	*0*	34	36m	6	21	36	36m	6	38	40	31m
5		44	23	5		39	33	5		34	37	5		*33*	37	6		37	36	6		40	29
4		40	28	4		33	36	4		28	38	4		29	35	5		35	*32*	5		40	24
3		33	32	3		25	37	3		21	37	3		22	32	4		32	29	4		37	*20*
2		23	38	2		15	38	2		11	35	2		13	28	3		26	25	3		31	15
1		12	37	1		*4*	37	1		1	32	1		3	24	2		17	20	2		22	10
.		.	.	.		.	.	.		.	.	.		.	.	1		8	15	1		11	6
Mer		0	37	Mer		- 8	35	Mer		-11	28	Mer		- 8	19	Mer		- 4	11	Mer		- 1	3
.		.	.	.		.	.	.		.	.	.		.	.	1		16	6	1		13	1
1		-12	37	1		*19*	31	1		22	23	1		19	14	2		26	3	2		24	0
2		23	38	2		30	27	2		32	18	2		29	10	3		36	1	3		34	1s
3		33	32	3		39	23	3		41	14	3		38	6	4		43	0	4		42	2
4		40	28	4		45	18	4		46	9	4		45	2	5		48	1s	5		46	5
5		44	23	5		49	14	5		50	5	5		49	1	6		51	2	6		49	10
5	15	46	23	5	22	50	*11*	5	39	51	3	6	*0*	51	0	6	21	51	3	6	38	50	11
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(d-2) =38 $bn $htv, *cett.;* 35 $c. **(d+1)** 35 Lu Ou. **(d+2)** =38 $bn $htv, *cett.;* 35 $c. **(d+3)** 37 Lu Ou. **(d+4)** 38 Lu Ou $htv. **(d+5, d+5;15)** 33, 33 Lu Ou; 24, 22 $c. **(g-1)** 8 Lu Ou Co $ba. **(g Mer)** 4 $ba. **(g+1)** 16 Lu; 18 Ou Co; 19.5 $c. **(h-5;22)** 30 Lu Ou Co $ba. **(h-5)** 23 Ou. **(h+3)** 33 $ba. **(h+5;22)** 11: $ba $bn $htv; 11.5 $c; 12 *omnes.* **(L-5)** 37 $ba. **(L-4)** 29 Lu $c. **(L+5)** 30 $ba. **(m-4)** 39 Lu. **(m Mer)** 38 $ba. **(m+1)** 24 Co. **(o-6, o+6)** *om.* Ey Lu Co $ba. **(p-5)** 37 Lu Ou Co. **(p-4)** 39 Ou Co. **(p-3)** 32 Ou Co. **(p-1)** 10 $htv. **(p+1)** 12 Lu; 20 $c. **(p+2)** 19 $ba; 30 $c. **(p+3)** 37 Lu; 39 $c. **(q-6)** 37 Ey; 37.5 $c. **(q-5)** 39 Lu. **(s+6;21)** 22 Co. **(t Mer)** 2 $bn $hts(HB); =4 $hts(VA). **(u-5)** 32: $htv $hts!; 33 $c: 36 $ba, *omnes.* **(u Mer...u6;21)** 11, 6--3: 6--3, 4 $htv, *prave.* **(+u Mer)** 10 $c. **(+u+5)** s: *om.* $ba $htv. **(v+6;38)** *om.* $ba. **(w-6;38, w+6;38)** 37, 37 Lu. **(x-2)** 32 Ou Co. **(x Mer)** 1 *aut* 4 $htv. **(x+6;38)** 30 $ba; 49 $c. **(y-6;38)** 30 Lu. **(y-4)** 19 Lu Ou Co. **(y Mer)** 4 Ey. **(y+3)** s: *om.* $ba $htv. **(y+6;38)** 10 $ba; 11.5 $c.

HC31. Parallax, Climate 3, Albatenian.

Toomer 1968, no. 74. — Same as Albattani, Nallino II p. 97, from Handy Tables (Stahlman table 30).

Witnesses: **{a0}** Ey,68r; Ea,52v. — **{aX}** Vd,18r (values blank). — **{aT}** Lu,73r; Oj,142r-v. — **{k}** Eh,114r-v; Lw,107r-108v; Ou,73r-v; Co,168v; Cn,103v.

Headings. — General:

(1) Tabula diversitatis aspectus lunae in climate tertio (/t.c. Lw Ou Co) **cuius latitudo est 30 (+gr) (+et) 40 (+mi), horae vero eius** (v.e.: e. Vd Ou; *om.* Lw) **14** (+et 0 Vd; +0 Co) :: {a0:} Ey; {aX} Vd; {k:} Lw Ou Co Cn!.
(2: other) :: Ea (30°40′, 14h); Lu (30°0′, 14h;0); Oj (30°, 14h); Eh (no values).

Sub-headings for Cancer:

(3) Horae cancri; Diversitas aspectus (*om.* Oj; +lunae Eh) **[Longitudo; Latitudo]** :: {a0:} Ey Ea; {aT:} Lu Oj; {k:} Eh.
(4) Horae cancri; Diversitas aspectus lunae [Minuta longitudinis; Minuta latitudinis] :: {k:} Lw Ou Co.
(5: other) :: Vd & Cn (blank).

Values. Recomputed from latitude 30;22° and obliquity 23;51°; cf. H* and HC*.

Text. Collated for values: **{a0}** Ey; **{aT}** Lu; **{k}** Ou Co. — Headings according to Ey. — Layout: Ey Lu have 2 sections, 6 sub-tables across the page. This layout is used here. Ou Co show the table in 4 sections, 3 sub-tables across the page. — Also quoted for values: **$bn** = Batt., Nallino II p. 97 (ignored unless quoted). **$ba** = Batt., Paris Arsenal 8322, 61r. **$htv** = Handy Tables, Vat. gr. 304, 207v-208r (not for entrance values). **$hts** = Handy Tables, Stahlman 1960, Table 30 (not for entrance values). **$c** = recomputed values; see "Values" above. In selection; see under HC*.

Lu Ou Co $ba place a label "meridies" near the heads of the columns for latitude. I have represented these labels as "m". They are not in Ey.

Readings chosen: see HC*. Italics are used where all of Lu Ou Co depart from the adopted text.

Variant groups. The grouping *Ey (Lu (Ou Co))* is recognizable here as it was for HC21. In 6 cases, *Ey* agrees with the recomputation against varying portions of the rest; these cases amount to 3 symmetrical pairs (e.g., Vir(L-4) / Tau(t+4)) and may be due to self-revision. Ey may also copy erroneous values in this way; cf., e.g., Sco(u-5;32) with Psc(m+5;32).

Tabula diversitatis aspectus lunae in climate tertio,
cuius latitudo est 30 gr et 40 mi, horae vero eius 14.

Horae cancri	Diversitas aspectus Longitudo Mi	Latitudo Mi	Horae leonis	Diversitas aspectus Longitudo Mi	Latitudo Mi	Horae virginis	Diversitas aspectus Longitudo Mi	Latitudo Mi	Horae librae	Diversitas aspectus Longitudo Mi	Latitudo Mi	Horae scorpii	Diversitas aspectus Longitudo Mi	Latitudo Mi	Horae sagitarii	Diversitas aspectus Longitudo Mi	Latitudo Mi
7 *0*	43	28m	6 51	48	17m	6 28	50	*9*m	6 *0*	51	6m	5 32	50	*9*m	5 9	48	17m
6	44	23	6	48	14	6	51	*8*	5	49	7	5	49	10	5	48	19
5	43	19	5	46	11	5	48	*6*	4	45	8	4	46	14	4	45	*23*
4	38	15	4	41	8	4	42	*6*	3	39	11	3	40	18	3	38	28
3	31	11	3	33	6	3	35	7	2	31	14	2	33	23	2	30	32
2	22	8	2	24	6	2	27	8	1	21	19	1	*23*	28	1	18	36
1	11	7	1	13	7	1	17	*11*	.	.	.	.	.	.	.	.	.
Mer	0	6	Mer	2	9	Mer	6	15	Mer	11	24	Mer	12	32	Mer	8	39
1	-11	7	1	- *9*	11	1	- 5	20	.	.	.	.	.	.	.	.	.
2	22	8	2	20	16	2	14	24	1	0	28	1	1	36	1	- 3	41
3	31	11	3	28	20	3	22	29	2	-10	33	2	- *9*	39	2	14	*42*
4	38	15	4	34	24	4	28	33	3	18	37	3	18	*40*	3	23	41
5	43	19	5	37	29	5	32	36	4	25	39	4	25	*41*	4	30	40
6	44	23	6	37	33	6	32	40	5	29	41	5	29	40	5	35	37
7 *0*	43	28	6 51	36	36	6 28	31	40	6 *0*	30	41	5 32	31	40	5 9	36	36
(a) (b)	(c)	(d)	(e) (f)	(g)	(h)	(j) (k)	(L)	(m)	(n) (o)	(p)	(q)	(r) (s)	(t)	(u)	(v) (w)	(x)	(y)

(a Mer) meridies Ey Ou, *ubique;* recessio Lu, *ubique;* med(ia) d() Co, *ubique.* **(b-7, b+7)** *om.* Ey Lu Co $ba. **(c+1)** 1 Lu. **(c+2)** 21 $bn. **(c+4)** 58 $ba. **(d-7)** 38 Co, Ou.ac?. **(g Mer)** 7 $ba. **(g+1)** 8 Lu Ou Co. **(g+4)** 36 $ba. **(g+5)** 36 Lu. **(h-6;51)** 16 $ba; 17.5 $c. **(h Mer)** 8 Lu Ou. **(L-6;28)** 1 Ou. **(L-4)** 43 Ey $c. **(L+3)** 20 $ba. **(m-6;28 ... m-1)** 6, 7, 8, 11, 12, 13, 14 Lu; 6, 7, 8, 11, 14, 18, *(vac.)* Ou Co, *cf. col. (q).* **(+m-2)** 9 $c. **(+m-1)** 11: $ba $htv; 12 Ey $c; *alia* Lu Ou Co. **(m+2)** 27 $ba; 24.5 $c. **(m+5)** 56 $ba; 37 $c. **(o-6, o+6)** *om.* Ey Lu Co $ba. **(q-6)** 7 Lu Ou. **(q+1)** 18 $ba. **(t-5;32)** 30 $ba. **(t-4)** 47 Co. **(t-2)** 34 Co. **(t-1)** 22 Lu Ou Co $ba. **(t+2)** 9: $ba $htv $c; 8 *omnes.* **(t+5)** 30 Ey $c. **(u-5;32)** 9: $ba $htv $c; 8 *omnes.* **(u-3)** 38 $ba. **(u-2, u-1)** 13, 18 Ou Co. **(u+3)** 40: $ba $htv; 41 $c, *omnes.* **(u+4, u+5)** 40, 40 Lu; 40, 41 Ou Co; 41, 41 $c. **(x-1)** 19 $ba $bn $hts!; 20 $c. **(x+2)** 13 Lu Ou $c. **(x+3)** 33 Ou; 34 Co. **(y-5;9)** 18 Lu Ou; 17.5 $c. **(y-4)** 23: $ba $htv $c; 24 *omnes.* **(y-2)** 22 $ba. **(y+1)** 40 $ba. **(y+2)** 42: $ba $htv; 41.5 $c; 41 *omnes.* **(y+3, y+4)** 40, 37 Ey; 41, 39 $c.

Horae capricorni		Diversitas aspectus Longitudo Mi	Latitudo Mi
5	*0*	43	28m
4		38	32
3		31	36
2		22	39
1		11	41
.		.	.
.		.	.
Mer		0	42
.		.	.
.		.	.
1		-11	41
2		22	39
3		31	36
4		38	32
5	*0*	43	28
(a)	(b)	(c)	(d)

Horae aquarii		Diversitas aspectus Longitudo Mi	Latitudo Mi
5	9	36	36m
5		35	37
4		30	40
3		23	41
2		14	42
1		3	41
.		.	.
Mer		- 8	39
.		.	.
1		19	36
2		30	32
3		38	28
4		45	23
5		48	19
5	9	48	17
(e)	(f)	(g)	(h)

Horae piscium		Diversitas aspectus Longitudo Mi	Latitudo Mi
5	32	31	40m
5		29	40
4		25	41
3		18	40
2		*9*	39
1		- 1	36
.		.	.
Mer		12	32
.		.	.
1		23	28
2		33	23
3		40	18
4		46	14
5		49	10
5	32	50	9
(j)	(k)	(L)	(m)

Horae arietis		Diversitas aspectus Longitudo Mi	Latitudo Mi
6	*0*	30	41m
5		29	41
4		25	39
3		18	37
2		10	33
1		- 0	28
.		.	.
Mer		11	24
.		.	.
1		21	*19*
2		31	*14*
3		39	11
4		45	8
5		49	7
6	*0*	51	6
(n)	(o)	(p)	(q)

Horae tauri		Diversitas aspectus Longitudo Mi	Latitudo Mi
6	28	31	40m
6		32	40
5		32	36
4		28	33
3		22	29
2		14	24
1		5	20
Mer		- 6	15
1		17	11
2		27	8
3		35	7
4		43	6
5		48	6
6		51	8
6	28	50	9
(r)	(s)	(t)	(u)

Horae geminorum		Diversitas aspectus Longitudo Mi	Latitudo Mi
6	51	36	36m
6		37	33
5		37	29
4		34	24
3		28	20
2		20	16
1		9	11
Mer		- 2	9
1		13	7
2		24	6
3		33	6
4		41	8
5		46	11
6		48	14
6	51	48	17
(v)	(w)	(x)	(y)

(b-5, b+5) *om.* Ey Lu Co $ba. **(c-4)** 39 Ey. **(c+4)** 39 Ey. **(d-5)** m: *om.* Lu. **(d-2)** 29 $ba. **(d+1)** 40 Lu. **(d+5)** 38 Ou. **(g-3)** 33 $ba; 24 $htv. **(g-2)** 13 $htv $c. **(g+1)** 9 $htv; 20 $c. **(g+5)** 46 $ba; 47 $c. **(h-5;9)** m: *om.* Lu. **(h+4)** 24 Ey. **(h+5)** 49 $ba; 18 $c. **(h+5;9)** 37 $ba; 17.5 $c. **(L-5)** 30 Ey $c. **(L-2)** 9: $ba $htv $c; 8 *omnes.* **(L Mer)** 11 Co. **(L+2)** 23 Ou Co. **(m-3)** 41 Ey $c. **(m+3)** 13 $ba. **(m+5;32)** 8 Ey. **(o-6, o+6)** *om.* Ey Lu Co $ba. **(p-2)** 0 $ba. **(p+1)** 11 Ou; 24 $ba. **(q-6)** 40 $htv. **(q-3)** 34 $ba; 36 $c. **(q+1)** 18 Lu Ou Co. **(q+2)** 13 Lu Ou Co; 17 $ba; 15 $c. **(t+4)** 42 $ba $bn $hts(HAB); 45 $htv $hts(V). **(u-2)** 40 $ba. **(u+1)** 12 Ey $c. **(u+2)** 3 $ba; 9 $c. **(u+4)** 40 $ba. **(x-5)** 29 $htv. **(x+1)** 14 Ey; 43 Ou. **(x+3)** 18 $ba. **(y-6;51)** m: *om.* Co. **(y-6)** 37 $htv. **(y+3)** 7 $ba.

HC41. Parallax, Climate 4, Albatenian.[1]

Same as Albattani, Nallino II p.98, from Handy Tables (Stahlman table 31).

Witnesses: **{a0}** Ey,68v. – **{k}** Eh,115r-v; Lw,109r-110v; Co,169r; Cn,103v.

Heading:

> (1) **Tabula** (-lae Co) **diversitatis aspectus lunae in climate quarto** (/q.c. Eh Co) :: Ey Eh Lw Co Cn. – *Added:* (nothing) Eh; **cuius latitudo est 36 (+gr) (+et) 22 (+mi), horae vero eius** (v.e.: *om.* Lw) **14 (+et) 30 (+mi)** Ey Lw Co Cn.

Sub-headings for Cancer:

> (2) **Horae cancri; Diversitas aspectus [Longitudo; Latitudo]** Ey;
> (3) **Horae cancri; Diversitas aspectus lunae [Minuta longitudinis; Minuta latitudinis]** Lw Co.
> **(4: other)** :: Eh (like Lw Co but omitting the column-headings. "[Minuta...]"); (blank) Cn.

Values. Recomputed from latitude 36;0° and obliquity 23;51°; see H* and HC*.

Text. Collated for values: Ey Co. – Headings according to Ey. – Layout: Ey has 2 sections, 6 sub-tables across the page. This layout is used here. Co shows the table in 4 sections, 3 sub-tables across the page. – Also quoted for values: **$bn** = Batt., Nallino II p. 98 (ignored unless quoted). **$ba** = Batt., Paris Arsenal 8322, 61v. **$htv** = Handy Tables, Vat. gr. 304, 208v-209r (not for entrance values). **$hts** = Handy Tables, Stahlman 1960 no.31 (not for entrance values); see HC* for details. **$c** = recomputed values; see "Values" above. In selection; see under HC*.

Co places the label "meridies" near the heads of the columns for latitude. I have represented these labels as "m". They are not in Ey.

Readings chosen: see HC* above. I adopt the text that is likely to be original, judging from $htv $ba $c, (Ey Co). I italicize where the text thus adopted disagrees with the majority of $ba Ey Co.

Variant groups. – *Ey Co* form an error group against $ba and the other sources, and with *$ba* against $htv $c. Each of Ey Co has errors against the other one; Co may be more faulty than Ey, or perhaps Ey is more carefully corrected. A conspicuous error in *Co $ba* against the rest is at Gem:(x-2,x-1).

---

1 Tables HC41 and HC51 are not in Toomer 1968. They mainly occur in group {k}, but the only manuscript of this class known to Toomer was ms. Ou, which happens to omit the two tables.

Tabula diversitatis aspectus lunae in climate 4'o,
cuius latitudo est 36 gr et 22 mi, horae vero eius 14 et 30 mi.

Horae can cri		Diver sitas aspec tus Lo ng it ud Mi	La ti tu do Mi	Horae leo nis		Diver sitas aspec tus Lo ng it ud Mi	La ti tu do Mi	Horae virg inis		Diver sitas aspec tus Lo ng it ud Mi	La ti tu do Mi	Horae lib rae		Diver sitas aspec tus Lo ng it ud Mi	La ti tu do Mi	Horae scor pii		Diver sitas aspec tus Lo ng it ud Mi	La ti tu do Mi	Horae sagit tarii		Diver sitas aspec tus Lo ng it ud Mi	La ti tu do Mi
7	15	39	33m	7	4	45	23m	6	35	49	14m	6		50	11m	5	25	49	14m	4	56	45	23m
7		40	32	7		46	*23*	6		49	12	5		49	12	5		48	15	4		42	*27*
6		41	27	6		*46*	*18*	5		47	11	4		45	13	4		45	18	3		37	31
5		40	23	5		45	15	4		43	11	3		39	*15*	3		40	22	2		29	35
4		36	19	4		40	13	3		36	12	2		31	19	2		32	27	1		19	38
3		29	16	3		32	12	2		28	14	1		22	23	1		23	31	.		.	.
2		20	13	2		24	11	1		18	16	.		.	.	.		.	.	.		.	.
1		11	12	1		14	12	.		.	.	.		.	.	.		.	.	.		.	.
Mer		0	11	Mer		3	14	Mer		8	20	Mer		12	28	Mer		14	35	Mer		9	42
1		-11	12	1		- 8	16	.		.	.	.		.	.	.		.	.	.		.	.
2		20	13	2		17	20	1		- 2	24	.		.	.	.		.	.	.		.	.
3		29	16	3		24	24	2		12	29	1		2	32	1		*4*	39	.		.	.
4		36	19	4		31	28	3		19	33	2		- 7	36	2		- 6	42	1		- 1	43
5		40	23	5		34	33	4		24	36	3		15	39	3		15	44	2		11	44
6		41	27	6		34	*37*	5		27	40	4		21	42	4		21	44	3		20	44
7		40	32	7		32	40	6		28	42	5		25	44	5		26	44	4		27	42
7	15	39	33	7	4	32	40	6	35	27	43	6		26	44	5	25	27	*43*	4	56	32	40
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(a Mer) mer: meridies Ey, *ubique;* med() d() Co, *ubique.* **(c-4)** 38 Co. **(d-7;15)** 37 $bn. **(d-5)** 22 Co. **(d+6)** 26 $ba. **(d+7;15)** 38 $ba; 37 $bn. **(e-7...e+1)** (7+6), 5, 3, 3, 2, 1, (Mer), 1, 2 $ba. **(e+6)** (6+7) $ba. **(e+7)** *om.* $ba. **(f-7;4, f+7;4)** 3, 3 $c. **(g-6)** 46: $ba $htv $c; 45 Ey Co. **(g-1)** 34 $ba. **(g+2)** 14 $ba. **(g+6)** 32 $ba. **(g+7)** *om.* $ba. **(h-7)** 23: $ba $htv; 22 $c; 20 Ey Co. **(h-6)** 18: $htv; 58 $ba; 18.5 $c; 15 Ey Co. **(h-5)** 18 Co. **(h-4)** 16 Co. **(h+1)** 6 Co. **(h+6)** 37: Ey $htv; 34 $ba; 36 $c; 38 Co. **(h+7)** 41 Ey; <*> $ba; 39.5 $c. **(h+7;4)** 41 Ey. **(j-6;35)** *vacat* $ba. **(j-4...j+6)** (4+3), 2, 1, (Mer), 2...6, *(vac.)* $ba. **(L-6;35)** 45 $htv. **(L-6)** 49: $htv $c; 48 $ba $bn $hts! Ey Co. **(L-5)** 48 $htv. **(L-3)** 46 $htv; 35 Co. **(L-2)** 38 Co; 27 $c. **(L Mer)** *om.* $ba. **(L+2)** 2 $ba; 11 $c. **(m-6;35)** 10 $ba. **(m-1)** 56 $ba. **(m Mer)** *om.* $ba. **(m+3)** 38 $ba. **(m+4)** 36: $htv $c; 37 $ba $bn $hts! Ey Co. **(m+6;35)** 44 Ey. **(n-3...n Mer)** *(vac.),* 3, 2, (1+Mer) $ba. **(p+2)** 6 $ba. **(q-3)** 15: $htv; 16 $c; 14 $ba Ey Co. **(q+5)** 41 $htv; 43.5 $c. **(q+6)** 45 Ey. **(t-1)** 22 Ey; 23.5 $c. **(t Mer)** 24 Co. **(t+1)** 4: $ba $htv; 3 $c Ey Co. **(t+2)** 7 Ey. **(t+4)** 22 Ey. **(u+4, u+5)** 48, 48 $htv; 44, 43.5 $c. **(u+5;25)** 43: $ba $htv $c; 44 Ey Co. **(v+4;56)** 50 $ba. **(w-4;56, w+4;56)** 57, 57 $c. **(x-4)** 43 Ey. **(x-3)** 36 $ba. **(x+4)** 24 $ba. **(y-4)** 27: Ey $htv $c; 26 $ba Co. **(y-1)** 39 Ey $c. **(y+1)** 44 Co; 43.5 $c. **(y+3)** 45 $ba.

Horae capricorni		Diversitas aspectus: Longitudo Mi	Latitudo Mi
4	45	39	33m
4		35	35
3		29	39
2		*21*	42
1		11	44
.		.	.
.		.	.
.		.	.
Mer		0	44
.		.	.
.		.	.
.		.	.
1		-11	44
2		*21*	42
3		29	39
4		35	35
4	45	39	33
(a)	(b)	(c)	(d)

Horae aquarii		Diversitas aspectus: Longitudo Mi	Latitudo Mi
4	56	32	40m
4		27	42
3		20	44
2		11	44
1		1	43
.		.	.
.		.	.
.		.	.
Mer		- 9	42
.		.	.
.		.	.
.		.	.
1		19	*38*
2		29	35
3		37	31
4		42	27
4	56	45	23
(e)	(f)	(g)	(h)

Horae piscium		Diversitas aspectus: Longitudo Mi	Latitudo Mi
5	25	27	43m
5		26	44
4		*21*	44
3		15	44
2		6	42
1		- 4	39
.		.	.
.		.	.
Mer		14	35
.		.	.
.		.	.
1		23	31
2		32	27
3		40	22
4		45	18
5		48	15
5	25	49	*14*
(j)	(k)	(L)	(m)

Horae arietis		Diversitas aspectus: Longitudo Mi	Latitudo Mi
6		26	44m
5		25	44
4		21	42
3		15	39
2		7	36
1		- 2	32
.		.	.
.		.	.
Mer		12	28
.		.	.
.		.	.
1		22	23
2		31	*19*
3		39	15
4		45	13
5		49	12
6		50	11
(n)	(o)	(p)	(q)

Horae tauri		Diversitas aspectus: Longitudo Mi	Latitudo Mi
6	35	27	43m
6		28	42
5		27	40
4		24	36
3		19	33
2		12	29
1		2	24
.		.	.
Mer		- 8	20
.		.	.
1		18	16
2		28	14
3		36	12
4		43	11
5		47	11
6		48	12
6	35	49	14
(r)	(s)	(t)	(u)

Horae geminorum		Diversitas aspectus: Longitudo Mi	Latitudo Mi
7	4	32	40m
7		32	*40*
6		34	37
5		34	33
4		31	28
3		24	24
2		*17*	20
1		*8*	16
Mer		- 3	14
1		14	12
2		24	11
3		32	12
4		40	13
5		45	15
6		*46*	*18*
7		46	*23*
7	4	45	23
(v)	(w)	(x)	(y)

(c-2) 21: $htv $c; 24 $ba Ey; 44 Co. **(c+2)** 21: $htv $c; 24 $ba Ey Co. **(d-2)** 41 $htv. **(d+3)** 19 $ba. **(f-4;56, f+4;56)** 57, 57 $c. **(g-1)** 50 Co; 10 $htv. **(g+3)** 27 Co. **(g+4)** 43 Ey. **(h+1)** 38: $ba $htv; 39 Ey $c; 28 Co. **(L-5;25)** 24 $ba. **(L-5)** 21 Co. **(L-4)** 21: $ba $htv $c; 22 Ey; 26 Co. **(L-2)** 16 $htv; 7 Ey. **(L-1)** 3 Ey $c. **(L+5;25)** 45 $htv. **(m-5;25)** 44 Ey. **(m+2)** 37 $htv. **(m+5;25)** 14: Ey $c; 11 $htv; 8 $ba Co. **(p+2)** 21 Co. **(q-6)** 45 Ey. **(q-2, q-1)** 32, 36 $ba. **(q+2)** 19: $ba $htv $c; 18 Ey Co. **(t-4)** 14 Co. **(t+4...t+5)** *vacat* $ba. **(u-6;35)** 44 Ey. **(u-4)** 36: $ba $c; 38 Co; 37 Ey $bn $htv $hts!. **(u+1)** 36 $ba. **(w-7;4, w+7;4)** 3,3 $c. **(x-2)** 32 Co $ba. **(x-1)** 8: Ey $htv; 40 Co $ba; 7.5 $c. **(x+3)** 37 Co; 33 $c. **(x+4)** 44 $ba. **(x+6)** 46: $ba $htv $hts! $c; 45 Ey Co. **(x+7)** 48 $hts(VA). **(x+7;4)** 49 $htv $hts(VA). **(y-7;4)** 41 Ey. **(y-7)** 40: $htv; 39.5 $c; 41 $ba Ey Co. **(y+6)** 18: $ba $htv; 18.5 $c; 16 Co; 15 Ey. **(y+7)** 20 Ey; 22 $c.

HC51. Parallax, Climate 5, Albatenian.[1]

Same as Albattani, Nallino II p. 99, which is from the Handy Tables (Stahlman table 32). — The same table, but with a faulty set of entrance values, occurs in a number of witnesses; see HC52 below.

Witnesses: **{a0}** Ey,69r. — **{k}** Eh,116r-v; Lw,111r-112v; Co,169v; Cn,104r. — **{d}** Pv,37r-v (some values perhaps from HB51).

Headings. — General:

> **(1) Tabula** (-lae Co) **diversitatis aspectus lunae in climate quinto** (/q.c. Eh) :: Ey Eh Lw Co Pv. — *Added:* (nothing) Eh; **cuius latitudo est 41 (+(+gr) et) 14 (+mi), horae (+vero eius** Ey) **15 (+0** Co Pv) Ey Lw Co Cn Pv.
> **(2: other)** :: Cn (heading missing).

Sub-headings for Cancer:

> **(3) Horae cancri; Diversitas aspectus [Longitudo; Latitudo]** Ey Pv;
> **(4) Horae cancri; Diversitas aspectus lunae [Minuta longitudinis; Minuta latitudinis]** Lw Co.
> **(5: other)** :: Eh (like Lw Co but omitting the column-headings. "[Minuta...]"); (blank) Cn.

Values. Recomputed from latitude 40;56° and obliquity 23;51°; see H* and HC*.

Text. Collated for values: Ey Co; (from HC52:) Pa A Es Xg. — Headings according to Ey. — Layout: Ey Pa A Es Xg have 2 sections, 6 sub-tables across the page. This layout is used here. Co shows the table in 4 sections, 3 sub-tables across the page. — Also quoted for values: **$bn** = Batt., Nallino II p. 99 (ignored unless quoted). **$ba** = Batt., Paris Arsenal 8322, 62r (ignoring a case of misalignment, in Cancer, between entrances and values). **$htv** = Handy Tables, Vat. gr. 304, 209v-210r (not for entrance values). **$hts** = Handy Tables, Stahlman 1960, no.32 (not for entrance values); see under HC* for specifications. **$c** = recomputed values; see "Values" above. In selection; see under HC*.

Coverage: Whole table, Ey Co $ba; whole table apart from entrance columns ("horae"), Pa A Es Xg $htv $hts. — Co $ba place the label "meridies" near the beginning of the columns for parallax in latitude. I have represented these labels as "m". They are not in Ey Pa A Es Xg.

Readings chosen: see under HC*. Italics are used where $ba plus one or both of Ey Co depart from the adopted text.

Variant groups. — *$ba and all witnesses* are in error against the source at, e.g., Sgr(x+4), Tau (u-1). *$ba and all witnesses apart from Ey* show a conspicuous slide against the source at Lib(p-4), etc.; the original damage may have been preserved in *$ba Co,* slightly repaired in *Pa A Es Xg.*

The witnesses that show our table in the form HC52, i.e., *Pa A Es Xg,* are clearly an error group; cf. notably the miscopying at Lib(q+1...). *Es Xg* may be a sub-group, cf Tau(t+6), Gem(x+6). Pa A do not seem to have any errors of their own, but they share some with Es alone, perhaps because of correction in Xg. However, *$ba Co,* with or without *Ey,* is also an error group against Pa A Es Xg and the source; cf. Cnc(d-7;30, d+7;30); Vir(m-2); Aqr(h+4;44); Psc(L-4).

Thus the stemma for the tabular values may be *$htv (($ba ?Ey Co), (Pa A (Es Xg))),* except that Ey is vacillating and may show old readings. Pa A Es Xg, too, occasionally have more primitive readings than $ba has. Some of this confusion may, as always, be due to internal correction. In any case, it is fairly certain that the late witnesses Es Xg draw on a tradition that resembles Pa A closely.

---

1 Not in Toomer 1968; see note to HC41.

Tabula diversitatis aspectus lunae in climate 5'o,
cuius latitudo est 41 gr et 14 mi, horae vero eius 15.

Horae can cri		Diver sitas aspec tus		Horae leo nis		Diver sitas aspec tus		Horae virg inis		Diver sitas aspec tus		Horae lib rae		Diver sitas aspec tus		Horae scor pii		Diver sitas aspec tus		Horae sagit tarii		Diver sitas aspec tus	
		Lo ng it ud Mi	La ti tu do Mi			Lo ng it ud Mi	La ti tu do Mi			Lo ng it ud Mi	La ti tu do Mi			Lo ng it ud Mi	La ti tu do Mi			Lo ng it ud Mi	La ti tu do Mi			Lo ng it ud Mi	La ti tu do Mi
7	30	36	*36*m	7	16	43	27m	6	42	48	18m	6	*0*	49	15m	5	18	48	18m	4	44	43	27m
7		37	35	7		44	26	6		47	15	5		47	15	5		47	19	4		40	30
6		39	31	6		45	22	5		46	15	4		*44*	17	4		44	23	3		36	34
5		38	27	5		42	19	4		41	15	3		*38*	19	3		39	26	2		28	38
4		34	23	4		38	17	3		36	16	2		*32*	23	2		32	30	1		19	41
3		28	20	3		32	16	2		27	*17*	1		*23*	27	1		24	34	.		.	.
2		20	17	2		24	15	1		18	20	.		.	.	.		.	.	.		.	.
1		10	16	1		14	16	.		.	.	.		.	.	.		.	.	.		.	.
Mer		0	15	Mer		4	18	Mer		9	23	Mer		*14*	31	Mer		15	38	Mer		10	43
1		-10	16	1		- 6	20	.		.	.	.		.	.	.		.	.	.		.	.
2		20	17	2		15	24	1		- 0	27	.		.	.	.		.	.	.		.	.
3		28	20	3		22	28	2		9	31	1		*5*	35	1		5	42	.		.	.
4		34	23	4		27	32	3		16	36	2		- *4*	39	2		- 4	44	1		- 0	45
5		38	27	5		30	35	4		21	39	3		*11*	42	3		12	45	2		9	46
6		39	31	6		31	38	5		24	42	4		*17*	44	4		17	46	3		18	46
7		37	35	7		28	42	6		24	44	5		21	45	5		23	46	4		*24*	44
7	30	36	*36*	7	16	28	43	6	42	23	45	6	*0*	22	46	5	18	23	45	4	44	*28*	43
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(a Mer) meridies Ey, *ubique;* med() d() Co, *ubique;* rec() Es Xg, *ubique;* rem(oti)o Pa A, *ubique.* **(c-3)** 18 Es; 27 $c. **(c+7)** 31 $ba. **(d-7;30)** 37 $ba Ey Co. **(d+7)** 34 Pa A Es Xg; 34.5 $c. **(d+7;30)** 37 $ba Ey Co. **(f-7;16, f+7;16)** 56, 56 $ba. **(g-2)** 25 Pa A Es Xg; 23 $c. **(g-1)** 15 Pa A Es Xg. **(g+4)** 26 Pa Es Xg; 36 A. **(g+5)** 31 Co; 35 Pa A Es Xg. **(g+6)** 30 Co; 29 $htv. **(h-5)** 29 Co. **(h-3)** 17 Pa A Es Xg; 15.5 $c. **(h+7)** 43 $htv. **(k-6;42, k+6;42)** 41, 41 $c. **(L-2)** 26 $ba; 28 $htv; 27.5 $c. **(L Mer)** 19 Co. **(L+1)** 4 Pa A Es Xg. **(m-6;42)** m: *om.* $ba. **(m-6)** 17 $c. **(m-2)** 16 Co $ba; 17.5 $c. **(m+1)** 24 Ey; 20 Pa A Es Xg. **(o-6, o+6)** *om.* Ey Co $ba; *def.* Pa A Es Xg. **(p-4...p+3)** 44, 38--11: Ey $htv $c; 38--11, 17 (14 Pa A Es Xg) Co Pa A Es Xg $ba. **(+p-1)** 24 Ey; 33 *(ad p-2)* Pa A Es Xg. **(+p+1)** 4 Ey $c. **(+p+2)** 3 Ey. **(p+4)** 21 Co $ba. **(q-5)** 16 Pa A Es Xg; 15.5 $c. **(q-2)** 33 Pa A Es; 27 $htv. **(q-1)** 37 Es.ac. **(q Mer)** 14 Pa A Es Xg. **(q+1 ... q+6)** 5, 4, 12, 17, 23, 23 Pa A Es; 4, 5, 12, 17, 23, 23 Xg; *cf. col. (t).* **(s-5;18, s+5;18)** 19, 19 $c. **(t-5)** 48 Co. **(t-1)** 25 Pa A Es Xg. **(t Mer)** 14 Pa A Es Xg. **(u-2)** 32 Pa A Es Xg. **(w-4;44, w+4;44)** 45 $bn. **(x+1)** 10 Pa A Es Xg. **(x+4)** 24: $htv $c; 21 $ba, *omnes.* **(x+4;44)** 24 Co Pa A Es Xg $ba. **(y-4;44)** 40 Pa A Es. **(y-4)** 39 Es.

Horae capricorni		Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi	Horae aquarii		Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi	Horae piscium		Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi	Horae arietis		Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi	Horae tauri		Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi	Horae geminorum		Diversitas aspectus Longitudo Mi	Diversitas aspectus Latitudo Mi
4	30	36	36m	4	44	28	43m	5	18	23	45m	6	*0*	22	46m	6	42	23	45m	7	16	28	43m
4		34	38	4		*24*	44	5		23	46	5		21	45	6		24	44	7		28	42
3		27	42	3		18	46	4		*17*	46	4		17	44	5		24	42	6		31	38
2		19	44	2		9	46	3		12	45	3		11	42	4		21	39	5		30	35
1		10	46	1		0	45	2		4	44	2		*4*	39	3		16	36	4		27	32
.		.	.	.		.	.	1		- 5	42	1		- 5	35	2		9	31	3		22	28
.		.	.	.		.	.	.		.	.	.		.	.	1		0	*27*	2		15	24
.		.	.	.		.	.	.		.	.	.		.	.	.		.	.	1		6	20
Mer		0	46	Mer		-10	43	Mer		15	38	Mer		14	31	Mer		- 9	23	Mer		- 4	18
.		.	.	.		.	.	.		.	.	.		.	.	.		.	.	1		14	16
.		.	.	.		.	.	.		.	.	.		.	.	1		18	20	2		24	15
.		.	.	.		.	.	1		24	34	1		23	27	2		27	17	3		32	16
1		-10	46	1		19	41	2		32	30	2		32	23	3		36	16	4		38	17
2		19	44	2		28	38	3		39	26	3		38	19	4		41	15	5		42	19
3		27	42	3		36	34	4		44	23	4		44	17	5		46	15	6		45	22
4		34	38	4		40	30	5		47	19	5		47	15	6		47	15	7		44	26
4	30	36	36	4	44	43	*27*	5	18	48	18	6	*0*	49	15	6	42	48	18	7	16	43	27
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(c+4) 24 A; 33 $c. **(f-4;44,f+4;44)** 45,45 $bn. **(g-4;44)** 27 Co. **(g-4)** 27 Co; 23 Ey. **(g-2)** 19 $htv; 9.5 $c. **(g Mer)** 15 $htv. **(g+3)** 35 $ba $c. **(h-4;44)** m: *om.* $ba. **(h+3)** 44 Pa A Es Xg. **(h+4)** 31 $ba. **(h+4;44)** 26 Co $ba. **(k-5;18, k+5;18)** 19, 19 $c. **(L-4)** 27 Co $ba; 18 $c. **(L+5)** 40 $ba. **(m-5)** 47 Pa A Xg, Es.pc. **(m-3, m-2)** 44, 42 Pa A Es Xg. **(o-6, o+6)** *om.* Ey Co $ba; *def.* Pa A Es Xg. **(p-6)** 20 Pa A Es Xg. **(p-2)** 3 Ey Co. **(p+4)** 38 Co.ac; 34 $htv. **(p+6)** 48 Es.ac; 48.5 $c. **(q-6)** 16 Co; 56 $htv. **(q+2)** 27 Pa A Es Xg. **(q+3)** 18 Co; 20 $c. **(q+4)** 16 Pa A Es Xg. **(s-6;42, s+6;42)** 41 $c. **(t-6)** 25 Pa A Es Xg. **(t+1)** 48 Co. **(t+2)** 22 $ba. **(t+6)** 44 Es Xg. **(u-1)** 27: $htv $c; 24 $ba, *omnes.* **(u+2)** 10 $ba; 17.5 $c. **(u+6)** 17 $c. **(w-7;16, w+7;16)** 56 $ba. **(x-5)** 31 $htv. **(x-4)** 37 Pa A Es Xg. **(x+3)** 30 Pa A Es Xg; 35 $ba; 31.5 $c. **(x+6)** 40 Es Xg; 44 $c. **(y-2)** 25 Pa A Es Xg; 23.5 $c. **(y-1)** 24 Pa A Es Xg. **(y+4, y+5)** 19, 20 Pa A Es Xg.

HC52. Parallax, Climate 5, Albatenian, variant.

Toomer 1968 no. 70. – The values in the body of the table are the same as in the Albatenian HC51, i.e., for the fifth climate, but the entrance values are as in HC61, which is for the sixth climate. Thus the maximum half day-length is incorrectly shown as 7h;45, as against the correct length of daylight of 15h, which is still apparent from the headings.

Witnesses: **{aT}** Ek1,31r. – **{d}** Lb,45r; Pa,51v; A,230v; Fj,52v; Nc,132v; Fd2,54r; Gr3,124v; Ok,61r; Ok,71r. – **{x}** Oc,91v; X,168v; Mv,107r; Cm,149r; B,159r; T,297v; Lf,108v; Lg,187r; Lh,154r; Xj,290r; Xg,71v; G,75v; Xb,91r; Es,196v; Fb,81v; Pq,200v; Oy,88r; Wa,76r; Nu,156r. – **{?}** Da1,131v (:?). – Duplicates in {d} Ok, with different headings. — Extra: **{a2}** Mp,226v shows a table with blanks for entrances and values. The context is that of HC52 rather than HB51, cf. T:05(8.5), so the table has been listed here for its headings.

Headings. – General:

(1) Diversitas (/Tabulae (-a Lb) **diversitatis** Lb Fj Gr3) **aspectus in climate quinto, latitudo eius 41 14, horae eius 15 (+et) 0** (10 Fd2; *om.* Lb) **(+mi)** :: {d:} Lb Pa! A! Fj Nc Fd2! Gr3.
(2) Tabula diversitatis aspectus lunae (*om.* Ok Xb) **in climate quinto (/q.c.), cuius latitudo (+est) 41 gr 14 (/44** Cm Fb Oy Ek1; 44+ Oc) **mi, horae (+eius) 15** :: {d:} Ok(61r)!; {x-}; {?:} Da1! Ek1. – *Added:* **+(+et) 0 in minutis** B Lf Lg Lh Xj! Xg G Pq Nu; **+luna (/supponens lunam** Oc! Xb) **in longitudine longiori** Oc Cm Xb Fb Oy Ek1.
(3: other) Mp ("... in longitudine longiore ...", lat. 41°); Ok(71r) (lat. 45°24'); X (no numbers); Wa (41°14', 15h).

Sub-heading for Cancer:

(4) Horae cancri; Diversitas aspectus [Longitudo; Latitudo] :: {d:} Lb Pa A Fj Fd2 Gr3 Ok.
(5) Horae cancri; Longitudo; Latitudo :: {a2:} Mp; {x-}; {?:} Da1.
(6: other) :: Mv & Xg (both including "Cancer [Horae; Longitudo; Latitudo]"; Nc Ok(61r) Ek1.

Sample showing the half-day entrance values (same as in HC61, as mentioned). From Pa A Es Xg.

Cnc:	7;45	Cap:	4;15
Gem, Leo:	7;28	Sgr, Aqr:	4;32
Tau, Vir:	6;48	Sco, Psc:	5;12
Ari:	6;0	Lib:	6;0

The *tabular values* are comparable to HC51, q.v. for values and variants in the witnesses Pa A Es Xg.

HC61. Parallax, Climate 6, Albatenian.

Toomer 1968, no. 71. – Same as Albattani, Nallino II p. 100, from Handy Tables (Stahlman table 33).

Witnesses: **{a0}** Ey,69v. – **{aX}** Vo,0r (fly-leaf, only upper half seen); R,66r; Ov,102r-v. – **{aT}** Lu,75r; Oj,144r-v; P,85r. – **{k}** Eh,117r-v; Lw,113r-114v; Ou,74r-v; Co,170r; Cn,104r. – **{d}** Pv,35r-v. – **{p}** O,87v-88r; Pd,78v-79r; Ch2,177v. – **{?}** Ew1,33v-34r. — {a2:} Mp,227r shows a table with blanks for values; see HB61.

Headings. – General:

(1) Tabula diversitatis (t.d.: **/Diversitas** Ov Co Ew1) **aspectus lunae** (*om.* Ch2 Ew1) **in sexto climate (/c.s.), cuius latitudo est 45** (*om.* P) **(+gr) (+et) 22** (24 Ov) **(+mi)** :: {a0:} Ey; {aT:} Lu P; {aX:} Ov; {d:} Pv; {k:} Lw Ou Co; {p:} Ch2!; {?:} Ew1!. – *Added:* **+horae (+vero** Ey Ou Co**) (+eius) 15 (+et) 30 (+mi)** Ey Ov Pv Lw Ou Co Ch2! Ew1!; **+et eius horae aequales 15 et 30 mi** Lu P.

(2) Diversitas aspectus in climate sexto in longitudine longiori, cuius latitudo est 45 gr et 22 mi, (+et O) **horae maximae diei 15 et mi 30** (30 m. R) :: {aX:} R; {p:} O Pd.

(3: other) :: Vo (45°, 15h;30); Oj (45°22′, 15h;30); Eh (no numbers); Cn (no headings).

Sub-headings for Cancer:

(4) Horae cancri; Diversitas aspectus (*om.* Oj) **[Longitudo; Latitudo]** :: {a0:} Ey; {aX:} Ov; {aT:} Lu Oj P; {d:} Pv.

(5) Cancer, horae; Diversitas aspectus [Longitudo; Latitudo] :: {aX:} Vo R; {p:} O Pd Ch2.

(6) Horae cancri; Diversitas aspectus lunae [Minuta longitudinis; Minuta latitudinis] :: {k:} Lw Ou Co.

(7: other) :: Eh (like Lw but "[Minuta...]" absent); Cn Ew1 (no sub-headings).

Values. Recomputed from latitude 45;1° and obliquity 23;51°; see H* and HC*.

Text. Collated for values: **{a0}** Ey; **{aT}** Lu; **{k}** Ou Co. – Headings according to Ey. – Layout: Ey Lu have 2 sections, 6 sub-tables across the page. This layout is used here. Ou Co show the table in 4 sections, 3 sub-tables across the page. – Also quoted for values: **$bn** = Batt., Nallino II p. 100 (ignored unless quoted explicitly). **$ba** = Batt., Paris Arsenal 8322, 62v. **$htv** = Handy Tables, Vat. gr. 304, 210v-211r (not for entrance values). **$hts** = Handy Tables, Stahlman 1960 no.33 (not for entrance values); see HC* for specifications. **$c** = recomputed values; see "Values" above. In selection; see HC*.

Labels "meridies" in the latitude columns occur in $ba, but not in the witnesses for the present table. These labels are not reproduced.

Readings chosen: see under HC*. Italics are used where most of $ba Ey Lu Ou Co depart from the adopted text.

Variant groups: All of *Ey Lu Ou Co* (with or without *$ba*) may be in error together against the source; cf. Vir(m-6;48), Cap(c-3, c+3), and Tau(u+6;48). *Ou Co* is certainly an error group, which can be extended to *$ba Ou Co* (Leo(g-2, h+4), Psc(m+3)) or to *$ba Lu Ou Co* (Leo(h-7;28), Gem (x-7;28)). Thus the placement of Ey Lu, or of $ba, is doubtful, due perhaps to secondary corrections.

Tabula diversitatis aspectus lunae in climate 6'o,
cuius latitudo est 45 gr et 22 mi, horae vero eius 15 et 30 mi.

Horae cancri		Diversitas aspectus Longitud Mi	Latitudo Mi	Horae leonis		Diversitas aspectus Longitud Mi	Latitudo Mi	Horae virginis		Diversitas aspectus Longitud Mi	Latitudo Mi	Horae librae		Diversitas aspectus Longitud Mi	Latitudo Mi	Horae scorpii		Diversitas aspectus Longitud Mi	Latitudo Mi	Horae sagitarii		Diversitas aspectus Longitud Mi	Latitudo Mi
7	45	32	38	7	28	41	*30*	6	48	46	*20*	6	*0*	48	18	5	*12*	46	22	4	32	41	30
7		35	36	7		42	29	6		46	20	5		46	18	5		46	22	4		39	33
6		36	33	6		42	25	5		44	19	4		44	20	4		43	25	3		34	36
5		35	29	5		40	22	4		41	19	3		38	23	3		38	28	2		27	39
4		32	26	4		37	20	3		35	19	2		31	25	2		32	32	1		18	42
3		25	23	3		31	19	2		27	20	1		*23*	29	1		24	36	.		.	.
2		18	20	2		*23*	18	1		19	23	.		.	.	.		.	.	.		.	.
1		9	19	1		14	19	.		.	.	.		.	.	.		.	.	.		.	.
Mer		0	19	Mer		5	20	Mer		10	26	Mer		15	33	Mer		15	40	Mer		10	45
1		- 9	19	1		- 4	23	.		.	.	.		.	.	.		.	.	.		.	.
2		18	20	2		13	26	1		1	30	.		.	.	.		.	.	.		.	.
3		25	23	3		20	30	2		- 7	34	1		6	36	1		6	44	.		.	.
4		32	26	4		25	*34*	3		13	38	2		- 2	40	2		- 2	45	1		1	46
5		35	29	5		27	37	4		18	42	3		9	43	3		9	47	2		- 7	47
6		36	33	6		28	40	5		20	44	4		14	46	4		15	48	3		16	47
7		35	36	7		26	44	6		21	46	5		18	46	5		19	47	4		22	46
7	45	32	38	7	28	24	45	6	48	20	47	6	*0*	20	47	5	*12*	20	47	4	32	24	45
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(a Mer) meridies Ey Ou, *ubique;* recessio Lu, *ubique;* med(ia) d(ies) Co, *ubique.* **(d-6)** 34 Lu Co. **(d+6)** 34 Lu. **(f-7;28, f+7;28)** 24 Ou; 27 Co; 48 $ba. **(g-7)** 43 Ey. **(g-2)** 23: $htv $c; 24 Ey; 33 Ou Co $ba; 22 Lu. **(g Mer)** 15 Co. **(g+2)** 15 Lu. **(g+7;28)** 21 Ou Co. **(h-7;28)** 36 Lu Ou Co $ba. **(h-7)** 79 (!) Co. **(h+4)** 37 Ou Co $ba. **(L-2)** 26 Lu. **(L-1)** 15 $bn. **(L+2)** 2 $ba; 6.5 $c. **(L+4)** 13 $ba. **(m-6;48)** 20: $htv; 22 $bn $hts! $c; 26 $ba, *omnes.* **(m-1)** 24 Ou Co. **(m+3)** 33 $ba. **(o-6, o+6)** *om.* Ey Lu Co $ba. **(p-1)** 33 Ou Co; 22 Ey. **(p+6)** 18 $c. **(s-5;12, s+5;12)** 42, 42 Ou Co; 52, 52 $ba. **(t-5, t-4)** 43, 40 Lu. **(t+5;12)** 22 $ba. **(u-4)** 34 $ba. **(u-2)** 22 $ba; 32.5 $c. **(u+5;12)** 40 $htv. **(x-2)** 26 Lu. **(x+2)** 7: Lu Ou Co $htv; 4 $ba; 8 $c; 9 Ey. **(y-4)** 34 Co; 32 $c. **(y+2)** 46 Ou Co; 48 $c.

Horae capricorni		Diversitas aspectus Longitud Mi	Latitudo Mi
4	15	32	38
4		31	40
3		*25*	43
2		18	46
1		9	47
.		.	.
.		.	.
.		.	.
Mer		0	48
.		.	.
.		.	.
.		.	.
1		- 9	47
2		18	46
3		*25*	43
4		31	40
4	15	32	38
(a)	(b)	(c)	(d)

Horae aquarii		Diversitas aspectus Longitud Mi	Latitudo Mi
4	32	24	45
4		22	46
3		16	47
2		7	47
1		- 1	46
.		.	.
.		.	.
.		.	.
Mer		10	45
.		.	.
.		.	.
.		.	.
1		18	42
2		27	39
3		34	36
4		39	33
4	32	41	30
(e)	(f)	(g)	(h)

Horae piscium		Diversitas aspectus Longitud Mi	Latitudo Mi
5	12	20	47
5		19	47
4		15	48
3		9	47
2		2	45
1		- 6	44
.		.	.
.		.	.
Mer		15	40
.		.	.
.		.	.
1		24	36
2		32	32
3		38	*28*
4		43	*25*
5		46	*22*
5	12	46	*22*
(j)	(k)	(L)	(m)

Horae arietis		Diversitas aspectus Longitud Mi	Latitudo Mi
6	*0*	20	47
5		18	46
4		14	46
3		9	43
2		2	40
1		- 6	36
.		.	.
.		.	.
Mer		15	33
.		.	.
.		.	.
1		23	29
2		31	25
3		38	23
4		44	20
5		46	18
6	*0*	48	18
(n)	(o)	(p)	(q)

Horae tauri		Diversitas aspectus Longitud Mi	Latitudo Mi
6	48	20	47
6		21	46
5		20	44
4		18	42
3		13	38
2		7	34
1		- 1	30
.		.	.
Mer		10	26
.		.	.
1		19	23
2		27	20
3		35	19
4		41	19
5		44	19
6		46	20
6	48	46	*20*
(r)	(s)	(t)	(u)

Horae geminorum		Diversitas aspectus Longitud Mi	Latitudo Mi
7	28	*24*	45
7		26	44
6		28	40
5		27	37
4		25	34
3		20	30
2		13	26
1		4	23
Mer		- 5	20
1		14	19
2		*23*	18
3		31	19
4		37	20
5		40	22
6		42	25
7		42	29
7	28	41	30
(v)	(w)	(x)	(y)

(b-4;15, b+4;15) 30, 30 $ba. **(c-3)** 25: $htv $c; 24 $ba, *omnes.* **(c-1)** 10 Ey. **(c+1)** 10 Ey. **(c+3)** 25: $htv $c; 24 $ba, *omnes.* **(d-3)** 44 Lu. **(d+3)** 44 Lu. **(g-4;32)** 22 $ba. **(g-2)** 9 Ey; 8 $c. **(g+2)** 24 Ou Co. **(g+4)** 49 $htv. **(h+1)** 43 Lu $c. **(h+4)** 34 Lu; 32 $c. **(k-5;12, k+5;12)** 32, 32 $ba. **(L+4)** 44 Lu. **(m-3, m-2)** 48, 47 $htv. **(m-1)** 43 Ey $c. **(m+3 ... m+5;12)** 38, 43, 46, 46 Ou Co $ba, *cf. col. (L).* **(+m+3)** 29 $c. **(o-6, o+6)** *om.* Ey Lu Co $ba. **(p-6)** 18 $c. **(p+1)** 22 Ey. **(p+2)** 21 Ou Co. **(p+4)** 41 $htv; 43 $c. **(p+6)** 43 Ou Co; 47 $c. **(q Mer)** 34 Lu. **(s-6;48)** *om.* $ba. **(t-2)** 1 Ou Co; 30 $ba; 6.5 $c. **(t-1)** 2 Ou Co. **(t+1)** 15 $bn. **(t+2)** 26 Lu. **(u-5)** 45 $ba. **(u-3)** 48 Ou Co. **(u+6;48)** 20: $ba $htv $hts(VA); 22 $bn $hts(HB) $c; 26 *omnes.* **(x-7;28)** 22 Lu Ou Co $ba. **(x-7)** 27 $ba. **(x-1)** 3 Ou Co; 4.5 $c. **(x+1)** 4 Lu. **(x+2)** 28 $ba; 24 Ey Ou Co. **(x+7)** 43 Ey. **(y-1)** 24 Lu. **(y+7;28)** 36 Lu.

HC71. Parallax, Climate 7, Albatenian.

Toomer 1968 no. 72. — Same as Albattani, Nallino II p. 101, from Handy Tables (Stahlman table 34).

Witnesses: **{a0}** Ey,70r. — **{a2}** Cz,87v-88r; Cj,161v-162r; Mp,227v. — **{aX}** R,66v; Ov,103r-v. — **{aT}** Lu,75v; Oj,144v, 149r; P,85v. — **{k}** Eh,118r-v; Lw,115r-116v; Ou,75r-v; Eg,24r; Co,170v; Cn,104v. — **{d}** Lb,46r; Pa,52v (values blank); A,231v (values blank); Fj,53v (values blank); Pv,38r-v; Gr3,125v; Ok,62r. — **{e}** Ek3,118r. — **{x}** Oc,92v; X,169v; Vz,73r; Mv,108r; Cm,149v (faulty, entrances like HA11); Cm,150r; B,160r; T,298r; Lf,109v; Lg,187v; Lh,151v; Xj,291r; Xg,72v; G,76v; Xb,92r; Es,197v; Fb,82v; Pq,201v; Oy,89r; Wa,77r; Ow,170r; Nu,157r. — **{p}** O,88v-89r; Pd,79v-80r; Ch2,178r. — **{?}** Ef,67r-v; Ew1,34v (first half of table only); Ew2,39v-40v (:Ut Annos); Pn,50v (:Jo. Lin.); Fc2,114v (:Jo. Lin.); Ut,134r (:?). — Duplicate in {x:} Cm. — {d:} Pa A have the table-frame with headings, but the table lacks all numbers.

Headings. General. — Some lesser variants are ignored. The Albatenian latitude (48°53′) is shown by {d:} A Fj Gr3, Pa(m2?), and with an Abjad error (as 48°13′) by Ey Pv, {k:} Lw Ou Co. In the rest of the witnesses it is vulgarized into 48°.

(1) Tabula diversitatis aspectus lunae in climate septimo (/s.c. Ou Co) **cuius latitudo est 48 (+gr** Ey Pv) **et 13 (+mi** Ey Pv), **horae (+vero** Ou Co) **(+eius** Co Ey) **(+sunt** Ey) **16 (+et** Ou Co) **0** (*om.* Ey) :: {a0:} Ey; {k:} Ou Co; {d:} Pv.
(2) Tabula (-ae Gr3) **diversitatis** (t.d.: diversitas A) **aspectus in climate septimo, latitudo eius 48** (28 Fj) **53, horae 16 0** (9 Fj) :: {d:} A Fj Gr3.
(3) Tabula diversitatis (t.d.: /diversitas R Ov O Pd) **aspectus lunae** (*om.* Cj R Ok Nu O Pd Ch2 Ew1) **in septimo climate (/c.s.** Cz, Lu Oj P, O Pd Ch2) :: {a2:} Cz Cj Mp; {aT:} Lu Oj P; {aX:} R Ov; {d:} Ok; {p:} O Pd Ch2!; {x-}; {?:} Ew1 Ew2 Pn Fc2.
——— *Addition 1:*
(none) :: Cj Ok.ac Ow Ew2 (*other*, Ok.pc);
+cuius latitudo (+est) 48 (+gr) (+et) horae (+eius) (+maximae R O Pd) (++tantummodo R) **16** (*om.* Xj Pq) :: {a2:} Mp; {aX:} R Ov; {p:} O Pd Ch2!; {x-}; {?:} Ew1 Pn! Fc2!;
+cuius latitudo est 48 gr et dies (+eius Cz) **longior 16 horarum aequalium** :: {a2:} Cz; {aT:} Oj;
+cuius latitudo est 48 gr, et eius horae aequales (+sunt P) **16** :: {aT:} Lu P.
——— *Addition 2:*
(none) :: {a2:} Cz; {aX:} Ov; {aT:} Lu Oj P; {x:} T; {p:} Ch2; {?:} Ew1.
+quae (et Oc Xb) **supponit lunam esse in longitudine longiori (+epicycli** Mv B Lf Xj Xg G Nu Ew2) :: *(before Addition 1:)* Mp, Mv B Lf Lg Lh Xj Xg G Es Pq Nu, Pn Fc2; *(at end:)* Oc Xb, Cj Ok Ow Ew2.
+luna in longitudine longiori :: Cm(149v!, 150r) Vz Fb Oy;
+in quo *(sic!)* **supposita est luna esse in longitudine longiori** :: *(before Addition 1)* Wa.
+et factae sunt tabulae istae in longitudine longiori :: R O Pd.
(4: other) Lb (48°, 16h); Lw (48°13′, 16h;0); Pa (48°53′, 16h;0, in an addition); Ef (as if for HA11); Ut (48°, 16h); Ok.pc (cf. (3+Add.2) above, and adding "latitudo eius 48 gr et 33 (!) minutorum horae eius 16") above the line)
(5: no values or no heading) Ek3 Eh Eg Cn X.

Sub-headings for Cancer:

(6) Horae cancri; Diversitas aspectus (*om.* Oj) **[Longitudo; Latitudo]** :: {a0:} Ey; {aX:} Ov; {a2:} Cz; {aT:} Lu Oj P; {d:} Lb Pa A Fj Pv Gr3 Ok; {?:} Ef Ut.
(7) Horae cancri; Diversitas aspectus lunae [Minuta longitudinis; Minuta latitudinis] :: {k:} Lw Ou Co.
(8) Cancer, horae; Diversitas aspectus [Longitudo; Latitudo] :: {aX:} R; {p:} O Pd Ch2; {?:} Ew1.
(9) Horae cancri; Longitudo; Latitudo :: {a2:} Cj Mp; {e:} Ek3; {x-}; {?:} Pn Fc2 Ew2.
(10: other) :: Mv & Xg (including "Cancer [Horae; Longitudo; Latitudo]"; Eh (like (7) but lacking "[Minuta...]"); Eg (like (7) but with "[Minuta...]" miswritten); Cn (no headings).

Values. Recomputed from latitude 48;32° and obliquity 23;51°; see H* and HC*.

All sources and witnesses show a slide in Lib(q-2...q+4) and, symmetrically, in Ari(q-4...q+2). This is inherited from the Handy Tables, and has been left uncorrected in the text. The Handy Tables manuscript used here ($htv) shows an overlapping slide at Lib(q+1...), absent from the rest of the tradition.

Text. Collated for values: **{a0}** Ey; **{aT}** Lu; **{k}** Ou Co; **{x}** Es Xg. — Headings according to Ey. — Layout: Ey Es Xg (and the empty copies in Pa A) have 2 sections, 6 sub-tables across the page. This layout is used here. Ou Co show the table in 4 sections, 3 sub-tables across the page. — Also quoted for values:

$bn = Albattani, Nallino II p. 101 (ignored unless quoted). **$ba** = Albattani, Paris Arsenal 8322, 63r. **$htv** = Handy Tables, Vat. gr. 304, 211v-212r (not for entrance values). **$hts** = Handy Tables, Stahlman 1960, no. 34 (not for entrance values); see HC* for specifications. **$c** = recomputed values; see "Values" above. In selection; see HC*.

The labels "meridies" above the latitude columns, shown by Ou Co in similar tables, are absent here. $ba does show them. They are not reproduced.

Readings chosen: see under HC*. Italics are used if the adopted text has support from just one of the sets (Ey), (Es Xg), (Lu Ou Co), or from none of them. – This rule is taken over from HC11, though the status of Lu (or of Es Xg) may be different here; see below.

Variant groups. Of error groups, *Ou Co ($ba (Lu))* and *Es Xg (Lu)* are common, and appear independent of each other; *Ey* is vacillating as usual. This situation is much the same as for HC11, where the same witnesses were collated. Thus, Ou Co are close to the Albatenian tradition but are faulty on their own account. Ey and (Es Xg) appear independent, even in comparison with the Albattani witness used ($ba), since the variation at Psc(m+3) does not seem conclusive. This, once again, is probably because $ba is mixed or self-correcting. I have not looked further into this possibility.

Tabula diversitatis aspectus lunae in climate 7'o,
cuius latitudo est 48 gr et 13 mi, horae eius sunt 16.

Horae can cri		Diver sitas aspec tus Lo ng it ud Mi	Diver sitas aspec tus La ti tu do Mi	Horae leo nis		Diver sitas aspec tus Lo ng it ud Mi	Diver sitas aspec tus La ti tu do Mi	Horae virg inis		Diver sitas aspec tus Lo ng it ud Mi	Diver sitas aspec tus La ti tu do Mi	Horae lib rae		Diver sitas aspec tus Lo ng it ud Mi	Diver sitas aspec tus La ti tu do Mi	Horae scorp ionis		Diver sitas aspec tus Lo ng it ud Mi	Diver sitas aspec tus La ti tu do Mi	Horae sagit tarii		Diver sitas aspec tus Lo ng it ud Mi	Diver sitas aspec tus La ti tu do Mi
8	*0*	30	42	7	40	39	33	6	54	45	23	6	*0*	46	21	5	6	45	24	4	20	39	33
7		33	38	7		40	32	6		45	24	5		45	22	5		45	25	4		37	34
6		34	35	6		40	28	5		43	22	4		42	23	4		42	27	3		33	38
5		32	31	5		39	25	4		40	21	3		37	25	3		37	30	2		27	41
4		29	28	4		35	23	3		35	22	2		31	26	2		31	*34*	1		19	44
3		24	25	3		30	22	2		27	24	1		23	28	1		24	38	.		.	.
2		17	23	2		22	22	1		19	26	.		.	.	.		.	.	.		.	.
1		9	22	1		14	22	.		.	.	.		.	.	.		.	.	.		.	.
Mer		0	21	Mer		5	23	Mer		11	29	Mer		15	31	Mer		17	41	Mer		10	47
1		- 9	22	1		- 3	26	.		.	.	.		.	.	.		.	.	.		.	.
2		17	23	2		11	29	1		3	32	.		.	.	.		.	.	.		.	.
3		24	25	3		18	32	2		- 5	36	1		7	35	1		8	44	.		.	.
4		29	28	4		22	36	3		11	40	2		0	38	2		- 0	47	1		2	48
5		32	31	5		25	39	4		15	43	3		- 6	42	3		7	48	2		- 6	49
6		34	35	6		25	42	5		18	45	4		11	45	4		13	48	3		14	48
7		33	38	7		23	45	6		18	47	5		14	48	5		17	48	4		20	47
8	*0*	30	42	7	40	21	46	6	54	17	48	6	*0*	16	48	5	6	17	48	4	20	21	46
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(a Mer) meridies Ey Ou, *ubique;* recessio Lu, *ubique;* med() d() Co, *ubique;* rec() Es Xg, *ubique.* **(b-8, b+8)** *om.* Ey Lu Co $ba. **(c-7)** 38 Lu Es Xg. **(c-3)** 20 $ba. **(c+7)** 38 Lu Es Xg. **(d-6, d-5)** 3<->, 3<-> Co. **(+d-5)** 32 $htv; 31.5 $c. **(d-2)** 24 Lu Es Xg. **(d-1)** 32 Es. **(d+2)** 24 Lu Es Xg. **(d+4)** 23 $ba. **(d+7)** *n.l.* Ou. **(g-7;40)** 49 $htv; 38.5 $c. **(g+1)** 6 $htv. **(h-3)** 23 Es Xg. **(h+1)** 25 $ba. **(h+3)** 33 Co. **(k-6;54, k+6;54)** 15, 15 $ba. **(L-3)** 33 $ba; 34 $c. **(L-2)** 26 Lu. **(L-1)** 18 Ou Co. **(L+6)** 28 $ba. **(L+6;54)** 18 $ba. **(m-6;54)** 23: Lu $ba $htv; 22 Ou Co; 24 Ey Es Xg $bn; 25 $c. **(m-6)** 24: Lu Ou Co $ba; 21 $htv; 23 Ey Es Xg $bn $c. **(m-3)** 20 Es Xg. **(m+1)** 3<-> *(31 a.c.?)* Ou; 39 $htv. **(m+4)** 42 Lu $c. **(m+6)** 46 Lu Es Xg. **(o-6, o+6)** *om.* Ey Lu Co $ba. **(p-3)** 47 $htv. **(p Mer)** 5 Es Xg. **(q-4)** 27 Lu. **(q-3)** 30 Lu.

(q-2...q+4) 26 28 31 35 38 42 45 : $bn $hts!, *cett.*
28 32 35 39 42 45 47 $c.
(q+1...q+5) 34 35 38 42 45 $htv, *prave.*

(+q Mer) 30 Es Xg. **(t+3)** 17 Ey.pc. **(u-3)** 31 Es Xg $bn $c. **(u-2)** 37 Lu Ou Co $ba; 34.5 $c. **(u+1)** 47 Ou Co $ba. **(u+2)** 46 Es Xg $bn $hts!; 48 $htv. **(u+3)** 47 Lu Es Xg. **(v-w -4;20)** (4.20 + 4) $ba. **(v+4;20)** 5(?) Lu. **(x-4;20 ... x+3)** 39, 37--14: 37--14 (11 $htv), 20 $htv, *prave.* **(+x-4;20)** 29 Es Xg. **(+x-4)** 27 Es Xg. **(+x-2)** 26 Lu Es Xg $c. **(y-4)** 37 Lu. **(y Mer)** 40 $ba; 46.5 $c. **(y+4)** 46 $ba.

Horae capricorni		Diversitas aspectus		Horae aquarii		Diversitas aspectus		Horae piscium		Diversitas aspectus		Horae arietis		Diversitas aspectus		Horae tauri		Diversitas aspectus		Horae geminorum		Diversitas aspectus	
		Longitudo Mi	Latitudo Mi			Longitudo Mi	Latitudo Mi			Longitudo Mi	Latitudo Mi			Longitudo Mi	Latitudo Mi			Longitudo Mi	Latitudo Mi			Longitudo Mi	Latitudo Mi
4	*0*	30	42	4	20	21	46	5	6	17	48	6	*0*	16	48	6	54	17	48	7	40	21	46
3		24	45	4		20	47	5		17	48	5		14	48	6		18	47	7		23	45
2		17	47	3		14	48	4		13	48	4		11	45	5		18	45	6		25	42
1		9	48	2		6	49	3		7	48	3		6	42	4		15	43	5		25	39
.		.	.	1		- 2	48	2		0	46	2		- 0	38	3		11	40	4		22	36
.		.	.	.		.	.	1		- 8	44	1		7	35	2		5	36	3		18	32
.		.	.	.		.	.	.		.	.	.		.	.	1		- 3	32	2		11	29
.		.	.	.		.	.	.		.	.	.		.	.	.		.	.	1		3	26
Mer		0	49	Mer		10	*47*	Mer		17	41	Mer		15	31	Mer		11	29	Mer		- 5	23
.		.	.	.		.	.	.		.	.	.		.	.	.		.	.	1		14	22
.		.	.	.		.	.	.		.	.	.		.	.	1		19	26	2		22	22
.		.	.	.		.	.	1		24	38	1		23	28	2		27	24	3		30	22
.		.	.	1		19	44	2		31	34	2		31	26	3		35	22	4		35	23
1		- 9	48	2		27	41	3		37	30	3		37	25	4		40	21	5		39	25
2		17	47	3		33	38	4		42	27	4		42	23	5		43	22	6		40	28
3		24	45	4		37	34	5		45	25	5		45	22	6		45	23	7		40	32
4	*0*	30	42	4	20	39	33	5	6	45	24	6	*0*	46	21	6	54	45	24	7	40	39	33
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)	(x)	(y)

(b-4, b+4) *om.* Ey Lu Co $ba. **(c-1)** 5 $htv. **(c+1)** 5 $htv. **(c+3)** 21 $htv. **(d-2)** 17 Ou; 4 $ba. **(d-1)** 18 Ou. **(d+1, d+2)** 45, 48 $htv. **(g Mer, +1-+3)** 19, 27, 33, 37 Lu. **(g+2)** 26 Es Xg $c. **(g+3)** 23 Es Xg. **(g+4;20)** 33 $ba; 38.5 $c. **(h Mer)** 46.5 $c; 46 Ey Ou Co. **(h+2)** 44 $htv. **(k-5;6, k+5;6)** 36, 36 Lu. **(L-3)** 50 $ba. **(L Mer)** 16 Lu. **(L+4)** 41 Es Xg. **(m-3)** 47 Lu Es Xg. **(m-2)** 47 Ey $c. **(m+1)** 37 Es Xg.pc. **(m+2)** 31 $htv; 34.5 $c. **(m+3)** 30: $htv $hts(VA) Ey; 31 Lu Ou Co Es Xg $ba $bn $hts(HB) $c. **(m+4)** 26 $ba; 28 $c. **(m+5;6)** 1 (!) $htv; 25 $c. **(o-6, o+6)** *om.* Ey Lu Co $ba. **(p Mer)** 17 $htv; 15.5 $c. **(p+3)** 27 $htv. **(q-4...q+2)** 47, 45, 42, 39, 35, 32, 28 $c. **(+q-3)** 47 Ou Co. **(+q+1)** 21 Ou. **(s-6;54, s+6;54)** 14, 14 $ba. **(t+2)** 20 $ba. **(u-6;54)** 44 Es Xg. **(u+3)** 20 Lu Es Xg. **(u+6, u+6;54)** 21, 23 $htv; 23, 25 $c. **(x Mer)** 23 Lu. **(y-5)** 49 $htv. **(y Mer)** 25 Lu; 24 $c. **(y+2)** 40 $ba. **(y+3)** 23 Es Xg.

HD. Tables for "arcs and angles", etc., from the Almagest.

These tables are the same as in Almagest II,13. – Ms. Ey has tables for the 4th (78v-79r), 5th (79v-80r), 6th (80v-81r), and 7th (81v-82r) climates. I reproduce samples from the table for the 4th climate, and from the table for the 7th climate since this is also in ms. Cu.

No emendations have been done, except obvious ones. One gloss for such tables is in ms. H; see CbA.G42.

HD14. "Tabula arcuum et angulorum", Climate 4.

Same as Almagest II,13, Rhodes, 14;30 hours, latitude 36°.

Witness: **{a0}** Ey,78v-79r. – *Sample.* From Ey. – Compared to: **$pm** = Almagest, above, p. 126 in Toomer 1984; **$pl** = Arabo-Latin Almagest, ed. Liechtenstein 1515, f. 24r. There is one possible Abjad error in Ey (g7;15), not shared by $pl.

Tabula arcuum et angulorum in climate quarto, cuius longior dies est 14 horarum et dimidiae, et latitudo eius est 36 graduum.

Hore cancri	Arcus		Anguli orientales		Anguli occidentales		Hore leonis	Arcus		Anguli orientales		Anguli occidentales	
	Gr	Mi	Gr	Mi	Gr	Mi		Gr	Mi	Gr	Mi	Gr	Mi
Mer.	12	9	90	0	0	0	Mer.	15	30	102	30	0	0
1	17	47	133	14	46	46	1	20	20	139	32	65	28
2	28	22	147	45	32	15	2	30	28	155	19	49	41
3	40	27	151	45	28	14	3	42	6	160	37	44	23
4	52	36	151	52	28	8	4	54	12	162	11	42	49
5	64	36	149	54	30	6	5	66	17	161	5	43	55
6	76	16	146	25	33	35	6	78	7	158	10	46	50
7	87	23	141	30	38	30	7	89	27	153	39	51	21
7;15	90	0	140	1	39	39	7;3	90	0	153	36	51	24
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)

(e3) 46 $pm $pl. **(g7;15)** 59 $pm $pl. **(h7;3)** 7;3: $pl; 7;4 $pm.

Hours of sunrise/sunset from all sub-tables:

Cnc:	7;15	Leo:	7;3	(7;4 $pm)
Vir:	6;35	Lib:	6	
Sco:	5;25	Sgr:	4;57	(4;56 $pm)
Cap:	4;45	Aqr:	4;57	(4;56 $pm)
Psc:	5;25	Ari:	6	
Tau:	6;35	Gem:	7;3	(7;4 $pm)

HD15-16. Climates 5-6.

HD15. Ey,79v-80r: "Tabula arcuum et angulorum in climate quinto, cuius longior dies est 15 horarum, et eius latitudo est 40 graduum et 56 minutorum". – Same as Almagest II,13, Hellespont, 15 hours, latitude 40°56′.

HD16. Ey,80v-81r: "Tabula arcuum et angulorum in climate sexto, cuius longior dies est 15 horarum et dimidie, latitudo autem eius est 45 graduum". – Same as Almagest II,13, Middle of Pontus, 15 1/2 hours, latitude 45°1′.

HD17. "Tabula arcuum et angulorum", Climate 7.

Same as Almagest II,13, Borysthenes, 16 hours, latitude 48°32′. – There are 12 tables, one for each sign. The two witnesses arrange them differently; the text below reproduces neither arrangement.

Witnesses: **{a0}** Ey,81v-82r; **{aX}** Cu,83v-84r. – *Sample.* From Ey Cu. Main heading from Ey; it is absent from Cu. The sub-headings are the same in Ey and Cu except that Cu lacks the symbols for the signs here noted as "(CNC)", etc.

For a rough check, the sample is compared to **$pm** = Almagest, above, Toomer 1984 p. 126; **$pl** = Arabo-Latin Almagest, ed. Liechtenstein 1515, f. 24r. Cu may have Abjad errors against Ey at (e8, f2). They are not shared by $pl.

Tabula arcuum et angulorum in climate septimo, cuius longior dies est 16 horarum, et eius latitudo est 48 graduum.

Hore cancri	Arcus		(CNC) Anguli orientales		Anguli occidentales	
	Gr	Mi	Gr	Mi	Gr	Mi
Mer.	24	41	90	0	0	0
1	27	30	111	44	68	16
2	34	9	126	7	53	53
3	43	2	133	18	46	42
4	52	44	136	6	43	54
5	62	40	136	4	43	56
6	72	24	134	0	46	0
7	81	38	130	16	49	44
8	90	0	124	58	55	2
(a)	(b)	(c)	(d)	(e)	(f)	(g)

Hore leonis	Arcus		(LEO) Anguli orientales		Anguli occidentales	
	Gr	Mi	Gr	Mi	Gr	Mi
Mer.	28	2	102	30	0	0
1	30	32	122	9	82	51
2	36	55	135	54	69	6
3	45	32	143	28	61	32
4	55	3	146	50	58	10
5	64	59	147	19	57	41
6	74	47	145	46	59	14
7	84	10	142	27	62	33
7;40	90	0	139	20	65	40
(h)	(j)	(k)	(L)	(m)	(n)	(o)

(b6) 72: $pm; 82 Cu; *vacat* Ey. **(c7)** 34 Ey. **(d8)** 134 Cu. **(e1)** 40 Cu. **(e3)** 14 Cu. **(e8)** 18 Cu. **(f-gMer)** 0 0: *vacant* Cu $pm, *et hic et locis similibus*. **(f2)** 58 Cu. **(f6)** 45 Ey. **(h7;40)** 7;40: Ey $pm $pl; 7 Cu. **(jMer)** 27 Cu. **(k3)** 32; $pl, *cett.*; 30 $pm. **(L1)** 132 Cu. **(L5)** 146 Cu. **(m7)** 37 Cu $pl. **(n7)** 57 Cu. **(o7)** 23 $pl.

Hours of sunrise/sunset from all sub-tables:

Cnc: 8	Leo: 7;40
Vir: 6;54	Lib: 6
Sco: 5; 6	Sgr: 4;20
Cap: 4	Aqr: 4;20
Psc: 5; 6	Ari: 6
Tau: 6;54	Gem: 7;40

(Vir) 7 Cu. **(Sco)** 7 Cu. **(Sgr)** *vacat* Cu. **(Aqr)** 4 Cu. **(Psc)** 6 Cu. **(Ari)** 6 Cu. **(Tau)** 7 Cu.

HD21. Parallax in altitude, Albatenian / Almagest.

Like Albattani, Nallino II p. 93 (rule: ch. 39, Nallino I p. 79 ff.), or Almagest V,18; see "Versions" below.
Sub-tables (3-4) are in Azarchel's Almanac, Millás 1950 p. 232 table 81 (rule: Almanac ch. 21, Millás p. 140-41). This version has not been compared.

Witnesses: **{a0}** Pz,100r(m2); Ey,82v-83r; Ea,51r. — **{aT}** Oj,161v-163r. — **{d}** Lb,52r; Mh,9r.

Headings. — General:

(1) **Tabula diversitatis** (t.d.: diversitas Mh) **aspectus solis et lunae** (+secundum Ptolomaeum Ey) **in circulo altitudinis** *(Ey Mh:)* **in terminis 4 longitudinum a centro terrae** *(Ey:)* **et sunt 9 tabulae** :: Ey Ea Mh.
(2) **Tabula diversitatis aspectus in circulo altitudinis in terminis longitudinum 4 de centro latitudinis** (=?) :: Oj.
(3) **Tabula diversitatis aspectus solis et lunae ad omnem terram** :: Pz.
(4: **none)** :: Lb.

Sub-headings vary, and are not listed; they are blank in Lb. They may number the sub-tables as "secunda ... nona" (Ey Mh) or, including the entrance column, as "prima ... nona" (Pz Oj).

Versions. The table of Albattani (as in Nallino or in Par. Arsenal 8322, 59v) shows some differences from the Almagest (Arabo-Latin version, readings from the 1515 printing by Liechtenstein). The most conspicuous differences pertain to cols. (j-m), as noted by Nallino II p. 235; cf. the sample below, where a few of the differences are illustrated.

The Almagest table, apart from readings such as those shown, has some oddities: thus, most of col. (k) is filled out with the repeated phrase "40 20 0", and most of col. (m) with the phrase "50 40 30 20 10 0". These features are shared by *Pz Ey Mh,* though in slightly varying ways. The Greek Almagest shows other values in columns (j,m); cf., e.g., Toomer 1984 p. 265.

The Albatenian readings, reproduced in the main table below, are shown by *Ea Oj Lb,* with some lesser variants.

The present witnesses differ in conflicting ways. Probably most or all of the copies are independent of each other, or corrections have been introduced from traditions unrelated to the Toledan tables.

Sample of Albatenian version. From Ea Lb. Not emended.

Tabula diversitatis aspectus solis et lunae in circulo altitudinis.

(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Nume rus auc tus per duos grad.	Diver sitas aspec tus solis	Aspec tus lunae in primo ter mino	Aspec tus lunae in sc'do ter mino	Aspec tus lunae in tertio ter mino	Aspec tus lunae in quarto ter mino	Portio epi cycli	Portio epi cycli	Portio excen trici
	Mi Se	Mi Se	Mi Se	Gr Mi Se	Mi Se	Mi Se	Mi Se	Mi Se
2	0 7	1 54	0 23	0 2 40	0 50	0 14	0 11	0 15
4	0 13	3 48	0 45	0 5 25	1 40	0 28	0 22	0 30
6	0 19	5 41	1 7	0 8 10	2 30	0 42	0 33	0 45
....	.....	.....	.....	....	.....	.....	.....	.....
84	2 50	53 21	10 16	1 18 0	24 52	59 21	59 15	59 30
86	2 50	53 29	10 16	1 18 20	24 56	59 34	59 30	59 40
88	2 51	53 33	10 17	1 18 40	24 59	59 47	59 45	59 50
90	2 51	53 34	10 17	1 19 0	25 0	60 0	60 0	60 0
(a)	(b)(c)	(d)(e)	(f)(g)	(h)(j)(k)	(L)(m)	(n)(o)	(p)(q)	(r)(s)

(d6) 6 Lb. **(e4)** 58 Ea. **(e84-90)** *vacat* Lb. **(e88)** 32 Ea; *def.* Lb. **(e90)** 37 Ea; *def.* Lb. **(g2)** 2 Lb. **(h2)** 1 Lb. **(k2-4)** 0, 20 Lb. **(m86)** 57 Lb. **(q6)** 53 Ea. **(q88)** 46 Ea. **(s2)** 11 Lb; 55 Ea. **(s86-88)** 45, 55 Ea.

Readings from Almagest V,18 (Arabo-Latin version, Liechtenstein), used for comparison:

2	3 0	
4	6 0	
6	9 0	
....	....	.....
84		24 0
86		24 40
88		24 50
(a)	(j)(k)	(L)(m)

J. Tables for eclipses.

JA. True velocities; diameters of luminaries and shadow, etc.

This section contains tables for finding the true velocities of the sun and moon near syzygy, and for finding the diameters of the sun, the moon, and the shadow of the earth. One table concerning planetary velocities (JA54) is included; other tables for planetary velocities are listed under DF-DG (arguments for computing retrograde periods). – Below, some standard parameters are summarized for convenience.

Albattani.

Values like those of Albattani, or approximations to them, are used in tables JA11, JA45, JE11-21, and perhaps in JA52-53. See the extensive discussion in Toomer 1968, on tables 56, 61 and D4.

Solar eccentricity:	2; 4,45	(Batt. 28, Nallino I p. 44:12, p. 213)
Lunar epicycle radius:	5;15	(as in Almagest, cf. Nallino I p. 221)

Velocities (Batt. 30, Nallino I p. 58, cf. I p. 234-35):

	Perigee	**Mean**	**Apogee**
Sun	0; 2,33°		0; 2,23°
Moon	0;36,10°		0;30,12°

Diameters (*ll.cc.*, cf. Nall. I,236):[1]

Sun	0;33,40°	0;32,30°	0;31,20°
Moon	0;35,20°	0;32,25°	0;29,30°

Radii (for the shadow, see Batt., *l.c.;* the rest are half the above)

Sun	0;16,50°	0;16,15°	0;15,40°	
Moon	0;17,40°	0;16,13°	0;14,45°	(0;17,45 for perigee, JE11)
Shadow	0;46, 0°		0;38,30°	(moon in perigee/apogee; sun in apogee)

Other values for the shadow are, however, to be found in JE21. – For the relations between diameters and velocities according to the Toledan canons, see notes to JA45.

Alkhwarizmi.

Values that are likely to be Alkhwarizmian are expressed or implicit in tables JA31* and JD11-21, and perhaps in JA41. See Neugebauer 1962 p. 105-07 and 118. – Radii:

Sun	0;16,54°	0;16,17°	0;15,40°	(constant = 0;16,17° in JD11-21)
Moon	0;17,17°		0;14,38°	
Shadow	0;44,44°		0;36, 0°	(assumed in JD21)
	0;45,14°		0;35,29...°	(assumed in JA31)

For the relations between diameters and velocities according to various sources for Alkhwarizmi, see notes to JA31.

---

1 Apparently a different set of solar and lunar diameters is in CbA.G21.d. It is based on Albattani ch. 43 and 44, and presupposes values that occur in Nallino's manuscript but are rejected by Nallino in favour of the values shown here. Its status is in doubt.

JA11. Hourly velocity, sun and moon.

Toomer 1968, no. 56. – Same as Albattani, Nallino II p.88, and Almanac of Azarchel, Millás p. 174a, table 23.

Witnesses: **{a0}** Oo,29r; Cq2,96; Pz,132r; Mc,30r; Mb,58r; Ey,63r; Ea,50v; Ea,51v; Lo,77v. – **{a1}** Xa,32r; Ad,80r; Cq,57; Fc,46r; Ps,70r; Sg,166; Wd,32r; Fh,53r; Xw,31r. – **{a2}** Cz,86r; Cj,159v; Md,93v; Mp,223r. – **{aX}** Vo,62r; Xr,83v; R,64v; R,91v (:Novara); Ov,97r. – **{aT}** Lu,68r; Oj,140v; P,82r. – **{k}** Eh,100r; Lw,117r; Ou,69v; Eg,23r; Co,166v; Cn,102r. – **{d}** Op,74v; C,370; Lb,40v; A,226v(m2); Fj,49v; Fj,82v; Nc,115r; Fd2,50v; Ok,59r. – **{e}** Gr,63r; Eq,81v; Ek3,108v; Xc,76r; Vj,99v; Ej,82v; Vm,13r. – **{x}** Oc,87r; X,164r; Vz,70r; Mv,98v; Cm,144r; B,154v; T,295v; Lf,104r; Lg,183r; Lh,149r; Xj,286r; Xg,67r; G,71v; Xb,86v; Es,192v; Fb,77r; Pq,196r; Oy,84r; Wa,72v; Ow,166v; Nu,152r. – **{p}** O,82r; Pd,76r; Ch2,179v. – **{?}** Ch,4v (:prologue); Ch,58v (:Savasorda 2); Da2,215r (:with CE40); Ej2,96v (:Novara); Ew2,37r (:Ut Annos); Ew2,38v (:Ut Annos); Ox,90v (:Ut Annos); Oq,19v (:Ut Annos); Pn,49r (:Jo. Lin.); Fc2,110r (:Jo. Lin.); Ut,131r (:?). – Duplicates in {a0} Ea, {aX} R, {d} Fj, {?} Ew2 Ch; for one further copy, in Ea, see JA11a.

Canons. The rules that expressly mention tables of hourly velocity of sun and moon are Cb176-177 = CcD176-77 and Cc285 (similar to Albattani ch. 42), and Cc287 (similar to Albattani Appendix H). The Albatenian canons belong to tables JA11 and JA21.

The term in Cc287 is "motum solis *diversum* in una hora" (for the value); in Cb176 it is "tabulam *aequalis* motus solis et lunae in una hora". Thus Cb represents a version that is most often, but not exclusively, found in the later tradition of the tables.

Several rules require a value for the velocity but do not mention any table; they may or may not imply the use of tables (e.g., the rules for true syzygy, Ca128+, Cc241, Cb172b, all similar to Albattani 42).

Gloss CaB05(1), added to canons Ca123-125 in ms. Oo only, may be meant for this table, but the wording is unspecific. The gloss CaB05(2) has "(tabulae) diversi motus solis et lunae in una hora", much like the headings below.

Headings. – General. As is often the case, headings of varying origins may coincide. Thus, under (5) below, the instance in Oo is no doubt derived from (1), with "diversi" left out, whereas some of the instances in {x} are from (4), with "aequalis" left out.

(1) Tabula diversi (+vel aequalis Ok) **motus solis et lunae** (e.l.: *om.* Ey) **in una hora** (u.h.: h.u. Xa; **/horis** Xc Vj Ej Pn Fc2) :: {a0:} Cq2 Lo Ey; {a1:} Xa Ad Cq Fc Ps Sg Wd Fh Xw!; {aX:} Ov Vo; {a2:} Cz Md; {aT:} Lu Oj P; {d?:} Op C Ok; {e:} Gr Eq Xc Vj Ej; {?:} Ch(4v) Da2! Pn Fc2.

(2) Tabula (-ae Co) **motus solis et lunae diversi** (**/d.m.s.e.l.** Eg Cn) **in una hora** (u.h.: hore Lb) :: {aX:} R(91v); {k:} Eh Lw Ou Eg Co Cn; {d:} Lb! Fj(82v); {x:} Fb Oy; {?:} Ej2 Ch(58v)!. – *Added:* (nothing) Eh Lb Fb Oy Ch(58v); **+augmentata per 6 gradus** R Ej2; **+ex horis coniunctionis** Lw; **+ex horis coniunctionis et praeventionis per portionem uniuscuiusque eorum** (+et praeventionem Eg) :: Ou Eg! Co Cn Fj(82v).

(3) Tabula aequalis (aequationis vel Mb) **motus solis et lunae** (s.e.l.: *om.* Xr) **in una hora** :: {a0:} Pz Mc Mb; {aX:} Xr; {d:} A Fj(49v) Nc! Fd2; {e:} Ek3; {?:} Ox Oq.

(4) Tabula (+diversi B Lf) **motus solis et lunae aequalis** (ae. et l. Cj) **in una hora** (+haec est Mp) :: {a2:} Cj Mp; {x:} Vz! Mv B Lf Lh Xg Es Pq Wa Ow.

(5) Tabula (*om.* Ea(51v) R(64v) X T Pd) **motus solis et** (*om.* Oo) **lunae** (+diversus T) **in una hora** :: {a0:} Oo Ea(51v); {aX:} R(64v); {x:} Oc X Cm T Lg Xj G Xb Nu; {p:} Pd Ch2; {?:} Ew2(37r)!.

(6: other) Ea(50v) & O (beginning "Tabula aequationis..."); Ut. No heading: Vm Ew2(38v).

Sub-headings:

Normally: **(7) Motus solis in (+una) hora; Motus lunae in (+una) hora,** with displacement or omission of "una" in some cases. – Modifications, each applicable to both headings:

(8) Motus solis diversus in... {aT:} Lu Oj P; {k:} Eh Lw Ou Eg Co; {d:} Fj(82v); {?:} Fc2 Ch(58v). – **(9) Motus solis aequalis in...** {a0:} Pz Mc Mb; {d:} Nc. – **(10) Aequalis motus solis in...** {d:} Fj(49v) A Fd2. – **(11) Motus solis** {a0:} Lo; {?:} Ew2(37r)! Ew2(38v) Ut. – **(12) Solis** {aX:} Xr R(64v); {p:} Pd Ch2. – **(13: other)** Cn Ok; Lb ("Deambulatio solis...").

Version. Most copies show the arguments 0°-180°, stepping 6°. The tables of Ey Op C show entrances in signs and degrees, but their values are normal, so they are included here. For two versions that step 1°, see JA11a-13 below.

Values. The solar table can be reproduced[1] assuming standard Albatenian parameters (eccentricity 2;4,45; mean velocity 0;2,28°/h, same as 1/24 of the daily mean velocity from CA01). This yields four deviations of 1" from the adopted values, unrelated to variation in the witnesses.

The lunar table, as shown by Goldstein (1996), can be recomputed by means of the rule in Almagest VI,4, thus: velocity(x) = 0;32,56 - 0;32,40 * (ear(x+1°)-ear(x)), where 0;32,56 is the mean hourly velocity in longitude; 0;32,40, the mean hourly velocity on the epicycle; and "ear" is the equation of argument from table EA11.Ear. In this way the values presented below are reproduced to within 2 seconds, and the end values are reproduced exactly (cf. Goldstein 1996 p. 183).[2] Thus, even if the table does not show the velocities listed under JA* (cf. Toomer 1968 p. 83-84), this need not cause doubt about the attribution to Albattani.[3] – The recomputed values are not quoted.

Text. Collated for values: **{a0}** Pz Oo; **{a1}** Xa Cq; **{aT}** Lu; **{k}** Ou Co; **{d}** A; **{e}** Eq Xc; **{x}** Es Xg. – Headings according to Xa. – Also quoted: **$ba** = Batt., Paris Arsenal 8322, 57ra; **$aa** = Almanac of Azarchel, Paris Arsenal 8322, 105ra.

For a collation of the lunar table, involving more witnesses, see T:06(12).

Readings chosen: The archaic and vulgate readings (mainly the majority of Pz Oo Xa Cq Lu) are adopted; they are underscored where contradicted by Ou Co $ba.

Variant groups: Ou Co $ba often join each other, as usual. By contrast, the vulgate appears to tend towards $aa. Apart from the double error in Eq Xc Es Xg, and one or two in Ou Co alone, readings are not distinctive; the readings of Ou Co $ba are not obvious improvements on those adopted.

---

1 By the procedure in van Dalen's "Table-Analysis" program, as:
velocity(x) = (mean_velocity) * (1 - equation(x+1°) + equation(x)), where
equation(t) = arc tan(eccentricity * sin(t) / [60 + eccentricity * cos(t)]),
as for table EA01.

2 This holds when using normal rounding, in which case most of the adopted values are 0" or 1" less than the recomputed ones; only for 102° and 138° are they 2" less. Generally I have chosen the Albatenian readings in EA11. There are errors in EA11 near 108°, 114° and 138°, which have not affected the present table; in these places the computed equation values are used instead of those of EA11.

3 The table may also be reproduced as a solar velocity (cf. preceding paragraph), thus in effect using the formula velocity(x) = 0;32,56 - 0;32,**56** * (ear(x+1°)-ear(x)). One may then to some extent compensate for the error in the last coefficient by using an epicyclic pseudo-radius of, say, 5;12 instead of 5;15 (cf. Toomer p.84). This, too, will approximate the tabular values to within some 2 seconds.

Tabula diversi motus solis et lunae in una hora.

Lineae numeri		Motus solis in hora una		Motus lunae in hora una	
Gr	Gr	Mi	2a	Mi	2a
0	360	2	23	30	18
6	354	2	23	30	19
12	348	2	23	30	21
18	342	2	23	30	24
24	336	2	23	30	28
30	330	2	24	30	35
36	324	2	24	30	43
42	318	2	24	30	51
48	312	2	25	31	1
54	306	2	25	31	12
60	300	2	25	31	24
66	294	2	26	31	38
72	288	2	26	31	53
78	282	2	27	32	8
84	276	2	27	32	25
90	270	2	28	32	42
96	264	2	28	32	59
102	258	2	29	33	17
108	252	2	29	33	36
114	246	2	29	33	55
120	240	2	30	34	14
126	234	2	30	34	32
132	228	2	31	34	49
138	222	2	32	35	4
144	216	2	32	35	18
150	210	2	32	35	31
156	204	2	33	35	43
162	198	2	33	35	52
168	192	2	33	35	58
174	186	2	33	36	2
180	180	2	33	36	4
(a)	(b)	(c)	(d)	(e)	(f)

(d-e) *ordine (e-d)* Oo. **(d18-24)** 24, 24 Ou Co. **(d72)** 27 $ba. **(d78)** 26 Ou Co $aa. **(d90)** 27 Co $aa. **(d102)** 28 $aa. **(d108)** 39 Es. **(d114)** 30 Es. **(d132)** 30 $ba. **(d138)** 31 Ou Co Eq Xc Es Xg $ba $aa. **(e96)** 33 Co(pc). **(e174)** xxxn *aut* xxxii Oo. **(e180)** xxxii Oo. **(f60)** 25 $aa. **(f66)** 39 Ou Co $ba. **(f72)** 33 $aa. **(f84)** 24 Ou Co $ba. **(f96)** 57 Ou Co $ba. **(f108)** 35 Eq Xc Es Xg; 16 $aa. **(f114)** 56 Eq Xc Es Xg. **(f120)** 23 Ou Co. **(f138)** 14 Es.

JA11a-13. Tables similar to JA11.

JA11a. Ea,55v: "T. diversi motus lunae in una hora". – Like JA11, but only the lunar table is present. Listed separately because of its specific heading.

JA12. Ey,63v-66r: "Tabula diversi motus solis et lunae in una hora". – Stepping by 1°; entrances in signs and degrees. The values are the same as in JA11 where this has corresponding arguments. Our table shares its entrance with a table for diameters of luminaries (JA43) and with JC12, both of which are also proper to Ey.

JA13. Fc2,112v-113v: "T. aequationis solis et lunae et ad sciendum motum solis et lunae in una hora". – Stepping by 1°; entrances in signs and degrees. Appended to Alfonsine tables of solar equation and of lunar equation of argument, which show values as in Poulle 1984 p. 145-153. Is to be connected with *John of Lignères*, cf. Rosinska 1984 p. 491 no. 16. The values are the same as in JA11 where this has corresponding arguments.

JA21. "Tabula aequationis diversi motus...".

Toomer 1968, no. 57. – As in Azarchel, Almanac, table 82 (one manuscript). Similar to Albattani, Nallino II p.88; cf. Schiaparelli's explanation, *ibid.* p.273.

Witnesses: **{a0}** Ct,32v; Oo,29r; Cq2,96; Pz,132r; Mc,30r; Mb,58r; Ey,63r; Ea,55v. – **{a1}** Xa,32r; Ad,80r; Cq,57; Fc,45v (two copies); Fc,60r; Ps,69v; Sg,167; Wd,32r; Fh,53v; Xw,31r. – **{a2}** Cz,85v; Cj,158v; Md,94r; Mp,223r. – **{aX}** Vo,62v; Xr,84r; R,64v; R,91v (:Novara); Ov,96v; Vd,12v. – **{aT}** Lu,67v; Oj,140r; P,89r. – **{k}** Co,176v; Cn,102r. – **{d}** Op,75r; C,371; Lb,40v; Pa,49r; A,228r; Fj,50r; Fj,82v; Nc,121r; Pv,34r; Fd2,51v; Gr3,122r; Ok,59v. – **{e}** Gr,62v; Eq,81r; Eq,82r(m2); Ek3,108r; Xc,75v; Vj,99r; Ej,82r; Vm,13r. – **{x}** Oc,87r; X,164v; Vz,70v; Mv,99r; Cm,144v; B,155r; T,296r; Lf,104v; Lg,183v; Lh,149r; Xj,286v; Xg,67v; G,72r; Xb,87r; Es,192r; Fb,77v; Pq,196v; Oy,84v; Wa,72r; Ow,166v; Nu,152v. – **{p}** O,82r; Pd,76r; Ch2,179v. – **{?}** Ef,72r; Ch,4v (:prologue); Ej2,96v (:Novara); Ew2,38v (:Ut Annos); Ox,90v (:Ut Annos); Oq,19r (:Ut Annos); Pn,49r (:Jo. Lin.); Fc2,110v (:Jo. Lin.); Ut,130v (:?). — Duplicates in {a1} Fc, {aX} R, {d} Fj, {e} Eq.

Canons: Cc286 ("tabulam minorem ad hoc constitutam"); Cc288 (entrance "per secunda superfluorum quae sunt inter solem et lunam", another rendering than in the tables): Cb178 = CcD178 ("tabulam aequationis (+diversi) motus lunae in una hora", more or less the common type). These canons are comparable to Albattani, Appendix H, Nallino I p. 150, except Cc288, for which I have not found any parallel.

Headings.

Outer heading, meant as general heading: **(1: none)** :: normally. – **(2) Tabula aequationis** (*om.* Vj Ej Ox; *alibi* Oq) **diversi motus** (solis et+ O) **lunae** (d.m.l.: **/m.l.d.; /m.d.l.) in una hora** :: {a0:} Ey; {aT:} P; {a2:} Cj Mp; {e:} Vj Ej; {x} except Wa; {p:} O Ch2; {?:} Ej2 Ew2 Ox! Oq Fc2. – **(3: other)** R(91v), for which cf. (10) below; Ch2 ("Aequatio"); Fc2 Ew2.

Inner heading, or sole general heading. In either case this may stand as if pertaining to the whole table, or only to the body of the table. –

(4: type like outer heading:) {aT:} Oj; {e:} Vm! (:omits "in una hora"); {x:} Wa.
(5) Tabula aequationis motus (+solis et Mc) **lunae** (*om.* Nc) **in una hora** :: {a0:} Pz Mc Mb; {d:} Nc.
(6) Aequatio diversi (-sitatis Ct) **motus** (+solis et Cq2 Sg) **lunae in una hora** (u.h.: **/h.u.** Xa Ad; **/h.** Op C Gr Eq) :: {a0:} Ct Oo Cq2 Ey Ea; {a1:} Xa Ad! Cq Fc(45v) Sg Wd Fh Xw; {a2:} Cz Md; {aX:} Vo Xr; {aT:} Lu P; {k:} Cn; {d:} Op C Ok!; {e:} Gr Eq Xc.pc; {?:} Pn Ej2 Ch Ef Ut.
(7) Aequatio motus (+solis et Fc) **lunae diversi** (-sis Fc Vd.ac) **in horis** (ho(raX) Vd; una hora Fj(82v) :: {a1:} Fc(60r); {aX:} Vd; {d:} Lb Pa A Fj(50r) Fj(82v) Pv Fd2 Gr3.
(8) Aequatio diversi (*om.* Ox Oq) **motus** :: {k:} Co; {e:} Ek3 Vj Ej; {p:} O; {?:} Ox Oq.
(9) Aequatio motus lunae (*om.* Es) **in una** (*om.* Cj; prima X) **hora** :: {a2:} Cj Mp; {aX:} R(64v); {x-}; {p:} Pd Ch2.
(10: other) :: Ov Ps Fc2 Ew2. – R(91v) has an outer hdg. of type (10) and an inner one of type (6). – None: Xc.ac.

Entrance column: normally **(11) Longitudo inter solem et lunam,** but:

(12) Differentia (**/Distantia** Cn Op C) **inter solem et lunam** :: {a1:} Fc(60r); {aX:} Vd; {k:} Cn; {d:} Op C Lb Pa A Fj(50r) Nc Pv Fd2 Gr3.

(13) Longitudo solis et lunae :: {?:} Ox Oq.

(14: other) :: Ct ("Residuum quod est inter s. et l."); Ch ("Superatio quae est inter s. et l."); Md Ch2 Ew2. – None: R(64v) Pd Wa.

Versions. The only column with significant figures is the second-column, but most witnesses show extra columns, all filled with zeros. A version with columns for degrees, minutes and seconds is in the early parts of Class {a} and in part of Class {d}; this is no doubt the original type, and is the one reproduced below. Tables with minute- and second-columns are in Class {x} and part of Class {d}; and tables with 4 columns occur in the Toulouse collections Lu Oj P.

Sources. A table that matches the values of the present one precisely is reported by Millás (1950 p. 233, table 82) from his Arabic manuscript of the Almanac of Azarchel. It is not in the other witness (Paris Arsenal 8322), nor is it mentioned in the canons for the Almanac as printed by Millás.

The table is comparable to Albattani, Nallino II p.88, but all the Albattani values are 1" greater than the present ones. This is also true for the copy of the Albattani table in Paris Arsenal 8322, 57r. These tables have columns corresponding to (a,c,d) below.

Text. Collated for values: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** Lu; **{k}** Co; **{d}** Pa A; **{e}** Eq(81r) Xc; **{x}** Es Xg. – Headings according to Xa. – Lu adds an extra, zero-filled, column before col. (b). For other details of layout, see the apparatus.

Longitudo inter solem et lunam	Aequatio diversi motus lunae in una hora		
Nus	Gr	Mi	2a
1	0	0	0
2	0	0	1
3	0	0	2
4	0	0	3
5	0	0	4
6	0	0	5
7	0	0	6
(a)	(b)	(c)	(d)

(b) Ct Oo Pz Xa Co Pa Xc; *om.* A Eq Es Xg. **(c)** *om.* Eq.

JA31. Hourly velocities of sun and moon, and radii of luminaries and shadow. Alkhwarizmian.

Same as Khw/M, Suter Tab.61-66 p.175-180.

Witnesses: **{a0}** Ct,33r-34r. – **{aX}** Vd,25r-27v. – **{aT}** Lu,68v-71r; Oj,150v-153r; P,90v-93r. – **{k}** Eh,104r-106v. – **{d}** Fj,75r-77v. — Also in Ch,201r, not excerpted.

Headings. – General:

(1) Tabula (*om.* Ct) **buht, id est motus solis et lunae** (+in una hora Oj Eh), **et dimidium quantitatis circulorum ipsorum, et dimidium quantitatis** (e.d.q.: d.-que q. Oj; dimid<-> Eh) **circuli Geuzahar** (geuza Vd) :: Ct Vd Lu Oj P Eh Fj.

Sub-headings:

(2) (ab): **Lineae numeri** (+communes Vd) :: everywhere.
(3) (c): **Motus solis in una hora** :: Ct Vd Oj Eh. – **Buth id est motus solis in una hora** :: Lu P Fj.
(4) (d): **Motus lunae in una hora** :: everywhere.
(5) (e-f): **Dimidium quantitatis circuli solis, ... lunae** :: normally. – **Medietas diametri solis, ... lunae** Oj Eh.
(6) (g-h): **Prima tabula ad dimidium quantitatis circuli Geuzahar, Secunda tabula** (t.s. Lu)... :: normally. – **Prima tabula ad Geuzahar, Secunda ...** :: Oj Eh.

Values. Parameters, according to Neugebauer 1962 p. 105-07: see JA* above, the note for Alkhwarizmi. The relation between diameters and velocities is described, e.g., in Ibn Almuthanna Q66 (which is much the same as Cc134) and in Indian sources. The rules are as follows, "velocity" being motion per hour expressed in seconds:

```
Solar_radius = (solar_velocity * 24) * (11 / 20) / 2
= solar_velocity * 6;36

Lunar_radius = (lunar_velocity * 24) * (10 / 247) / 2
= lunar_velocity * 0;29,9 (approx.)
```

In the present table, these are the relations between columns (e) and (c), for the sun, and between (f) and (d), for the moon. See Neugebauer for the imprecision involved.

```
Shadow_radius =
= [8 * (lunar_velocity * 24) - 25 * (solar_velocity * 24)] / 60 / 2
= (8/5 * lunar_velocity) - (5 * solar_velocity).
```

The two terms after the last equal sign correspond to columns (h) and (g) in the table, respectively.

Since the table complies with these rules, which are attested as Alkhwarizmian, it is possible that the table itself is Alkhwarizmian and not the work of Maslama. The parameters have recognizable counterparts in JD11 and JD21 (cf. Neugebauer), but no certain ones elsewhere.

Sample. From Ct Lu; headings according to Ct. – Also collated for the tabular values shown: **$km** = Khw/M, Suter, *tab. cit.*, mss. "C" and "O" only.

A few places that are likely to be incorrect are underscored, but some lesser deviations from $km are ignored. In several cases, Lu follows $km whereas Ct has its own readings; but this is inconclusive.

Buht, id est motus solis et lunae, et dimidium quantitatis circulorum ipsorum, et dimidium quantitatis circuli Geuzahar.

Lineae numeri		Motus solis in una hora	Motus lunae in una hora	Dimid. quanti tatis circuli solis	Dimid. quanti tatis circuli lunae	Prima tabula ad di- midium quanti tatis circuli Geuzahar	Secunda tabula ad di- midium quanti tatis circuli Geuzahar
Si Gr	Si Gr	Mi Se	Mi Se	Mi Se	Mi Se	Mi Se	Mi Se
0 1	11 29	2 22	30 12	15 12	14 38	11 52	48 19
1 0	11 0	2 23	30 34	15 34	14 49	11 55	48 55
1 1	10 29	2 23	30 36	15 45	14 50	11 56	48 57
2 0	10 0	2 25	31 29	15 58	15 16	12 5	50 25
2 1	9 29	2 25	31 32	15 58	15 17	12 6	50 28
3 0	9 0	2 28	32 56	16 16	15 58	12 20	52 47
3 1	8 29	2 28	32 58	16 18	15 59	12 21	52 52
4 0	8 0	2 31	34 22	16 36	16 40	12 34	55 0
4 1	7 29	2 31	34 25	16 37	16 41	12 35	55 4
5 0	7 0	2 33	35 20	16 50	17 7	12 45	56 31
5 1	6 29	2 33	35 21	16 51	17 8	12 45	56 34
6 0	6 0	2 34	35 40	16 54	17 17	12 48	57 4
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

(c3,1) 28'': 29 $km. **(c4,0)** 31'': 30 $km. **(d3,1)** 52 $km.C. **(d4,0)** 34': 54 $km.C. 22'': 12 $km.O. **(e0,1-1,0)** 12'', 34'': *cf. (d0,1-1,0)*; 40, 44 $km. **(e2,1)** 58'': 57 $km.O. **(e3,0)** 16'': 17 $km. **(f1,0)** 14': Lu $km; 15 Ct. 49'': Lu $km; 48 Ct. **(f3,1)** 15': Lu $km; 16 Ct. **(f5,0)** 16 $km.C. **(g0,1-6,0)** 11'--12': Ct $km; 41--42 Lu. **(g4,0)** 34'': 35 $km. **(h2,0)** 25'': 24 $km. **(h3,0)** 52': Lu $km; 53 Ct. **(h3,1)** 52': Lu $km; 51 Ct. 52'': Lu $km; *vacat* Ct.

JA31a. Sun, hourly velocity, from JA31.

This is an extract of the Alkhwarizmian table JA31 (q.v. for references), sub-table "motus solis in hora".

Witnesses: **{a1}** Fc,54r. – **{aX}** Vd,14r. – **{d}** Pa,48v; A,227v; Fj,49v; Nc,120v; Pv,36r; Fd2,51r; Gr3,121v. – **{p}** Pd,47r.

Often occurring among eclipse tables. In most of the manuscript group {d}, some series such as "JA31b (JA11) JA31a KB11 KB21 KB31" (see T:04(6J2-3)) occurs after the mean syzygy tables and before the rest of the eclipse tables.

Headings. – General:

> **(1) Tabula** (-ae Pa) **motus solis diversi** (-sus Pd) **in horis** :: everywhere. – Fc adds a lower heading of "12 12 12 12", of no obvious use.

Sub-headings for entrance columns:

> **(2) Gradus argumenti** (twice) :: Fc Vd; (same, once above and once below the table:) Pd.
> **(3) Gradus superiorum signorum** (*om.* Fc); **Gradus inferiorum signorum** (*om.* Fc) :: Fc (below the table), Pa, Pv (inserted).
> **(4) Gradus inferiorum** (-ris Nc) **signorum** (*om.* Nc Fd2); **Gradus superiorum** (-ris Nc) **signorum** (*om.* A Nc Fd2) :: (A) Fj Nc Fd2 Gr3. – First heading blank in A.

Sub-headings for body of table:

> **(5)** Above the table: **0 1 2 3 4 5**;
> **(6)** below: **11 10 9 8 7 6**.

Versions. There is a double entrance, 1°...30° (0...29 Pa; 1...29,0 A Fj Fd2 Gr3) and 29°...0° (30...1 Pd). The column with ascending values is outermost in Fc Vd Pa Pv Pd, innermost in A Fj Nc Fd2 Gr3; cf. the sub-headings quoted above.

Parallel. A table with layout and values similar to the present one ("T. diversi motus solis in una hora quod est respectus") is in Ibn al-Kammad, Madrid 10023, 51va. It is mentioned in the canons for these tables (as "in tabulis respectuum eorum"; ch. 25, *ms. cit.* 13va).

Values. The values have not been recomputed. They might be checked for consistency with those for the solar radius in JA31, q.v., and cf. Neugebauer 1962 p. 105. At 120° = 3s30°, Suter's text of JA31 shows 0;2,30, emended by Neugebauer to 0;2,31 (*ibid.*, n.2). The latter reading is shown by the present table (and by JA31 in the manuscripts used here). The check has not been carried further.

Text. Collated for values: **{a1}** Fc; **{aX}** Vd; **{d}** Pa A. – Headings according to Fc. – Fc is present where values change in any column, and is otherwise mostly blank; this has only been noted where it causes ambiguity. – Also quoted for values: **$km** = Khw/M, Suter Tab. 61-66 p. 175-80; only the readings of Suter's mss. "C" and "O" are reproduced. **$kd** = Ibn al-Kammad, Madrid 10023, 51va.

Variant readings. The witnesses collated are mainly consistent with each other; an exception is at 2s27°-30°, not marked. There are some deviations from $km; underscoring is used in the text below where the witnesses disagree with both manuscripts of $km, whether or not these agree between themselves. In at least one instance (3s30°), $km is at fault; cf. "Values" above.

Agreement with $kd is much better: deviations are only found at 1s25°-26°, 2s15°-16° and 4s22°-23°, apart from two obvious errors in $kd. These places are not marked.

Tabula motus solis diversi in horis.

Gradus arg'ti	Gradus arg'ti	0 Mi	0 Se	1 Mi	1 Se	2 Mi	2 Se	3 Mi	3 Se	4 Mi	4 Se	5 Mi	5 Se
1	29	2	22	2	23	2	25	2	28	2	31	2	33
2	28	2	22	2	23	2	25	2	28	2	31	2	33
3	27	2	22	2	23	2	25	2	28	2	31	2	33
4	26	2	22	2	23	2	26	2	28	2	31	2	33
5	25	2	22	2	23	2	26	2	29	2	31	2	33
6	24	2	22	2	23	2	26	2	29	2	31	2	33
7	23	2	22	2	23	2	26	2	29	2	31	2	33
8	22	2	22	2	23	2	26	2	29	2	32	2	33
9	21	2	22	2	24	2	26	2	29	2	32	2	33
10	20	2	22	2	24	2	26	2	29	2	32	2	33
11	19	2	22	2	24	2	26	2	29	2	32	2	33
12	18	2	22	2	24	2	26	2	29	2	32	2	33
13	17	2	22	2	24	2	26	2	29	2	32	2	33
14	16	2	22	2	24	2	26	2	29	2	32	2	33
15	15	2	22	2	24	2	26	2	30	2	32	2	33
16	14	2	22	2	24	2	26	2	30	2	32	2	33
17	13	2	23	2	24	2	27	2	30	2	32	2	33
18	12	2	23	2	24	2	27	2	30	2	32	2	33
19	11	2	23	2	24	2	27	2	30	2	32	2	33
20	10	2	23	2	24	2	27	2	30	2	32	2	33
21	9	2	23	2	24	2	27	2	30	2	32	2	34
22	8	2	23	2	24	2	27	2	30	2	33	2	34
23	7	2	23	2	24	2	27	2	30	2	33	2	34
24	6	2	23	2	24	2	27	2	30	2	33	2	34
25	5	2	23	2	24	2	27	2	30	2	33	2	34
26	4	2	23	2	24	2	27	2	30	2	33	2	34
27	3	2	23	2	25	2	28	2	31	2	33	2	34
28	2	2	23	2	25	2	28	2	31	2	33	2	34
29	1	2	23	2	25	2	28	2	31	2	33	2	34
30	0	2	23	2	25	2	28	2	31	2	33	2	34
Gradus superiorum (a)	Gradus inferiorum (b)	11		10		9		8		7		6	

(a/b) *inverso ordine exhibet* A. **(a1°-30°)** 1°--30°: Fc $kd, *cett.;* 0--29 Pa. **(a30)** 0 A. **(0s15°-16°)** 23", 23" $km. **(1s9°)** 23" $km. **(1s25°-26°)** 25", 25" $km $kd. **(2s1°)** 24 $kd. **(2s15°-16°)** 25", 25" $km.C; 27", 27" $kd. **(2s17°)** 27": *vacat* Fc; 26 $km. **(2s25°-26°)** 28", 28" $km. **(2s27°-30°)** 28"--28": Pa $km $kd; <->, <->, 27, 27 Fc; 27--27 Vd A. **(3s1°-4°)** 29"...29" $km. **(3s15°-26°)** 29"...29" $km.C. **(3s27°-29°)** 30"...30" $km.O; 29"...29" $km.C. **(3s30°)** 30" $km. **(4s6°-7°)** 32", 32" $km. **(4s22°-23°)** 32", 32" $kd. **(5s20°)** 34" $km. **(5s21°-30°)** 24...24 $kd.

JA31b. Moon, hourly velocity, from JA31.

This is an extract of the Alkhwarizmian table JA31 (q.v. for references), sub-table "motus lunae in hora".

Witnesses: **{a1}** Fc,54v. — **{aX}** Vd,14v. — **{d}** Pa,48r; A,227r; Fj,47r; Nc,120r; Pb,36r; Pv,36v; Fd2,50r; Gr3,119r; Ok,66v. — **{p}** Pd,47v.

Occurs close to eclipse tables: after GA11-14 in Pa A Fj Nc Pb Fd2 Gr3; after JA31a in Fc Vd Pv Pd. See also the note to JA31a.

Headings. — General:

(1) Tabula (-ae Pa) **motus lunae diversi** (-sus Pd) **in horis** (in hora coniunctionis et oppositionis *add.* Fj Gr3) :: normally. — **(2) Motus lunae in una hora** :: Pb. — Fc adds a lower heading of "12 12 12", of no obvious use.

Sub-headings for entrance columns:

(3) Gradus argumenti (**+inferioris** A Nc Fd2); **Gradus argumenti** (**+superioris** A Nc Fd2) :: {a1:} Fc; {aX:} Vd; {d:} Pa A Nc Pv Fd2.

(4) Gradus argumenti (*om.* Pb) **superiorum signorum; Gradus argumenti** (*om.* Pb) **inferiorum signorum** :: {d:} Fj Pb Gr3.

(5: other) :: Ok (type (3) above the table, type (4) below); Pd ("Gradus argumenti" once above and once below the table, still with a double entrance column).

Sub-headings for body of table:

(6) Above the table: **0 1 2 3 4 5**;

(7) Below the table: **11 10 9 8 7 6**.

Versions. There is a double entrance, 1°...29°,0° (0...29 Pa; 1...30 Pd) and 29°...0° (0,29...1 Pb; 30...1 Pd). The column with ascending values is outermost in Fc Vd Pa Fj Pb Pv Gr3 Ok Pd, innermost in A Nc Fd2; cf. the sub-headings quoted above.

Parallel. A table with layout and values similar to the present one ("T. diversi motus lune in una hora quod est respectus") is among the tables of Ibn al-Kammad, Madrid 10023, 51vb. It is mentioned in the canons for these tables (as "in tabulis respectuum eorum"; ch. 25, *ms. cit.* 13va).

Values. I have not recomputed the table; for its rationale see Suter 1914 p. 78-80 and Neugebauer 1962 p. 106, and cf. notes to JA31.

Text. Collated for values: **{a1}** Fc; **{d}** Pa A. — Headings from Fc. — Also quoted for values: **$km** = Khw/M, Suter Tab. 61-66 p. 175-80; only the readings of Suter's mss. "C" and "O" are reproduced here. **$kd** = Ibn al-Kammad, Madrid 10023, 51vb.

I accept the majority of Fc Pa A, underscoring where it differs from $km. Fc Pa A agree as to the large deviations from $km, and they have at least one error in common (at 4s8°).

The agreement with $kd is generally better than with $km, and includes the error at 4s8° against $km. Since the Ibn al-Kammad text is unlikely to depend on Latin sources, it follows that our Class {d} has had an Arabic source that carried this table, plus JA31a, in their present layout and with some of their textual oddities. This source, immediate or not, seems unknown in the rest of the tradition of the Toledan tables.

Tabula motus lunae diversi in horis.

Gradus arg'ti	Gradus arg'ti	0 Mi	0 Se	1 Mi	1 Se	2 Mi	2 Se	3 Mi	3 Se	4 Mi	4 Se	5 Mi	5 Se
1	29	30	12	30	36	31	32	32	58	34	25	35	21
2	28	30	12	30	37	31	35	33	0	34	27	35	22
3	27	30	12	30	38	31	37	33	2	34	30	35	24
4	26	30	13	30	40	31	40	33	5	34	32	35	25
5	25	30	13	30	41	31	42	33	7	34	34	35	26
6	24	30	13	30	43	31	45	33	10	34	37	35	27
7	23	30	14	30	44	31	47	33	13	34	40	35	28
8	22	30	14	30	46	31	49	33	16	34	45	35	29
9	21	30	14	30	47	31	51	33	20	34	45	35	30
10	20	30	15	30	49	31	54	33	23	34	48	35	31
11	19	30	15	30	51	31	57	33	26	34	50	35	32
12	18	30	16	30	52	32	1	33	29	34	53	35	33
13	17	30	16	30	54	32	5	33	32	34	55	35	33
14	16	30	18	30	56	32	8	33	36	34	58	35	34
15	15	30	18	30	58	32	12	33	39	35	0	35	35
16	14	30	19	31	0	32	16	33	42	35	3	35	35
17	13	30	20	31	2	32	20	33	45	35	4	35	36
18	12	30	21	31	4	32	23	33	48	35	5	35	37
19	11	30	22	31	6	32	27	33	51	35	6	35	37
20	10	30	23	31	8	32	31	33	54	35	8	35	38
21	9	30	24	31	10	32	34	33	57	35	8	35	38
22	8	30	25	31	12	32	37	34	0	35	9	35	38
23	7	30	26	31	14	32	39	34	3	35	10	35	39
24	6	30	27	31	16	32	42	34	5	35	12	35	39
25	5	30	28	31	18	32	46	34	9	35	13	35	39
26	4	30	29	31	21	32	47	34	12	35	14	35	39
27	3	30	30	31	23	32	49	34	15	35	16	35	39
28	2	30	32	31	25	32	52	34	17	35	17	35	40
29	1	30	33	31	27	32	54	34	20	35	18	35	40
0	0	30	34	31	29	32	56	34	22	35	20	35	40
(a)	(b)	11		10		9		8		7		6	

(a/b) *inverso ordine exhibet* A. **(a)** 1°--29°,0°: 0--28,29 Pa. **(0s7°)** 13" $km. **(0s10°)** 14" $km. **(0s12°)** 15" $km $kd. **(0s14°)** 17" $km $kd. **(0s15°-23°)** 17"...25" $km. **(0s23°)** 26": *ras.* A. **(1s3°)** 39" $km.O. **(1s5°)** 41": *vacat* Fc. **(1s14°)** 56": 50 Pa A. **(1s25°-29°)** 18", 21--27: 21--27, 29 $kd. **(1s26°)** 20" Fc. **(2s2°)** 34": 24 Fc. **(2s9°)** 52" $km. **(2s10°)** 30′ $km.C. **(2s12°)** 31′ $kd. **(2s14°)** 9" $km.O. **(2s16°-18°)** 17", 23, 27 $kd. **(+2s18°)** 24" $km. **(2s25°)** 45" $km. **(3s1°)** 32′: 52 $km.C. 58": 50 A. **(3s8°)** 14" $km.C. **(3s9°)** 21" Fc. **(3s2°-21°,22°-30°)** 53′...53, 54...54 $km.C. **(+3s22°)** 33′ $km.O. **(3s24°)** 6" $km. **(3s27°-28°)** 17", 15" Pa A. **(3s30°)** 12" $km.O. **(4s1°)** 26" $kd. **(4s5°)** 36" $kd. **(4s8°)** 45": Fc Pa A $kd; 42 $km. **(4s14°)** 14′ Pa. **(4s16°-20°)** 1", 3, 4, 5, 6 $km $kd. **(4s28°)** 16" $km.C.

JA32. Diameters and hourly velocities, John of Lignères?

Pn,56v: "Tabula semidiametrorum solis et lunae et umbrae, et pertinet ad eclipses". Entries for 0°(6°)180°.

The tables in Pn are mainly those of John of Lignères. Another copy (without the sub-tables "Motus solis/lunae in hora") is found in Berlin SPK lat. fol. 246, 141r, within a set of tables also ascribed to John of Lignères. The table is, however, absent from ms. Fc2 and from the inventory of Rosinska 1984. – Sample, from Pn, not emended:

Lineae numeri		Semidiametri solis			Semidiametri lunae			Semidiametri umbrae			Variatio umbrae			Motus solis in hora			Motus lunae in hora		
Gr	Gr	Mi	2a	3a	Mi	2a	3a	Mi	2a	3a	Mi	2a	3a	Mi	2a	3a	Mi	2a	3a
0	360	15	40	30	14	30	5	37	42	13	0	0	0	2	22	30	29	37	13
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30	330	15	45	27	14	41	1	38	10	39	0	3	45	2	23	15	29	59	31
60	300	15	57	53	15	12	3	39	31	20	0	13	10	2	25	8	31	2	55
90	270	16	15	16	15	59	28	41	34	37	0	26	20	2	27	46	32	39	45
120	240	16	35	4	16	56	5	44	1	49	0	31	20	2	30	46	34	35	24
150	210	16	50	1	17	44	10	46	6	58	0	52	40	2	33	2	36	13	37
180	180	16	54	12	18	6	20	47	4	28	0	55	50	2	33	40	36	58	54

JA41. Diameters of luminaries and shadow, as in "Investigantibus". Using Alkhwarizmian parameters?

This table is the same as section Jn287A of the treatise "Investigantibus", ed. Pedersen 1990 (whole table reproduced, p.280; discussion, p.219, summarized below). For other versions see JA42.

Witnesses: **{a0}** Lo,79r (lacks last sub-table). – **{aX}** Fj2,110v (m2?).

Occurs among eclipse tables (Lo) or appended to them (Fj2). There are several further witnesses, for which see Pedersen 1990, but they are unconnected with the Toledan tables and are not listed in this section.

Rule: Jn287-92, "In eclipsi tam solis quam lunae invenienda" (Pedersen 1990 p. 281). This also occurs as a separate tract (*ibid.* 206), likely to be from the 1170s or earlier. Two versions of this are reproduced in the appendix to Cb (CbA.G21.b and .c).

Headings. – No main heading.

Sub-heading for entrance column: **Lineae numeri** Fj2; **Argumentum tam solis quam lunae** Lo.

Remaining sub-headings: **Quantitas solis (+in aspectu** Lo); **Quantitas lunae (+in aspectu** Lo); **Portio solis** (solaris Fj2) **ad quantitatem (+circuli** Lo) **draconis; Portio lunae** (lunaris Fj2) **ad quantitatem** (**+circuli** Lo) **draconis; (Minuta excrescentia)** (m.e.: *om.* Lo *cum tabula*).

Values. The values of cols. (c-f) should be diameters, corresponding to the radii shown by the Alkhwarizmian table JA31, cols. (e-h). The former are indeed roughly twice the latter; so it may be assumed that the two sets are based on the same rules, for which see the note to JA31 and Neugebauer 1962 p. 105-07. Thus our values may be cognate to the Alkhwarizmian hourly velocities (JA31, cols. (c-d)).

The following example concerns the tabular values for 3s0° in columns (c-f) of the table, since these values seem to be those which come closest to the assumption above. The list below shows what quotients are expected from dividing diameter values like these by the solar or lunar hourly velocity, whichever is appropriate, according to the rules under JA31. These quotients are compared to those found by dividing the diameter values for the argument 3s0°, shown by the present table, by the velocities of 0;2,28° and 0;32,56° per hour, respectively, as shown by table JA31 for the same argument.

The agreement with the expected values appears tolerable, considering the low precision of the tabular values.

	Expected quotient from division by solar velocity	Expected quotient from division by lunar velocity	Quotient from division of tabular values
col.(c)	24*11/20 = **13;12**		13;10,56,...
col.(d)		24 * 10/<u>248</u> ~ **0;58,4**	0;58, 3,...
col.(e)	**10**		9;59,11,...
col.(f)		2 * 8/5 = **3;12**	3;12, 1,...

The reading "<u>248</u>" may be found in "Investigantibus" and as a variant in the tradition of Ibn Almuthanna (Q66, Goldstein p. 104). The normal reading is "247", which is also that implied by the values of JA31, but it does not fit this table.

On the basis of these four values it may be assumed that Alkhwarizmian parameters are at play. The agreement is, however, mostly worse for arguments other than 3s0°. As a whole, our tables appear crudely made: indeed, (c-e) are almost linear, and (f) increases irregularly.

Column (g), not in JA31, has a canon explaining it as the difference between the hourly lunar velocity in the apogee and elsewhere ("Investigantibus", Jn340, cf. Jn344). I do not know whether it is analogous to JA45, column (g); in this case it depends on the solar velocity, in the way stated there.

Sample. From F. S. Pedersen 1990 p. 280, based on Oxford B.L. Bodl. 625, 119v; Paris BN lat. 16656, 36r; Pz, 4v; and others. Variants are insignificant, and are not noted. Headings from Fj2.

Lineae numeri				Quantitas solis		Quantitas lunae		Portio solaris ad quantitatem draconis		Portio lunaris ad quantitatem draconis		Minuta excrescentia
Si	Gr	Si	Gr	Mi	Se	Mi	Se	Mi	Se	Mi	Se	Mi
0	0	0	0	31	24	29	*20*	23	47	97	6	0
0	6	11	24	31	28	29	30	23	50	97	36	0
...	...	...	...	...	...	...	...	...	...	...	...	...
1	0	11	0	31	44	30	10	24	0	99	52	2
...	...	...	...	...	...	...	...	...	...	...	...	...
2	0	10	0	32	6	31	2	24	18	103	30	6
...	...	...	...	...	...	...	...	...	...	...	...	...
3	0	9	0	32	31	31	52	24	38	105	24	11
...	...	...	...	...	...	...	...	...	...	...	...	...
4	0	8	0	32	56	32	42	24	56	108	10	16
...	...	...	...	...	...	...	...	...	...	...	...	...
5	0	7	0	33	20	33	33	25	13	110	56	21
...	...	...	...	...	...	...	...	...	...	...	...	...
6	0	6	0	33	42	34	23	25	30	113	43	24
(a)		(b)		(c)		(d)		(e)		(f)		(g)

(d0,0) 20: 24 *codd.*

JA42. Variants of JA41.

Tables like JA41, all with their values rounded to minutes, are in Ov,98r (containing sub-tables c-f above); R,64v (sub-tables c-d); Ef,66v (whole table). These, too, occur among eclipse tables.

Ef has a title, "Tabula de eclipsibus, in qua intrandum est cum argumento solis et cum argumento lunae aequato; quod si numerus argumenti et in signis et in gradibus non inveniatur, in nine (=lineam?) propiorem descendendo". Ov R show no main headings; their sub-headings are abridged in different ways from those listed for JA41.

JA43. Diameters, unknown values; perhaps connected with JA11.

Ey,63v-66r: columns "Diameter solis; Diameter lunae; Diameter umbrae", added to JA12, q.v., and sharing its entrances. Range 0s1°(1°)6s0°, extra entrance 11s29°(-1°)6s0°. The values for moon and shadow are blank from 2s1° on (except at 3s28° where the values "33;24", "86,50" are given). All values vary in steps, at arguments divisible by 6°, as indicated.

The solar diameters step in about the same places as they do in JA11, and are about 66/5 the values of JA11 (cf. notes to JA45), though not exactly. Still the parameters are possibly the same as there. I have not examined the values further. — Inventory of values:

Sun:	Mi Se	Moon and shadow:		
0s 1°-0s29°	31 30	0s 1°-0s11°	29 20	76 16
1s 0°-1s17°	31 42	0s12°-0s23°	29 40	77 8
1s18°-2s 5°	31 54	0s24°-0s29°	29 50	77 34
2s 6°-2s17°	32 6	1s 0°-1s11°	30 0	78 0
2s18°-2s29°	32 18	1s12°-1s17°	30 10	78 26
3s 0°-3s11°	32 36	1s18°-1s23°	30 20	78 52
3s12°-3s23°	32 48	1s24°-1s29°	30 30	79 18
3s24°-4s11°	33 0	2s 0°	30 40	79 44
4s12°-4s17°	33 12		<**>	<**>
4s18°-5s 5°	33 24			
5s 6°-6s 0°	33 42			

JA44. Correction for diameter, cf. Cb197-98.

Ey,72v: "Tabula aequationis diametri umbrae". — The argument is the hourly solar velocity; its range is as in JA11, which is Albatenian. The values are a tabulation of the rule Ca188 / Cb197-8 / Cc293-4, thus equal to 10 * (argument - 2'23"). — Text:

Motus solis in una hora	Aequatio diametri umbrae
Mi Se	Mi Se
2 23	0 0
2 24	0 10
2 25	0 20
2 26	0 30
2 27	0 40
2 28	0 50
2 29	1 0
2 30	1 10
2 31	1 20
2 32	1 30
2 33	1 40

JA45. Radii of luminaries and shadow.

Toomer 1968 p.157 ("D4", from ms. Op), with discussion of values. – Printed, F.S. Pedersen 1984 p. 681. No sources known.

Witnesses: **{d}** Op,75v; C,372. — In Op C, this table is attached to table JC11, sharing its entrance column. – It is also used in Peter of St.Omer's *Tractatus de semissis*, composed ca. AD 1293/4. A copy in this context is in Vat. Barb. lat. 303, 17v; cf. F.S. Pedersen 1984 p. 668.

Canons: ms. C, p.239a, reproduced in the appendix to Ca as CaC09. This rule mentions the column title "Variatio umbrae", characteristic of our table. It belongs to a miscellany of canons for the Toledan tables: see Ca:02(1), ms.C. – The rule in Peter of St. Omer, *Semissa* 10,5, shows similar phrasing and is probably dependent on such a canon.

Heading: as shown, Op C.

Values. The radii for 0° and 180° (perigee and apogee) are much like the Albatenian ones (see JA*), so our table is likely to have such an origin; cf. Toomer 1968 p.157.

Rules for deriving the diameters of the luminaries and the shadow from their velocities[1] are given by all the canons (Ca185+, Cb193+, Cc289+). The source is uncertain, but the values shown as examples are Albatenian (Toomer 1968 p.83).

The rules are as follows. "Velocity" is the motion per hour expressed in seconds; "solar apogee velocity" is the velocity of the sun when it is in its apogee; "shadow apogee radius" is the radius of the shadow when the sun is in its apogee. All values are expressed in seconds, of time or of arc.

```
Solar_radius = solar_velocity * (2 + 1/5) * 60 / 10 / 2 =
= solar_velocity * 6;36                                  (as in Alkhwarizmi)
Lunar_radius = lunar_velocity * (6 - 1/8) / 6 / 2 =
= lunar_velocity * 0;29,22,30
Shadow_apogee_radius = lunar_radius * (2 + 3/5) =
= lunar_radius * 2;36                                    (for sun in apogee)
Shadow_radius =
= shadow_apogee_radius - 5 * (solar_velocity - solar_apogee_velocity)
```

Column (g) in this table should contain the term 5 * (solar_velocity - solar_apogee_velocity). Cf. canons Cb198 and Toomer p. 157-58.

On the basis of the velocities of table JA11, the present values for the solar and lunar radii (a-d) can be reproduced fairly well for the arguments 0s0° and 6s0° by the rules above; indeed, these will yield the solar radii 0;15,44 and 0;16,50, and the lunar radii 0;14,50 and 0;17,39. Thus there is not much doubt that our table uses Albatenian parameters.

Some of the other values in the table are, however, badly reproduced from JA11 (thus, for 4s0°, the rules give: sun, 0;16,30; moon, 0;16,46). The values in column (g) are not precisely reproducible from JA11 either, though the last value fits the rule for column (g). Thus, our table cannot be based on JA11, even if one assumes that the values have been smoothed secondarily.

The radius of the shadow is, however, exactly reproducible from the lunar radius as it is found in this table, except that one would expect 0;38,52° at 1s0°. This serves to authenticate the readings of both sub-tables, regardless of how the values of the lunar radius have been constructed.

Sample, from Op C:

1 These rules are partly different from the Alkhwarizmian ones, for which see note to JA31.

Tabula semidiametrorum solis et lunae et umbrae.

(Si Gr)	Semidi ameter solis Mi 2a	Semidi ameter lunae Mi 2a	Semidi ameter umbrae Mi 2a	Va ria tio umb rae
(0 0)	15 43	14 50	38 34	0
(0 6)	15 44	14 51	38 36	1
.....	.....	.....	.....	...
(1 0)	15 48	14 57	38 54	5
.....	.....	.....	.....	...
(2 0)	15 58	15 21	39 55	13
.....	.....	.....	.....	...
(3 0)	16 14	15 55	41 23	24
.....	.....	.....	.....	...
(4 0)	16 33	16 37	43 12	38
.....	.....	.....	.....	...
(5 0)	16 45	17 22	45 9	47
.....	.....	.....	.....	...
(6 0)	16 49	17 40	45 56	50
	(a) (b)	(c) (d)	(e) (f)	(g)

(d4;0) 27 Op C.

JA51. Daily true velocity, sun and moon. Derived from JA11.

Witnesses: **{aX}** Vd,20v; **{aT}** Lu,71v; Oj,153v; P,114v; **{k}** Eh,110r; **{p}** Pd,97v. — Follows on JA31 in Lu Oj; no stable placement in the rest. – Also in Of,96r, sharing the common reading at (h180), other readings not recorded.

Headings. – General: **Tabula motus solis et lunae in una** (*om.* Vd) **die** (hora Eh), everywhere. – Sub-heading: **Lineae numeri** (*gem.* Pd; +communes Vd); **Motus solis in una** (*om.* Eh) **die; Motus lunae in una** (*om.* Eh) **die.**

Values. The table is structured like JA11. The values are those of JA11 multiplied by 24; this has caused the solar table to vary in steps, and no smoothing has been attempted.

Text. Collated for values: Vd Lu Oj P Eh Pd. – Headings from Lu. – Also quoted: **$c** = the value adopted in JA11, multiplied by 24. – The readings in the witnesses are remarkably uniform; the errors underscored below are universal.

Tabula motus solis et lunae in una die.

Lineae numeri		Motus solis in una die			Motus lunae in una die		
Gra	Gra	Gr	Mi	Se	Gr	Mi	Se
0	360	0	57	12	12	7	12
6	354	0	57	12	12	7	36
12	348	0	57	12	12	8	24
18	342	0	57	12	12	9	36
24	336	0	57	12	12	11	12
30	330	0	57	36	12	14	0
36	324	0	57	36	12	17	12
42	318	0	57	36	12	20	24
48	312	0	58	0	12	24	24
54	306	0	58	0	12	28	48
60	300	0	58	0	12	33	33
66	294	0	58	24	12	39	12
72	288	0	58	24	12	45	12
78	282	0	58	48	12	51	12
84	276	0	58	48	12	58	0
90	270	0	59	12	13	4	48
96	264	0	59	12	13	11	6
102	258	0	59	36	13	18	48
108	252	0	59	36	13	26	24
114	246	0	59	36	13	34	0
120	240	1	0	0	13	40	40
126	234	1	0	0	13	48	0
132	228	1	0	24	13	55	36
138	222	1	0	48	14	1	36
144	216	1	0	48	14	7	12
150	210	1	0	48	14	12	24
156	204	1	1	12	14	17	12
162	198	1	1	12	14	20	48
168	192	1	1	12	14	23	12
174	186	1	1	12	14	24	48
180	180	1	1	12	14	25	34
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

(g120) 41 $c. **(h60)** 36 $c. **(h96)** 36 $c. **(h102)** 28 Vd. **(h120)** 36 $c. **(h126)** 48 $c. **(h180)** 36 $c.

JA52-53. Daily true velocity, sun and moon.

Witnesses: **{aX}** Vd,13r-v (JA53 only, most entrance columns blank). — **{d}** Lb,54v-56r; Pa,54r-55v; A,233v-235r; Fj,55r-56v; Gr3,127r-128v; Mh,11r-12v.

Typical of manuscript class {d}. Close to eclipse tables in all cases. Meant for eclipses; cf. the title of JA53.

Canon. The rule CbA.G52 (see appendix to canons Cb) refers to "tabulam ad inveniendam diaetam lunae in die coniunctionis vel oppositionis", the same title as for JA53. The rule is indeed meant for finding true syzygy from mean syzygy. It does not use any table for solar velocity.

Entrances and values. Each of tables JA52 and JA53 has a double entrance, covering twice 6 signs. JA52 begins with the argument 1°, as usual, and JA53 with the argument 7°. The tabular values are, however, probably valid for arguments 1°-180°, or perhaps 0°-179° (cf. JA53). The parameters appear similar to those of JA11; thus they are probably Albatenian, or at least in the Ptolemaic tradition.

The rule CbA.G52, presumably meant for JA53, states that the argument value to be used for entering JA53 is the lunar argument at mean syzygy, plus (13/12)/2 of the elongation from the moon to the sun at the time of mean syzygy. This is the same as in the Albatenian rule (for which cf., e.g., Cb177). This rule, however, seems to presuppose a velocity table such as JA11, where the tabular argument is arranged in the usual way. I do not know why it is shifted in the present tables.

JA52. Daily true velocity, sun.

Witnesses, etc.: see under JA52-53, above.

Headings. — General: **(1) Tabula ad inveniendum diaetam solis cum argumento ipsius** Pa.pc A Fj Gr3 Mh. — **(2) Tabula a.i.d. solis** Pa.ac. — **(3)** Blank in Lb. — Sub-headings: **(4) Argumentum; Argumentum; Diaeta; (5)** blank in Lb.

Values. The adopted values are slightly uneven (e.g., for 1°-10°; unexpected leap between 3s0° and 3s1°), but show no gross irregularities. It is not obvious that linear interpolation has been used.

The values are reproduced fairly well when using standard Albatenian parameters (eccentricity 2;4,45; mean velocity 0;59,8°/d; for the method, see note to JA11), and assuming that the range of the tabular argument is in fact 1°-180°. Deviations are mostly of 0"-2", a few of 3"; the fit is worse if the first argument is assumed to be 0°. This does not give grounds for doubt about the parameters or the scaling of the table. The recomputed values are not quoted.

Versions. In the table for 3 signs, the witnesses apart from Lb A leave out the degree-column in the tabular values, and show 1° as 60′. In the table for 4s, the same witnesses leave out the minute-column (=(n), which is zero everywhere). The table for 5s has 3 columns, of which the third one (column (v)) shows occasional signs of having been attached secondarily; thus, in Fj it is separated from the preceding ones with a double stroke.

Text. Values from Lb Pa A. Headings according to A.

Tabula ad inveniendum diaetam solis cum argumento ipsius.

Argumentum		Argumentum		Diaeta		Argumentum		Argumentum		Diaeta		Argumentum		Argumentum		Diaeta	
Si	Gr	Si	Gr	Mi	Se	Si	Gr	Si	Gr	Mi	Se	Si	Gr	Si	Gr	Mi	Se
0	1	0	0	57	8	1	1	11	0	57	25	2	1	10	0	58	7
0	2	11	29	57	10	1	2	10	29	57	26	2	2	9	29	58	8
0	3	11	28	57	10	1	3	10	28	57	27	2	3	9	28	58	9
0	4	11	27	57	11	1	4	10	27	57	28	2	4	9	27	58	11
0	5	11	26	57	10	1	5	10	26	57	30	2	5	9	26	58	13
0	6	11	25	57	10	1	6	10	25	57	31	2	6	9	25	58	16
0	7	11	24	57	11	1	7	10	24	57	32	2	7	9	24	58	18
0	8	11	23	57	10	1	8	10	23	57	34	2	8	9	23	58	20
0	9	11	22	57	11	1	9	10	22	57	35	2	9	9	22	58	21
0	10	11	21	57	11	1	10	10	21	57	36	2	10	9	21	58	23
0	11	11	20	57	11	1	11	10	20	57	37	2	11	9	20	58	24
0	12	11	19	57	12	1	12	10	19	57	38	2	12	9	19	58	27
0	13	11	18	57	13	1	13	10	18	57	39	2	13	9	18	58	30
0	14	11	17	57	13	1	14	10	17	57	40	2	14	9	17	58	32
0	15	11	16	57	14	1	15	10	16	57	41	2	15	9	16	58	34
0	16	11	15	57	15	1	16	10	15	57	43	2	16	9	15	58	36
0	17	11	14	57	14	1	17	10	14	57	45	2	17	9	14	58	37
0	18	11	13	57	15	1	18	10	13	57	46	2	18	9	13	58	39
0	19	11	12	57	16	1	19	10	12	57	47	2	19	9	12	58	41
0	20	11	11	57	17	1	20	10	11	57	49	2	20	9	11	58	44
0	21	11	10	57	17	1	21	10	10	57	50	2	21	9	10	58	46
0	22	11	9	57	17	1	22	10	9	57	52	2	22	9	9	58	48
0	23	11	8	57	18	1	23	10	8	57	54	2	23	9	8	58	50
0	24	11	7	57	19	1	24	10	7	57	56	2	24	9	7	58	52
0	25	11	6	57	20	1	25	10	6	57	59	2	25	9	6	58	55
0	26	11	5	57	21	1	26	10	5	58	1	2	26	9	5	58	57
0	27	11	4	57	22	1	27	10	4	58	3	2	27	9	4	58	59
0	28	11	3	57	22	1	28	10	3	58	4	2	28	9	3	59	1
0	29	11	2	57	23	1	29	10	2	58	5	2	29	9	2	59	2
1	0	11	1	57	24	2	0	10	1	58	6	3	0	9	1	59	3

(a) (b) (c) (d) (e) (f) (g) (h) (j) (k) (L) (m) (n) (o) (p) (q) (r) (s) (t) (u) (v)

(o1,2) 26: Pa A; 20 Lb. **(v2,27)** 59: Pa A; 50 Lb.

Argum entum		Argum entum		Diaeta			Argum entum		Argum entum		Diaeta			Argum entum		Argum entum		Diaeta		
Si	Gr	Si	Gr	Gr	Mi	Se	Si	Gr	Si	Gr	Gr	Mi	Se	Si	Gr	Si	Gr	Gr	Mi	Se
3	1	9	0	0	59	8	4	1	8	0	1	0	10	5	1	7	0	1	1	1
3	2	8	29	0	59	10	4	2	7	29	1	0	12	5	2	6	29	1	1	2
3	3	8	28	0	59	12	4	3	7	28	1	0	14	5	3	6	28	1	1	3
3	4	8	27	0	59	14	4	4	7	27	1	0	16	5	4	6	27	1	1	3
3	5	8	26	0	59	16	4	5	7	26	1	0	19	5	5	6	26	1	1	4
3	6	8	25	0	59	18	4	6	7	25	1	0	21	5	6	6	25	1	1	4
3	7	8	24	0	59	20	4	7	7	24	1	0	23	5	7	6	24	1	1	5
3	8	8	23	0	59	22	4	8	7	23	1	0	25	5	8	6	23	1	1	5
3	9	8	22	0	59	24	4	9	7	22	1	0	26	5	9	6	22	1	1	5
3	10	8	21	0	59	26	4	10	7	21	1	0	28	5	10	6	21	1	1	5
3	11	8	20	0	59	28	4	11	7	20	1	0	30	5	11	6	20	1	1	6
3	12	8	19	0	59	30	4	12	7	19	1	0	32	5	12	6	19	1	1	7
3	13	8	18	0	59	34	4	13	7	18	1	0	32	5	13	6	18	1	1	8
3	14	8	17	0	59	38	4	14	7	17	1	0	34	5	14	6	17	1	1	8
3	15	8	16	0	59	40	4	15	7	16	1	0	36	5	15	6	16	1	1	8
3	16	8	15	0	59	41	4	16	7	15	1	0	37	5	16	6	15	1	1	9
3	17	8	14	0	59	42	4	17	7	14	1	0	38	5	17	6	14	1	1	10
3	18	8	13	0	59	44	4	18	7	13	1	0	39	5	18	6	13	1	1	13
3	19	8	12	0	59	46	4	19	7	12	1	0	41	5	19	6	12	1	1	13
3	20	8	11	0	59	48	4	20	7	11	1	0	42	5	20	6	11	1	1	13
3	21	8	10	0	59	50	4	21	7	10	1	0	43	5	21	6	10	1	1	13
3	22	8	9	0	59	53	4	22	7	9	1	0	45	5	22	6	9	1	1	14
3	23	8	8	0	59	54	4	23	7	8	1	0	47	5	23	6	8	1	1	14
3	24	8	7	0	59	56	4	24	7	7	1	0	48	5	24	6	7	1	1	14
3	25	8	6	0	59	57	4	25	7	6	1	0	50	5	25	6	6	1	1	15
3	26	8	5	0	59	59	4	26	7	5	1	0	51	5	26	6	5	1	1	15
3	27	8	4	1	0	3	4	27	7	4	1	0	52	5	27	6	4	1	1	15
3	28	8	3	1	0	5	4	28	7	3	1	0	54	5	28	6	3	1	1	15
3	29	8	2	1	0	7	4	29	7	2	1	0	56	5	29	6	2	1	1	15
4	0	8	1	1	0	8	5	0	7	1	1	0	59	6	0	6	1	1	1	15
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)

(e) *om.* Pa. **(f3,27-4,0)** 0...0: A; 60...60 Pa; 59...59 Lb. **(g3,1)** 8: Lb Pa; 0 A. **(n)** *om.* Pa.

JA53. Daily true velocity, moon.

Witnesses, etc.: see under JA52-53, above.

Headings. – General: **(1) Tabula ad inveniendum diaetam lunae in die** (diebus Lb) **coniunctionis et oppositionis** Lb A Pa.pc Fj Gr3 Mh. – **(2) Tabula a.i.d. lunae** Pa.ac. – **(3) Tabula a.i.d. lunae in coniunctione et oppositione etc.** Vd. – Sub-headings: **(4) Argumentum; Argumentum; Diaeta**, except that Vd has **(5) Lineae numeri communes; Diaeta lunae**.

Values. It is not clear why the argument is shifted, and this will not be discussed here.

The tabular values at the beginning and end of the table, when divided by 24, give 0;30,19° and 0;36,3,52...°. This suggests an affinity with JA11.Lun.[1] Accordingly, I have tried to compare our table to the recomputation of JA11.Lun (q.v.), multiplied by 24 to yield daily velocities, and at argument values that are multiples of 6°. In the later part of the table (after about 60°) the two series of values agree within some 20" if one assumes that the proper argument for the first item is 1° (instead of the ostensible 7°); earlier on, the fit is better if the first argument is taken to be 0°, still, the difference may be up to half a minute. This agreement may be good enough[2] to show that the present parameters are similar to those of JA11.Lun; however, JA11.Lun is plainly not the source of our table, and on the whole it is unclear how the values have been obtained.

For practical purposes, the values can be quite well approximated as solar velocities, thus, by taking the lunar epicycle radius as an equivalent to the solar eccentricity; see JA11 for the method. This will fit the values best if one assumes that the argument starts in 0°, instead of the expected 1° or the ostensible 7°. Then, a recomputation using 13;10,35°/d for the standard mean daily velocity, plus an estimated epicycle radius of 5;11,40[3] will generally reproduce our values to within 7". In some 20 cases, where the deviation is 10" or more, I quote this estimated value as "**$c**"; see below.

The adopted values show many lesser irregularities, as may be noted from observing tabular differences. In the text I have marked the most conspicuous cases, and noted any likely emendations as "**$d**"; see below. These emendations are, of course, incomplete and approximate. There is no sign of piecewise linear variation in the values, so key values cannot be identified.

The readings that are presumed to be faulty are shared by all the collated witnesses.

Text. Collated for values: Lb Pa A. – Headings according to A. – Quoted in selection: **$c** = approximated values, computed as indicated under "Values" above. They are only quoted where they differ by 10" or more from the adopted values. – **$d** = emendation likely from tabular differences.

The collated witnesses are fairly uniform, and the majority readings have been adopted in almost all cases. Underscoring is applied to draw attention to notes concerning **$c** and **$d**, as just described.

---

1 One also notes that the values at intervals of 6° (disregarding the shift of the argument in the present table) are similar to, though not the same as, those of the lunar subtable in JA51; and these are derived from JA11.

2 It should be recalled that the recomputation of JA11.Lun is not exact; indeed, it is based on values that are found from EA11, such that an error of 1" in these values would already cause an error of about 13" in the daily velocities here considered.

3 Cf. the pseudo-value 5;12 that was used for a similar approximation in the case of JA11.Lun.

Tabula ad inveniendum diaetam lunae in die coniunctionis et oppositionis.

Argum entum		Argum entum		Diaeta			Argum entum		Argum entum		Diaeta			Argum entum		Argum entum		Diaeta		
Si	Gr	Si	Gr	Gr	Mi	Se	Si	Gr	Si	Gr	Gr	Mi	Se	Si	Gr	Si	Gr	Gr	Mi	Se
0	7	0	6	12	7	36	1	7	11	6	12	14	34	2	7	10	6	12	34	17
0	8	0	5	12	7	37	1	8	11	5	12	15	0	2	8	10	5	12	35	11
0	9	0	4	12	7	39	1	9	11	4	12	15	29	2	9	10	4	12	36	4
0	10	0	3	12	7	42	1	10	11	3	12	15	57	2	10	10	3	12	36	55
0	11	0	2	12	7	45	1	11	11	2	12	16	33	2	11	10	2	12	37	48
0	12	0	1	12	7	50	1	12	11	1	12	16	55	2	12	10	1	12	38	42
0	13	12	0	12	7	56	1	13	11	0	12	17	25	2	13	10	0	12	39	37
0	14	11	29	12	8	2	1	14	10	29	12	17	58	2	14	9	29	12	40	34
0	15	11	28	12	8	9	1	15	10	28	12	18	28	2	15	9	28	12	41	32
0	16	11	27	12	8	17	1	16	10	27	12	19	2	2	16	9	27	12	42	30
0	17	11	26	12	8	26	1	17	10	26	12	19	37	2	17	9	26	12	43	30
0	18	11	25	12	8	36	1	18	10	25	12	20	16	2	18	9	25	12	44	31
0	19	11	24	12	8	47	1	19	10	24	12	20	52	2	19	9	24	12	45	32
0	20	11	23	12	8	57	1	20	10	23	12	21	30	2	20	9	23	12	46	33
0	21	11	22	12	9	9	1	21	10	22	12	22	9	2	21	9	22	12	47	31
0	22	11	21	12	9	22	1	22	10	21	12	22	49	2	22	9	21	12	48	31
0	23	11	20	12	9	36	1	23	10	20	12	23	29	2	23	9	20	12	49	34
0	24	11	19	12	9	50	1	24	10	19	12	24	10	2	24	9	19	12	50	41
0	25	11	18	12	10	4	1	25	10	18	12	24	51	2	25	9	18	12	51	45
0	26	11	17	12	10	19	1	26	10	17	12	25	34	2	26	9	17	12	52	51
0	27	11	16	12	10	37	1	27	10	16	12	26	19	2	27	9	16	12	53	54
0	28	11	15	12	10	56	1	28	10	15	12	27	4	2	28	9	15	12	55	0
0	29	11	14	12	11	19	1	29	10	14	12	27	50	2	29	9	14	12	56	7
1	0	11	13	12	11	40	2	0	10	13	12	28	37	3	0	9	13	12	57	12
1	1	11	12	12	12	2	2	1	10	12	12	29	33	3	1	9	12	12	58	20
1	2	11	11	12	12	26	2	2	10	11	12	30	9	3	2	9	11	12	59	28
1	3	11	10	12	12	50	2	3	10	10	12	30	55	3	3	9	10	13	0	40
1	4	11	9	12	13	14	2	4	10	9	12	31	43	3	4	9	9	13	1	54
1	5	11	8	12	13	39	2	5	10	8	12	32	33	3	5	9	8	13	3	7
1	6	11	7	12	14	5	2	6	10	7	12	33	24	3	6	9	7	13	4	17
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)

(g0,24) 50": Lb Pa; 57 A. **(n1,22)** 22′: Lb; 24 Pa A. **(n1,23)** 23′: Pa A; 22 Lb. **(n1,27)** 26′: Pa A; 20 Lb. **(n2,0)** 28′: Lb; 23 Pa; 38 A. **(n2,1)** 29′: Lb Pa; 39 A. **(o1,11)** 26 $d; 23 $c. **(o1,20)** 30": Lb Pa; 20 A. **(o2,1)** 23 $d; 22 $c. **(v2,25)** 45": Lb Pa; 41 A. **(v3,5)** (2,)57 $c. **(v3,6)** 7 $c.

Argum entum		Argum entum		Diaeta			Argum entum		Argum entum		Diaeta			Argum entum		Argum entum		Diaeta		
Si	Gr	Si	Gr	Gr	Mi	Se	Si	Gr	Si	Gr	Gr	Mi	Se	Si	Gr	Si	Gr	Gr	Mi	Se
3	7	9	6	13	5	25	4	7	8	6	13	41	41	5	7	7	6	14	13	9
3	8	9	5	13	6	33	4	8	8	5	13	43	2	5	8	7	5	14	13	57
3	9	9	4	13	7	41	4	9	8	4	13	44	16	5	9	7	4	14	14	44
3	10	9	3	13	8	47	4	10	8	3	13	45	27	5	10	7	3	14	15	28
3	11	9	2	13	9	57	4	11	8	2	13	46	34	5	11	7	2	14	16	10
3	12	9	1	13	11	9	4	12	8	1	13	47	41	5	12	7	1	14	16	52
3	13	9	0	13	12	23	4	13	8	0	13	48	50	5	13	7	0	14	17	38
3	14	8	29	13	13	36	4	14	7	29	13	50	1	5	14	6	29	14	18	14
3	15	8	28	13	14	45	4	15	7	28	13	51	19	5	15	6	28	14	18	51
3	16	8	27	13	15	32	4	16	7	27	13	52	30	5	16	6	27	14	19	26
3	17	8	26	13	17	1	4	17	7	26	13	53	44	5	17	6	26	14	19	59
3	18	8	25	13	18	15	4	18	7	25	13	54	53	5	18	6	25	14	20	31
3	19	8	24	13	19	32	4	19	7	24	13	55	58	5	19	6	24	14	21	2
3	20	8	23	13	20	40	4	20	7	23	13	57	1	5	20	6	23	14	21	31
3	21	8	22	13	22	9	4	21	7	22	13	58	1	5	21	6	22	14	21	58
3	22	8	21	13	23	31	4	22	7	21	13	59	3	5	22	6	21	14	22	27
3	23	8	20	13	24	47	4	23	7	20	14	0	9	5	23	6	20	14	22	51
3	24	8	19	13	26	1	4	24	7	19	14	1	15	5	24	6	19	14	23	14
3	25	8	18	13	27	10	4	25	7	18	14	2	18	5	25	6	18	14	23	36
3	26	8	17	13	28	19	4	26	7	17	14	3	20	5	26	6	17	14	23	55
3	27	8	16	13	29	41	4	27	7	16	14	4	19	5	27	6	16	14	24	12
3	28	8	15	13	30	49	4	28	7	15	14	5	16	5	28	6	15	14	24	36
3	29	8	14	13	32	8	4	29	7	14	14	6	9	5	29	6	14	14	24	41
4	0	8	13	13	33	22	5	0	7	13	14	7	0	6	0	6	13	14	24	54
4	1	8	12	13	34	34	5	1	7	12	14	7	52	6	1	6	12	14	25	5
4	2	8	11	13	35	43	5	2	7	11	14	8	43	6	2	6	11	14	25	15
4	3	8	10	13	36	50	5	3	7	10	14	9	42	6	3	6	10	14	25	22
4	4	8	9	13	37	58	5	4	7	9	14	10	38	6	4	6	9	14	25	28
4	5	8	8	13	39	9	5	5	7	8	14	11	32	6	5	6	8	14	25	31
4	6	8	7	13	40	23	5	6	7	7	14	12	23	6	6	6	7	14	25	33
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)

(f3,22) 23′: Pa A; 24 Lb. **(g3,16)** 52(?) $d; (16,)4 $c. **(g3,17-19)** 18, 31, 45 $c. **(g3,20)** 50 $d; 59 $c. **(g3,27)** 31 $d. **(g4,3-6)** (37,)3, (38,)16, 29, 42 $c. **(o4,7)** 55 $c. **(o4,12-14)** 52, (49,)3, 12 $c. **(v5,13)** 33 $d. **(v5,20)** 31": Pa A; 3? Lb. **(v5,22)** 27": Pa A; 3? Lb. **(v5,23)** 51": Pa A; 5? Lb. **(v5,28)** 36": Pa A; 3<-> Lb; 27 $d. **(v6,3-4)** 22", 28": Pa A; 2<->, 2<-> Lb.

JA54. Daily true velocity, five planets; hourly true velocity of moon.

Fully treated by Goldstein / Chabás / Mancha 1994, mainly on the basis of copies in John of Lignères and the Castilian Alfonsine tables; the values are printed *ibid.*, p.90-92. A list of 21 witnesses (p. 87-88) includes ms. Mh,9v+, (="A") and Pn,55r (="Q"), and some other late material (thus, mss. Yc,162v; Ol,142r/132r; Ba,69r, all John of Lignères; earliest printing by Schöner 1536). The present ms. Mh is considered independent of all the rest considered (p.89). — Samsó 1997 reports readings from two copies due to Ibn ^{c}Azzuz; see "Parallels".

Witnesses: **{a0}** Lo,78r/77v. — **{aX}** Vd,21r. — **{d}** Lb,37v-38r; Pa,56r-v; A,235v-236r; Fj,57r-v; Gr3,129v-130r; Mh,10r/9v. — **{?}** Pn,55r (:Jo. Lin.); Fc2,108v (:Jo. Lin.). — Another copy in Mp, see below.

Occurs after JA52-53 in Pa A Fj, near the end of the eclipse tables. No typical context elsewhere.

A further copy is in Mp,295v (14th c.). Sub-tables .Cme, .Ame and .Mlu are not filled in. This table belongs to a small collection, apparently unconnected with the context, also comprising QB54 (imperfect), a variant of QB51, a month-table for mean motion of the eighth sphere (with normal values), and (296r:) MB13. There are no glosses.

Rules: Mh,10r, gloss to this table: "Intra cum centro et argumento aequatis, et aggrega simul quod invenitur in directo eorum, et habebis motum planetae verum in die illa. Unde, quando volueris scire motum planetae ad diem sequentem, adde illud aggregatum super verum locum planetae si fuerit directus, vel subtrahe illud ab eo si fuerit retrogradus. .M.C.". — "M.C." may refer to a person, but I do not know to whom.

A rule, "Buth solis et lunae", connected with John of Lignères (Pn,40r, etc., reproduced by Goldstein & all., p. 79+) also prescribes adding the values found from the centrum and from the argument, but makes plain that values after the argument marked R(etrogradus) are to be treated as negative. — Apart from an uninformative gloss in Fj,57r, there are no further texts attached to the table in the manuscripts treated here.

Headings.

General: **(1) Tabula motus planetarum diversi in diebus** :: {d:} A Fj Gr3 Mh. — **(2) Tabula diversorum motuum planetarum in una die** :: {?:} Pn Fc2. — **(3: other)** :: Vd ("T. ostendens diversum motum 5 planetarum in diebus"); Pa ("Tabula motus planetarum <<diversi in diebus>>"). — **(4: none)** :: Lo Lb.

Entrance column(s): **(5) Lineae numeri** :: Lo Lb Pn. — **(6) Lineae numeri augmentatae per sex gradus** :: Fc2. — **(7) Lineae numeri communes** :: Vd Pa A Fj Gr3; Mh (+"scilicet argumenti et centri" in the first instance).

Table of Saturn:

(8) Motus Saturni diversus ad dies (a.d.: in diebus Lb) **[Motus centri; Motus argumenti]** :: {aX:} Vd; {d:} Lb Pa A Fj Gr3 Mh.

(9) Motus Saturni diversus (d.s. Pn) **in una die [Motus puncti; Motus portionis** (proportionalis Fc2.ac)**]** :: {?:} Pn Fc2.

(10: other) :: Lo ("Motus Saturni in una die". The column headings "[Motus puncti; Portionis]" are present for Venus and Mercury).

Table of hourly lunar motion (absent in Lo Vd Fc2): **(11) Motus lunae diversus in horis** :: Lb Pa A Fj Gr3 Mh. — **(12) Motus lunae in una hora** :: Pn.

Versions. The core of this table consists in 5 sub-tables, one for each planet, with values for the velocities of centrum and of argument. The sub-tables for Venus and Mercury may be on a separate page, in which case the entrance column is repeated (except in Lo, where these sub-tables share the entrance column of JA11).

The table is in this state in mss. Lo Vd Fc2. In {d} and Pn, it has been extended by a column of "Motus lunae in una hora"; this has not been found as a separate table, so it is reproduced here.

Class {d} further adds a table, with its own entrance, purporting to yield the mean lunar motion in days; this does occur separately, and is here reproduced as QB54.

Parallels. The table is known from the Muwafiq zij by Ibn ᶜAzzuz, of the mid 14th century; cf. Samsó 1997 p. 88-90, also citing earlier evidence for tables of planetary velocity. On p. 104-05, Samsó reports the numerical variants in two manuscripts of Ibn ᶜAzzuz; they do not seem related to any variants among the witnesses collated here, so Ibn ᶜAzzuz is probably still another independent witness. A Hebrew version is in a collection by Judah ben Asher, of the mid 14th century too; see Goldstein 1998 p.179 and note 24.

Values. Goldstein & all., 1994, on the basis of their own analysis, recompute selected values from Albatenian parameters. In the present connection I have confined myself to correcting one obvious error, on the basis of tabular differences, and no doubt there are many left.

Text. Collated for values: **{a0}** Lo; **{d}** Pa A; **{?}** Pn. — Headings according to A. — "R" stands for the superscript "retrogradus", absent from Pa.

Coverage: .Mlu is absent from Lo.

Text chosen according to the majority of Lo Pa A Pn, except for a few likely corrections. More thorough emendation has not been attempted.

Tabula motus planetarum diversi in diebus.

		(Csa)		**(Asa)**			**(Ciu)**		**(Aiu)**			**(Cma)**		**(Ama)**		
Lineae numeri communes		Motus Saturni diversus ad dies					Motus Iovis diversus ad dies					Motus Martis diversus ad dies				
		Motus centri		Motus argumenti			Motus centri		Motus argumenti			Motus centri		Motus argumenti		
		Mi	Se	Mi	Se		Mi	Se	Mi	Se		Mi	Se	Mi	Se	
6	354	1	44	5	43		4	32	8	50		25	43	11	5	
12	348	1	45	5	36		4	33	8	42		25	50	11	0	
18	342	1	46	5	24		4	34	8	30		26	0	10	55	
24	336	1	46	5	12		4	36	8	18		26	15	10	48	
30	330	1	47	5	0		4	37	8	7		26	30	10	42	
36	324	1	48	4	46		4	39	7	50		26	45	10	36	
42	318	1	48	4	32		4	40	7	34		27	0	10	30	
48	312	1	49	4	16		4	42	7	14		27	15	10	24	
54	306	1	50	3	50		4	44	6	50		27	30	10	11	
60	300	1	51	3	20		4	46	6	20		27	50	10	0	
66	294	1	52	2	52		4	48	5	45		28	25	9	48	
72	288	1	53	2	22		4	50	5	5		29	0	9	30	
78	282	1	55	1	50		4	53	4	15		29	40	9	10	
84	276	1	56	1	15		4	55	3	10		30	20	8	50	
90	270	1	58	0	36		4	58	2	5		31	0	8	25	
96	264	2	0	0	0	R	5	0	1	10		31	35	7	55	
102	258	2	1	0	36		5	3	0	0		32	10	7	10	
108	252	2	3	1	20		5	6	1	15	R	32	55	6	20	
114	246	2	4	2	0		5	10	2	30		33	30	5	20	
120	240	2	6	2	40		5	13	3	45		34	10	4	0	
126	234	2	7	3	10		5	16	5	0		34	50	2	10	
132	228	2	8	3	50		5	19	6	15		35	35	0	0	
138	222	2	9	4	30		5	21	7	25		36	5	2	18	R
144	216	2	10	5	0		5	23	8	32		36	35	7	45	
150	210	2	11	5	20		5	25	9	40		37	0	13	0	
156	204	2	12	5	50		5	27	10	40		37	20	25	20	
162	198	2	12	6	15		5	28	11	35		37	40	29	30	
168	192	2	13	6	40		5	29	12	25		38	0	39	29	
174	186	2	14	7	0		5	30	12	50		38	20	49	20	
180	180	2	14	7	15		5	30	13	0		38	40	53	50	
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(j)	(k)		(L)	(m)	(n)	(o)	

(c90) 2 Pa A. **(e48)** 3 Pa A. **(f30)** 1 Pa A. **(f48)** 18 Pa A. **(f84)** 18 Pa A. **(h18-48)** 35 36 38 39 41 43 Pn. **(k48)** 14: Lo; 24 Pn; 34 Pa A. **(k78-90)** 45 34 22 Pn. **(L162)** 38 Pn. **(m96)** 45 Pn. **(m108)** 15 Pa A. **(m120)** 0 Pn. **(m138)** 10 Pn. **(m180)** 30 Pa A. **(o138)** R: Lo; *ad* (o132) Pn; *def.* Pa A.

Tabula motus planetarum diversi in diebus.

		(Cve)		(Ave)			(Cme)		(Ame)			(Mlu)	
Lineae numeri communes		Motus Veneris diversus ad dies					Motus Mercurii diversus ad dies					Motus lunae diversus in horis	
		Motus centri		Motus argumenti			Motus centri		Motus argumenti				
		Mi	Se	Mi	Se		Mi	Se	Mi	Se		Mi	Se
[0	360	57	6	15	32		56	5	*****]				
6	354	57	8	15	30		56	10	51	10		29	0
12	348	57	10	15	28		56	15	51	5		29	4
18	342	57	13	15	26		56	21	50	58		29	8
24	336	57	14	15	23		56	28	50	30		29	13
30	330	57	21	15	18		56	36	49	50		29	22
36	324	57	27	15	12		56	46	49	0		29	33
42	318	57	34	15	4		56	57	47	30		29	46
48	312	57	42	14	56		57	8	45	30		30	2
54	306	57	50	14	46		57	22	43	0		30	19
60	300	58	0	14	34		57	34	40	0		30	37
66	294	58	12	14	20		57	46	37	0		30	58
72	288	58	24	14	2		58	0	34	0		31	18
78	282	58	36	13	40		58	14	31	0		31	39
84	276	58	50	13	19		58	28	28	0		32	3
90	270	59	5	12	48		58	44	25	0		32	26
96	264	59	20	12	18		59	0	19	0		32	49
102	258	59	34	11	30		59	16	12	0		33	15
108	252	59	47	10	20		59	34	5	0		33	44
114	246	59	59	8	50		59	*52*	3	0	*R*	34	17
120	240	60	11	7	5		60	10	11	0		34	49
126	234	60	23	5	0		60	28	19	0		35	17
132	228	60	36	0	0		60	44	31	0		35	44
138	222	60	41	5	0	R	61	0	44	0		36	11
144	216	60	48	7	20		61	14	58	0		36	38
150	210	60	54	14	10		61	26	71	0		37	1
156	204	61	0	25	50		61	36	83	0		37	19
162	198	61	5	42	30		61	45	94	0		37	33
168	192	61	9	65	0		61	53	102	0		37	44
174	186	61	13	87	0		62	0	108	0		37	52
180	180	61	15	96	0		62	5	112	0		37	56
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(j)	(k)		(L)	(m)

(a-k 0) Lo; *lineam om.* Pn Pa A. **(d42)** 24 Lo. **(d90)** 10 Pn. **(d144)** 54 Pn. **(e102)** 10 Pn. **(e126)** 5: Lo: 2 Pn Pa A. **(e144)** 2 Lo. **(e168)** 45 Pa A. **(e174)** 17 Pa A. **(f60)** 30 Pn. **(f84)** 10 Pn. **(f138)** R: *ad f132* Lo *ubi spatium vacat; def.* Pa A. **(g24)** 57 Lo. **(h48-54)** 8, 22: 7, 20 Lo. **(h72)** 5 Lo. **(h114)** 52: 42 *omnes.* **(j0-174)** <*>, 51--108: 51--108, 110 Lo. **(j108)** 0 Lo. **(j144)** 51 Pn. **(j162)** 94: Pn; 44 Lo; 84 Pa A. **(j168)** 102: Pn; 103 Lo; 83 Pa A. **(k0-48)** <*>, 10--30: 10--30, 0 Lo. **(k18)** 55 Lo. **(k120)** R: *ad* (120) Pn; *def.* Lo Pa A. **(L72--150)** 31--36, 37: 30, 31--36 Pn. **(L96)** 33 A. **(m132-168)** (44,38), 11, 38, 33, 44, <*>, <*> A. **(m180)** 46 Pa.

JB. Auxiliary tables, dubious, for division by velocity?

JB10. Cn,105v: 6 small tables, entrances 1-8, presumably degrees. First table headed "Prima tabula verae coniunctionis divisa per 36 minuta et 4 secunda, lunae motus in minuto 36 secunda et 4 tertia", values 1,48,4-14,24,34. Values shown by the headings of all 6 tables:

```
Divisor:       36,4  35,50  34,49  33,55  31,53  30,51
Lunar motus:   36,4  36, 2  35,21  34, 5  32, 7  31, 9
```

JB15. Cn,*ibid.*, 6 other tables, with a common entrance 1-30. First table headed "Motus in minuto 36 secunda 4 tertia", values 1,29-54,2. Values shown by the headings of all 6 tables:

```
Lunar motus:   36,4  36, 2  35,ii  34, 5  32, 7  31, 9.
```

An extra table, in the same form, has the heading "Motus in minuto 33 secunda 4 tertiis minus (=?)", values 1,32-59,7. – The motus value 36;4, and some others, may be from JA11. The value 31;9 is, however, unfamiliar, and the details of the whole scheme remain to be clarified.

JB20. Pn,52v-53r: "Tabula longitudinis horarum". – The entrance column has the range 0;27,50° (10") 0;33,50°, and the following columns gives the first 13 multiples of each of the entrance values. This table is the "T. divisionis longitudinis buth" of *Profatius'* Almanac (Boffito 1908 p. 110-11). Most other tables in Pn are ascribable to John of Lignères.

JB25. Pn,53v: "Tabula minutorum correspondentium longitudini inter solem et lunam". – Entrance column for r = 1 up to r = 33; six sub-tables for c = 28 up to c = 33, each giving r/c*60 with 2 sexagesimal places for 1 <= r <= c.

Another copy of this is in Cambr. UL Gonv. & Caius 110 (=Cp), p. 116 and p. 118. The collection it occurs in seems to lack an attribution. The table is not easy to connect with, e.g., John of Lignères, since it is not in Fc2 nor apparently in other relevant witnesses.

JC. Other tables common to solar and lunar eclipses.

JC11. Table of proportion.

Toomer 1968 no. 79. – Same as Albattani, Nallino II p. 89. Also in the Almanac of Azarchel, Millás 1950 p. 233, table 82. – Sub-tables:

> **JC11:3** (last value "60"): for interpolation between two eclipse tables that are valid, respectively, for the apogee and perigee of the epicycle. Same as Almagest VI,8.
>
> **JC11:4** (last value "12"): for correcting parallax when the moon is not in the apogee of the epicycle. As in Handy Tables, table 18 Stahlman.
>
> **JC11:5** (last value "32"): for correcting parallax when the lunar epicycle is not in the apogee of the deferent. Not used for eclipses. As in Handy Tables, table 18 Stahlman.

Our table is universally present in the Toledan tables and must be native to the tradition. An alternative, at least for the purpose of eclipse calculation, is offered by JC13 (analogous to sub-table JC11:3) plus JC11a (same as sub-table JC11:4). JC11a is an innovation, confined to the later tradition. Where it is present, JC13 is generally present too, but so is still JC11.

Witnesses: **{a0}** Ct,30r; Oo,29r; Cq2,96; Ey,63r; Ea,51v. — **{a1}** Xa,32r; Ad,80r; Cq,57; Fc,46r; Fc,72v; Fc,81v; Ps,70r; Sg,166; Wd,32r; Fh,53r; Xw,31r. — **{a2}** Cz,86r; Cj,159v; Md,93v. — **{aX}** Vo,62r; Xr,83v; R,64v; Ov,97r; Vd,16r. — **{aT}** Lu,68r; Oj,140v; P,82r. — **{k}** Eh,100r; (Lw? See below); Ou,69v; Eg,23r; Co,166v; Cn,102r. — **{d}** Op,75v; C,372; Lb,42r (first sub-table only); Pa,50v; A,229v; Fj,51v; Fj,82v; Nc,122v; Nc,134r; Fd2,53r; Gr3,123v; Ok,59r. — **{e}** Gr,63v; Eq,82r; Ek3,108v; Xc,76r; Vj,99v; Ej,82v. — **{x}** X,164r; Vz,70r; Mv,98v; Cm,144r; B,154v; T,295v; Lf,104r; Lg,183r; Xj,286r; Xg,67r; G,71v; Xb,86v; Es,192v; Fb,77r; Pq,196r; Oy,84r; Wa,72v; Nu,152r. — **{p}** O,82r; Pd,76r; Ch2,179v. — **{?}** Ox,96v (:Ut Annos); Oq,21v (:Ut Annos); Pn,49r (:Jo. Lin.); Fc2,110r (:Jo. Lin.). — Triplicate in {a1} Fc; the two copies on (72v, 81v) seem much the same. Duplicates in {d} Fj Nc. — The table is perhaps in Lw,117v-118r too, but I have not seen the exposure.

Canons. In canons Ca, the following passages constitute one, apparently self-consistent, translation from Albattani: Ca147 ~ Ca151 (diameters; both = Batt. 43); Ca164-169 (interpolation for parallax; = Batt. 39); Ca170-182 (solar eclipses; = Batt. 44). These rules are certainly meant for JC11, since there is no alternative in Albattani. The terms, discounting inflexions, are:

whole table:	"tabula attacium";
JC11:3:	"tabula tertia ... pars/partes longitudinis", or (Ca179) "minuta partium";
JC11:4:	"tabula quarta (+attacium)..." (title:) "circulus brevis"
JC11:5:	"tabula quinta (+attacium)..." (title:) "circulus egressus"

The title "tabula attacium" is much as in Class {k} of the tables, cf. the list of table headings below. The title of JC11:3 is a little off the common form; the rest are the common sub-headings.

In the other canons, it is uncertain whether JC11 or some of the alternative tables are meant. The cases (again reducing inflexional forms) are:

> "Tabula aequationis": Cc248 (= Cc295-97; values JC11:4, "minuta partium"); Cc303 ~ Cb182b (values JC11:4, "minuta (+proportionalia Cb)"); Cc307; Cc311 (values JC11:3, "portiones longitudinum").

This may fit the present table, in the vulgate manuscripts. The reference "Minuta partium / proportionalia" fits JC11:4 badly, but does resemble JC11:3 or analogues. Perhaps in fact there was confusion about which sub-table to use.

For the references to "tabula affinitatis" and "tabula proportionis", see JC13. These terms occur in the headings for the present table too, but they appear to be additional, to judge from their placement in the context.

Headings. I choose the common spelling "attacium", except when quoting single witnesses. I have not seen unambiguous examples of the expected spelling "attacuim" in these headings. At least the words "aequatio" and "directio" are likely to be separate translations of this. The terms "(pro)portio" and "affinitas" may be loans from JC13, where they are common. — General headings:

(1) Tabula aequationis :: {a0:} Ct Oo Cq2 Ea; {a1:} Xa Ad Cq Sg Wd Fh Xw; {a2:} Cz; {aX:} Vo; {d:} Nc(134r).

(2) Tabula directionis :: {a1:} Fc(72v) Fc(81v)!; {aX:} Vd; {d:} Lb Pa A Fj(51v) Nc(122v) Fd2 Gr3; {x:} T. — *Added:* (nothing) Fc(72v) Fc(81v) Lb T; **+sive proportionis** Vd Pa A Fj(51v) Nc(122v) Fd2 Gr3.

(3) Tabula (+attacium sive X B Lf) **aequationis sive directionis** :: {a2:} Cj Md; {d:} Ok; {e:} Gr Eq Ek3 Vj Ej; {x:} X Vz Mv Cm B Lf Lg Xj Xg G Xb Es Fb Pq Oy Wa Nu; {p:} O; {?:} Ox Oq Pn Fc2. — *Added:* (nothing), normally; **+portionum** Vj Ej; **+sive atacium** Ok; **+quae dicitur tabula actatium** O; **+diversitatis aspectus lunae ad solem** Wa; **+sive proportionis secundum quosdam** (+in aspectu de deferente <-> de epicyclo Ox) Ox Oq; **+(pro+)portionum sive actatium** Pn Fc2!.

(4) Tabula attacium (stationum Cn) :: {aT:} Lu Oj P; {aX:} Ov; {k:} Eh Eg Ou Co Cn; {d:} Op C Fj(82v); {p:} Pd Ch2. — *Added:* (nothing) Eh Eg Co Op C Fj(82v) Pd Ch2; **+sive affinitatis** (-tum Cn) Ou Cn; **+sive aequationis** (-num Ov) Ov Lu Oj P.

(5: other) :: Ey (hdg. in common with JA11); Fc(46r: secondary only; like Ct); Ps ("Tabula portionis vel aequationis"); Xr & R & Xc (no heading in first hand).

(6) A numbering of the sub-tables (**1 2 3 4 5** as shown in the edition below) has been noted in {a0:} Ct Cq2; {a1:} Xa Cq Ps Fh; {aX:} Vo; {aT:} Lu; {d:} Fj(51v, 82v); {k:} Ou.

Entrance column: absent where the table is coupled with JA11; see "Versions" below. Otherwise normally **(7) Lineae numeri,** except: — **(8) Lineae numeri communes** {a1:} Fc(72v,81v); {aX:} Vd; {d:} Lb Pa A Fj(51v) Nc(122v) Fd2 Gr3; {?:} Fc2. — **(9) Lineae numeri pro ambabus tabulis** (i.e. JC11 and JA45), Op C. — **(10) Lineae numeri augmentatae per 6 gradus** Ea.

Sub-table (3): **(11) Portiones** (partes Ct) **longitudinum** (=Pq Oy, *alii;* **/-nis** Fc(46r) Cj Md Eg Xc {x-} Ox Oq) :: normally. — **(12) Argumentum** (-ta A Fj Gr3) **longitudinis** (-num A Gr3) :: {a0:} Ea; {a1:} Fc(72v,81v); {aX:} Vd; {d:} A Fj(51v) Gr3. — **(13) Longitudo (+portionum** Pn Fc2) :: {e:} Vj Ej; {?:} Pn Fc2. — **(14) Minuta proportionalia sive superfluitatis** (-tes Pd Ch2) (p.s.s.: s. sive p. Ey Xr) :: {a0:} Ey; {aX:} Xr R; {p:} O Pd Ch2. — **(15) Minuta proportionalia (+ad eclipsim lunae** Nc(122v) Fd2) :: {a2:} Cz; {d:} Lb Nc(122v) Fd2. — **(16: other)** :: (none:) Gr Eq Ek3; Ou ("portiones longitudinum, minuta residuorum").

Sub-table (4): **(17) Circulus brevis** :: normally. — **(18) Circulus epicycli** :: {a1:} Fc(72v,81v); {aX:} Vd; {d:} Pa A Fj(51v) Fd2 Gr3. — **(19) Minuta circuli brevis** :: Op C, perhaps Xw. — **(20: other)** :: Ea R Nc(122v) G Oy Wa; (none, incomplete, or lost:) Lb Eq Ek3 Xc Oq.

Sub-table (5): **(21) Circulus egressus** :: normally. — **(22) Egressus** {a2:} Cj; {e:} Gr; {p:} O Pd. — **(23) Minuta circuli egresse** (!) :: {d?:} Op C. — **(24) Circulus excentrici** :: {a1:} Fc(72v,81v); {aX:} Vd; {d:} Pa A Fj(51v) Gr3. — **(25) Minuta circuli excentrici** :: {d:} Nc(122v) Fd2. — **(26) Excentricus** :: {x:} G Oy. — **(27) Circulus egressus, Minuta proportionalia, Excentricus** :: {x:} Vz Cm. — **(28: other)** :: Ct ("Circulus egressae cuspidis"); Ea Xw R Lf; (none, incomplete, or lost:) Lb Eq Ek3 Xc Oq.

Versions. Our table may be coupled with JA11, thus losing its own entrance column; this has been observed in {a0:} Ey; {a2:} Cz (Cj, with JC11a in between); {aX:} Xr; {x:} Vz Cm T (Lg, separated again) G Fb Pq Nu. In Ey Cz Xr T G this has caused the table to start in 0°, an incipit also shown by Wa. — {d?:} Op C attach JA45 to this table. — The entrance column, where present, is normally in degrees; in Op C, it is in signs and degrees.

Parallels. Albattani and Azarchel; see above. For the relation of sub-table JC11:3 to Almagest VI,8 and V,18, see "Values". — In the Handy Tables (Halma t.I p.146, cf. Nallino II p. 231; here according to Stahlman 1960), Table 18 contains sub-tables JC11:(4-5) in their present form, whereas Table 16 has values like JC11:(3), though rounded to minutes.

Values. Sub-table JC11:3 is the same as Almagest VI,8 (Toomer 1984 p. 308). The values for 12°, 24°,... are the only independent ones; in fact they are the same as the values for 6°, 12°,... in Almagest V,18 (sub-table 7, Toomer 1984 p. 265; cf. HD21.7). The rest of the values in JC11:3 (i.e., for 6°, 18°, 30°,...) were found by linear interpolation; cf. Stahlman 1960 p. 73.

I have tried to recompute JC11:3[1] for each entry, using the normal epicycle radius of 5;15. It turns out that there are substantial deviations, especially for values up to 42°. One reason is that the values for 24° and for 132° in Almagest VI,8 (=the values for 12° and 66° in Almagest V,18) were already faulty; the expected values are 2;24 and 49;18. The resulting errors are of course present in the whole tradition. — I do not quote any recomputed values for this sub-table, nor for the others.

Text. Collated for values: **{a0}** Ct Oo; **{a1}** Xa Cq; **{aT}** Lu; **{k}** Ou Co; **{d}** Pa A; **{e}** Eq Xc; **{x}** Es Xg. — Headings according to Xa. — Also quoted: **$ba** = Batt., Paris Arsenal 8322, 57va; **$aa** = Almanac of Azarchel, Paris Arsenal 8322, 133ra; **$pm** = Almagest VI,8, Toomer 1984 p. 308 (only for sub-table (3)); **$ht** = Handy Tables, ed. Stahlman 1960 no. 18 (only for sub-tables (4-5)).

I reproduce the majority readings, underscoring those which differ from $pm (in JC11:3) or $ht (in JC11:4-5).

The witness for Azarchel's Almanac normally agrees with the vulgate against Ou Co $ba. Once (d66), Ou Co $ba are in error. One may thus discern the usual error groups *$ba Ou Co; Ou Co* alone; *Pa A; $aa* with the *vulgate;* and *Es Xg.*

---

1 As: LPIA(x) = 60 * (60 + epicycle_radius - dist) / (2 * epicycle_radius),
where "dist", the Moon's distance from the Earth, is given by
dist = ([60 + epicycle_radius*cos(x)]**2 + [epicycle_radius*sin(x)]**2) ** (1/2).

Tabula aequationis.

Lineae numeri		Portiones longitudinum		Circulus brevis	Circulus egressus
1	2	3		4	5
Gr	Gr	Mi	2a	Mi	2a
6	354	0	21	0	0
12	348	0	42	0	0
18	342	1	42	0	1
24	336	2	42	1	2
30	330	4	1	1	3
36	324	5	21	1	4
42	318	7	18	2	5
48	312	9	15	2	6
54	306	11	37	2	8
60	300	14	0	3	9
66	294	16	48	3	11
72	288	19	36	4	13
78	282	22	36	4	14
84	276	25	36	5	16
90	270	28	42	6	17
96	264	31	48	6	19
102	258	34	54	7	21
108	252	38	0	8	22
114	246	41	0	8	24
120	240	44	0	9	26
126	234	46	45	9	27
132	228	49	30	10	28
138	222	51	39	10	29
144	216	53	42	11	30
150	210	55	34	11	30
156	204	57	15	11	31
162	198	58	18	12	31
168	192	59	21	12	32
174	186	59	41	12	32
180	180	60	0	12	32
(a)	(b)	(c)	(d)	(e)	(f)

(d18) 2 Lu. **(d24)** 43 Pa A. **(d54)** 36 Co.ac; 3 Co.pc. **(d66)** 58 Ou Co $ba, *prave*. **(d96)** 42 Xg. **(d102)** 50 Pa A; 48 Xg. **(d126)** 41 Es Xg; 44 $aa. **(d132)** 34 (?) Es.ac. **(d144)** 48 $pm. **(d150)** 32 Ou Co $ba $pm; 14 $aa. **(e72)** 3 Ou Co. **(f72)** 14 Co. **(f120)** 25 Ou Co $ba $ht.

JC11a. Table of proportion: sub-table of JC11, max. 12′.

Toomer p.117, note on no. 79 (from mss. Ok Oc Ow, his "Ca, C, S"). – The values are the same as in JC11:4.

Witnesses: **{a1}** Fh,57r(m2). – **{a2}** Cj,159v; <Mp,.see below>. – **{d?}** Op,78r; Gr3,129r; Ok,59v. – **{e}** Eq,82v(m2). – **{x}** Oc,93r; X,170r; Vz,72v; Mv,109r; Cm,150v; B,161r; T,298v; Lf,110v; Lg,189r; Lh,156r; Xj,292r; Xg,73v; G,77v; Xb,92v; Es,198v; Fb,83v; Pq,202v; Oy,90r; Wa,78r; Ow,170v; Nu,158r. – **{?}** Ej2,96v(m2) (:Novara); Ew2,39r (:Ut Annos); Pn,51r (:Jo. Lin.); Fc2,115v (:Jo. Lin.). — Probably lost from ms. Mp; see T:03(2),Mp.

To judge from the distribution in the witnesses, this table is an innovation, confined to the late vulgate tradition.[1] The same table normally accompanies the tract "Ut Annos"; see CbB02.

Canons meant for JC11:4 are common. Any such canon will work for the present table, so the canons do not show revisions on this account. The headings of the table are perhaps adapted, e.g., to canon Cb182b "cum argumento lunae *tabulam aequationis* eius" (sc. *diversitatis aspectus*, Cb182b) "intra, et accipiens ... *minuta proportionalia*..."

Headings.

General: **(1) Tabula aequationis diversitatis aspectus** :: {a2:} Cj; {d:} Gr3 Ok; {e:} Eq; {x:} Oc X Vz Cm T Lh Xb Es Fb Oy Ow; {?:} Ew2 Ej2. – **(2) Tabula aequationis diversitatis aspectus lunae ad solem** :: {a1:} Fh(57r); {d?:} Op; {x:} Mv B Lf Lg Xj Xg G Pq Wa Nu; {?:} Pn Fc2.

Entrance columns: **(3) Lineae numeri** :: normally. – **(4) Lineae numeri argumenti lunae** :: Oc X Vz Cm T Xb Fb Oy. – **(5: other)** Garbled :: Ok.

Body of table: **(6) Minuta proportionalia** :: normally. – **(7) Proportionalia** :: Xg Es Fb Wa Fc2. – **(8: none)** :: Ok Ej2.

Versions. In Cj the table is attached to JA11 and shares its entrances.

Text. Collated for values: **{a2}** Cj; **{d}** Gr3; **{e}** Eq(m2); **{x}** Es Xg. – Headings according to Xg.

The table in Cj only shows col. (c); cf. "Versions" above.

There are no distinctive differences from the readings of JC11:4.

---

1 Assuming that the occurrence in Gr3 is a chance admixture. At least it looks like an intrusion in its context; cf. T:04(6J4). Manuscripts Op Ok are mixed in any case; for instance, both have received copies of table JC51, which, like JC11a, is typical of the eclipse tract CbB.

Tabula aequationis diversitatis
aspectus lunae ad solem.

Lineae numeri		Propor.
Gr	Gr	Mi
0	360	0
6	354	0
12	348	0
18	342	0
24	336	1
30	330	1
36	324	1
42	318	2
48	312	2
54	306	2
60	300	3
66	294	3
72	288	4
78	282	4
84	276	5
90	270	6
96	264	6
102	258	7
108	252	8
114	246	8
120	240	9
126	234	9
132	228	10
138	222	10
144	216	11
150	210	11
156	204	11
162	198	12
168	192	12
174	186	12
180	180	12
(a)	(b)	(c)

(b36) 320 Eq. **(b42)** 314 Gr3 Eq. **(b66)** 204 Eq.

JC12. Table of proportion, values derived from JC11.

Ey,63v-66r, no proper heading; sub-headings, "Circulus brevis; Minuta superfluitatis sive proportionalia". Attached to JA12, sharing its entrance column. Range 0s1°(1°)6s0°. – Sample:

				Circulus brevis		Minuta superfl.	
(0	1	11	29)	0	1	0	2
(1	0	11	0)	1	40	4	1
(2	0	10	0)	3	19	14	0
(3	0	9	0)	6	0	28	42
(4	0	8	0)	9	0	44	0
(5	0	7	0)	11	20	55	34
(6	0	6	0)	12	0	60	0

The "Minuta" table agrees with JC11:3 at the arguments present in both; the rest of the values have no doubt been interpolated.

The "circulus brevis" table may have been made from JC11:4 by placing its values (which are integers) at convenient arguments, and interpolating between them. The following sample shows the arguments where the values are integers or close to integers:

Argu ment		JC12 (Circ.brev.)	
0	18	0	58
0	19	1	1
1	6	2	0
1	24	3	0
2	12	4	0
2	24	5	0
3	0	6	0
3	12	7	0
3	18	8	0
4	0	9	0
4	12	10	0
4	24	11	0
5	20-30	12	0

All arguments are multiples of 6°, except at the ends. The values "4"-"11" are placed as in JC11:4, each value against the lowest possible argument; the values "2-3" appear to be off by 6°. Most or all of the values shown here have been used as key values for interpolation.

JC13. Table of proportion, max. 60;0.

Toomer 1968, no. 80. — The values are the same as in Alkhwarizmi / Maslama, Suter Tab. 73-75 p.187-89, column "Tabula proportionis". They are, however, derived from Almagest VI,8, like those of JC11:3, though in a different way. Thus the table is not Alkhwarizmian originally.

Witnesses: **{a0}** Ct,31r-v; Oo,27v-28r; Cq2,93-94; Pz,131v; Mc,29v; Mb,60r; Ea,50v; Lo,81r. — **{a1}** Xa,34v; Ad,82v; Cq,61; Fc,47v; Ps,74v; Sg,178; Wd,34v; Fh,58v; Xw,33v. — **{a2}** Cz,89v; Cj,161r; Md,99r; Mp,224v. — **{aX}** Vo,66v; Xr,88v; R,93r (:Novara); Ov,104r; Fj2,108v. — **{aT}** Lu,76r; Oj,158r; P,86r. — **{d}** Op,77v-78r; A,233r(m2); Nc,135v; Fd2,47v; Ok,64r. — **{e}** Gr,65r; Eq,84r; Ek3,110r; Xc,79r; Vj,102v; Ej,85v; Vm,15r. — **{x}** Oc,88v; X,165v; Vz,71v; Mv,104v; Cm,145v; B,156r; T,296r; Lf,105v; Lg,184v; Lh,150v; Xj,287v; Xg,68v; G,73r; Xb,88r; Es,194r; Fb,78v; Pq,197v; Oy,85v; Wa,73v; Ow,168r; Nu,153v. — **{p}** O,85r; Pd,38r; Pd,83v. — **{?}** Ef,68r; Ej2,98r (:Novara); Ew2,39r (:Ut Annos); Ox,94r (:Ut Annos); Pn,51v (:Jo. Lin.); Fc2,114r (:Jo. Lin.); Ut,132r-v (:?). — Duplicate in {p} Pd.

The table is common in the vulgate tradition, but is absent from class {k} and perhaps not native to {d}.

Canons. Rules written for this table and for JC11:3 are equivalent and cannot normally be distinguished. The rules listed below may, however, refer to the present table, since they show its characteristic headings, "T. affinitatis / T. proportionis". Originally, these rules were no doubt meant for JC11 and JE*, since they are connected with Azarchel's Almanac; but in their actual state they appear to serve the present table plus the Alkhwarizmian eclipse tables JD11-21, q.v. For the doubtful status of the canon Ca142, see, however, T:04(5). Some of the apparent sub-headings in the canons are better known from JC11:3, as indicated.

Rules listed under Pr:05(J3b.8): Cb190.d ("T. proportionis; Minuta proportionalia"); Cc260 ("T. affinitatis").

Rules listed under Pr:05(J5b.4): Ca142 ("tabula affinitatis id est attacium (cf. JC11)". Values: "de minutis residuorum", for which cf. a heading in ms.Ct, below, or JC11:3) — Cb201a ("T. proportionis; Minuta proportionalia"). — Cc271 (values: "de minutis affinitatis (superfluitatis *ms.* Oo)", for the latter cf. JC11:3 and JC12).

One more mention of "tabula affinitatis", nondescript, is in the gloss CaB05(2) (ms. Oo only).

Headings. — General:

(1) Tabula affinitatis :: {a0:} Oo Cq2.
(2) Tabula proportionis :: {a0:} Pz Mc; {a1:} Xa Ad Cq Fc Ov Ps Sg Wd Fh Xw; {a2:} Md Mp; {aX:} Vo Xr Fj2; {aT:} Lu Oj P; {d:} Nc Fd2 Ok; {e:} Gr Eq Ek3 Xc Vj! Ej Vm; {x:} Oc X Xb! Es; {?:} Ef Pn Fc2 Ew2 Ut. — *Added:* **+vel affinitatis** {a0:} Pz.m2; {aT:} Oj P; {aX:} Fj2.m2; {?:} Ef.
(3) Tabula proportionis augmentata per 2 gradus :: {a2:} Cz Cj; {aX:} R; {d?:} Op; {x-}; {p:} O; {?:} Ej2.
(4: other) :: Ct ("T. aequationis"); Ea ("T. proportionis ad eclipsim"); Pd (38r: "T.p. addens 2 partes"); Ox; (none, or secondary only:) Lo Mb A Pd(83v).

Entrance column: **(5) Gradus proportionis (/portionis** Ct Oo Cq2 Vj) :: {a0:} Ct Oo Cq2; {a1:} Xa Ad Cq Fc Ov Ps Sg Wd Fh Xw; {a2:} Md; {aX:} Vo Xr Fj2; {d:} A Nc Fd2 Ok; {e:} Xc Vj Ej Vm!; {?:} Pn Fc2. — **(6) Gradus argumenti** :: {a0:} Pz Mc Mb; {e:} Gr Eq Ek3. — **(7) Lineae numeri (+argumenti** Oc X Xb) :: {a2:} Cz Cj Mp; {aX:} R; {aT:} Lu Oj P; {d?:} Op; {p:} O Pd(38r,83v); {x}; {?:} Ej2 Ew2 Ef Ox. — **(8: other)** :: Lo ("Partes diversitatis"); Ea ("Argumentum"); Ut.

Body of table: **(9) Minuta** :: {a0:} Oo Cq2; {a1:} Xa Ad Cq Fc Ov Ps Sg Wd Fh Xw; {a2:} Md; {aX:} Vo Fj2; {d:} A Nc Fd2; {e:} Gr Eq Xc Vj Ej. — **(10) Minuta proportionalia** :: {a0:} Ea Pz Mc Mb; {a2:} Cz Cj Mp; {aX:} R; {aT:} Lu Oj P; {d:} Op Ok; {e:} Ek3 Vm; {d:} O Pd(38r!, 83v); {x}; {?:} Ej2 Pn Fc2 Ew2 Ef Ox. — **(11: other)** :: Ct ("Minuta residuorum"); Lo ("Puncta residui"); Xr (none); Ut.

Values. The present table has essentially the same values as Almagest VI,8 (=Toomer 1984 p.308, "Sixtieths"; cf. Neugebauer 1962 p. 118, "Column 8"). This is the same as JC11:3 above, q.v. for further notes on the Almagest parallels.

The key values of the Almagest table (=the values in JC11:3 for 12°, 24°,...) are copied by the present table, including the faulty values at arguments 24° and 132°, mentioned under JC11. Thus, like JC11, it is surely based on the Almagest tables. Since these presuppose a lunar epicycle radius of 5;15, different from that of Alkhwarizmi, our table is not Alkhwarizmian originally.

A comparison with a standard recomputation[1] does not indicate that there are any other key values than those for multiples of 12°. The remaining values have surely been found by interpolation. This is not linear, so our table does not reproduce the interpolated values in Almagest VI,8 nor in Almagest V,18. The second-order tabular differences appear to be roughly constant, so this may reflect the interpolation scheme intended. – The recomputation has been used for guessing at correct readings, but is not quoted.

Text. Collated for values: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** Lu; **{d}** A; **{e}** Eq Xc; **{x}** Es Xg. – Headings according to Xa. – The table of A is in a hand that is secondary though perhaps contemporary with the text-hand. – Also quoted for values: **$km** = Khw/M, Suter Tab. 73-75, "Tabula proportionis", p. 187-189, mss "C" and "O" only.

Readings chosen. I normally adopt the values shown by the majority among Ct Oo Pz Xa Cq Lu. If the value shown by $km is plausible according to the recomputation, and the majority reading is evidently derived from it, I choose $km and italicize at the place; otherwise, where they differ, I reproduce the majority reading and underscore it.

Variant groups. The *whole tradition* is in error at d28, m126, m130. – At m122-124, *all except Ct* incorrectly show zeros, causing the minute values to look inconsistent. *Ct* alone carries traces, though faulty, of the Alkhwarizmian readings; thus Ct may be independent of the rest of the tradition.

Lu Es Xg show correct readings against all the rest at L144, L158, L164, m170, m174, where the faulty values are not hard to emend by observing the tabular differences. They show no good readings in the places mentioned earlier, which are more difficult to correct; indeed, at L122-126, *Es Xg* adapt to the faulty second-values by altering the minute-values. Thus one need not assume that Lu Es Xg have independent sources.

Lesser error groups, one or two instances of each: *Eq Xc; Es Xg;* perhaps *Xa Cq,* if the errors at k162-180 and at k178-180 have the same genesis. The rest do not show any striking peculiarities. In particular, *A* reads much like the majority, so the table, which is not general in Class {d}, is likely to be a stray loan into A from the vulgate tradition.

1 Done as for JC11:3; see note under JC11. Epicycle radius, 5;15.

Tabula proportionis.

Gradus proportionis		Minuta		Gradus proportionis		Minuta		Gradus proportionis		Minuta	
Gr	Gr	Mi	2a	Gr	Gr	Mi	2a	Gr	Gr	Mi	2a
2	358	0	2	62	298	14	52	122	238	44	*58*
4	356	0	6	64	296	15	45	124	236	45	*55*
6	354	0	12	66	294	16	41	126	234	46	*50*
8	352	0	20	68	292	17	38	128	232	47	*46*
10	350	0	30	70	290	18	36	130	230	48	*37*
12	348	0	42	72	288	19	36	132	228	49	30
14	346	0	57	74	286	20	36	134	226	50	19
16	344	1	15	76	284	21	36	136	224	51	6
18	342	1	34	78	282	22	36	138	222	51	50
20	340	1	55	80	280	23	36	140	220	52	32
22	338	2	18	82	278	24	36	142	218	53	11
24	336	2	42	84	276	25	36	144	216	*53*	48
26	334	3	5	86	274	26	38	146	214	54	24
28	332	3	25	88	272	27	40	148	212	54	59
30	330	3	54	90	270	28	42	150	210	55	34
32	328	4	21	92	268	29	44	152	208	56	8
34	326	4	50	94	266	30	46	154	206	56	42
36	324	5	21	96	264	31	48	156	204	57	15
38	322	5	57	98	262	32	50	158	202	*57*	43
40	320	6	34	100	260	33	52	160	200	58	8
42	318	7	13	102	258	34	54	162	198	58	31
44	316	7	52	104	256	35	56	164	196	*58*	50
46	314	8	32	106	254	36	58	166	194	59	7
48	312	9	15	108	252	38	0	168	192	59	21
50	310	10	0	110	250	39	0	170	190	59	*33*
52	308	10	46	112	248	40	0	172	188	59	43
54	306	11	33	114	246	41	0	174	186	59	*51*
56	304	12	21	116	244	42	0	176	184	59	56
58	302	13	10	118	242	43	0	178	182	59	58
60	300	14	0	120	240	44	0	180	180	60	0
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)

(b8) 350 Pz. **(c16)** 0 $km. **(c60)** 13 Ct. **(d12)** xii *ut vid.* Cq. **(d18)** 33 $km.C. **(d26)** 2 Pz. **(d28)** 29 $km, *melius.* **(d30)** 24 Xc. **(d34-52)** 50, 21, 57--46: 57--46, *<vac.>*, *<vac.>* Pz, *partim quidem suppletus, v.i.* **(d38)** 59 Es Xg. **(d46)** 31 Eq Xc. **(d50-60)** *vacat* Pz.ac; *<vac.>*, 33, 21, 10, 0, 0 Pz.pc. **(d52)** 45 $km.O. **(g108-120)** 38--43, 44: 37, 38--43 Cq. **(h64)** 55 $km.O. **(j-m 122-124)** *in fine tabulae anterioris* Ct. **(j170)** 160 Pz. **(k162-180)** 198--180: 298--280 Cq. **(+k178, 180)** 282, 280 Xa. **(L122-126)** 45, 46, 47 Es Xg. **(L138-140)** 52, 53 Oo.ac. **(L144)** 53: Lu Es Xg $km; 54 *cett.* **(L148-156)** 55, 56, 56, 57, 58 Eq Xc. **(+L148)** 59 Pz. **(+L156)** 56 A. **(L158)** 57: Lu Es Xg $km; 58 *cett.* **(L162)** 59 Eq Xc. **(L164)** 58: Lu Es Xg $km; 59 *cett.* **(L180)** 59 Pz. **(m122)** 58: $km; 38 Ct; 0 *cett.* **(m124)** 55 $km; 35 Ct; 0 *cett.* **(m126)** 50: $km; 7 *omnes.* **(m128)** 44 $km, *melius.* **(m130)** 37: $km; 57 *omnes.* **(m164)** 1 Ct. **(m168)** 27 Es Xg. **(m170)** 33: Lu Es Xg $km; 53 *cett.* **(m174)** 51: Lu Es Xg $km; 11 *cett.*

JC21. Area of segment of circle, by Alkhwarizmi.

For computing the area of the segment of the solar circle that forms part of the area eclipsed. Well attested as Alkhwarizmian (cf. on the canon, below), though not present in Maslama's revision. – Printed by Pedersen 1993.

Witness: **{a0}** Ct,31v. – *Canon:* Cc171 "... intra cum eo in tabulam magnitudinis ...". This is Alkhwarizmian, cf. Ibn Almuthanna, Goldstein 1967, Q82, p.137:20 and p.240. The Hugo translation of Ibn Almuthanna (Millás-Vendrell p.195, line 6 from bottom) cites the table as "tabulam magnam".

Values. For a radius of 6 and a total area of 12 digits, given the sagitta x (0 =< x < 6), the half-chord y(x) corresponding to x is

```
y(x) = (x * (12-x))**(1/2),
```

and the area A(x) of the corresponding segment of the circle is

```
A(x) = [36 * arc tan(y/(6-x)) - y*(6-x)] * 12 / (36 * π).
```
[1]

The values found in this way differ by less than 12" from the manuscript readings, except in the two places where the readings are underscored.

Text. The readings are left as in the manuscript. I only note the two largest deviations from the recomputed value, quoting this as **$c.** Both readings may be Abjad errors.

Numerus		Tabula magnitudinis secundum Alchoarizmi de sole.		
Pc	Mi	Pc	Mi	Se
0	30	0	10	15
1	0	0	28	43
1	30	0	52	5
2	0	1	18	48
2	30	1	48	<u>18</u>
3	0	2	20	48
3	30	2	54	53
4	0	3	30	8
4	30	4	6	37
5	0	4	43	<u>17</u>
5	30	5	21	50
6	0	6	0	0
(a)	(b)	(c)	(d)	(e)

(e2;30) 18": *fort. ex* 38"; 40" $c. **(e5;0)** 17": 57" $c.

1 For this purpose, the arc tangent is expressed in radians.

JC31a-c. Area digits.

Toomer 1968 no. 76-77.

Differences between JC31a and JC31b. Both of the tables here listed as JC31a and JC31b descend from Almagest VI,8 (Toomer 1984 p. 308), via the Handy Tables (Halma II p.95, cf. Toomer 1968 p. 113 n.3) and Albattani. Several important witnesses of the vulgate version of the Toledan tables contain copies of both. They mainly differ in respect of their headings and certain numerical variants (below; cf. Toomer 1968, ibid.). Either occurs in several sources, e.g.:

	Sun 3p	Sun 5p	Sun 12p	Moon 3p	Moon 7p
Almagest VI,8:	45′	40′	0′	4′	45′
Handy Tables, Stahlman tab. 19:	45′	40′	0′	4′	45′
Khw/M., Suter tab.76:	45′	40′	0′	4′	45′
Azarchel, Alm., Arsenal 8322, 133r:	45′	40′	0′	4′	45′
Kammad, Madrid 10023, 52v:	45′	40′	*	*	*
JC31b, typically:	45′	40′	0′/20′	4′/8′	45′
Albattani, Nallino II p.89:	45′	40′	0′	**5′**	45′
Albattani, Arsenal 8322, 57v:	**50′**	**20′**	0′	**5′**	46′
JC31a, typically:	**50′**	**20′**	0′	**5′**	45′/42′

To judge from the three variant readings, in bold type, JC31a may be an innovative variant of Albatenian type whereas JC31b is nondescript. It is plain that the Castilian version of Albattani (Arsenal 57v) is closer to JC31a than is Nallino's version; such transitory readings are often seen in the Arsenal text.

In a gloss in ms. Ct, some of the JC31a readings are apparently attributed to Albattani, and the normal ones to Ptolemy; see JC31a, "Versions". I have not seen any attributions elsewhere, either of tables or of values.

I have distinguished between JC31a and JC31b mainly on the basis of the table headings, supported by notes on (Sun, 5p); in cases of doubt I have checked all the values above. Details are not reported.

Canons for JC31a or JC31b. Ca155 and Ca183, which are close translations of Albattani ch. 43-44, both give the names "in *tabulam quantitatis eclipsis* in linea numeri ... *quantita(te)s eclipsis lunae/solis*". These are generally like JC31a, and unlike JC31b. This, if not a coincidence of different translations, appears to confirm that JC31a is Albatenian.

Cc274 and Ca141 (lunar eclipses, Ca141 doing double duty with Ca155) both have "tabula aequationis punctorum". Compare JC31a, heading (6); strangely enough this heading is only in mss. Op C, but at least it is unlike JC31b. Sub-heading, "tabula lunae", nondescript.

Cc261: just referring to the values as "de punctis circuli Solis", nondescript.

Cb191 and Cb204 have the two different references "in tabulam quantitatis obscurationis solis et lunae (like JC31a, Pz Mc Mb...) and "tabulam aequationis quantitatis (+tenebrarum *recc.*) eclipsis", somewhat like the common heading of JC31a.

In short, the headings implied by the canons are heterogeneous, no doubt partly because of different sources (cf. Pr:05 for guesses at these). However, most of the references can be recognized in some version of JC31a, and none definitely point to JC31b.

JC31a. Area digits, perhaps Albatenian tradition.

Toomer 1968, no. 76 (p. 113; printed in full from mss. Wd O).

Witnesses: **{a0}** Ct,30r; Oo,29r; Cq2,96; Pz,132r; Mc,30r; Mb,63r; Ey,72v; Ea,50v. — **{a1}** Xa,32r; Ad,80r; Cq,57; Fc,45v; Fc,72v; Fc,81v; Ps,69v; Sg,167; Wd,32r; Fh,53v; Xw,31r. — **{a2}** Cz,85v; Cj,159r; Md,94r; Mp,225r. — **{aX}** Vo,62v; Xr,84r; R,50r; Ov,96v; Fj2,108r; S,102v; Vd,16v. — **{aT}** Lu,67v; Oj,140r; P,89r. — **{k}** Eh,101v; Lw,102r; Lw,119r; Ou,76r,70v (solar and lunar table, resp.); Eg,23v; Co,167r; Co,176v; Cn,102v. — **{d}** Op,77r; C,376; Lb,42r; Pa,50v; A,229v; Fj,51v; Nc,122v; Fd2,53r; Gr3,123v; Ok,59v. — **{e}** Gr,62v; Eq,81r; Ek3,108r; Xc,75v; Vj,99r; Ej,82r. — **{x}** Oc,86v; X,163v; Vz,72r; Mv,98r; Cm,146r; B,156v; T,296r; Lf,106r; Lg,182v; Lh,151r; Xj,285v; Xg,69r; G,71r; Xb,86r; Es,192r; Fb,79r; Pq,198r; Oy,83v; Wa,72v; Ow,168v; Nu,151v. — **{p}** O,81v; Pd,80v; Ch2,180r. — **{?}** Ef,72r; Ew1,34v; Ew2,37v (:Ut Annos); Ox,90v (:Ut Annos); Ox,96v (:Ut Annos); Oq,19v (:Ut Annos); Pn,51v (:Jo. Lin.); Fc2,116r (:Jo. Lin.); Ut,132v (:?). — Triplicate in {a1} Fc, of which (72v,81v) seem to have the same readings. Duplicates in {k} Lw Co, {?} Ox.

Headings. — General, lesser variants ignored:

(1) Tabula quantitatis tenebrarum eclipsis (*om.* Sg O; **/in utraque eclipsi** Ps Ov Cj Mp, {x}, Ew2 Ox(96v)) :: {a0:} Ct Oo Cq2; {a1:} Xa Ad Cq Fc(45v) Ps Sg Wd Fh Xw; {a2:} Cj Md Mp; {aX:} Ov Vo Xr R Fj2; {aT:} Lu Oj P; {k:} Co(176v); {e:} Gr Eq Ek3 Xc Vj Ej; {x}; {p:} O; {?:} Ef Ew2 Ox(96v) Pn Fc2. — *Added:* **+solis** (**+scilicet** Mp Lh) **et lunae** Mp Lh Ek3 Pn Fc2.

(2) Quantitas tenebrae (-arum Ok) **eclipsis** (-sium Ok; **/in eclipsi** Nc Fd2; +solis et lunae Fj) :: {aX:} Vd; {d:} Lb Pa A Fj Nc Fd2 Gr3 Ok.

(3) Tabula quantitatis umbrae solis et lunae in eclipsi :: {k:} Eh Lw(102r, 119r) Eg Co(167r).

(4) Tabula quantitatis obscurationis (**+eclipsis** Mc Mb) **solis et lunae** (e.l.: *om.* Mb; +in una hora Pz) :: {a0:} Pz Mc Mb Ey; {?:} Ox(90v) Oq.

(5) Quantitas (tabula q-tatis Ch2) **obscurationis** (*om.* R) **de superficie corporum luminarium** (**/luminosorum** Ch2 Ew1) :: {a2:} Cz; {aX:} R S; {p:} Pd Ch2; {?:} Ew1.

(6) Tabula aequationis punctorum :: {d:} Op C.

(7: other) :: R (outer heading like (5), inner like (1); noted under both); Ea; Fc(72v,81v); Ou(76r,70v); Cn (composed of types (3) and (5)); Ut.

Entrance column: **(8) Numerus punctorum (+diametri)** (**/+ex diametro** (**+eclipsis** Ct) Ct Ey; p.d.n. Xc; p.n.d. Vj Ej; +lunae R) :: normally. — **(9) Puncta** (/numerus punctorum B Lf) **diametri solis et lunae** :: {a2:} Cj Mp; {x}; {?:} Ew2 Ox(90v,96v) Oq. — **(10) Digiti eclipsati de diametro** :: {d:} Pa A Fj Nc Fd2 Gr3. — **(11) Puncta** (**+diametri** Ea Fc2 Ut) :: {a0:} Ea; {aX:} S; {d?:} Op C; {?:} Fc2 Ut. — **(12: other)** :: Vd ("Numerus digitorum eclipsati diametri"); Fc(72v,81v) & Lb ("Numerus digitorum eclipsis (+de diametro Fc(72v,81v))"); Gr & Eq (none); R (first set of headings, not noted; second one noted under (8)); Fc(45v) Wa.

Solar and lunar tables: normally, **(13) Quantitas eclipsis solis** (-aris Mp; +est haec Cm); **Quantitas eclipsis lunae** (-aris Ps Mp Lh). — **(14) Solis; Lunae** :: {aX:} R(first set) S; {p:} Pd Ch2; {?:} Ew1. — **(15: other)** :: Ey; Ov ("Ad solem; Ad lunam", cf. JC31b); Ou(76r/70v: "Quantitas eclipsis superficiei circuli solis/lunae"); Ut.

Versions. — *Ou* has the table in two parts. The solar table reads like JC31a, so this version is different from JC31c. — *Ct*, in four of the places mentioned under JC31a-b, has the JC31b-readings in context and the JC31a-readings as alternatives but still in the main hand; see the apparatus to the table below. For (Sun, 12p) Ct only has "12,0", like JC31a. For (Moon, 3p, 7p) Ct has the alternatives "5","42" with a gloss which is perhaps contemporary, "In numero isto discordavit Albateni a Tolomeo V X'II", thus attributing the alternatives (=JC31a) to Albattani. — *Ey* and *Fc*(72v,81v) show readings variously mixed from JC31a and JC31b. — *Ek3* has one table, which is mixed such that the heading is as for JC31a whereas the values are those of JC31b. The values have subsequently been changed into those of JC31a.

Source. As is seen from the preamble (JC31a-c), our table shares a few characteristic readings with Albattani. The headings, too, look similar to the Albatenian ones in Nallino or in Arsenal 8322 (entrance column of the latter: "Dedos de lo eclipsado del diametro del sol (et) de la luna"), whereas the headings of JC31b are different; see JC31b. Thus perhaps our version depends on a version of Albattani; cf. the ascription in Ct, quoted under "Versions" above.

Text. Collated for values: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** Lu; **{k}** Ou Co(167r) Co(176v); **{d}** Pa A; **{e}** Eq Xc; **{x}** Es Xg. — Headings according to Xa. — Also quoted: **$ba** = Batt., Paris Arsenal 8322, 57v. This has the readings (c3, c5) in common with our witnesses, unlike other sources; see the notes to JC31a-b.

I reproduce the majority of the witnesses, and underscore the values that differ from those typical of JC31b; see notes to JC31a-b. At (e7), the witnesses of classes {k,d} read like Albattani and the other sources whereas $ba has its own error. The second copy in Co, at 176v, reads like the vulgate and may be imported from there. — Ct shows four pairs of double readings, as noted under "Versions" above.

Tabula quantitatis
tenebrarum eclipsis.

Nu's punctorum diametri	Quantitas eclipsis solis		Quantitas eclipsis lunae	
	Pc	Mi	Pc	Mi
1	0	20	0	30
2	1	0	1	10
3	1	50	2	5
4	2	40	3	10
5	3	20	4	20
6	4	40	5	30
7	5	50	6	42
8	7	0	8	0
9	8	20	9	10
10	9	40	10	20
11	10	50	11	20
12	12	0	12	0
(a)	(b)	(c)	(d)	(e)

Sigla: Co = Co(167r). — Co(176v) has no variant readings. — **(b8)** 6 Co. **(c3)** (45,50) Ct. **(c5)** (40,20) Ct. **(c9-11)** 10, 20, 20 Eq Xc, *cf. col. (e).* **(d8)** 4 Xa. **(d11)** 12 $ba. **(e1)** 49 Pz; 20 Co; 10 Eq.ac. **(e3)** (4,5) Ct. **(e7)** (45,42) Ct; 45 Ou Co Pa A *(cf. JC31b);* 40 Es Xg; 46 $ba.

JC31b. Area digits, common tradition.

Toomer 1968, no. 77. — See notes to JC31a-c for the distinction between the versions. All the witnesses that contain JC31b also show one or more copies of JC31a.

Witnesses: **{a0}** Oo,28r; Cq2,94. — **{a1}** Xa,31v; Ad,79v; Cq,56; Fc,45v; Ps,74r; Sg,165; Wd,32r; Fh,53v; Xw,31r. — **{a2}** Md,94r. — **{aX}** Vo,61v; Xr,84r. — **{aT}** Oj,149v. — **{k}** Eh,102v; Co,171v; Cn,104v. — **{d}** Fj,83v; Nc,136v; Fd2,53r; Ok,59v. — **{e}** Gr,62v; Eq,81r; Xc,75v; Vj,99r; Ej,82r. — **{x}** Fb,76v; Wa,73r. — **{p}** O,81v. — **{?}** Ef,71v; Pn,51r (:Jo. Lin.); Fc2,116r (Jo. Lin.).

Canons: see notes to JC31a-b.

Headings. A separate version is in class {k} plus Fj. — General:

(1) Pars duodecima puncti aequati ad solem et lunam (e.l.: e. ad l. Vj Ej Pn; *om.* Nc.ac Gr Eq) :: {a0:} Oo Cq2; {a1:} Xa Ad Cq Fc Sg Fh Xw; {aX:} Vo Xr; {aT:} Oj; {d:} Nc Fd2 Ok; {e:} Gr Eq Xc Vj Ej; {x:} Wa; {p:} O; {?:} Pn Fc2!.
(2) Pars duodecima puncti aequati :: {a1:} Wd; {a2:} Md; {x:} Fb; {?:} Ef.
(3) Tabula aequationis (portionis Cn) **digitorum solis et lunae** :: {k:} Eh Co Cn; {d:} Fj.
(4: other) :: Ps (no hdg.); Oj (outer hdg.: "Tabula quantitatis tenebrarum eclipsis", cf. JC31a, in addition to (1) above).

Entrance column: **(5) Puncti** (-ta Md Nc Fc2) **diametri** :: normally. — **(6) Diameter** (/**-tri** Xc Vj) :: {d:} Ok; {e:} Xc Vj Ej; {x:} Wa; {?:} Pn. — **(7) Digiti communes** :: {k:} Eh Co Cn; {d:} Fj. — **(8: other)** :: O ("Numerus punctorum", as in JC31a) — **(9: none)** (no heading:) Gr Eq.

Solar and lunar tables: **(10) Ad solem; Ad lunam** :: normally. Either or both may be joined to the word **puncti** from the heading below it. — **(11) Pars de 12 (+de) digitis solis; Pars de 12 (+de) digitis lunae in longitudine media** :: {k:} Eh Co Cn; {d:} Fj. — **(12: other)** :: Xr ("Solis; Ad lunam").

Versions. Ct,30r has the values of JC31b as primary readings, ascribed to Ptolemy, and those of JC31a as alternatives, ascribed to Albattani; see JC31a, "Versions". The table headings are as for JC31a, so the table has been listed there. — O has a table whose heading is typical of JC31b, but with values like JC31a. It has been listed here.

Parallel tables. The readings of the present table are the standard ones, as in the Almagest, and differ from the known witnesses of Albattani at least in one instance: cf. the notes under JC31a-c. A parallel for the headings may be seen in Alkhwarizmi / Maslama, Suter Tab.76 p.190, "partes duodecimarum solis / partes duodecimarum lunae". This is not conclusive.

Text. Collated for values: **{a0}** Oo; **{a1}** Xa Cq; **{k}** Co; **{e}** Eq Xc Ej. — Headings according to Xa. — Parallels quoted: **$km** = Khw/M., Suter Tab. 76; **$aa** = Almanac of Azarchel, Paris Arsenal 8322, 133r. These are collated *exempli gratia;* the values are generally the same as in Almagest VI,8.

I reproduce the readings of the majority of the witnesses, underscoring two values that differ from the parallel texts. In these places, ms. Co joins the latter.

Pars duodecima puncti
aequati ad solem et lunam.

Puncti diametri	Ad solem		Ad lunam	
	Puncti	Minuta	Puncti	Minuta
1	0	20	0	30
2	1	0	1	10
3	1	45	2	<u>8</u>
4	2	40	3	10
5	3	40	4	20
6	4	40	5	30
7	5	50	6	45
8	7	0	8	0
9	8	20	9	10
10	9	40	10	20
11	10	50	11	20
12	12	<u>20</u>	12	0
(a)	(b)	(c)	(d)	(e)

(a9) 8 Oo. **(b5)** 4 $aa. **(b9)** 7 Oo. **(b12)** 11 $aa. **(c12)** 0 Co Eq Ej $km $aa. **(e3)** 4 Co $km $aa. **(e6)** 31 $km(ms.N). **(e10)** 10 $km(ms.N).

JC31c. Area digits, in two parts. From Novara tables?

Has separate entrance columns for the solar and lunar tables, and peculiar headings. The values resemble JC31b for the solar table and JC31a for the lunar table.

Witnesses: **{aX}** R,92v (:Novara). — **{e}** Eq,83v (secondary hand; one table below the other). — **{?}** Ej2,97v (:Novara).

This table may be proper to Novara collections, such as those found in R Ej2. There are parallels in the Novara tables of Dublin Trinity 444, 71r-v, and Berlin SPK Hdschr. 218 (after 65r).

Headings. General heading: as reproduced below, R Eq Ej2. — Sub-headings: "Puncta diametri solis; Puncta superficiei corporis solaris (s.c. Eq Ej2) eclipsata (-ti Eq); Puncta diametri lunae; Puncta superficiei corporis lunaris (l.c. Eq; luminarium c. Ej2)) eclipsata (-ti Eq)".

Text. Values from R Eq Ej2. Headings according to R. — Eq Ej2 show poor alignment of the columns.

Tabula quantitatis superficiei corporis amborum luminarium eclipsatae.

Puncta dia metri solis	Puncta super ficiei corpo ri<s> sola ris eclip sata		Puncta dia metri lunae	Puncta super ficiei corpo ris luna ris eclip sata	
	Pc	Mi		Pc	Mi
1	0	20	1	0	30
2	1	0	2	1	10
3	1	55	3	2	5
4	2	40	4	3	10
5	3	40	5	4	20
6	4	40	6	5	30
7	5	50	7	6	42
8	7	0	8	8	0
9	8	20	9	9	10
10	9	40	10	10	20
11	10	50	11	11	30
12	12	0	12	12	0
(a)	(b)	(c)	(d)	(e)	(f)

(c1) 30 R. **(c3)** 55: R; 45 Eq; 50 Ej2.pc; *n.l.* Ej2.ac. **(c7)** 50: R Ej2.pc; *n.l.* Ej2.ac. **(c8-c10)** 20, 40, 50 Eq.ac.

JC41. "Tabula reflexionis tenebrarum..."

Toomer 1968, no. 78. – Same as Albattani, Nallino II p. 89. Albattani's table is from the Handy Tables (Stahlman 1960 p. 256, Table 17). The values in either are as in Almagest VI,12 (Toomer 1984 p. 319) except that this shows two-place values, which are rounded in the present table (Toomer 1968 p. 115). – The table serves to determine the angle between the ecliptic and the great circle through the centers of the luminaries or the shadow, at the beginning and end of an eclipse (sub-tables .Sol, .Lu1), and at the beginning and end of totality for a lunar eclipse (sub-table .Lu2; see Toomer 1968 p. 115 and Nallino II p. 231-32). It belongs with JF11, where see the note.

Witnesses: **{a0}** Ct,30r; Oo,29r; Cq2,96; Ey,72v. – **{a1}** Xa,32r; Ad,80r; Cq,57; Fc,45v; Fc,72v; Fc,81v; Ps,69v; Sg,167; Wd,32r; Fh,53v; Xw,31r. – **{a2}** Cz,86r; Cj,159v; Md,94r. – **{aX}** Vo,62v; Xr,84r; R,50r; Ov,96v; Vd,16v. – **{aT}** Lu,80r; P,90r. – **{k}** Lw,102v; Co,176v; Cn,102v. – **{d}** Op,77r; C,375; Pa,50v; A,229v; Fj,51v; Nc,122v; Fd2,53r; Gr3,123v; Ok,59v. – **{e}** Eq,83r(m2); Xc,76r; Vj,99v; Ej,82v. – **{x}** X,164r; Vz,70r; Mv,98v; Cm,144r; B,154v; T,295v; Lf,104r; Lg,183r; Xj,286r; Xg,67r; G,71v; Xb,86v; Es,192v; Fb,77r; Pq,196r; Oy,84r; Wa,72v; Nu,152r. – **{p}** O,82v. – **{?}** Ef,71v; Pn,51r (:Jo. Lin.); Fc2,116r (:Jo. Lin.). — Triplicate in {a1} Fc; the copy on 72v seems partly filled in from that on 81v.

Relevance. The table is common in the early witnesses, but the usual canons do not take account of it. In the sources it is meant to be used in connection with JF11, but this is not normally present in the witnesses for the Toledan tables. Thus our table is probably just a left-over from Albattani, and not intended for practical use. A special canon is CbA.G64(02-04), also treating of JF11. It differs from the Albatenian rules (c.43-44, Nallino I p. 101-02, 112).

Headings. There is one normal type of headings, and another type in Fc(81v) Vd {d} Eq. Many variants that only occur in single manuscripts have been ignored.

General: **(1) Tabula** (-ae Cq Fc(72v,81v); quantitas Vd) **reflexionis** (-num Co) **tenebrarum** (**/-rae** Vd Pa A Nc Gr3; *om.* Cq2 R Fc(72v,81v)) **in utraque** (-isque Ct; *om.* Fc(72v,81v) Vd Pa A Fj Fd2 Gr3 Eq) **eclipsi** (-sis Ct) :: normally. – **(2: other)** :: Lu (outer heading, apart from the normal one) & Cz ("T. r. tenebrarum"); Oy (extra heading, "De reflexione tenebrarum"); Ey ("T. conversionis t. ..."); Lw ("T. r. umbrae..."); Cn ("T. recessus t."); Ok ("Reflexio tenebrarum..."); (no heading, or secondary headings:) Xc Vj Ej.

Entrance column: **(3) Numerus punctorum** (={x:} Es Pq Wa, *alii;* **+utriusque** {x-}; +solis Fc2; *om.* Ey) **eclipsis ex diametro** :: normally. – **(4) Digiti eclipsati** (-ptici Eq) **de diametro** :: {d:} Pa A Fj Nc Fd2 Gr3; {e:} Eq. – **(5) Numerus digitorum eclipsati** (-sorum *(sic!)* Fc) **diametri** :: {a1:} Fc(81v); {aX:} Vd. – **(6: other)** :: Fc(72v: like Fc(81v), secondary hand); Ov R Ok Xc Vj Ej Cn.

.Sol: **(7) Initium eclipsis solis et finis (+eius(+dem))** (f.e.: eius f. Ct; *alii alia*) :: normally. – *Added:* (nothing) :: {a0:} Ct; {a2:} Cj; {d?:} Op C; {e:} Vj; {k:} Cn; {x}; {?:} Ef. **+defectionis** (=Cq2; **/delec-** Oo Ps Fh Ov, Ad *fere;* <->etionis Cq; declinationis Xw) :: {a0:} Oo Cq2; {a1:} Ad Cq Ps Fh Xw; {aX:} Ov. **+recessionis** (/-ssus Fc; reces() Ej) :: {a0:} Ey; {a1:} Xa Fc(45v) Sg Wd; {a2:} Cz Md; {aX:} Vo Xr; {aT:} Lu P; {k:} Co!; {d:} Ok; {e:} Ej.
(8) Principium eclipsis solis et finis claritatis eius (solis Nc; *om.* Fd2) :: {a1:} Fc(81v); {aX:} Vd; {d:} Pa A Fj Nc Fd2 Gr3; {e:} Eq.
(9: other) :: R ("Principium et finis solis", cf. {d}); Pn & Fc2 ("Initium eclipsis solis et lunae"); Lw; (secondary or absent:) Fc(72v) Xc O.

.Lu1: **(10) Initium eclipsis** (*om.* Xb) **lunae et finis (+eius)** (et f.e.: et eius f. Ct Cq2; *alii alia*) :: normally. – *Added:* (nothing) :: {a0:} Ct; {k:} Lw Cn; {e:} Vj; {x:} Fb; {?:} Pn Fc2. **+recessionis (/recessus** Fc(45v) X Nu; rec() Ej; remissionis Cm; retroces() Oy) :: {a0:} Oo Cq2 Ey; {a1:} Xa Ad Cq Fc(45v) Ps Sg Wd Fh Xw; {a2:} Cz Cj Md; {aX:} Ov Vo Xr; {aT:} Lu P; {k:} Co; {d?:} Op C Ok; {e:} Ej; {x-}; {p:} O; {?:} Ef.
(11) Principium eclipsis (/directionis Fc) **lunae et finis detectionis** (=Vd Fj Gr3 Eq; directionis Fc; *om.* A Nc Fd2) **eius** :: {a1:} Fc(81v); {aX:} Vd; {d:} A Fj Nc! Fd2 Gr3; {e:} Eq.
(12: other) :: R ("Principium et finis lunae", cf. {d}); Fc(45v) ("Init. e.l. et initium eius recessus"); Fc(72v: secondary, like {d}); Wa. (None:) Pa Xc.

.Lu2: **(13) Finis** (/Punctus(!) Vj Ej Fc2) **eclipsis lunae et initium** (/finis Vj; +finis Ct) **(+eius(+dem)) recessionis** (*om.* Ct; **/recessus** Cn C Vj Ej X Xb Es Fb Oy Wa Fc2 Pn; /remissionis Cm; +et finis Ej) :: normally. The last two words ("eius recessionis" or variants) may be interchanged.

(14) Finis eclipsis lunae et principium detectionis (/directionis Pa A Fd2; *om.* Fc) **(+eius)** :: {a1:} Fc(81v); {aX:} Vd; {d:} Pa A Fj Fd2 Gr3; {e:} Eq.

(15: other) :: R ("Finis et principium lunae"); Ps Nc. (Secondary or absent:) Fc(45v: like common type); Fc(72v: like {d}); Xc O.

Parallels. Albattani and Ptolemy; see above. The table, with one-place values like the present ones, also occurs in the Almanac of Azarchel, Millás p. 233, table 82; it is not mentioned in Millás's text of the canons for the Almanac.

Values. The values may be recomputed[1] using parameters from Almagest VI,11, namely, solar radius 0;15,40°, lunar radius 0;16,40° (mean distance), and radius of shadow 0;43,20° (= 2 3/5 times lunar radius, Almagest VI,5, Toomer 1984 p. 285). The values of the present table are rounded from those of Almagest VI,12, in the usual manner. Thus, at (c1), the recomputed value is 72;29,50; the Almagest has "72,30"; and this was eventually rounded upwards to 73. At (c4) the Almagest reading used was no doubt "54;27"[2] instead of a recomputed 54;34; cf. Toomer 1984 p. 318 n. 60. Elsewhere the Almagest is precise to within 1′, so our values show no further errors either.

Text. Collated for values: **{a0}** Ct Oo; **{a1}** Xa Cq; **{aT}** Lu; **{k}** Co; **{d}** Pa A; **{e}** Eq(m2) Xc; **{x}** Es Xg. — Headings according to Xa.

Also quoted: **$ba** = Batt., Paris Arsenal 8322, 57vb; **$aa** = Almanac of Azarchel, Paris Arsenal 8322, 133rb; **$c** = recomputation; see "Values".

Variant groups. — *Pa A* form an error group, joined by the copy secondarily added in *Eq.* At (c9) this group agrees with $ba, but there seems to be nothing else to connect all or part of the witnesses with one or other of the proposed sources. A curious slide in the entrance column is perhaps original, and has been corrected independently by some of the scribes. It is not in $ba or $aa.

---

1 Sub-table (b), inclination at beginning of solar eclipse:
SEI(x) = arc sin([(1-x/6)*solar_radius + lunar_radius] / [solar_radius + lunar_radius]).
Sub-table (c), inclination at beginning of lunar eclipse:
LEI(x) = arc sin([(1-x/6)*lunar_radius + shadow_radius] / [lunar_radius + shadow_radius]).
Sub-table (d), inclination at beginning of totality of lunar eclipse:
LEIT(x) = arc sin([(1-x/6)*lunar_radius + shadow_radius] / [shadow_radius - lunar_radius]).

2 This reading is also in the Liechtenstein printing of Almagest VI,12, on f.72r.

Tabula reflexionis tenebrarum in utraque eclipsi.

	(Sol)	(Lu1)	(Lu2)
Numerus punctorum eclipsis ex diametro	Initium eclipsis solis et finis eius recessionis	Initium eclipsis lunae et finis eius recessionis	Finis eclipsis lunae et initium eius recessionis
0	90	90	0
1	67	73	0
2	57	65	0
3	49	59	0
4	43	54	0
5	37	50	0
6	31	46	0
7	26	43	0
8	21	39	0
9	16	36	0
10	11	32	0
11	6	29	0
12	2	26	90
13	0	23	64
14	0	21	52
15	0	18	43
16	0	15	36
17	0	12	29
18	0	10	22
19	0	7	16
20	0	4	10
21	0	2	4
(a)	(b)	(c)	(d)

(a11-a16) 11,12--16: Pa A Eq Xc Es; 12--16, 16 Ct Oo Xa Cq Lu Co. **(b0)** 60 $aa. **(b1)** 97 Pa A Eq; 66 $aa. **(b2-b12)** 57, 49--2: 49--2, 0 Xg. **(+b5)** 47 $ba. **(+b9)** 26 $aa. **(b11-21)** 13, 14, 16, 17, 19, 21, 22, 24, 27, 27, (28 + 29 + 30) $aa, *nescio unde sumpta.* **(+b12)** 12 $ba. **(c0)** 60 $aa. **(c1)** 72 Co $c; 75 Xg. **(c2)** 75 Pa A Eq. **(c4)** 55 $c. **(c9)** 46 Pa A Eq $ba. **(c10)** 33 Es. **(d12-17)** 90--36, 29: 0, 90--36 Eq. **(d12)** 60 $aa. **(d13)** 44 Pa A Eq; 63 $ba. **(d14)** 57 $ba.

JC51. Lunar latitude, excerpt from EA11.

Toomer 1968, no. 62. — This table is an excerpt from EA11. It is connected with the eclipse tract "Ut Annos" (CbB).

Witnesses: **{a1}** Fh,59v(m2). — **{a2}** Cj,159r; Mp,225r. — **{d}** Op,76r; Ok,58v. — **{x}** Oc,86v; X,163v; Vz,72r; Mv,98r; Cm,146r; B,156v; T,296r; Lf,106r; Lg,182v; Lh,151r; Xj,285v; Xg,69r; G,71r; Xb,86r; Es,192r; Fb,79r; Pq,198r; Oy,83v; Wa,72r; Ow,168v; Nu,151v. — **{?}** Ew2,38v (:Ut Annos); Ox,93v (:Ut Annos); Pn,51v (:Jo. Lin.); Fc2,116r (:Jo. Lin.).

Within the Toledan table collections, our table seems typical of Class {x} and some of its usual associates such as Cj Mp. In Fh the table is in a secondary hand; in Op Ok the table may be secondarily entered, though perhaps still by the main hand. The normal canons do not refer to it. — The table may originate in the eclipse tract "Ut annos Arabum" (CbB). Indeed, a rule for it is in CbB01(42), and it occurs in most of the tabular collections that belong to CbB; cf. CbB02. For a similar case, see JC11a and cf. T:05(5.1).

Headings. These appear to imitate Cb203b.

> *General:* **Tabula latitudinis lunae** (*om.* Cm) **in principio (+et) (+in) medio (+et) (+in) fine eclipsis** (*om.* Es Fb; +et hoc T; **++in utraque eclipsi** Ok Vz Cm B T Lg Fb Nu) :: normally. — **(other)** :: Cj Oy Ox.
>
> *Entrance columns:* **Argumentum latitudinis (+lunae** Mp Ok Cm B Lg Xj Fb Oy Nu**) septentrionale (/-lis); (...) meridionale (/-ianae, /-ianum)** :: everywhere, with slight variants.
>
> *Body of table:* **Latitudo lunae** :: everywhere.

Versions. The entrance values are in signs and degrees both in the common tradition and in the witnesses for the tract "Ut annos". The only exception seems to be ms. Ox, where the entrances are in integral degrees.

Text. Collated for values: **{a2}** Cj Mp; **{x}** Es Xg. — Headings according to Xg.

There are no significant variants relative to EA11. At (L0,6) both traditions are split: the error in the majority for this table follows mss. Eq Xc of EA11. EA11 offers no parallel to the error "4" at L0,3, nor to the reading "52" ("53" EA11) at L0,5. These two errors have been corrected below.

Tabula latitudinis lunae in principio, medio et in fine eclipsis.

Argumentum latitudinis septentrionale				Argumentum latitudinis meridionale				Latitudo lunae		
Si	Gr	Si	Gr	Si	Gr	Si	Gr	Gr	Mi	2a
0	0	6	0	12	0	6	0	0	0	0
0	1	5	29	11	29	6	1	0	5	13
0	2	5	28	11	28	6	2	0	10	27
0	3	5	27	11	27	6	3	0	15	*40*
0	4	5	26	11	26	6	4	0	20	52
0	5	5	25	11	25	6	5	0	26	7
0	6	5	24	11	24	6	6	0	31	*19*
0	7	5	23	11	23	6	7	0	36	31
0	8	5	22	11	22	6	8	0	41	42
0	9	5	21	11	21	6	9	0	46	52
0	10	5	20	11	20	6	10	0	52	1
0	11	5	19	11	19	6	11	0	57	9
0	12	5	18	11	18	6	12	1	2	16
0	13	5	17	11	17	6	13	1	7	23
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)

(L0,3) 4 Mp Es Xg. **(L0,6)** 19: Es; 13 Cj Mp Xg. **(d0,9-0,13)** 21--18, 17: 22, 21--18 Mp.

JD. Eclipse digits, etc., Alkhwarizmian.

The eclipse tables JD11 and JD21 are the same as in Alkhwarizmi / Maslama, and their parameters are consistent with each other and with those of JA31, so probably these tables are indeed by Alkhwarizmi (Neugebauer 1962 p. 126-28).

Phrases like "secundum Cordubenses" are found as stray additions to the table headings (in mss. Lw Fj2.m2, for both tables; in Fh.m2 for JD11; in Op C for JD21). The phrase may refer to Maslama (Toomer 1968 p. 93 n.5), or it may have the same origin as in the canons Cc250-60; these, while apparently connected with Azarchel, Almanac 24, involve the use of JD11 and mention Cordoba three times (Cc250, 251, 257).

JD11. Eclipse digits, solar.

Toomer 1968, no. 58. – Same as Alkhwarizmi / Maslama, Suter Tab.78 p.193. The parameters are likely to be Alkhwarizmian; see "Values".

Comprises two partial tables for the apogee **(1-2)** and two for the perigee **(3-4).** Each of these four partial tables has two sub-tables, thus:

(1-2)	(3-4)	
.Lpc	**.Ppc**	: digits of eclipse
.Lcs	**.Pcs**	: minutes of immersion.

Witnesses: **{a0}** Ct,31r-v; Oo,27v-28r; Cq2,93-94; Pz,131r; Mc,29r; Mb,59v-60r; Ey,70v-71r; Ea,49v-50r; Lo,79v. – **{a1}** Xa,34r; Ad,82r; Cq,60; Fc,46v-47r; Ps,73v-74r; Sg,173-175,177; Sg,203; Wd,34r; Fh,57v-58r; Xw,33r,33v. – **{a2}** Cz,88v-89r; Cj,162v-163r; Md,98r-v; <Mp, see below>. – **{aX}** Vo,65v-66r; Xr,87v-88r; R,49r; R,92v (:Novara); Ov,105r-v; Fj2,107v-108r. – **{aT}** Lu,76v; Oj,158v-159r; P,86v. – **{k}** Lw,102r. – **{d}** Op,77r; C,375; Nc,134v-135v; Fd2,47r; Gr3,129r; Ok,63r-v. – **{e}** Gr,64v; Eq,83r; Ek3,109v; Xc,78r-v; Vj,101v-102r; Ej,84v-85r; Vm,14v. – **{x}** Oc,93r; X,170r; Vz,72v; Mv,109r; Cm,150v; B,161r; T,298v; Lf,110v; Lg,189r; Lh,156r-v; Xj,292r; Xg,73v; G,77v; Xb,92v; Es,198v; Fb,83v; Pq,202v; Oy,90r; Wa,78v; Ow,170v; Nu,158r. – **{p}** O,89v,90r; Pd,80v,81r; Ch2,180v. – **{?}** Py,46r; Ef,68v-69r; Ej2,97v (:Novara); Ew2,40v-41r (:Ut Annos); Ox,96v (:Ut Annos); Pn,51r (:Jo. Lin.); Fc2,115v-116r (:Jo. Lin.); A2,302r-v (:?); Ut,133v (:?). — Duplicates in {a1} Sg, {aX} R; in the latter, one copy is for a set of Novara tables. – Probably lost from ms. Mp; see T:03(2),Mp.

Canons: Cc258, Cc260: "in tabulas ecl. solis in long. maiori / minori". Values: "puncti", minuta casus". Argument: "portio latitudinis ad medium eclipsis". These terms (apart from "maiori /minori", which may be an independent translation) are the same as in many of the older headings listed below.

Cb190a, Cb190d: "tabulam ecl. solaris ad long. longiorem / propiorem". Values: "puncta", "minuta casus". Argument: "argumentum (+latitudinis)". These terms resemble the headings found in the later vulgate and, a little oddly, in Pz Mc too.

Headings for table (1). An outer heading that pertains to several tables has only been observed in R(49r) Lw Pd Ch2; it has been listed as no. (3) below.

Table (1), general: normally, **(1) (Tabula+) eclipsis solaris (/solis) ad longitudinem longiorem** (l-rem l-nem Xa Ad Fh) :: normally. – **(2) Tabula eclipsis solis** (solaris Ut Ox) **in longitudine longiori** :: {a0:} Ey; {d?:} Op C; {?:} Ut Ox. – **(3)** (Outer:) **Tabula eclipsis solis (+secundum Cordubenses** Lw) (Inner:) **In longitudine longiori** :: {aX:} R(49r); {k:} Lw; {p:} Pd Ch2. – **(4: other:)** Lo ("Eclipsis solis in remotione remotiori"); Fh & Fj2 (headings like (1) but with "secundum Cordubenses" inserted in secondary hands; cf. Lw).

Entrance column (if this is folded, only the text for northern latitude is given): **(5) Portio latitudinis septentrionalis** :: {a0:} Oo Cq2 Lo; {a1:} Xa Ad Cq Fc Ps Sg(173) Wd Fh Xw!; {a2:} Cz Md; {aX:} Ov Vo Xr Fj2; {aT:} Lu Oj P; {d:} Nc Fd2! Ok; {e:} Xc Vj Ej Vm; {x:} T Fb Oy; {?:} Pn Fc2 A2 Ef Py. – **(6) Argumentum latitudinis septentrionalis (/-ale)** (sep.: *om.* Pd Ch2) :: {a0:} Pz Mc Mb Ey Ea; {a2:} Cj; {d:} Op C Gr3; {e:} Gr Eq Ek3; {x-}; {p:} O Pd Ch2; {?:} Ew2 Ox Ut. – **(7) Argumentum latitudinis septentrionalis vel meridionalis indifferenter** :: {aX:} R(92v); {?:} Ej2. – **(8: other)** :: Ct ("Pars latitudinis septentrionalis"); Sg(203, partial table only); R(49r) Lw.

.Lpc: normally, **(9) Puncta (/-ti) eclipsis** (+solaris Cq2; +solis Oj); the form "puncti" is early, observed from {a0:} Ct Cq2; {a1:} Xa Ad Cq Ps Sg(203) Wd Fh Xw; {a2:} Cz; {aX:} Vo; {aT:} Lu P; {d:} Ok; {?:} Py. — **(10) Quantitas eclipsis solis** (*om.* Ey) :: {a0:} Pz Mc Mb Ey. — **(11: other)** :: Lo ("Digiti eclipsis"), Fc2 Ef.

.Lcs: **Minuta casus,** except in Lo ("Puncta casus"), Ey ("Pars casus"); Vj.

Versions. The original form of our table is no doubt the one found in the tradition of Alkhwarizmi, Tab.78 Suter (cf. Toomer 1968 p.87). This consists of two tables, one for apogee covering the arguments 6;37°-0;0°-353;0° (=partial tables (1-2) below), and one for perigee covering the arguments 7;11°-0;0°-352;30° (=partial tables (3-4) below). The argument is generally decremented by 30′, and shows some variation in the outer limits just quoted. Both tables have two parallel entrances, one with the arguments mentioned and another one with their supplement values, as is usual in the tradition of our table.

In all the witnesses of the Toledan tables, each of these two tables has been cut into two halves, for northern latitude (=partial tables (1) and (3) below) and for southern latitude (=partial tables (2) and (4) below). The four resulting tables may show the following configurations:

(A) In the perigee table (=partial tables (3-4)) the cut mostly falls between 0;0° and 359;30°; the apogee table (=partial tables (1-2)) has then been divided after the same number of entries, such that the cut typically occurs between 359;30 and 359;0. Despite the cuts, the four partial tables mostly retain their position; thus, on occasions when they are divided across two pages, either the apogee table is written vertically on its own page, or the northern halves of both tables are written side-by-side on their own page, and correspondingly for the remaining parts. One or another of these configurations is seen in

{**a:** Ct Lo Ey Oo Xa Ad Cq Fc Ov Ps Sg Fh Xw Md Wd Vo Xr Fj2; **d:** Nc Fd2 Ok; **e:** Xc Vj Ej Vm; **p:** O Pd; **x:** T Fb Oy; **?:** A2 Py Ut}

All these witnesses divide the apogee-table after 359;30°, except Ey Vj, which have the appropriate cut after 0°.

(B) In a few witnesses the four partial tables have been re-ordered such that the two halves of the apogee-table stand side by side, mostly under a common heading; the perigee-table is treated in the same manner. This is found in

{**a:** Ea Pz Mc Mb Cq2 Cz; **aT:** Lu Oj P; **?:** Pn Ef}

Of these, Mc Cz Lu Oj P Ef cut the apogee-table after 0°, the rest after 359;30° as usual.

(C) Some witnesses retain only the northern halves of either table (=partial tables (1) and (3)). These half-tables keep the two parallel entrances described above (except that R(92v) Ej2 show tables with single entrances only). This is found in

{**a:** R(49r); **d:** C; **e:** Gr Eq Ek3; **k:** Lw; **p:** Ch2(180v); **?:** Ej2; R(92v) (:Novara)}

Of these, R(49r) C Lw Ch2 cut the apogee-table as usual, the rest after 0°.

(D) Both the apogee- and the perigee- tables are symmetrical about 0°, and some later witnesses fold both of them around 0° so as to make up two tables (=(1-2) and (3-4)), each with four parallel entrances. These tables end in 0°.

{**a:** Cj; **d:** Op Gr3; **x:** Oc X Vz Mv Cm B Lf Lg Lh Xj Xg G Xb Es Pq Wa Ow Nu; **?:** Ew2}

This form is cited by Toomer (1968 p.87) from ms. Oc. It is also normal in the collection that belongs to the tract "Ut Annos"; see CbB02.

(E) Other forms are only found in: Sg(203) (only the table for apogee, southern half); Ox (quadruple entrance columns as in (D), but those for southern latitudes outermost); Fc2 (four tables in disorder).

Values. Parameters implied, according to Neugebauer 1962 p. 126-128: inclination of deferent, 4;27° (cf. JD21). Solar radius: 0;16,17° (cf. JA31 and Neugebauer p. 106). Lunar radii: 0;14,38° (apogee), 0;17,17° (perigee). The values are the same as in JA31 and JD21, presumedly Alkhwarizmian; so they are likely to be authentic.

Both of the tables **(1-2)** and **(3-4)** are symmetrical about 0°, as was noted, and sub-table .Lpc is close to linear, cf. Neugebauer 1962 p. 127. This allows a number of plausible guesses at the correct values, without recomputation, which has not been carried out.

Text. Collated for values:

Version (A-B):	**{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** Lu; **{e}** Xc;
Version (C):	**{e}** Eq;
Version (D):	**{x}** Es Xg.

Headings according to Xa. Also quoted for values: **$km** = Khw/M, Suter Tab. 78, (v.s.), taking account of Suter's mss. "C" and "O" only.

Coverage. Full text, Ct Oo Pz Xa Cq Lu Xc. — Eq has partial tables (1) and (3) down to and including 0;0°, with entrances as shown. Es Xg also show these two tables with entries down to 0;0°, but they add the entrance values of the remaining half of each table (plus 360°, 180° to duplicate 0°,180°) in the reverse order.

Readings chosen. I normally adopt the readings shown by the majority of Ct Oo Pz Xa Cq Lu. If a reading for a tabular value is in conflict with its symmetrical counterpart in this table and with the two analogous values in $km, then it can generally be corrected, in which case the result is italicized. Other dubious majority readings are retained but underscored. A few dubious values at the end-points of the entrance columns are underscored too.

In the apparatus, cols. (a-b) are used as index for cols. (a-h), cols. (j-k) for cols. (j-q), as indicated by the use of bold type.

Variant groups. Quite often (e.g., o5;0, o359;0, o358;0, o356;30, q353;30) the *whole of our tradition* shows errors against $km. It must be assumed (cf. for JD21) that the table was corrupt from the beginning. Conversely, $km shows errors against our text, e.g., o5;0; and where our text agrees with either $km.C or $km.O, the other one is generally in error ($km.C in error, e.g., d6;37, m7;1; $km.O in error, o4;30-4;0, q354;0; exception, perhaps k352;30). Thus our text is likely to be independent of $km (mss. C and O).

The early witnesses, *(Ct) Oo Pz Xa Cq*, are often in error against *Lu*, $km, and any late witnesses that may be present. These cases (e.g., e357;30, p359;30-359;0, f358;0, p1;30, b353;23, k7;1, k352;30) may be interpreted as old errors, corrected from the table itself in the later tradition. However, the correction, if it is one, does not seem to have introduced any errors; so it cannot be excluded that Lu and the later witnesses have independent sources.

Es Xg form an error group (h6;0, q4;0), and so may *Xa Cq* (f358;0). There does not seem to be any other evidence for error groups.

(1) Eclipsis solaris
ad longiorem longitudinem.

				(Lpc)		(Lcs)	
Portio latitudinis septentrionalis				Puncti eclip sis		Minuta casus	
Gr	Mi	Gr	Mi	Pc	Mi	Mi	2a
6	**37**	173	23	0	0	0	0
6	**30**	173	30	0	11	5	30
6	**0**	174	0	1	5	13	7
5	**30**	174	30	1	55	17	10
5	**0**	175	0	2	45	20	10
4	**30**	175	30	3	37	22	41
4	**0**	176	0	4	29	24	41
3	**30**	176	30	5	21	26	15
3	**0**	177	0	6	13	27	21
2	**30**	177	30	7	6	28	39
2	**0**	178	0	7	57	29	28
1	**30**	178	30	8	48	30	7
1	**0**	179	0	9	39	30	34
0	**30**	179	30	10	32	30	51
0	**0**	180	0	10	45	30	55
359	**30**	180	30	10	32	30	51
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

(3) Tabula eclipsis solis
ad longitudinem propiorem.

				(Ppc)		(Pcs)	
Portio latitudinis septentrionalis				Puncti eclip sis		Minuta casus	
Gr	Mi	Gr	Mi	Pc	Mi	Mi	2a
7	***11***	172	49	0	0	0	0
7	**0**	173	0	0	17	7	56
6	**30**	173	30	1	9	14	11
6	**0**	174	0	2	0	18	32
5	**30**	174	30	2	53	21	37
5	**0**	175	0	3	45	24	2
4	**30**	175	30	4	37	26	12
4	**0**	176	0	5	28	27	*13*
3	**30**	176	30	6	20	29	17
3	**0**	177	0	7	12	30	19
2	**30**	177	30	8	5	31	31
2	**0**	178	0	8	56	32	15
1	**30**	178	30	9	*47*	*32*	49
1	**0**	179	0	10	*38*	33	15
0	**30**	179	30	11	30	33	30
0	**0**	180	0	12	44	33	34
(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

Testes: Ct Oo Pz Xa Cq Lu Xc Es Xg $km; Eq (*exceptis* a-h 359;30).

(a-h 0;0, j-q 0;0) *et hic et in initio sequentis semitabulae ponit* Lu. **(a-h 359;30)** *in sequenti semitabula ponit* Lu. **(a0;0)** 360 Lu. **(b6;37)** 36 Oo; 27 Xc; 38 $km.C. **(c6;37)** 182 Oo. **(c6;0)** 128 Oo. **(d6;37)** 33 $km.C. **(f4;0)** 39 Xc. **(f2;30)** 7 $km.C. **(f0;0)** 48 $km. **(h6;0)** 0 Es Xg. **(h2;30)** 29 Xc. **(k7;11)** 11: Lu Eq Es Xg $km; 1 *cett.* **(L2;30)** 176 Pz. **(m7;11)** 30 $km.C. **(o5;0)** 47 $km. **(o4;30-4;0)** 27, 38 $km.O. **(o1;30-1;0)** 47, 38: $km; 37, 48 *omnes.* **(p)** 0, 7, 14+18, 21+24, 26...33, *vac., vac.* Oo. **(p2;30)** 30 Xc. **(p1;30)** 32: Lu.?pc Eq Es Xg $km; 33 Lu.ac?, *cett.* **(p0;0)** *om.* $km.O. **(q)** *eodem modo atque col. (p), q.v., deformata* Oo. **(q4;0)** 13: $km; 52 Es Xg; 53 *cett.*

(2) Tabula eclipsis solaris ad longitudinem longiorem.

Portio latitudinis meridianae				(Lpc) Puncti eclip sis		(Lcs) Minuta casus	
Gr	Mi	Gr	Mi	Pc	Mi	Mi	2a
359	**0**	181	0	9	39	30	34
358	**30**	181	30	8	48	30	7
358	**0**	182	0	7	*57*	29	28
357	**30**	182	30	7	6	28	39
357	**0**	183	0	6	13	27	21
356	**30**	183	30	5	21	26	15
356	**0**	184	0	4	29	24	41
355	**30**	184	30	3	37	22	41
355	**0**	185	0	2	45	20	10
354	**30**	185	30	1	55	17	10
354	**0**	186	0	1	5	13	7
353	**30**	186	30	0	11	5	30
353	**23**	186	37	0	0	0	0
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

(4) Eclipsis solaris ad longitudinem propiorem tabula.

Portio latitudinis meridiana				(Ppc) Puncti eclip sis		(Pcs) Minuta casus	
Gr	Mi	Gr	Mi	Pc	Mi	Mi	2a
359	**30**	180	30	11	30	*33*	30
359	**0**	181	0	10	*38*	*33*	15
358	**30**	181	30	9	47	32	*49*
358	**0**	182	0	8	*56*	32	15
357	**30**	182	30	8	5	31	31
357	**0**	183	0	7	12	30	19
356	**30**	183	30	6	*20*	29	17
356	**0**	184	0	5	28	27	13
355	**30**	184	30	4	37	26	12
355	**0**	185	0	3	45	*24*	2
354	**30**	185	30	2	53	21	*37*
354	**0**	186	0	2	0	18	32
353	**30**	186	30	1	9	14	*11*
353	**0**	187	0	0	17	7	*56*
352	***49***	187	11	0	0	0	0
(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

Testes: Ct Oo Pz Xa Cq Lu Xc $km; (Es Xg) *pro introitibus (a-d, j-m).*

(a359;0-357;30) *in ras.* Pz, *cf. seqq.* **(a357;0-353;23)** 300 57 *etc.* Pz. **(b353;23)** 23: Ct Es Xg; 33 Oo Pz Xa Cq Lu; 0 Xc $km. **(c353;23)** 186: Lu Es Xg; 187 Ct Oo Pz Xa Cq Xc $km. **(d353;23)** 0 Xc $km. **(e357;30)** 7: Lu $km; 6 *cett.* **(f358;30)** 38 Xc. **(f358;0)** 57: Lu $km; 47 Xa Cq; 37 Xc; 17 *cett.* **(f356;30)** 22 Xc. **(f355;0)** 55 $km. **(f353;30)** 10 Pz. **(h358;0)** 18 $km.C; 38 $km.O. **(h353;23)** 10 Lu. **(j353;30-352;49)** 333, 333, 332 Xa. **(k352;49)** 49: Lu $km.O; 30 $km.C, *cett.* **(m352;49)** 30 $km.C; *om.* $km.O. **(n356;0)** 6 $km.C. **(o359;0)** 38: $km; lxiii Oo; 58 *cett.* **(o358;0)** 56: $km; 36 *omnes.* **(o356;30)** 20: $km; 1 *omnes.* **(o355;30)** 27 $km. **(p359;30-359;0)** 33, 33: Lu $km; 53, 53 *cett.* **(p358;30-358;0)** 52, 52 Xc. **(p355;0)** 24: $km; 28 Ct; 23 *cett.* **(p353;30)** 18 Xc. **(q358;30)** 49: $km; 45 *omnes.* **(q354;30)** 37: $km; 17 *omnes.* **(q354;0)** 31 $km.O. **(q353;30)** 11: $km; 16 *omnes.* **(q353;0)** 51 (!) $km; 16 *omnes.*

JD21. Eclipse digits, lunar.

Toomer 1968, no. 60. — Same as Khw/M, Suter Tab.73-76 p.187-90 (except that the Khw/M tables attach our JC13 and JC31b as extra columns).

Comprises two partial tables for the apogee **(1-2)** and two for the perigee **(3-4).** Each of these four partial tables has three sub-tables, thus:

(1-2)	(3-4)	
.Lpc	**.Ppc**	: digits of eclipse
.Lcs	**.Pcs**	: minutes of immersion
.Lmo	**.Pmo**	: half delay in totality.

Witnesses: **{a0}** Ct,31v-32v; Oo,28v; Cq2,95; Pz,131v-132r; Mc,29v-30r; Mb,62v; Ey,71v-72r; Ea,55v; Lo,80r-v. — **{a1}** Xa,35r-v, 30v; Ad,83r-v; Cq,62-63; Fc,52r-53v; Ps,75v+77r-78r, 76r-v; Sg,179-182, 161; Wd,35r-v; Fh,50v, 59v, 60r(m2), 64v-65r; Xw,34r-v + Xw2,35r. — **{a2}** Cz,90r-91v; Cj,160r-v; Md,100r-101r; Mp,223v-224r. — **{aX}** Vo,67v-69r; Xr,89v-91r; R,49v; R,92r (:Novara); Ov,106r-107v; Fj2,109v, 107r. — **{aT}** Lu,77r-78v; Oj,159v-161r; P,87r-88v. — **{k}** Lw,101r-v. — **{d}** Op,76r-v; C,373-374; Nc,136v-137r, 134v; Ok,64v-66r, 62v. — **{e}** Gr,65v-67r; Eq,84v-86r; Ek3,110v-112r; Xc,80r-v; Vj,103v-104r; Ej,86v-87r; Vm,15r-v. — **{x}** Oc,87v-88r; X,164v-165r; Vz,70v-71r; Mv,99r-v; Cm,144v-145r; B,155r-v; T,295v-296r; Lf,104v-105r; Lg,183v-184r; Lh,149v-150r; Xj,286v-287r; Xg,67v-68r; G,72r-v; Xb,87r-v; Es,193r-v; Fb,77v-78r; Pq,196v-197r; Oy,84v-85r; Wa,72v-73v; Ow,167r-v; Nu,152v-153r. — **{p}** O,82v-84r; Pd,82r-83r; Ch2,180r. — **{?}** Py,43v-45v; Ef,69v-71r; Ej2,97r (:Novara); Ew2,37v-38r (:Ut Annos); Ox,93r-v (:Ut Annos); Oq,24r-(v) (:Ut Annos; incomplete); Pn,52r (:Jo. Lin.); Fc2,117r-v (:Jo. Lin.); A2,300r-301v (:?); Ut,131r-132r (:?). — Duplicate in {aX} R, one copy for a set of Novara tables.

Canons: Ca136 + Ca142; Cc270-271; Cb200-201a. All refer to the table as "tabula(e) eclipsis lunaris ad longitudinem longiorem / propiorem"; to values as "puncti (Ca Cc; puncta Cb)", "minuta casus", "dimidium morae"; the table is to be entered "cum portione latitudinis" (Ca Cc; "cum argumento latitudinis" Cb). All this agrees well with the majority of the table headings. The canons are similar to Azarchel's Almanac 24 (see Pr:05(J3b)), and may originally have been meant for JE21, q.v.

Headings for table (1). An outer heading that pertains to several tables is only in R(49v) Lw Pd Ch2; it has been listed under heading no. (2) below. — General:

(1) Tabula eclipsis lunaris (/lunae; /solis Cz Ek3) **ad** (+suam Vj Pn Oq) **longitudinem longiorem** :: normally. — *Added:* (nothing) :: {x:} Oc Es Ow, and most others; **+in epicyclo** (eclipsis (!) Xb) :: {a2:} Md Mp; {x-}.
(2) Tabula eclipsis lunae (+in longitudine longiori Op C Ey) **(+secundum Cordubenses** Lw Op C) (inner heading: **+[In longitudine longiori]** Lw R Pd Ch2) :: {a0:} Ey; {aX:} R(49v); {k:} Lw; {d?:} Op C; {p:} Pd Ch2.
(3: other) :: Lo ("Eclipsis lunae in remotione maiore"); Fj2 (like (1), but adds "secundum Cordubenses" secondarily); Ps Ut.

Entrance column (only for northern latitude, even where the column is folded): **(4) Argumentum latitudinis septentrionalis (/-nis** Mc Cq2; **/-nale** Ey, and most of {x}; *om.* R(92r) Fj2 Lw Ch2 Ow Ej2) :: normally. — **(5) Portio latitudinis septentrionalis** (/-nis Cq2) :: {a0:} Oo Cq2 Lo; {a2:} Cz; {aT:} Lu Oj P; {?:} Ef. — **(6: other)** :: Ct ("Pars longitudinis (!) septentrionalis"); Pz ("Argumentum vel portio latitudinis lunae sept."); R(49v) ("Argumentum sive motus latitudinis"); Ea Es.

.Lpc: normally, **(7) Puncta (/-ti) eclipsis**; "puncti" is old, being found, e.g., in Ct Oo Cq2; Xa Cq Ps Sg Cz; Lu P; Ok; and Ef Py. — **(8: other)** :: Lo ("Digiti eclipsis"); Ey ("Quantitas eclipsis").

.Lcs: **(9) Minuta casus,** except Lo ("Puncta casus"); Ey ("Pars casus").

.Lmo: **(10) Dimidium morae** :: {x:} Ow, and most others. — **(11) Minuta morae** :: {e}; {?:} Pn Fc2. — **(12) Minuta dimidiae morae** :: {a2:} Mp; {x-}; {?:} Ew2 Ox Oq. — **(13: none)** Ef.

Versions. Unlike JD11, our table has probably been taken over in the form of four partial tables. In Suter's manuscripts of Alkhwarizmi (Tab. 73-76) these occur on separate pages as:

(1)	apogee, northern latitude	(entrances 10;50°-0;0°);
(2)	apogee, southern latitude	(359;30°-349;*10*°, continuing (1));
(3)	perigee, northern latitude	(13;17°-0;0°);
(4)	perigee, southern latitude	(359;30°-346;43°, continuing (3)).

Each has two parallel entrances, one with the arguments just mentioned and another one with their supplement values, as is usual in the tradition of our table.

(A) Table (3) faulty: The partial table (3) was probably corrupt originally. Indeed, in place of table (3) a number of early witnesses show a table whose heading and first entrance column are those proper to Table (3) whereas the rest of the table is filled in with values belonging to Table (1).[1] This faulty form is shown as table (3A) below. The witnesses are:

{a0} Ct Oo Cq2 Pz Mc Mb, (Ea); **{a1}** Cq Xw+Xw2; **{aX}** Vo Xr Ov; **{?}** A2.

Pz Mc Mb Cq show a corrupt version of table (4) too. – Ea has tables (1) and (3) only.

(B) Table (3) faulty, substitute present: Some witnesses, in addition to the faulty table (3A), exhibit a substitute for it, among tables 1-4 (thus Wd Py) or, mostly, separate from them, on an earlier page (thus, Xa Ps Sg Fj2 Nc Ok):

{a1} Xa Ps Sg Wd; **{aX}** Fj2; **{d?}** Nc Ok; **{?}** Py.

(C) Table (3) correct: Witnesses that show table (3) in its correct form are presumably those where the substitute table (3) has been allowed to supplant the faulty one, on whatever occasion. However, the copy in Lo may be assumed to show this table because it draws directly on Khw/M; indeed, it has primitive readings, very close to Khw/M.

{a0} Lo; **{a1}** Ad Fc Fh; **{aT}** Lu Oj P; **{a2}** Cz Md; **{e}** Gr Eq Ek3 Xc Vj Ej Vm; **{p}** O Pd; **{?}** Ef,69v-71r; Pn Fc2 (:Jo.Lin.); Oq Ox (:UtAnnos; Oq lacks Table (3)); Ut (:?).

(D) Only two tables present, entrances as usual: In a few scattered instances, only tables (1) and (3) are present, showing their usual double entrances. This is no doubt due to accidental loss of (2) and (4):

{aX} R(49v); **{k}** Lw; **{p}** Ch2; **{?}** Ej2 R(92r) (:Novara).

(E) Tables folded: Many late witnesses, mostly of group {x}, combine (1) with (2), and (3) with (4), such that each of the two resulting tables shows a quadruple entrance:[2]

{a0?} Ey; **{d?}** Op C; **{a2}** Cj Mp; **{x}** Oc X Vz Mv Cm B T Lf Lg Lh Xj Xg G Xb Es Fb Pq Oy Wa Ow Nu; **{?}** Ew2 (:Ut Annos).

This form is also normal in the collection that belongs to the tract "Ut Annos"; see CbB02.

Order of partial tables when all four are present (examples only): The order (1,2,3,4) is probably original, being found unmistakably in Ct Oo Cq2 Pz Mc Mb (and Pn). More commonly we find the apparent order (1,3,2,4), thus, in Xa Ad Cq Fc Ov Ps Sg Xw Cz Md Wd Vo Xr Fj2; Nc A2; {aT}; {e}; Py Fc2 Ef Ut. Other arrangements are observed in Lo (3,4,1,2); Ok (1,2,4,3); O Pd Ox Oq (2,4,1,3). This variation may be due to accidents of page layout, and does not seem to interact with other features of the tables.

In the witnesses for Alkhwarizmi, tables (2) and (4) begin with the entrances 359;30°, continuing downwards from 0;0°, which are the last entrances of (1) and (3). This is the case too in Ct Lo Pz Mc Mb Oo Xa Cq Cq2 Fj2 A2 Ut, so it is probably the original state of affairs. The rest of the witnesses that show (2) and (4) make them begin in 360°0 (or 0°0), thus repeating the last entry in (1) and (3). Xa and Fj2, too, show such an extra entry in (2) and (4), but separate from the body of the table; there may be other cases of this. Fc starts (2) in 360° but (4) in 359;30°.

Values. Parameters implied, according to Neugebauer 1962 p. 118-120, as corrected by Toomer 1968 p. 92 n.4: inclination of deferent, 4;27° (same as used in JD11; the Hindu value is 4;30). Lunar radii: 0;14,38°

---

1 Noted by Toomer (1968 p. 12, 93) from mss. Wd and Ok (his "V" and "Ca").

2 Noted by Toomer (1968 p.93) from mss. Op and Oc (his "C" and "D").

(apogee), 0;17,17° (perigee), same as used in JA31 and JD11. Radii of shadow: 0;36° (apogee), 0;44,44° (perigee), slightly different from those of JA31. Thus there is no reason to doubt that tables JA31, JD11 and JD21 are Alkhwarizmian. – The outer limits of the tables ought to be:

(1)	10;50° / 169;10°,	cf. Khw/M;
(2)	349;10° / 190;50°,	faulty in Khw/M too;
(3)	13;17° / 166;43°,	cf. Khw/M. The whole row has been omitted in the Toledan witnesses, but "43" has left a trace in Xa;
(4)	346;43 / 193;17,	as in Khw/M. This row has been omitted too, but "43" has infected the earlier rows in various places, or else it has been copied from (3).

Recomputation, which could follow the lines of Neugebauer 1962 p. 116-120, has not been carried out. The tables show symmetry, which has been utilized as indicated under "Readings..." below.

Text. Collated for values:

Version (A-B): **{a0}** Ct Oo Pz; **{a1}** Xa Cq;
Version (C): **{aT}** Lu; **{e}** Eq Xc;
Version (E): **{x}** Es Xg.

Headings according to Xa. – Also quoted for values: **$km** = Khw/M, Suter Tab. 73-76, *v.s.*, taking account of Suter's mss. "C" and "O" only. – Coverage:

Table **(1)**: Ct (=Ct,31v); Oo (=Oo,28v, upper); Xa (=Xa,35r, upper); Cq (=Cq,62, upper); Pz (=Pz,131v); Lu (=Lu,77r); Eq Xc; Es Xg.

Table **(2)**: Ct Oo Xa Cq Pz Lu Eq Xc.
– Only for cols. (c-d, a-b), which are attached to Table (1): Es Xg.

Table **(3),** showing correct values: Lu Eq Xc; Xa(30v); Es Xg.

Table **(4)**: Ct Oo Xa Cq Pz Lu Eq Xc.
– Only for cols. (c-d, a-b), which are attached to Table (3): Es Xg.

Table **(3A),** faulty: Ct2 (=Ct,32r); Oo2 (=Oo,28v, lower); Xa2 (=Xa,35r, lower); CqB (=Cq,62, lower); Pz2 (=Pz,132r).

Readings chosen. Since I have not recomputed the table, errors can only be identified in special cases. To some extent, $km will serve as a check.

I normally adopt the readings shown by the majority of Ct Oo Pz Xa Cq Lu. If a reading for a tabular value is in conflict with its symmetrical counterpart in this table, and with the two analogous values in $km, then it can generally be corrected, in which case the result is italicized. Other dubious readings shown by the majority of the manuscripts, including where our witnesses show errors that are symmetrical, are retained but underscored.

Variant groups. In the two last rows of **(4)**.Pcs, the value "20,52" has been omitted by all witnesses, except that *Eq* agrees with $km. These cases of agreement are frequent, and they comprise errors too (cf. (2),h351;0), so Eq is likely to have been corrected from a copy of Khw/M.

In (4.h351;0), note the almost universal reading "0" for "31", typical of Abjad numerals.

Apart from Eq, *Ct* ((1).b10;50, (4).k359;0), *Oo Pz* ((2).j355;30), *Lu* ((2).h359;0, (4).k359;30) occasionally preserve Alkhwarizmian readings, though they may be garbled. Loose groupings among *Ct Oo Pz Xa Cq* occur as error groups, but no doubt because they preserve old errors that have been corrected in the rest, e.g., at (2).e357;30, (4).f359;0, (2).c351;0-348;30. *Oo Pz* may, however, be a real error group; cf. (1).a0;30-0;0, (2).e350;30.

The copies from the values in table (1) which are erroneously used for table (3A), here denoted as *Ct2 Oo2 Pz2 Xa2 CqB,* have some peculiarities in common, cf. (3A).g9;30, (3A).h6;0, (3A).h8;30. The last one corresponds to a reading in $km that may be an error. In general, I cannot guess at the genesis of table (3A).

Eq Es Xg have some obvious errors ((1).h0;0; (3).g5;30, also in $km; (1).a10;50, false emendation). At (1).f8;30 the reading looks correct, but it has no parallels, so it may be an emendation too. At (1).g9;30 such a reading does agree with $km, by chance or not.

Thus, it is here assumed that the table has entered our tradition in a faulty state, and has been emended in various ways.[1]

---

1 The copy in ms. Lo, in contrast to the Toledan tables generally, shows the outer argument values in a comparatively good state ("10;50/169;10", "348;30/6;50", "13;17/166;30", "346;43/193;17", errors underscored), and it shares other readings with $km against the collated Toledan witnesses (thus, "4" at 1:j4;30; "50" at 1:h9;0; etc.). Perhaps, as was said under "Versions" above, this copy does not belong to the Toledan tradition but mirrors the Alkhwarizmian table directly.

(1) Tabula eclipsis lunaris ad longitudinem longiorem.

				(Lpc)		(Lcs)		(Lmo)	
Argumentum latitudinis septentrionalis				Puncti eclip sis		Minuta casus		Dimi dium morae	
Gr	Mi	Gr	Mi	Pc	Mi	Mi	Se	Mi	Se
10	*50*	169	*10*	0	0	0	0	0	0
10	30	169	30	0	40	12	10	0	0
10	0	170	0	1	40	19	30	0	0
9	30	170	30	2	40	*24*	32	0	0
9	0	171	0	3	35	28	*50*	0	0
8	30	171	30	4	29	31	13	0	0
8	0	172	0	5	30	34	10	0	0
7	30	172	30	6	25	36	27	0	0
7	0	173	0	7	23	38	42	0	0
6	30	173	30	8	21	40	28	0	0
6	0	174	0	9	20	42	11	0	0
5	30	174	30	10	17	43	36	0	0
5	0	175	0	11	14	44	52	0	0
4	30	175	30	12	11	41	4	*4*	0
4	0	176	0	13	9	36	42	10	21
3	30	176	30	14	7	34	1	13	47
3	0	177	0	15	4	32	44	15	48
2	30	177	30	16	2	31	38	17	38
2	0	178	0	17	0	30	31	19	14
1	30	178	30	17	57	30	3	20	12
1	0	179	0	18	53	29	52	20	52
0	30	179	30	19	50	29	19	21	16
0	0	180	0	20	46	29	16	21	22
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)

Testes: Ct Oo Pz Xa Cq Lu Eq Xc Es Xg $km. — **(a10;50)** 11 Eq Es Xg. **(a8;30)** 9 Cq. **(a0;30-0;0)** 1,1 Oo Pz. **(b10;50)** 50: Ct $km; 0 *cett.* **(d10;50)** 10: $km, *cett.;* 0 Lu Eq Xc Es Xg (*cum* Ct2 Oo2 Xa2). **(e4;30-3;30)** 13, 14, 15 Pz. **(f8;30)** 29: $km, *cett.;* 32 Eq Es Xg. **(f7;0)** 33 Cq $km.O (*cum* CqB). **(f6;30)** 40 $km.O. **(f0;0)** 43 Es. **(g9;30)** 24: Eq Es $km; 20 *cett.* **(g9;0)** 24 Xc. **(g4;0)** {(-}}vi Oo. **(h9;30)** 22 Es. **(h9;0)** 50: $km; 7 *omnes.* **(h8;30)** 53 $km. **(h6;30)** 48 Oo (*cum* Oo2). **(h5;30)** 56 $km. **(h2;30)** 28 Cq; 36 Ct. **(h1;0)** 52: $km, *cett.;* 12 Es; 32 *malim.* **(h0;0)** 46 Eq Es Xg.ac. **(j4;30)** 4: $km; 0 *omnes.* **(k3;30)** 48 Ct. **(k2;30)** 28 Cq.

(2) Tabula eclipsis lunaris ad longitudinem longiorem.

				(Lpc)		**(Lcs)**		**(Lmo)**	
Argumentum latitudinis meridianae				Puncti eclip sis		Minuta casus		Dimi dium morae	
[360	0]	[180	0]	[20	46]	[29	*16*]	[21	22]
Gr	Mi	Gr	Mi	Pc	Mi	Mi	Se	Mi	Se
359	30	180	30	19	50	29	19	21	16
359	0	181	0	18	53	29	*52*	20	52
358	30	181	30	17	57	30	3	20	12
358	0	182	0	17	0	30	31	19	14
357	30	182	30	16	2	31	38	17	38
357	0	183	0	15	4	32	44	15	48
356	30	183	30	14	7	34	1	13	47
356	0	184	0	13	9	36	42	10	21
355	30	184	30	12	11	41	4	*4*	0
355	0	185	0	11	14	44	52	0	0
354	30	185	30	10	*17*	43	36	0	0
354	0	186	0	9	20	42	11	0	0
353	30	186	30	8	21	40	28	0	0
353	0	187	0	7	23	38	42	0	0
352	30	187	30	6	*25*	36	27	0	0
352	0	188	0	5	30	34	10	0	0
351	30	188	30	4	29	31	13	0	0
351	0	*189*	0	3	35	28	*50*	0	0
350	30	189	30	2	40	24	32	0	0
350	0	*190*	0	1	40	19	30	0	0
349	30	190	30	0	40	12	10	0	0
349	0	191	0	0	0	0	0	0	0
348	30	191	30	.	.	.	.	.	.
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)

Testes: Ct Oo Pz Xa Cq Lu Eq Xc $km. *(a-d 360;0-349;0):* Es Xg. – **(a-k 360;0)** *supra notas graduum et fractionum, ut hic posita sunt, exhibet* Xa *(m1), in contextu* Lu Eq Xc, *om. cett.* **(a-k 348;30)** *om.* Eq $km. – **(a360;0)** 0 Lu. **(c351;0)** 189: 188 Ct Oo Pz Xa Cq. **(c350;0)** 190: Xa *v.l., cett.;* 189 Ct Oo Pz Cq, Xa *textus.* **(c349;0)** 190 Oo Cq. **(c348;30)** 190 Oo Pz Cq. **(e357;30)** 16: Xa *v.l.*, $km, *cett.;* 17 Oo Pz Cq, Xa *textus.* **(e350;30)** 3 Oo Pz. **(f354;30)** 17: $km; 16 *omnes.* **(f352;30)** 25: Eq $km; 9 *cett.* **(f351;0)** 25 $km.O. **(f349;0)** 40 $km. **(g351;0)** 38 Pz. **(h360;0)** 16: Lu; 46 Xa Eq Xc. **(h359;0)** 52: Lu Eq $km; 12 *cett.* **(h357;0)** 48 Xc. **(h351;0)** 50: $km.C, *Neugeb.;* 7 Eq (*in ras.?*), $km.O; 12 *cett.* **(h349;0)** 10 $km. **(j355;30)** 4: $km; 20 Ct Oo Pz; 0 *cett.* **(k356;0)** 31 $km.O.

(3) Tabula eclipsis lunaris ad longitudinem propiorem.

Argumentum latitudinis septentrionalis				(Ppc) Puncti eclip sis		(Pcs) Minuta casus		(Pmo) Dimi dium morae	
Gr	Mi	Gr	Mi	Pc	Mi	Mi	Se	Mi	Se
< *	*	*	*43*	*	*	*	*	*	*>
13	0	167	0	0	26	12	25	0	0
12	30	167	30	1	13	20	52	0	0
12	0	168	0	2	2	26	7	0	0
11	30	168	30	2	50	30	22	0	0
11	0	169	0	3	36	34	27	0	0
10	30	169	30	4	38	37	0	0	0
10	0	170	0	5	29	41	27	0	0
9	30	170	30	6	10	43	26	0	0
9	0	171	0	6	54	45	*31*	0	0
8	30	171	30	7	41	47	25	0	0
8	0	172	0	8	31	49	28	0	0
7	30	172	30	9	26	51	6	0	0
7	0	173	0	10	11	52	44	0	0
6	30	173	30	10	54	54	9	0	0
6	0	174	0	11	43	55	20	0	0
5	30	174	30	12	35	47	14	9	7
5	0	175	0	13	27	43	53	14	9
4	30	175	30	14	25	40	54	17	25
4	0	176	0	15	0	39	9	19	57
3	30	176	30	15	50	37	50	21	57
3	0	177	0	16	38	36	51	23	32
2	30	177	30	17	25	36	0	24	49
2	0	178	0	18	15	35	31	25	47
1	30	178	30	19	5	35	5	26	32
1	0	179	0	19	54	34	49	27	2
0	30	179	30	20	43	34	40	27	16
0	0	180	0	21	31	34	35	27	27
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)

Testes: Xa Lu Eq Xc Es Xg $km. — **(a-k,** *ante* **13;0)** *lineam* "13;17 166;30 (!) 0;0 0;0 0;0" *add.* $km.CO. — **(b13;0)** (0+30) Lu. **(b12;30)** (0+30) Lu. **(c13;0)** 165 Xa. **(c0;0)** 179 $km.C. **(d13;0)** 43 Xa. **(e10;30)** 3 $km.C. **(e3;0)** 15 $km. **(f13;0)** 36 Es. **(f12;30)** 17 $km. **(f11;0)** 46 Es. **(f10;30)** 34 Eq Es Xg; 58 $km. **(f10;0)** 39 Xg. **(f5;30)** 55 $km. **(f4;30)** 20 $km; 2015 Lu Es. **(f4;0)** 4 Es.ac. **(f3;30)** 58 Es.ac. **(f3;0)** 58 Lu; 28 Xa Xc. **(f1;30)** 0 Xg. **(g13;0)** 10 Lu. **(g5;30)** 57 Es Xg $km. **(g5;0)** 58 $km.C. **(h11;30)** 23 Xg. **(h9;0)** 31: $km; 21 *omnes.* **(h8;0)** 58 Lu. **(h5;0)** 13 $km. **(h2;30)** 5 $km. **(h1;30)** 9 Lu. **(h0;30)** 50 Xc. **(h0;0)** 34 $km. **(j5;30)** 0 Xg. **(k5;30)** 0 Xg. **(k3;30)** 54 Lu. **(k3;0)** 52 $km. **(k1;0)** 10 Lu. **(k0;30)** 26 $km.O. **(k0;0)** 26 Es.

(4) Tabula eclipsis lunaris ad longitudinem propiorem.

				(Ppc)		(Pcs)		(Pmo)	
Argumentum latitudinis meridianae				Puncti eclip sis		Minuta casus		Dimi dium morae	
[360	0]	[180	0]	[21	31]	[34	35]	[27	27]
Gr	Mi	Gr	Mi	Pc	Mi	Mi	Se	Mi	Se
359	30	180	30	20	43	34	40	27	*16*
359	0	181	0	19	*54*	34	49	27	*2*
358	30	181	30	19	5	35	5	26	32
358	0	182	0	18	15	35	31	25	47
357	30	182	30	17	25	36	0	24	49
357	0	183	0	16	38	36	51	23	32
356	30	183	30	15	50	37	50	21	57
356	0	184	0	15	0	39	9	19	57
355	30	184	30	14	25	40	54	17	25
355	0	185	0	13	27	43	53	14	9
354	30	185	30	12	35	47	14	9	7
354	0	186	0	11	43	55	20	0	0
353	30	186	30	10	*54*	54	9	0	0
353	0	187	0	10	11	52	44	0	0
352	30	187	30	9	26	51	6	0	0
352	0	188	0	8	31	49	28	0	0
351	30	188	30	7	41	47	25	0	0
351	0	189	0	6	54	45	*31*	0	0
350	30	189	30	6	10	43	26	0	0
350	0	190	0	5	29	41	27	0	0
349	30	190	30	4	38	37	0	0	0
349	0	191	0	3	36	34	27	0	0
348	30	191	30	2	50	30	22	0	0
348	0	192	0	2	2	26	7	0	0
347	30	192	*30*	1	13	*<20*	*52>*	0	0
347	0	193	*0*	0	26	*12*	*25*	0	0
< *	*43*	*	*	*	*	*0*	*0*	*	*>
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)

Testes: Ct Oo Pz Xa Cq Lu Eq Xc $km. *(a-d):* Es Xg. — **(a-k 360;0)** *supra notas graduum et fractionum, ut hic posita sunt, exhibet* Xa *(m1), in contextu* Lu Eq Xc, *om. cett.* — **(a-k,** *post* **347;0)** *lineam* "346;43 (;44 $km.C), 193;17, 0;0 0;0 0;0" *add.* $km. — **(a360;0)** 0 Lu. **(a352;30)** 353 Pz. **(c350;30)** 199 Lu. **(c349;0-348;30)** 192, 192 Pz. **(d348;30)** xxxo (?) Ct. **(d347;30)** 30: $km, *cett.;* 43 Ct Pz Xa Cq. **(d347;0)** 0: $km, *cett.;* 43 Ct Pz Xa Cq. **(e356;30)** 15 Xc. **(e356;0)** 14 Cq.ac. **(e349;0)** 4 $km.C. **(e347;30)** 2 $km.C. **(e347;0)** 1 $km.C. **(f359;0)** 54: Xa *v.l.*, $km.O, *cett.;* 14 Ct Oo Pz, Xa *textus*, Xc; 44 Cq; 53 $km.C. **(f357;0)** 37 $km.O. **(f355;30)** 20 $km. **(f353;30)** 54: Eq $km; 24 *cett.* **(f352;30)** 54 Xa *v.l.* **(f350;0)** 28 Ct. **(f349;0)** 37 $km.C. **(f348;0)** 1 Xc. **(g356;30)** 38 $km.C. **(g356;0)** 37 Oo.ac. **(g347;30-;0)** 20,12 Eq $km; 12,0 *cett.* **(h360;0)** 34 $km *(ad tab. 3.h0;0)* **(h358;30)** 9 Lu. **(h357;30)** 5 $km. **(h355;0)** 13 $km.O; 14 $km.C. **(h351;0)** 31: $km; 21 Eq; 0 *cett.* **(h347;30-;0)** 52,25 Eq $km; 25,0 *cett.* **(j358;0)** 26 Oo. **(j357;0)** 24 $km.C. **(j355;0)** 18 Pz. **(k359;30)** 16: Lu Eq $km.O; 12 $km.C; 10 *cett.* **(k359;0)** 2: Ct Eq $km; 10 *cett.* **(k358;30)** 22 $km. **(k358;0)** 46 $km.

Appendix to JD21, illustrating the faulty form of table (3). The heading and outer entrance of this table are as for table (3), but the inner entrance and the body of the table is a copy of table (1). See under "Versions" above.

Headings according to Ct. Underscored tabular values show the differences from the readings adopted in table (1). Most, but not all, of the underscored tabular values are incorrect. The underscored entrance values are those belonging to table (3). To the outer left, in **bold type,** I add the outer entrance column for table (1), and this is used for indexing the rows. The values quoted as "$km" are of course those belonging to Table (1).

In Xa2 the table has a gloss (still 13th c.?), "Pro hac tabula ponatur illa quae superius est in quinto folio", referring to the correct version on Xa,30v.

(3A) Tabula eclipsis lunaris ad longitudinem propiorem.

	Pars latitudinis septentrionalis				(Lpc) Puncti eclip sis		(Lcs) Minuta casus		(Lmo) Dimi dium morae	
	Gr	Mi	Gr	Mi	Pc	Mi	Mi	Se	Mi	Se
(10 50)	13	0	169	10	0	0	0	0	0	0
(10 30)	13	30	169	30	0	40	12	10	0	0
(10 0)	12	0	170	0	1	40	19	30	0	0
(9 30)	12	30	170	30	2	40	22	32	0	0
(9 0)	11	0	171	0	3	35	28	7	0	0
(8 30)	11	30	171	30	4	29	31	53	0	0
(8 0)	10	0	172	0	5	30	34	10	0	0
(7 30)	10	30	172	30	6	25	36	27	0	0
(7 0)	9	0	173	0	7	23	38	42	0	0
(6 30)	9	30	173	30	8	21	40	28	0	0
(6 0)	8	0	174	0	9	20	42	10	0	0
(5 30)	8	30	174	30	10	17	43	36	0	0
(5 0)	7	0	175	0	11	14	44	52	0	0
(4 30)	7	30	175	30	12	11	41	4	0	0
(4 0)	6	0	176	0	13	9	36	42	10	21
(3 30)	6	30	176	30	14	7	34	1	13	46
(3 0)	5	0	177	0	15	4	32	44	15	48
(2 30)	5	30	177	30	16	2	31	38	17	38
(2 0)	4	0	178	0	17	0	30	31	19	14
(1 30)	4	30	178	30	17	57	30	3	20	12
(1 0)	3	0	179	0	18	53	29	52	20	52
(0 30)	3	30	179	30	19	50	29	19	21	16
(0 0)	2	0	180	0	20	46	29	16	21	22
(* *)	1	30	180	30	0	0	0	0	0	0
(Index)	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)

Testes: Ct2 Oo2 Pz2 Xa2 CqB $km. – **(a10;50-0;0)** 13, 12, ..., 2,2 CqB.pc. **(+a10;0)** 13 Pz2. **(a*,*)** 2 Ct2. **(b10;50)** 50: Ct $km; 0 *cett.* **(d10;50)** 10: $km, *cett.;* 0 Ct2 Oo2 Xa2. **(f7;30)** 28 Pz2. **(f7;0)** 33 CqB $km.O. **(f6;30)** 40 $km.O. **(g9;30)** 22: *omnes;* 24 $km. **(h9;0)** 7: *omnes;* 50 $km. **(h8;30)** 53: $km, *omnes.* **(h6;30)** 48 Oo2. **(h6;0)** 10: *omnes.* **(h5;30)** 56 $km. **(h1;0)** 52: $km, *omnes.* **(h*,*)** 50 Oo2. **(j4;30)** 0: *omnes;* 4 $km. **(k3;30)** 47 Xa2.

JE. Eclipse digits, etc., Albatenian or from Azarchel's Almanac.

The tables JE11-21 are from Albattani, but in both cases there are indications that the Almanac of Azarchel is closer to the source. This may be why the tables show ascriptions to Azarchel (JE11: Ov Lu P Fj Fh.pc; JE21, often).

JE11. Eclipse digits, solar.

Toomer 1968, no. 59. – Same as Albattani, Nallino II p.91, and Almanac of Azarchel, Millás 1943 Tab.83 p.234. The latter has a number of errors in common with our table (Toomer p.89), or at least with the vulgate tradition; see "Text" below. – Comprises two partial tables, one for apogee **(1)** and one for perigee **(2).** Each has three sub-tables, thus:

(1)	(2)	
.Lla	**.Pla**	: latitude of moon
.Lpc	**.Ppc**	: digits of eclipse
.Lcs	**.Pcs**	: minutes of immersion.

Witnesses: **{a0}** Ct,32v; Oo,26r; Cq2,90. – **{a1}** Xa,33v; Ad,81v; Cq,59; Fc,82r; Ps,73r; Wd,33v; Fh,57r; Xw,33r. – **{a2}** Md,97v. – **{aX}** Vo,65r; Xr,87r; Ov,98r; Ov,104v; S,102v; Vd,16r. – **{aT}** Lu,79r; P,89r. – **{k}** Eh,101v; Lw,119r; Ou,76r; Eg,23v; Co,167r; Cn,102v. – **{d}** Op,75v; C,372; Lb,51v; Pa,53v; A,232v; Fj,54v; Nc,131v; Fd2,55v; Gr3,126v; Ok,61v. – **{e}** Xc,78r; Vj,101v; Ej,84v; Vm,14v. – **{x}** Vz,80r. – **{p}** O,90r; Pd,81r. – **{?}** Py,46v; Ef,71v; Pn,51r (:Jo. Lin.); Fc2,115v (:Jo. Lin.). — Duplicate in {aX} Ov. – Variant table in Lo,85r: see "Variant" below.

Canon: Ca178-180, which is a translation from Albattani ch. 44. Terms: argument, "latitudo lunae (+visa, Ca177)", "tabula latitudinis lunae"; whole table, "tabula eclipsis solis"; sub-tables "... longitudinis maioris / minoris"; values "ex punctis", "(ex) minutis casus". This has scattered points of similarity to the table-headings, to class {k} in two cases.

The sub-heading "latitudo lunae aequalis" is quoted in an addition to canons Ca (CaB01(1), ms. Oo).

A rule in Azarchel's Almanac, ch.24, is also meant for a table that is to be entered with the lunar latitude as argument.[1] The rule is presumably for the same table as here, since this occurs in the Almanac; cf. above. Column .Lla or .Pla is the one containing the latitude to be used; it increases linearly, but since its increment is not a round number, it requires an unfamiliar kind of interpolation, and it is strange that the Almanac and the canons (i.e., Albattani) contain no rules to meet this situation. Canons similar to the Almanac text are found as Cb190a-d and Cc258-60; these, however, belong to table JD11, q.v.

Headings. – General:

(1: none) :: normally.
(2) Tabula eclipsis solis (+secundum Azarchelem Ov) :: {aX:} Ov(98r) S; {k:} Eh Lw Ou Co Cn.
(3) Tabula Azarchelis :: {aT:} Lu P; {d:} Fj.

---

1 In the translation by Millás (1950 p.147), the corrected argument of latitude is first to be transformed into a lunar latitude by means of a table analogous to EA11.Lat; then it is merely stated that the solar eclipse table should be entered using this latitude. Later on in the text, however, it appears that the eclipse tables for apogee and perigee are to be entered using the argument of latitude directly. This may, of course, be shorthand for the previous rule, and need not be intended for a different table such as JD11.

Headings for table (1) and its sub-tables:

Table (1): **(4) Tabula eclipsis solis in longitudine longiori** (in l.l.: in l-nem l-rem Cq2; ad l-nem l-rem Ef Py; +secundum Azarchelem Fh.pc) :: normally. – Others, all coupled with general headings: **(5) Longitudo longior** :: {aX:} Ov(98r); {k:} Eh Lw Ou Eg Co Cn. – **(6) In longitudine longiori** :: S.

.Lla: **(7) Latitudo** (longi- Cq2 Fd2 Vj Ej) **lunae aequalis** (*om.* S Lw) :: normally. – **(8) Latitudo lunae visa** :: {aX:} Ov(98r); {k:} Eh Ou Eg Co Cn; {d:} Op C.

.Lpc: Independent versions in {k}, in {d}, and in the vulgate. –
(9) Quantitas punctorum qui (quae Md Xr Lu O Pd Ef; *om.* Cq2) **obscurantur ex diametro solis** (*om.* Xw Ef) :: {a0:} Ct Oo Cq2; {a1:} Xa Ad Cq Ps Wd Fh Xw; {a2:} Md; {aX:} Vo! Xr; {aT:} Lu P; {d:} Nc; {p:} O Pd; {?:} Ef Py.
(10) Quantitas quae eclipsatur (relinquitur Fd2) **de sole de digitis** :: {aX:} Vd; {d:} Lb Pa A Fj! Fd2 Gr3.
(11) Puncti (-ta Ov Ou) **eclipsis** (+solis Eg) **ex diametro solis** (*om.* Ov) :: {aX:} Ov(98r); {k:} Eh Lw Ou Eg Co Cn.
(12) Puncta diametri eclipsata (*om.* Ok Vm) :: {d:} Ok; {e:} Xc Vj Ej Vm; {?} Fc2.
(13) Puncta eclipsis :: {d?:} Op C.
(14: other) :: Fc Ov(104v) Pn S Vz.

.Lcs: **(15) Quantitas** (-ates Ct) **casus,** but **(16) Minuta casus** in S Op C.

Variant table: Lo,85r, "Tabula eclipsis solis cum fuerit luna in longitudine propiori", two tables with values like JE11 but stepping 15′ or 20′ in the column of digits.

Values. Parameters: solar radius, 0;16,15; lunar radius at apogee, 0;14,45; at perigee, 0;17,45. These can be found from .Lla and .Pla, values for 0 and 6 (reading "14,45" at .Lla(6)), and from the last entries in .Lcs and .Pcs; cf. Toomer 1968 p. 89. The lunar radius at apogee differs from that used for JE21, as noted by Toomer, e.g., p. 84 n.9. When the present values are used, the values to be recomputed below differ by less than 3" from the adopted values, except in the places stated.

Sub-tables *.Lla* and *.Pla* are linear, both with a tabular difference of (solar_radius)/6 = 0;2,42,30. This would make them zero for arguments of about 11;27 and 12;33, which may be compared to the last values of *.Lpc* and *.Ppc.* The Albatenian value of 11;23,30 for .Lpc can be found by extrapolation from the value "1,13" for argument 11, assuming a tabular difference of 0;2,42, equal to the apparent difference between the values for arguments 10 and 11; cf. Toomer 1968 p. 90, also generally for the problem of defining minutes of immersion. – Sub-tables *.Lcs* and *.Pcs* have been recomputed summarily.[1]

Text. Collated for values: **{a0}** Ct Oo; **{a1}** Xa Cq; **{aT}** Lu; **{k}** Ou Co; **{d}** Pa A; **{e}** Xc. – Headings according to Xa. – Also quoted: **$ba** = Batt., Paris Arsenal 8322, 58v; **$aa** = Almanac of Azarchel, Paris Arsenal 8322, 134r; **$c** = recomputation; for the methods and parameters, see "Values" above. The recomputed values are quoted wherever they differ from those adopted.

Readings chosen. I adopt the recomputed value ($c), if it has support from anywhere in the material; otherwise I choose freely. Italics are used where the adopted reading differs from the majority among Ct Oo Xa Cq Lu, if this exists, and also where this majority does not exist. Underscoring is used for one or two faulty readings which are adopted since they are in all witnesses.

In the apparatus, cols. (c-d) and (j-k) are used for indexing the rows of table (1) and (2), respectively, as indicated by the use of bold type.

Variant groups. Most of the gross errors in *.Lcs* and *.Pcs* are shared by $aa, as noted by Toomer 1968 p. 89. – Error groups: All witnesses (m8, perhaps m4); all against $ba (b11); *vulgate* plus *{d}* and *$aa* against Ou Co $ba, often; *Ou Co* (b3, f3, g11); *Pa A,* perhaps joined by $aa (b9, c-d 11;23, m10). – Ou Co $ba are all in error at (f8, h11), but with varying readings. As usual, $ba may join the vulgate, either in error (m10) or in a plausible reading (h10).

---

1 As: SEMI(x) = (solar_radius * x * [solar_radius * (1-x/12) + lunar_radius] / 3)**(1/2), where *x* denotes the digits, and the lunar radius is that at apogee or that at perigee, respectively.

(1) Tabula eclipsis solis in longitudine longiori.

(Lla) Latitudo lunae aequalis		**(Lpc)** Quantitas punctorum qui obscurantur ex diametro solis		**(Lcs)** Quantitas casus	
Mi	Se			Mi	Se
31	0	**0**		0	0
28	18	**1**		12	39
25	35	**2**		17	30
22	53	**3**		20	*55*
20	10	**4**		23	33
17	28	**5**		25	*37*
14	*45*	**6**		27	*16*
12	3	**7**		28	34
9	20	**8**		29	33
6	38	**9**		30	17
3	55	**10**		30	45
1	*13*	**11**		30	59
0	0	**11**	**23**	31	0
.	.	.		.	.
(a)	(b)	(c)	(d)	(e)	(f)

(2) Tabula eclipsis solis in longitudine propiori.

(Pla) Latitudo lunae aequalis		**(Ppc)** Quantitas punctorum qui obscurantur ex diametro solis		**(Pcs)** Quantitas casus	
Mi	Se			Mi	Se
34	0	**0**		0	0
31	18	**1**		13	16
28	35	**2**		18	25
25	53	**3**		22	2
23	10	**4**		24	50
20	28	**5**		27	9
17	45	**6**		29	0
15	3	**7**		30	30
12	20	**8**		31	56
9	38	**9**		32	37
6	55	**10**		33	*16*
4	13	**11**		33	44
1	30	**12**		33	*58*
0	0	**12**	***33***	34	0
(g)	(h)	(j)	(k)	(L)	(m)

(a0-a1) 38, 21 Oo. **(a5)** 16 Oo. **(b1)** 18 *vel* 48 Cq. **(b3)** 13 Ou Co. **(b6)** 45: Ou Co $ba $c; 41 *cett.* **(b9)** 28 Pa $aa. **(b11)** 13: $ba $c; 11 (?) A; 3 *cett.* **(c11)** *n.l.* Ou. **(c11;23)** 12 Pa A $aa. **(d11;23)** 23: *in ras.?* Ou; 203 (!) Lu; 24 Co; 23,30 $ba; 27 $c; *om.* Pa A $aa; m(a) *add.* Xc. **(e11;23)** (31,0) Lu. **(e,** *post 11;23)* 30 Xc. **(f1)** 32 Ct; 29 Xc; 40 $c. **(f3)** 55: $ba $c; 56 Ou Co; 15 *cett.* **(f4)** 34 Co. **(f5)** 37: Ou Co $ba $c; 36 *cett.* **(f6)** 16: Ou Co $ba $c; 36 *cett.* **(f8)** 13 Ou; 14 Co; 53 $ba; 34 $c. **(f9)** 57 $ba. **(f10)** 15 Oo. **(f11)** 49 Xc. **(g7)** 16 Oo. **(g11)** 3 Ou Co. **(g12)** *n.l.* Ou. **(h0)** 30 $ba. **(h9)** 28 Xc. **(h10)** 15 Ou Co $aa. **(h11)** 53 Ou $ba; 54 Co. **(k12;33)** 33: Ou $ba $c; 32 Co; *om.* $aa, *cett.* **(m1)** 36 $ba; 18 $c. **(m3)** 3 $c. **(m4)** 7 $aa; 53 $c. **(m8)** 41 $c. **(m9)** 38 Ou Co. **(m10)** 16: Ou Co; 46 Pa A; 17 $aa $c; 56 $ba, *cett.* **(m11)** 54 A. **(m12)** 58: Co Ou A $ba $c; 18 Oo; 48 *cett.*

JE21. Eclipse digits, lunar, "Tabula Toletana". As in Azarchel's Almanac.

Toomer 1968 no. 61. – Comprises two partial tables, one for apogee **(1)** and one for perigee **(2).** Each has five sub-tables, thus:

(1)	(2)	
.Llo	**.Plo**	: argument of latitude
.Lla	**.Pla**	: latitude of moon
.Lpc	**.Ppc**	: digits of eclipse
.Lcs	**.Pcs**	: minutes of immersion
.Lmo	**.Pmo**	: half delay in totality.

Same as Almanac of Azarchel, Millás 1943 Tab.80, p. 231 (which includes columns .Llo, .Plo), and perhaps adopted from there, which would explain the frequent mention of Azarchel in connection with this table (noted by Toomer 1968 p. 94).

Also similar to Albattani, Nallino II p. 90, which, however, lacks the .Llo and .Plo columns and has the .Lpc and .Ppc columns on the outer right of both tables.[1]

Witnesses: **{a0}** Ct,30v; Oo,29r; Cq2,96; Lo,84v. – **{a1}** Xa,34v; Ad,82v; Cq,61; Fc,48r; Fc,73r-v; Ps,75r; Wd,34v; Fh,59r; Xw,34r. – **{a2}** Md,99v. – **{aX}** Vo,67r; Xr,89r; Ov,97v; Ov,108r; Fj2,109r; S,102v; Vd,15r-v. – **{aT}** Lu,79v; P,89v. – **{k}** Eh,100v-101r; Lw,(118r-)118v (first table not seen); Ou,70r-v; Eg,23v; Co,167r; Cn,102v. – **{d}** Op,75r; C,371; Lb,41r-v; Pa,49v-50r; A,228v-229r; Fj,50v-51r; Nc,121v-122r; Nc,136r; Fd2,52r-v; Gr3,122v-123r; Ok,61v. – **{e}** Xc,79v; Vj,103r; Ej,86r; Vm,16r. – **{p}** O,84v; Pd,81v. – **{?}** Py,43r (second table only); Ef,72r; Ch,58v-59r (:Savasorda 2); Pn,51v (:Jo. Lin.); Fc2,116v (:Jo. Lin.). — Duplicates in {a1} Fc, {aX} Ov, {d} Nc.

Canon: Ca152, which is a translation from Albattani ch. 43. Terms: argument, "cum latitudine lunae vera"; sub-tables: "in duas tabulas eclipsis lunae quae sunt ad longitudinem longiorem et longitudinem propiorem"; values "de punctis, et minutis casus et morae". This rule is for the Albattani version, which has to be entered using the lunar latitude.

Azarchel's Almanac ch.23 contains the rule for the table found there. As this includes a column for the argument of latitude, the rule provides for entering the table in this way. Canons similar to the Almanac text are found as Ca136, Cb200 and Cc270, but all these may as well concern JD21, q.v.

Headings. – General:

(1: none) :: normally.
(2) Tabula Toletana (+Azarchelis Ps Fh.pc; +tab. Azarchelis Fj2.pc) :: {a1:} Xa Ad Fc(48r) Ps Fh; {aX:} Fj2; {d:} Nc(136r).
(3) Tabula (*om.* Op C Py) **Azarchelis** (zachelis Wd; +sive eclipsis Vo) :: {a1:} Wd; {aX:} Vo Xr; {aT:} Lu P; {d?:} Op C; {?:} Py.
(4: other) :: S ("Tabula eclipsis lunae", extract from the usual heading for Table (1); the rest remains in place, cf. below).

Headings for Table (1) and its sub-tables:

Table (1): **(5) Tabula eclipsis lunae in** (+sua Ct) **longitudine longiori** (/longitudine(!) Fd2; +secundum Azarchelem Ov(97v)) :: {a0:} Ct Lo; {a1:} Fc(73r); {aX:} Ov(97v) Vd; {k:} Eh Ou Eg Co Cn; {d:} Op C Lb Pa A Fj Nc(121v) Fd2 Gr3; {?:} Ch. – **(6) Tabula** (*om.* Ov(108r) Ps) **eclipsis lunae ad (+suam) longitudinem longiorem** (+in epicyclo Ok) :: {a0:} Oo Cq2; {a1:} Cq Ps Wd Xw; {a2:} Md; {aX:} Ov(108r) Vo Xr; {aT:} Lu P; {d:} Ok; {e:} Xc Vj Ej Vm; {p:} O Pd; {?:} Pn! Fc2 Ef. – **(7: none)** (no distinctive headings for apogee and perigee tables) :: {a1:} Xa Ad Fc(48r) Fh; {aX:} Fj2; {d:} Nc(136r). – **(8: other)** :: S ("In longitudine longiori"); Lw (not seen); Py (perigee-table only, hdg. like (6)); Cn ("secundum Arzach()" added to hdg. of perigee-table).

.Llo and .Lla, common heading: **(9) Numeri communes** :: {aX:} Ov; {k:} Eh Lw Ou Eg Co Cn. – **(10) Lineae communes** {?:} Ch. – **(11)** None elsewhere.

---

1 The copy in Paris Arsenal 8322, collated as "$ba" below, has these features too.

.Llo:

(12) Longitudo lunae a nodo :: normally. — *Added:* **+id est a capite draconis** {a0:} Ct; {aT:} Lu P; {?:} Ch; **+et a capite** (e.a c.: *om.* Lw) **draconis** {k:} Lw Ou Eg! Co Cn.

(13) Argumentum latitudinis :: {aX:} Vd; **d:** Lb, Pa A Fj Nc(121v) Fd2 Gr3. — **(14) Distantia a nodo** :: {aX:} S; {d?:} Op C. — **(15: other)** :: Fc(48r: "Longitudo"); Eh (secondary only); Vm.

.Lla: **(16) Latitudo lunae** :: normally. — **(17) Latitudo lunae vera** :: Op C. — **(18) Latitudo** :: Ej. — **(19: none)** :: Vj Eh.ac.

.Lpc:

(20) Puncti eclipsis ("puncta ..." noted from Cq2 Fc(48r) Xw Md Ov(97v) Fj2 Op C Xc Vj Ej Vm O Pn Fc2) :: normally. — *Added:* **+ex diametro lunae** (*om.* Ov(97v)) :: {aX:} Ov(97v); {k:} Lw Ou Eg! Co Cn; **+diametri lunae** :: Ch.

(21) Digiti eclipsati de diametro lunae (diam. lun.: Vd Pa Fj Gr3; **/diam.** Fc(73r) Lb A; luna Fd2; luna de diam. Nc(121v)) :: {a1:} Fc(73r) Vd; {d:} Lb Pa A Fj Nc(121v) Fd2 Gr3. — **(22: other)** :: Lo ("Digiti"); S & Ok ("Puncta"); Eh (secondary only); Nc(136r: "Numerus punctorum").

.Lcs and .Lmo: **(23) Tempora eclipsis [Casus; Mora]** :: {a0:} Ct Oo Cq2; {a1:} Xa Cq Ps Wd Xw; {aX:} Ov(97v) Ov(108r) Xr; {aT:} Lu P; {k:} Lw Ou Eg Co Cn; {?:} Ch Py. — **(24) Tempora casus; Eclipsis mora (/m.e.** Md Fj2) (from a mistaken division of type (23)) :: {a1:} Ad; {a2:} Md; {aX:} Fj2; {d:} Nc(136r); {p:} O Pd; {?:} Ef. — **(25) Casus; Mora** :: {a0:} Lo; {a1:} Fc(48r). — **(26) Minuta casus; Dimidium morae** :: {aX:} S Vd; {d:} Op C Lb Pa A Fj Nc(121v) Fd2 Gr3. — **(27) Minuta casus; Minuta morae** :: {d:} Ok; {e:} Xc Vj Ej Vm; {?:} Pn Fc2. — **(28: other)** :: Fc(73r) ("tempora casus; eclipsata fixio *(sic!)*"); Fh (like (23) but no sub-hdgs.); Vo; Eh (secondary only).

Versions. In **{a:}** Fc(73r) Vd; **{d:}** Lb Pa A Fj Nc(121v) Fd2 Gr3 there are three extra columns to the outer left, all with the title "Argumentum latitudinis", showing the argument of latitude as mirrored in the nodes (thus the first values of the columns in the apogee table are 169;49° / 190;11° / 349;49°). In Fc these three columns are separate from the fourth, original, one, and this retains its proper heading (12: "Longitudo..."); in the rest, all four columns are close together, and each has the secondary heading (13:) "Argumentum latitudinis".

Otherwise the sub-tables are present in the order shown, though the sub-headings of Xr are in disorder.

Parallels. Azarchel and Albattani; see above. For .Pcs and .Pmo, cf. Almagest VI,8, lunar eclipse, least distance, cols. 4-5 (e.g., Toomer 1984 p. 307). The values are essentially the same in all cases, though perhaps the tables have been computed independently.

Values and recomputation. Parameters:

	Lunar radius	Shadow radius	Relevant sub-tables
Table (1)	0;14,45	0:38,15	.Lcs .Lmo
Table (2)	0;17,40	0;45,56	.Pcs .Pmo

These are most easily found from .Lla and .Pla, values for 0, 6, and 12, and from the last entries in .Lcs, .Lmo, .Pcs and .Pmo. One should read "29,30" for the last value in .Lcs, as do the Albatenian sources; if so, all values mentioned are consistent. For some slightly different values in the tradition see Nallino I p. 235-6 and Toomer 1968 p. 94-95.

.Llo and *.Plo* are almost linear on the short stretch considered, and show no unevenness, except for two gross errors, marked in the text. The values for argument 0 can be reproduced, e.g., from those for argument 1 by proportion to the corresponding values in .Lla and .Pla: thus, in .Llo, the first value might be computed as 9;43 (0;53 / 0;50,33) = 10;11,15. In the same way one would get 12;15,5 in .Plo. Recomputed values are not reported.

.Lla and *.Pla* are linear, with tabular differences of -1/6*(lunar_radius), i.e., 0;2,27,30 and 0;2,56,40, respectively; cf. the apparatus to (e-f 21;31), and contrast the value printed by Nallino II p. 90b bottom. This would make them zero for arguments of approximately 21;34 and 21;36, which should then be the last values in *.Lpc* and *.Ppc*, respectively. The latter value is Albatenian; the former seems absent from the tradition. Elsewhere there are only two cases of deviation from the expected values, both noted in the apparatus.

.Lcs, .Lmo, .Pcs, and *.Pmo:* The values have been recomputed summarily,[1] using the relevant radii among those listed above. The results are cited where they differ from those adopted.

Text. Collated for values: **{a0}** Ct Oo; **{a1}** Xa Cq; **{aT}** Lu; **{k}** Ou Co; **{d}** Pa A; **{e}** Xc. – Headings according to Xa. The three extra entrance columns of "argumentum latitudinis" in Pa A, to the outer left (cf. "Versions" above) are ignored. – Also quoted: **$ba** = Batt., Paris Arsenal 8322, 58r (does not cover .Llo, .Plo); **$aa** = Almanac of Azarchel, Paris Arsenal 8322, 133v. **$c** = recomputed values, quoted in full for all sub-tables except .Llo and .Plo; see "Values" above.

Readings chosen. I adopt the reading of the majority of Ct Oo Xa Cq Lu, if supported from $c or in other ways; otherwise I choose freely. Italics are used where the adopted reading differs from this majority, and also where there is no such majority. Underscoring is used for a few readings that are adopted though dubious; they are variously attested.

In the apparatus, the values in cols. (e-f) and (p-q) are used as indexes for the rows of table (1) and (2), respectively, as indicated by the use of bold type.

Variant groups. In .Llo and .Plo, Ou Co show several deviations of 1 from the majority. There is nothing to show what status these readings have, since the Albatenian sources are absent.

In the sub-tables .Lcs, .Lmo, .Pcs, and .Pmo, the *vulgate* plus *{d}* and *$aa* are often in error against *Ou Co $ba;* some of the errors are of Abjad type. Conversely, the latter are in error against the former at (d6, s17, u19), and both groups are in error at (h2); these errors are, however, slight. The errors shared with the Almanac were noted by Toomer 1968 p. 94.

At (s2-s3) *all witnesses plus $ba $aa* have the error "35" for "45"; on top of this, the vulgate plus $aa interchange the values "20" and "35".

At (h8, h18, s12) *$ba* agrees with the majority, leaving Ou Co to represent the Albatenian tradition. Conversely, at (s7) $ba is correct against Ou Co and the rest (even if, at (r7), it shares the error "47" with all others).

Other error groups: parts of the *vulgate* (b2, m20); *Ou Co* (often); *Pa A* (m6, n17). Other configurations seem confined to single instances.

On the whole, then, Ou Co $ba reflect the Albatenian tradition, but with errors, some of which are inherited into Azarchel's Almanac and the vulgate. The two latter are closely connected, but there is no good evidence as to which of them depends on the other.

---

1 Recomputing .Lmo and .Pmo:
LEHT(x) = (lunar_radius * [(x/3-4) * shadow_radius - ((x/6)**2-x/3) * lunar_radius]) **(1/2)
Recomputing .Lcs and .Pcs when .Lmo (resp., .Pmo) are not present:
LEMI(x) = (lunar_radius * x * [lunar_radius*(1-x/12) + shadow_radius] / 3) **(1/2)
When .Lmo and .Pmo, respectively, are present, .Lcs and .Pcs show the values
LEMI(x) - LEHT(x).

Tabula Toletana.

(1) (Llo) Longitudo lunae a nodo Gr	Mi	(Lla) Latitudo lunae Mi	Se	(Lpc) Puncti eclipsis Nu's		(Lcs) Tempora eclipsis: Casus Mi	Se	(Lmo) Mora Mi	Se
10	11	53	0	**0**		0	0	0	0
9	43	50	33	**1**		15	*56*	0	0
9	*14*	48	5	**2**		22	*19*	0	0
8	46	45	38	**3**		26	*56*	0	0
8	17	43	10	**4**		*30*	45	0	0
7	49	40	43	**5**		33	*56*	0	0
7	20	38	15	**6**		36	*42*	0	0
6	52	35	48	**7**		39	5	0	0
6	23	33	*20*	**8**		41	*12*	0	0
5	55	30	53	**9**		43	5	0	0
5	26	28	25	**10**		*44*	44	0	0
4	58	25	58	**11**		46	12	0	0
4	30	23	30	**12**		47	30	0	0
4	2	21	3	**13**		38	11	10	27
3	34	18	35	**14**		35	*15*	14	23
3	5	16	8	**15**		33	24	17	5
2	37	13	40	**16**		32	5	19	7
2	9	11	13	**17**		31	9	20	39
1	41	8	45	**18**		30	27	21	49
1	12	6	18	**19**		29	58	22	39
0	44	3	50	**20**		29	41	23	11
0	16	1	23	**21**	Mi	29	31	23	28
0	0	0	0	**21**	**31**	29	*30*	23	30
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)

(2) (Plo) Longitudo lunae a nodo Gr	Mi	(Pla) Latitudo lunae Mi	Se	(Ppc) Puncti eclipsis Nu's		(Pcs) Tempora eclipsis: Casus Mi	Se	(Pmo) Mora Mi	Se
12	15	63	36	**0**		0	0	0	0
11	41	60	39	**1**		19	9	0	0
11	7	57	43	**2**		*26*	35	0	0
10	33	54	46	**3**		32	*20*	0	0
9	58	51	49	**4**		36	53	0	0
9	24	48	53	**5**		40	42	0	0
8	49	45	56	**6**		43	59	0	0
8	15	42	59	**7**		*46*	*53*	0	0
7	41	40	3	**8**		49	25	0	0
7	7	37	6	**9**		51	40	0	0
6	33	34	9	**10**		53	39	0	0
5	59	31	13	**11**		55	25	0	0
5	25	28	16	**12**		56	*59*	0	0
4	51	25	19	**13**		45	47	12	35
4	17	22	23	**14**		42	15	17	16
3	43	19	26	**15**		40	2	20	32
3	9	16	29	**16**		38	27	22	*58*
2	36	13	33	**17**		37	20	24	*48*
2	2	10	36	**18**		36	*31*	26	*12*
1	28	7	40	**19**		35	56	27	12
0	*54*	4	43	**20**		35	35	27	52
0	20	1	46	**21**		35	22	28	13
0	0	0	0	**21**	***36***	35	20	28	16
(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)

(b2) 14: $c, *cett.;* 18 Xa Cq Lu Ou Xc; 48 Oo. **(b5)** 19 Oo. **(b7)** 51 Ou Co. **(b9)** 54 Co. **(b10)** 27 Ou Co; 36 Xc. **(b18)** 40 Ou Co. **(c2)** 40 Cq. **(c5)** 10 Oo. **(c8)** 34 Ou Co. **(c9)** 0 *vel* t (=30) Oo. **(c18)** 28 $ba. **(d1)** 13 $aa. **(d5)** 44 $ba. **(d6)** 15: $c, *cett.;* 55 Ou Co $ba. **(d8)** 20: Ou Co $ba $c; 22 *cett.* **(d11)** 59 Ou Co. **(d14)** 30 Xc $ba. **(d16)** x Cq. **(d17)** 3 $ba. **(d19)** 58 $ba. **(d20)** i *vel* L Oo; 7 $aa. **(d21)** 28 $aa. **(e-f 21;31)** 31 + 0.2.27.30 $ba, *cf. Nallino II p. 90a.* **(+f21;31)** (et) 31 m() (?) Cq; (21,31) Co; *om.* Ou; 40 $aa; 34 $c. **(g0)** 2 $aa. **(g1)** 55 $ba. **(g4)** 30: Ou Co $ba $c; 29 *cett.* **(g10)** 44: Ou Co $ba $c; 45 *cett.* **(g13)** 48 Cq.ac Xc. **(h1)** 56: Ou Co $ba; 57 $c; tvi Cq *et sic saepius;* 36 *cett.* **(h2)** 19: *scripsi;* 18 $c; 59 Ou Co $ba; 39 *cett.* **(h3)** 56: Ou Co; 57 $ba; 58 $c; 16 *cett.* **(h5)** 56: Ou Co $ba $c; 15 *cett.* **(h6)** 42: Ou Co $ba; 41 $c; 22 *cett.* **(h8)** 12: Ou Co $aa $c; 52 $ba, *cett.* **(h11)** 52 $ba. **(h13)** 51 $ba. **(h14)** 15: Ou Co $ba $c; 14 *cett.* **(h18)** 27: $ba, *cett.;* 28 Ou Co $c. **(h19)** 59 $c. **(h21;31)** 30: Ou Co $ba $c; 20 *cett.* **(j13-19)** 14, 17, 19, 20, 22, 23, 23 $aa. **(+j16)** xo Cq. **(+j17)** 21 Ou Co. **(k13)** 22 Ou Co; 26 $ba; 28 $c. **(k15)** 6 $c. **(k16)** 50 $ba. **(k17-20)** 49, 39, 18, 28 $aa. **(k21)** 38 $ba. **(L4-5)** 8,8 Co *(eras.?)* **(m3)** 23 Oo. **(m5)** 29 $aa. **(m6)** 45 Pa.ac A. **(m10)** 34 Co. **(m13)** 11 $aa. **(m20)** 54: $aa, *cett.;* 24 Ct Oo Xa Cq Xc. **(n10)** 39 Ou Co. **(n17)** 22 Oo. **(n18)** 17 Cq.ac. **(o5)** 58 $aa. **(o8)** 30 $ba. **(o11)** 53 Ou Co. **(o12)** 36 $ba. **(o13)** xx (?) Cq. **(o19)** 39 $c. **(o20)** 42 $aa. **(q21;36)** 36: $ba $c; 31 Co; *om.* Ou Xc; 40 *cett.;* mi *add.* Lu. **(r2)** 26: Ou Co $ba $c; 36 Cq; xx<-> Oo; 27 *cett.* **(r4)** 35 $ba. **(r6)** 44 Co. **(r7)** 46: $c; 48(?) Oo; 47 $ba, *cett., cf. (s7).* **(r14)** 41 Ou Co. **(r16)** xxxn Cq. **(r17)** 38 (?) Oo; 32 $ba. **(s1)** 8 $c. **(s2)** 35: Ou Co $ba; 44 $c; 20 *cett., cf. (s3).* **(s3)** 20: Ou Co $ba $c; 25 Xc; 15 $aa; 35 *cett., cf. (s2).* **(s4)** 52 $c. **(s6)** 50 Xc. **(s7)** 53: $ba; 52 $c; 13 *omnes.* **(s8)** 24 $aa. **(s9)** 4 $aa; 39 $c. **(s10)** 30 Xc. **(s12)** 59: Ou Co; 58 $c; 29 $ba, *cett.* **(s13)** 46 Ou Co $ba. **(s14)** 45 Ou Co; 55 $ba; 16 $c. **(s16)** xxv<-> Cq; 26 $ba; 28 $c. **(s17)** 18 Ou Co $ba; 2 $aa. **(s18)** 31: Ou Co $ba; 30 $c; tvii *vel* x'vii Cq; 37 *cett.* **(s19)** 16 Ou Co. **(s20)** 34 Ou Co $ba; 33 $c. **(s21)** 32 Co; 23 Xc. **(t19)** 26 $ba. **(u13)** 35: $ba, *cett.;* 36 Ou Co; 34 $aa $c. **(u14)** 36 Xc. **(u16)** 58: Ou Co $ba $c; 38 *cett.* **(u17)** 48: Ou Co $ba; 49 $c; 58 Pa A; 28 Xc; 18 *cett.* **(u18)** 12: Ou Co $ba $c; 2 *cett.* **(u19)** 17 Ou Co $ba; 13 $c. **(u20)** 12 $ba $aa.

JF. Azimuth of ascendent and descendent.

JF11. Rota, Albatenian.

Table in the form of a wheel, showing the distance on the horizon between the east or west points and the beginning of each sign when this is rising or setting. It is meant for use together with JC41, for finding the points of the horizon that are aligned with the centers of the luminaries or shadow, at significant stages of an eclipse.

From Albattani (Nallino II p.92). A similar wheel, but with other values, is in Ptolemy's Almagest, at the end of the 6th book, and in the Handy Tables (Stahlman Table 27, Halma III 43).

Witnesses: **{a0}** Ey,77r; **{a1}** Fc,58r; Fc,101v (duplicate of 58r); **{aX}** Fj2,110r (m2?); **{aT}** Lu,80r; P,90r; **{k}** Lw,102v. – *Context:* after JC41 in Lu P Lw; after JD21 in Fj2; in other contexts not concerning eclipses, Ey Fc. – *Canon:* CbA.G64(02-04), also treating JC41. It differs from the Albatenian rules (c.43-44, Nallino I p. 101-02, 112).

Headings. – General: **Tabula ad inveniendum in qua parte horizontis incipiat vel finiat eclipsis solis vel lunae** Lu P Fj2. No main heading in the rest. – *Sector for climate numbers:* "Numerus climatum" Ey; "Climata" Fc; "Ordo climatum" Lu P Lw Fj2. – *Capricorn:* "Locus ortus capricorni" Ey; "Ortus hiemalis, Capricornus Sagittarius" Fc; "Capricornus, oriens hiemalis (o-tes h-les Lw) Lu P Lw Fj2.

Gloss in Ey, text-hand: "In hac rota sunt scripta loca in horizonte, in quibus principia signorum oriuntur in quolibet climate et occidunt, et sunt signata haec loca per distantiam eorum a puncto orientis et occidentis in septentrionem et meridiem".

Transcription and versions. In the transcription below, sectors (for signs, etc.) are shown as columns, and zones (for climates) are shown as rows. The lowest-numbered zones, here shown uppermost, are innermost in the rota; thus the sectors are listed counterclockwise. From sector (t), of course, one goes on to sector (a).

All headings are shown uppermost, regardless of their true placement; in fact, most headings are on the outside, though lesser column labels are normally on the inside.

In Lu P Fj2 the sector for climate numbers shows two parallel numberings, the second one in reverse of the one given here. Lw also shows two columns of numbers in parallel, but both of these are the same as shown here.

In Ey Lu P Lw Fj2, the numbers are oriented away from the centre, such as to make the zones readable from climate 1 outwards, towards climate 7. This arrangement is imitated below. It is probably not original; indeed, in both copies of Albattani ($bn and $ba, see "Text"), the direction of the numbers is the opposite one.

In both copies in Fc, the tabular values are arranged as in the Albattani copies, whereas the numbers in sectors (a-b) are oriented away from the centre. Fc, alone, has extra sectors for "miliaria" (width of each climate; column (b)) and for the latitudes of the middle and the end of each climate (column (k-L). All these three sets of values are the same as in MB11, except that the latitudes are truncated to integral degrees; the "miliaria" values are the same as in Alfargani ch. 8.

Values. The values have been recomputed as *Arc sin* (*sin*(declination of beginning of sign in question) / *cos*(latitude)), cf. Nallino II p. 232, using Albattani's declinations for 30°, 60° and 90° from Nallino II p. 57-58 (=11;32,22° / 20;16,20° / 23;35,0°), and his latitudes of climates from Nallino II p. 65-66 (see BG21), rather than the latitudes of column (k). – Each non-zero tabular value occurs four times.

Text. Collated for tabular values: Ey Lu; Fc1 = Fc,58r; Fc2 = Fc,101v; Lw P Fj2. – Headings according to Lu, omitting the sub-heading "Ordo climatum", for which cf. "Headings" above. – Also quoted for values: **$bn** = Albattani, facsimile in Nallino III p. 243 (ad fol. 196v); **$ba** = Albattani, Paris Arsenal 8322, 59r; **$c** = recomputation; see "Values".

Coverage: The items in columns (b,k,L) are in mss. Fc1 Fc2 only. They are enclosed in [brackets]. Lu P Fj2 have an extra sector of climate numbers, not reproduced. For other details, see "Transcription" above.

Readings chosen. For the tabular values, the reading of $c is adopted when supported by anything else in the material. If such a reading disagrees with the majority of the collated manuscripts, then the reading is italicized. If $c is alone, but there is one other well-attested reading, then the latter is adopted; if it differs from $c by more than a few minutes, it is underscored. Tabular symmetry is not taken into account, but since $c is taken as the standard, symmetry is mostly fulfilled.

Variant groups. At (d4, h4; j1; o5) *$bn $ba* are in error together against the rest, and at (c3; c7) $bn $ba are in error separately. The errors are not mirrored in the whole table, and may be proper to these witnesses for Albattani.

A general error against the Albatenian source is at (d2, h2, o2, s2), though at (d2) the witnesses for Albattani show a different error. At (e1, g1, p1, r1), *Fc1 Fc2* are correct alone, whereas they may be in error elsewhere; thus no doubt they are independent of the rest. *Lu P Lw,* joined by *Fj2,* form an error group against the rest; cf. (d1). *Ey* may join Lu P Lw or may have errors of its own. Otherwise Ey mostly joins the majority. At (d1, e3, g3) its readings could have been copied from their symmetrical counterparts; they are nevertheless accepted below, since they agree with $c.

It appears, then, that the Toulouse-table witnesses plus Fj2 present their own form of the text: thus our rota may have followed the Toulouse tables in this part of the tradition.

MERI DIES		Oriens hiemalis			ORI ENS			Oriens estivalis	(SEPTE NTRIO)	
		Cap	Aqr Sgr	Psc Sco	Ari Lib	Tau Vir	Gem Leo	Cnc	[Elev.poli]	
Cli mata	[Mil iar.]	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	[Gr]	[Gr]
1	[440]	24 39	21 *12*	12 *3*	0 0	12 *3*	21 *12*	24 39	[16]	[20]
2	[400]	26 0	22 48	12 39	0 0	12 39	22 *18*	26 0	[24]	[27]
3	[350]	27 42	23 45	13 27	0 0	13 27	23 45	27 42	[30]	[33]
4	[300]	29 48	25 29	14 23	0 0	14 23	25 29	29 48	[36]	[39]
5	[255]	32 8	27 26	15 26	0 0	15 26	27 26	32 8	[41]	[43]
6	[210]	34 57	29 33	16 33	0 0	16 33	29 33	34 57	[45]	[47]
7	[185]	37 28	31 46	17 43	0 0	17 43	31 46	37 28	[48]	[50]
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)

(b) Fc1 Fc2; *om. cett.* **(c1)** 41′ $c. **(c2)** 25°59′ $c. **(c3)** 31° Lw; 25° $bn; 20° $ba. 43′ $c. **(c5)** 22° $ba. 9′ $c. **(c6)** 25° $ba. 57′: Ey $bn $ba; 17′ Lu Lw P Fj2; 37′ Fc1 Fc2; 43′ $c. **(c7)** 58′ $bn; 48′ $ba. **(d1)** 22° Lu Lw P Fj2. 12′: Ey $c; 11 $bn $ba, *cett.* **(d2)** 38′ $bn $ba; 18′ $c. **(d4)** 49′ $bn $ba. **(d5)** 26°25′ $ba. **(d7)** 43′ Fc1 Fc2; 48′ $c. **(e1)** 3′: Fc1 Fc2 $bn $ba $c; 8 *cett.* **(e2)** 33′ Fc1 Fc2. **(e3)** 33° $ba. 26′ Ey. **(e4-5)** 34°, 35° $ba. **(e6)** 36°38′ $ba. **(e7)** 40° $ba. 46′ Fj2. **(g1)** 3′: Fc1 Fc2 $bn $c; 4′ $ba; 8 *cett.* **(g3)** 26′ Ey. **(g7)** 54° $ba. **(h1)** 24° $ba. 12′: Ey $c; 11 $bn $ba, *cett.* **(h2)** 18′: $bn $c; 38′ $ba; 48 *omnes.* **(h4)** 49′ $bn $ba. **(h6)** 38′ $ba. **(h7)** 48′ $c. **(j1)** 19′ $bn $ba; 41′ $c. **(j2)** 25°59′ $c. **(j3)** 21° Lw. 12′ $bn; 43′ $c. **(j5)** 9′ $c. **(j6)** 57′: Ey Lu $ba; 37′ Fc1 Fc2; 17′ Lw P Fj2 $bn; 43′ $c. **(j7)** 25′ Fc1 Fc2; 48′ $ba. **(k-L)** Fc1 Fc2; *om. cett.*

SEPTE NTRIO		Occidens estivalis			OCCI DENS			Occidens hiemalis	(MERI DIES)
		Cnc	Gem Leo	Tau Vir	Ari Lib	Psc Sco	Aqr Sgr	Cap	
	Ho Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	
(1)	13 0	24 39	21 *12*	12 *3*	0 0	12 *3*	21 12	24 39	
(2)	13 30	26 0	22 *18*	12 39	0 0	12 39	22 *18*	26 0	
(3)	14 0	27 42	23 45	13 *27*	0 0	13 *27*	23 45	27 42	
(4)	14 30	29 48	25 29	14 23	0 0	14 23	25 29	29 48	
(5)	15 0	32 8	27 26	15 26	0 0	15 26	27 26	32 8	
(6)	15 30	34 57	29 33	16 33	0 0	16 33	29 33	34 57	
(7)	16 0	37 28	31 46	17 43	0 0	17 43	31 46	37 28	
	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	

(m1-5) 18, <*>, 18;30, 14, 14;30 $ba. **(n1)** 28° Fc2. 29′ Fc2; 30′ Lw; 41′ $c. **(n2)** 25°59′ $c. **(n3)** 12′ $bn; 43′ $c. **(n4)** 18′ $bn. **(n5)** 9′ $c. **(n6)** 36° $ba. 37′ Fc1 Fc2; 43 $c. **(n7)** 25′ Fc1 Fc2. **(o1)** 11′ Fc1 Fc2 $bn; 41′ $ba. **(o2)** 18′: $bn $c; 38′ $ba; 48 *omnes.* **(o3)** 25′ $bn. **(o5)** 26°27′ $bn $ba. **(o7)** 16′ $bn; 48′ $c. **(p1)** 3′: Fc1 Fc2 $bn $c; 8 $ba, *cett.* **(p2)** 19 $bn. **(p3)** 33° $ba. 27′: Fc1 Fc2 $bn $c; 24′ $ba; 26 *cett.* **(p5)** 36′ Fc1. **(p6)** 38′ $ba. **(p7)** 46′ Fj2; 23 $bn. **(r1)** 3′: Fc1 Fc2 $bn $ba $c; 8 *cett.* **(r2)** 19′ $bn. **(r3)** 27′: Fc1 Fc2 $bn $ba $c; 26 *cett.* **(r5)** 36′ $ba. **(s1)** 11′ Fc1 Fc2 $bn $ba. **(s2)** 18′: $bn $c; 38′ $ba; 48′ *cett.* **(s3)** 25′ $bn. **(s4)** 26° $ba. **(s5)** 36′ Lu. **(s6)** 38′ $ba. **(s7)** 48′ $c. **(t1)** 41′ $c. **(t2)** 25°59′ $c. 31′ $ba. **(t3)** 24° $ba. 52′ $bn; 43′ $c. **(t5)** 38′ $bn; 9′ $c. **(t6)** 36° $bn. 37′ Fc1 Fc2 $bn; 43′ $c. **(t7)** 24′ Lw.

JG. Lists of eclipses.

JG11. Cz,98v, no heading, at end of Toledan tables. List of 29 eclipses between AD 1285 and 1312. – *Sample:*

Anni	Me	Di	Ho	Mi	Puncta diam-et-ri	Mi	Puncta superfi-ci-ei	Mi	Tota ec lipsis Ho	Mi	Initium eclipsis Ho	Mi	Finis eclipsis Ho	Mi	
1285	3	4	28	28	5	46	4	25	1	44	4	36	6	20	Coniunctio
1286	2	9	50	50	2	50	1	56	1	42	6	0	8	0	Oppositio
.....					.....		.....		.....		.....		.....		....
1295	2	29	3	3	6	13	16	13	3	18	10	24	13	42	Oppositio
.....					.....		.....		.....		.....		.....		....
1312	9	13	14	14	18	20	18	20	3	20	12	34	15	54	Oppositio

A similar list is in ms. Cw (Bernkastel/Kues 214), f. 19r, after a set of Toulouse tables. It only contains 14 eclipses, for AD 1297-1312. The tabular values are the same as here except that the column "puncta superficiei" is absent. Note in the text-hand: "Anni Christi hic positi sunt imperfecti, et nota quod incipiunt a Martio. Nota etiam quod dies et menses sunt Christi, et sunt perfecti, et hore et minuta etiam, et ostendunt medium eclipsis".

K. Visibility of lunar crescent.

KA.

KA11. "Tabula apparitionis lunae...", Spanish, elsewhere attributed to one "al-Qallas".

Toomer 1968 p.13, from Ou (his Sa). – Same as Alkhwarizmi / Maslama, Suter Tab.57a p.168. – The table has been examined by E.S. Kennedy and M. Janjanian, *Centaurus* 11 (1965) 73-78; by King 1987 p. 192-197; and by Hogendijk 1988 p. 32-35.

Witnesses: **{k}** Ou,79r (see "Variant table" below); Lw,129r; **{d}** C,343; Lb,52v; Mh,18v; **{x}** Vz,80r. — Other separate copies: appended to canons Ca, see below; to canons Cb, see CbA.K; also, ms. Lo,6v (rows and columns inverted); Ch,205v. No doubt there are many other copies.

Attached to the apparition table OA11 in Lw C, using its entrance column. No typical context in Ou Lb Mh Vz.

Canon. A rule for this table, which is an extract of the Adelard translation of Alkhwarizmi / Maslama (ch. 22 Suter), is appended to canons Ca in a majority of the witnesses, and is reproduced as Ca198. The table itself may or may not be appended in these cases; see CaA00. The provenance of the rule makes it likely that the table, at least when coupled with canons Ca, is from the Latin version rather than from an Arabic one. – Another rule, in ms. C, is reproduced as CaC04.

Headings. – General: **Tabula apparitionis lunae de sub** (d.s.: debuh *(sic!)* Lb) **radiis solis** (*om.* Mh) :: C Lb Mh Vz; **T. a. l. secundum facies signorum** :: Lw; **T. primae a. l. post coniunctionem** :: Ou. – *Entrance column:* "Nomina signorum" Vz; "Facies" Mh (though meant for the following sub-headings); blank in Lb. The column is absent in Lw C. – *Body of table:* "Facies prima (p.f. Lb); Facies secunda; Facies tertia" Lb Mh Vz; "10 gradus, facies prima; ... (etc.)" C; "Facies [prima, secunda, tertia]" Lw.

Variant table: Ou,79r "Tabula primae apparitionis lunae post coniunctionem", sub-headings "Signa; Facies signorum; Distantia lunae a sole". All the faces are written in one column, one value against each. The values are standard.

Parallels. Alkhwarizmi / Maslama: see above. In the zij of Ibn Ishaq al-Tunisi (Tunis, early 13th c.; for the manuscript, see "Text"), a table with essentially the same values is ascribed to one al-Qallas, otherwise unknown (King p. 194; Mestres 1996 p.428-29, sec. 4.8, no. 160b).

Values. According to Hogendijk 1988 (q.v. for the analysis), the first half of the table is compatible with an obliquity and a terrestrial latitude of, e.g., (23;51°, ca. 41;10°), or else of (23;35°, ca. 41;35°). The former latitude has no known parallels, though the same set of parameters may be valid for the middle part of BH12 (Toomer 1968 p. 146; cf. Hogendijk p. 34). In the latter case, the latitude is documented for Zaragoza. In either case the table was no doubt made in Spain. – Hogendijk (1988 p.34) recomputes the entries for Aries to Virgo for obliquity 23;35° and latitude 41;35°, and mirrors the result into the values for Libra to Pisces. On the assumptions of King and Hogendijk, this symmetry is artificial; still it is shown by all witnesses.

Text. Collated for values: **{k}** Ou Lw; **{d}** C Lb Mh; **{x}** Vz. – Headings according to Lb. – Also quoted for values: **$km** = Khw/M, Suter *tab. cit.*, but citing mss. "C" and "O" only; **$is** = al-Tunisi, Hyderabad Andhra Pradesh State L. 298, ca. AD 1400 (King 1987 p. 194), quoted from King, Tab. 2, p. 195, cf. Plate 4, p. 196; **$c** = recomputation by Hogendijk; see "Values". Wherever any variants are recorded, $c is quoted too, if it differs from the accepted value; otherwise $c is quoted where it differs by 2" or more.

Readings chosen: The adopted values are generally those of $km, correcting gross errors from $c and from symmetry. Italics are used where all Toledan witnesses are in error (or all except Ou; cf. c7). – *Variant groups:* Distinctive errors are few. One (g6) is universal; one (d7) is common to $km and the Toledan tables; one (c2) is common to $km (ms. "C") and the Toledan tables; and one (c7) is apparently proper to the *Toledan witnesses apart from Ou*, but $km is uncertain because of a misprint in Suter. *Lb Mh Vz* may be an error group, cf. the coupled errors (d4/d9). C and Lw seem indeterminate. On the whole, the tradition appears to be derived from $km.

Tabula apparitionis lunae de sub radiis solis.

		Prima facies		Facies secunda		Facies tertia	
		Gr	Mi	Gr	Mi	Gr	Mi
(1)	Ari	9	26	9	25	9	21
(2)	Tau	9	*19*	9	18	9	21
(3)	Gem	9	33	9	57	10	37
(4)	Cnc	11	29	12	48	14	15
(5)	Leo	15	58	17	31	19	11
(6)	Vir	20	20	21	4	21	*17*
(7)	Lib	21	*17*	*21*	4	20	20
(8)	Sco	19	11	17	31	15	58
(9)	Sgr	14	15	12	48	11	29
(10)	Cap	10	37	9	57	9	33
(11)	Aqr	9	21	9	18	9	19
(12)	Psc	9	21	9	25	9	26
	(a)	(b)	(c)	(d)	(e)	(f)	(g)

(b5) 12 $is. **(b8-10)** 21 19 18 Mh. **(c2)** 19: $km.O $is; 18 $c; 29 $km.C, *omnes*. **(c3)** 32 Mh Lw; 35 $c. **(c4)** 33 $c. **(c5)** 38 $is. **(c7-10)** 25 27 11 15 Mh. **(+c7)** 17: Ou $km.O ?$km.C $c; 57 $is; 27 Mh(*ad c8*), *cett.* **(+c8)** 5 Lw; 10 $c. **(+c9)** 18 $c. **(+c10)** 57 $is. **(d4)** 21 Lb Mh Vz; 11 C. **(d5)** 14 $is. **(d7)** 21: $is $c; 40 Ou; 20 $km, *cett.* **(d8-10)** 20 17 21 Mh. **(+d8)** 14 $is. **(+d9)** 21 Lb Vz, Mh(*ad d10*); 11 C; 14 $is. **(e1)** 35 Lw; 24 $c. **(e2)** 28 Ou; 19 $is. **(e3)** 59 $c. **(e4)** 28 Ou; 44 Vz. **(e5)** 39 $c. **(e8-10)** 4 31 48 Mh. **(+e8)** 39 $c. **(+e9)** 43 $is. **(e10)** 59 $c. **(e11)** 28 Ou. **(f3)** =10 $km.C; 9 $km.O. **(f7)** 15 Mh. **(f8)** 16 $km.C.ac. **(g3)** 35 Mh; 57 $is. **(g4)** 18 $c. **(g6)** 17: $c; 7 Lw; 57 $km $is, *omnes*. **(g7)** 58 Mh. **(g8)** 54 Lw; 28 $is. **(g9)** 33 $c. **(g10)** 35 $c.

KA21. "Apparitio lunae in crepusculo...".

Two tables, one for sunset ("... in crepusculo") and one for sunrise ("...in diluculo"). The table for sunset is the same as King's "early Andalusian crescent visibility table" (King 1987 p. 197-207). This is known from some 8 Arabic witnesses, though till now from no Latin ones. King's judgment (p.207) that "this table takes the prize as the most corrupt table in the known medieval Islamic sources" is not contradicted by the present copies.

The attribution is uncertain. A copy is in a collection connected with Ibn Ishaq al-Tunisi, who lived in the early 13th century;[1] this comprises climates 3-5 only (King p. 194, 203; Mestres 1996 p.402; p.437, section 4.13.9, no. 160a; cf. KA11).

In the table for sunrise, the values for sign N are roughly those for sign N+6 in the sunset table (King p. 205). The sunrise table is absent from most of the Arabic witnesses.[2]

Witnesses: **{d}** Lb,61v. – **{x}** Vz,80v. — There is one more copy in Erfurt Q369 (=Ek), 141v, cf. T:03(3,Ek), within a miscellany of tables, some for Toulouse. This table has been collated too.

Headings. General: as shown, Lb; "Tabula apparitionis lunae in crepusculo in quolibet 7 climatum; T. a. l. in diluculo i. q. 7 c." Vz Ek. – Sub-headings: as shown, Lb; "Nomina signorum; Clima primum; ...; Clima septimum" Vz.

Text. Values from Lb Vz Ek. Headings from Lb.

The readings of Lb are mostly accepted, and no emendation is attempted. The values, to judge from their variation, are faulty even where Lb Vz agree.

Sunset table: The minute column (b) is a repetition of the degree column (a). For the rest of the sunset table I cite: **$k** = the majority reading from King's manuscripts[3] where it disagrees with the adopted reading; **$k.XYZ** = a minority consisting of King's manuscripts XYZ, where this agrees with the adopted reading, the majority (if any) being still quoted as "$k"; in this way, not all King's manuscripts need be represented. If the present reading agrees with exactly half of King's witnesses, no note is made. See King for references to the manuscripts. The readings that have no support in $k are underscored.

The sunrise table has much in common with the sunrise values that are, almost uniquely, found in King's ms. "N"; still, the differences are many and of uncertain significance, so variants are not cited.

King's recomputation, which assumes an obliquity of 23;51,20°, does not give a good fit (King, p.205 bottom), and is not cited either.

---

1 King p.203. – The manuscript is Hyderabad, Andhra Pradesh State Library, 298, cf. Mestres 1996. The source is unknown (Mestres sec. 4.13), and the manuscript itself is as late as about AD 1400. Another copy is in an 18th-century manuscript of at-Tabari (ca. AD 800; King p. 203 and Plate 6). The other witnesses appear to be of the 13th century or later.

2 It is present in another, incomplete, copy ascribed to Ibn Ishaq (King p. 205, "K" and "L" for the sunset and sunrise table, respectively), and in a manuscript from Yemen of about AD 1800 (King, "M" and "N", respectively).

3 From King 1987, full apparatus on p. 198-99; excluding L and N, which are for sunrise.

Apparitio lunae in crepusculo.

Ordo sign orum	Primum clima		Secun dum clima		Ter tium clima		Quar tum clima		Quin tum clima		Sextum clima		Septi mum clima	
	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi
Ari	12	12	11	4	11	19	10	6	10	17	9	9	9	18
Tau	11	11	11	24	10	13	10	21	10	52	8	18	9	8
Gem	11	11	11	11	10	8	10	12	9	29	9	24	9	3
Cnc	11	11	11	15	11	38	14	32	12	18	12	46	12	9
Leo	13	13	13	13	13	4	15	0	16	7	16	37	13	15
Vir	14	14	16	9	17	2	17	10	23	27	23	31	24	50
Lib	15	15	16	7	18	19	19	4	21	28	21	24	24	50
Sco	14	14	14	32	16	19	17	16	18	7	18	42	21	50
Sgr	12	12	13	39	13	18	14	42	13	31	13	2	12	31
Cap	11	11	11	15	11	21	11	36	11	0	11	9	11	45
Aqr	11	11	11	51	10	2	11	4	9	15	9	7	9	15
Psc	11	11	11	11	11	9	10	9	9	11	9	0	8	14
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)

(a Ari) 12: $k.DEFM, *codd.;* 11 $k. **(a Leo)** 13°: Lb Ek; 11 Vz. **(a Lib)** 15: Lb $k.BCM; 13 Vz Ek; 14 $k. **(b)** *cf. col. (a);* 24 11 2 10 14/10 27/?? 2 12/?? 0 10 3 24 $k. **(d Vir)** 9: $k.FM, *codd.; alia* $k. **(d Aqr)** 51: Lb; [[1]]51 Ek; 53 Vz; *alia* $k. **(f Lib)** 19: Lb; 18 Vz Ek. **(h Tau)** 21: Lb; 12 Vz; 1[[0]]2 Ek. **(h Gem)** 12: 22 Ek. **(h Cap)** 36: *codd.;* 26 $k.BCDEFG; *alia* $k. **(k Tau)** 52: Lb $k.DEF; 22 Vz Ek; 12 $k. **(k Cnc)** 25 $k. **(k Leo)** 7: $k.C, *codd.;* 50 $k. **(k Sco)** 7: $k.DEFM, *codd.;* 2 $k. **(k Aqr)** 15: $k.CGI; *alia* $k. **(L Lib-Sgr)** *cf. col. (j);* 22, 19, 14 $k. **(m Ari)** 9: Vz Ek; *n.l.* Lb. **(m Vir)** 21 $k. **(n Cnc)** 12: Lb Ek; 11 Vz. **(n Aqr)** 9: Lb; 19 Vz Ek. **(n Psc)** 8: Lb; 18 Vz Ek. **(o Gem)** 3: Lb Vz.pc Ek; 9 Vz.ac. **(o Lib)** 30 $k.DE; 1 $k. **(o Sco)** 50: 30 $k.M; 2 $k. **(o Sgr)** 31: Lb; 30 Vz Ek.

Apparitio lunae in diluculo.

Ordo sign orum	Primum clima		Secun dum clima		Ter tium clima		Quar tum clima		Quin tum clima		Sextum clima		Septi mum clima	
	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi
Ari	15	4	16	6	18	19	19	14	21	8	22	35	24	1
Tau	14	42	14	32	16	19	17	16	18	7	10	42	21	22
Gem	13	0	13	39	13	18	14	21	13	31	12	12	14	31
Cnc	11	10	11	12	11	21	11	37	11	0	11	9	11	45
Leo	11	24	11	1	10	42	11	9	9	15	9	10	9	58
Vir	11	29	11	11	10	9	10	9	9	18	9	0	8	54
Lib	11	10	11	4	10	39	10	40	10	40	8	9	9	58
Sco	11	10	11	24	10	3	10	21	12	52	9	18	9	28
Sgr	11	9	11	41	10	8	10	42	9	29	9	27	9	4
Cap	11	4	11	15	11	38	12	32	12	20	12	16	12	9
Aqr	13	10	13	23	13	5	15	0	17	7	16	17	18	15
Psc	14	27	17	35	17	2	17	10	23	27	23	21	29	14
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)

(b Vir) 29: Lb; 20 Vz Ek. **(b Sgr)** 9: Lb; 10 Vz Ek. **(b Aqr)** 13 $k.N. **(f Gem-Cnc)** 18,21: Lb; 21,42 Vz Ek. **(g Vir-Sgr)** 10...10: Lb; 11..11 Vz Ek. **(L Tau)** 19/10 Ek. **(L Lib-Sco)** 8,9: Vz; 9,8 Lb Ek. **(L Sgr-Cap)** 9,12: Lb; 12,11 Vz. **(n-o Lib-Psc)** *vix leg.* Lb. **(+o Vir)** 58 Ek. **(+o Sco)** 58 Ek.

KB. Tables connected with the rule CbA.K11.

KB11. "Reflexio lunae".

Table showing values of 24*cos(x). For lunar crescent visibility.

Witnesses: **{a1}** Fc,60r. — **{aX}** Vd,12v. — **{d}** Pa,49r; A,228r; Fj,50r; Nc,121r; Pv,34r; Fd2,51v; Gr3,122r.

Context. Occurs in the series KB11 KB21 KB31 in all mss. except Vd; this series is placed among eclipse tables (after JA31 and before JA21 JE21 JC11 in all mss. except Fc Vd Pv).

Canon: probably the "Primi homines qui voluerunt ostendere apparitionem", reproduced as CbA.K11; this rule mentions a "tabula reflexionis lunae" with "medietatem primam / secundam linearum numeri communium". The "second half" is said to comprise 90°-270°.

Headings. There is no general heading. Sub-headings: as shown, Fc Vd Pv; "Lineae numeri communes; Reflexio lunae" Pa A Fj Nc Fd2 Gr3.

Parallels. A table for "parallax", but showing 24*sin(x), is in Habash (Kennedy 1956 p. 154; comment by Kennedy 1956a p. 42-43 and Debarnot 1987 p. 60 (ad 213r)). This may not be relevant.

Text. Collated for values: **{a1}** Fc; **{aX}** Vd; **{d}** Pa A. — Headings according to Fc.

The values listed are the computed values of 24*cos(x). One of the general errors (d110) is of Abjad type.

Lineae numeri	Lineae numeri	Reflexio lunae	
		Mi	Se
0	360	24	0
10	350	23	38
20	340	22	33
30	330	*20*	47
40	320	18	23
50	310	15	26
60	300	12	0
70	290	8	13
80	280	4	10
90	270	0	0
100	260	4	10
110	250	8	*13*
120	240	*12*	0
130	230	15	26
140	220	18	23
150	210	20	47
160	200	22	33
170	190	23	38
180	180	24	0
(a)	(b)	(c)	(d)

(b0) 0 Pa. **(c30)** 20: 22 Fc Vd Pa A. **(c120)** 12: 15 Fc Vd Pa A. **(d110)** 18 Fc Vd Pa A. **(d150)** 27 A.

KB21. Parallax for lunar visibility, for Cordoba?

The rule CbA.K11 is stated to be valid for Cordoba; this fits the values of the present table.

Witnesses: **{a1}** Fc,60r; **{d}** Pa,49r; A,228r; Fj,50r; Nc,121r; Pv,34r; Fd2,51v; Gr3,122r. – *Context:* as for KB11. Not in Vd.

Canon: CbA.K11 (cf. for KB11), mentioning Cordoba. The reference is: "...accipies diversitatem aspectus in longitudine et latitudine in illa tabula in qua scribitur 'Diversitas aspectus lunae in longitudine et latitudine apparitionis lunae',[1] vel in alia(?) tabula ubi sit diversitas aspectus lunae facta ad occasum solis in illa vila". Thus the table presupposed by the rule should be for the parallax of the moon at sunset, in conjunction or just after.

Headings. A main heading, such as that quoted by the canon above, is absent. – Sub-headings: **Signa** (=Fc Pv; **/Nomina signorum** *cett.*); **Minuta longitudinis; Minuta latitudinis.**

Values. The horizontal parallax in altitude derived from the values is about 55.9′, corresponding to a lunar distance of about 61.5 earth-radii; cf. preamble to H*. This is comparable to the standard values (ibid.), though not a very precise estimate, and it does not fit any particular configuration in syzygy.

I have, however, tried to recompute the tabular values as if for conjunction (cf. note to H*), using the altitude parallax of 55.9′, the terrestrial latitude of 38°30′ and the obliquity 23°51′, and rounding the results in the normal way. This reproduces the tabular values almost perfectly, with only one or two slight deviations when discounting gross errors. The recomputed values are quoted as "$c" below. Recomputation with latitudes 38°15′ or 38°45′, or with obliquity 23°33′, gives a few further deviations in all cases.

The likely latitude of 38°30′ suggests that Cordoba, mentioned in the rule CbA.K11, is in fact the place intended: indeed, this is a common latitude for Cordoba, perhaps connected with Maslama (see note to BH11, "Values").

Text. Collated for values: **{a1}** Fc; **{d}** Pa A. – Headings according to Fc. – Also quoted: **$c** = recomputation; see "Values" above. All deviations quoted. – I follow $c against the witnesses where this entails correcting an asymmetry; these places are italicized. Where this is unsafe to do, I keep the reading, and underscore it.

Signa	Minuta longitudinis	Minuta latitudinis
Ari	54	14
Tau	*53*	18
Gem	49	27
Cnc	41	38
Leo	*33*	45
Vir	28	49
Lib	26	<u>49</u>
Sco	28	*49*
Sgr	33	45
Cap	41	38
Aqr	49	27
Psc	53	<u>17</u>
	(a)	(b)

(a Tau) 53: $c; 58 Fc Pa A. **(a Leo)** 33: $c; 43 Fc Pa A. **(b Lib)** 50 $c. **(b Sco)** 49: $c; 45 Fc Pa A. **(b Psc)** 18 $c, *cf. (b Tau).*

---

1 A parallel to the title is the table of "Lunar parallax for visibility of the crescent" by Habash, quoted by Kennedy 1956 p. 152b, from Berlin <Ahlwardt> 5750, f. 153. This table is, however, different from both KB11 (where see note) and KB21.

KB31. Interpolation table?

Witnesses: **{a0}** Ey,63r; **{a1}** Fc,60r; **{d}** Pa,49r; A,228r; Fj,50r; Nc,121r; Pv,34r; Fd2,51v; Gr3,122r; **{e}** Eq,82r (m2). — *Context:* In Ey the table is attached to JA11 + JC11, sharing their entrance. In Eq, too, the values are secondarily attached to JC11. The rest of the witnesses shows it in the sequence KB11 KB21 KB31, for which cf. the notes to KB11.

The canon mentioned under KB11 does not refer to the present table. It is asymmetrical, with value 0 at 96°, in all witnesses consulted. If in fact it is intended to be symmetrical, one may guess that it shows the lunar latitude for (90° - the argument), in which case it is analogous to FB11.Par. Its purpose, however, remains obscure.[1]

Headings. — *Main heading,* only in Fd2 and Nc: **Tabula proportionis sive directionis** (+lunae Nc). — *Entrance:* "Lineae numeri communes"; none in Ey Eq. — *Body:* "Minuta directionis" normally, but "Minuta proportionalia" Ey Eq; "Minuta directionis vel minuta proportionalia ad (in Nc) eclipsim solis" Fd2 Nc.

Text. Collated for values: **{a0}** Ey; **{a1}** Fc; **{d}** Pa A. — Headings according to Fc. — Not recomputed. There are no variants in the tabular values.

Lineae numeri communes		Minuta directionis
6	354	5
12	348	5
18	342	5
24	336	5
30	330	5
36	324	4
42	318	4
48	312	4
54	306	3
60	300	3
66	294	3
72	288	2
78	282	2
84	276	1
90	270	1
96	264	0
102	258	1
108	252	1
114	246	2
120	240	2
126	234	3
132	228	3
138	222	4
144	216	4
150	210	4
156	204	5
162	198	5
168	192	5
174	186	5
180	180	5
(a)	(b)	(c)

(b30) 300 A. **(b72)** 388 A.

1 It may be thought to resemble Azarchel, Almanac, table 22 (p.173 Millás), for equation of the moon, column "Lo que monto a un grado dell argumento". This is asymmetrical in the same general way. I have not found any clue to the use of this table either.

L. Fixed stars.

LA.

Summary of datings of LA11, LA12, LA13 and LA13a. For details, see the notes to the single tables.[1] — Conspectus of main features, including increments in ecliptic longitudes relative to the Almagest, and datings that are visible in table headings or obtained from elsewhere:

Table	Increment	Ostensible dating	Other
LA11	+14; 7°	none	AH 459 (AD 1066-67) from parallels
LA13a	+14;55°	AAlex 1422 (~AD 1110-11)	Subset of LA13
LA13	+14;55°	none	Superset of LA12 and of LA13a
LA12	+14;55°,+15;7°	AH 577 (~AD 1181-82)	Subset of LA13, partly updated. True date perhaps AD 1132-33.

LA12 and LA13a are both derived from an Arabic table that was ordered like LA13 (Pedersen 1994), and the values are the same except for the partial updating of LA12. These three tables are independent translations; so if their common increment can be dated, the dating is likely to belong to their common Arabic original.

Such a dating, of AD 1181-82 in agreement with the reading of LA12, was proposed by Millás (1950 p. 69 n.1); to this end he corrected the dating of LA13a into Seleucid year "1492", same as AD 1180-81 ("1181-1182" Millás).

An alternative, following a suggestion by Kunitzsch, is to keep the dating of LA13a at Seleucid year 1422 = AD 1110-11; to correct the dating of LA12 to AH 527 = AD 1132-33; and to assign this date to the increment of 15;7°. If so, the increment will be exactly 1° greater than in LA11, at a time that is 68 lunar years later, in accordance with the standard Islamic precession rate of 1 degree per 66 solar years.[2] Hence the increment of 15;7° will be consistent with LA11 but unconnected (and apparently inconsistent) with the common increment of 14;55°; and the dating of the latter will only depend on the dating of LA13a.

Millás's corrected dating of LA13a, if true, would also have to fit LA13, as the increment is the same in both cases. In the only manuscript (=Ct), LA13 belongs to an archaic translation of the tables, lacking some Christian revisions; but the 1180s would appear rather late for such a translation. Further, no doubt LA13a and LA13 are independent translations, as was said above; so their common increment belongs to some Arabic originals, and if the dating was valid for these, the translation would have to be later still. On the other hand, ms. Ct shows glosses reflecting Arabic material of AD 1106-10 (see T:01(8)); this is loosely connected with the tables, but the dating agrees very well with the uncorrected dating of LA13a.

Thus **AD 1110-11** will here be accepted as a likely date for the increment of 14;55°, and thus presumably for the common Arabic original of LA13, LA12 and LA13a.

---

1 For the notes to LA11-LA13a I am much indebted to correspondence with Prof. Paul Kunitzsch during November 1994, on the occasion of my article on LA13 in CIMAGL 64. I have used his comments extensively; any errors are mine.
2 It is, to be sure, a conjecture that precession was put into use for updating the tables. An alternative such as the "Thebit" trepidation, known to have been employed by Azarchel, may also have come into play; but such an assumption seems even more difficult to verify than the former one, so it will not be considered further.

LA11. Kunitzsch Type XII, 40 stars, ecliptical (+14;7°).

Toomer 1968, no. 82, p.125-127, printed from Wd (Toomer's "V") and from O (his "L"); for the latter see LA13. – List of 40 or 41 stars, showing: name of star, longitude, latitude, and direction of latitude. The values are those of the Almagest, plus 14;7° (Toomer p.123).

Other editions: Zinner 1936 p. 755-56, from ms. Wd. – Millás 1950 p. 70, presumably from Md, 101v, but incomplete (cf. Kunitzsch 1966 p. 75(i)). – Poulle 1956 p. 309-13 (list of cooordinates, from R Xw Py). – Kunitzsch 1966, Typ XII (esp. p. 78-79), from ms. Mg,70r (his "e") and 16 other mss. as listed *ibid.* p. 75-76, with extensive commentary and parallels not quoted here.

Witnesses: **{a0}** Ct,25v; Oo,31v; Cq2,101; Pz,128v; Mc,26v; Mb,65v. – **{a1}** Xa,36r; Ad,84r; Cq,64; Fc,50v; Fc,82v; Ps,78v; Sg,183; Wd,36r; Fh,65v; Xw2,37r. – **{a2}** Cz,93v-94r; Cj,165r (stars no. 10-40); Md,101v; Vp,139r-v. – **{aX}** R,58r; Ov,108v. – **{aT}** Lu,80v; P,112v. – **{k}** Eh,110v-111r. – **{d}** Pa,74v; A,249v-250r; Fj,91v-92r (with 4 extra stars); Fd2,59v; Ok,67v. – **{e}** Gr,67v; Eq,86v; Ek3,112v; Xc,81r; Vj,104v; Ej,87v; Vm,16r. – **{?}** Da2,214r (with CE40); Py,46v. — Duplicate in {a1:} Fc. Variant in {?:} Vd2, see LA11a below. – Probably lost from {a2:} Mp; see T:03(2,Mp).

Canons. CcE31 and Cb209 quote the sub-tables as they stand here, and are no doubt meant for this table. Cb230 is just a brief reference.

Headings. – General:

(1: none) :: {a0:} Ct Oo Pz Mc Mb; {a1:} Xa Ad Cq Fc(50v) Sg Wd Fh; {a2:} Md; {aX:} R; {?:} Da2 Py.
(2) Tabula stellarum fixarum :: {aX:} Ov; {aT:} Lu P; {d:} Pa; {k:} Eh.
(3) Tabula (-ae Fc) **locorum stellarum fixarum in longitudine et latitudine** (e.l.: longiore Fd2) :: {a1:} Fc(82v) Xw2; {d:} A Fj Fd2.
(4) Tabula de longitudine et latitudine stellarum fixarum (s.f.: *om.* Cj; +famosarum Ej (:second copy); +scilicet famosarum Vm) :: {a2:} Cz Cj Vp; {e:} Xc Vj Ej Vm.
(5) Tabula longitudinis et latitudinis stellarum fixarum :: {e:} Gr Eq Ek3.
(6: other) :: Cq2 ("Tabula longitudinum et latitudinum signorum (!)"; Ps ("Tabula longitudinum et latitudinum, quae sunt elongationes stellarum fixarum ab aequinoctiali linea (!)"); Ok ("Tabula stellarum fixarum et earum latitudinum ab ecliptica, et sunt ibi gradus cum quibus mediant caelum", apparently taken over from another star-list).

Names: **(7) Nomina stellarum fixarum** :: normally. – **(8) Nomina stellarum** :: {a1:} Xa Wd; {d:} Pa Ok; {e:} Gr Eq Ek3 Xc Vj Ej Vm. – **(9: other)** :: Ov ("Stellae fixae"); Eh (none).

Sign in zodiac: **(10) Signa** :: normally, alone or as a sub-heading for the following. – **(11) Nomina signorum** :: {a0:} Ct; {a1:} Fc(82v) Xw2; {a2:} Cz Cj Vp; {aX} R; {d:} A Fd2; {e:} Xc Vj Ej Vm.

Degrees of longitude and latitude: **(12) Longitudo** (blank in Xw2); **Latitudo** :: everywhere.

Latitude, direction: **(13) Pars** :: {a0:} Ct Oo Cq2 Pz; {a1:} Ad Cq Fc(82v); {aX:} Ov; {e:} Gr Eq Xc Vm; {?:} Da2 Py. – **(14) Pars** (+ipsius R) **orbis** :: {a0:} Mc Mb; {aX:} R. – **(15) Pars mundi** :: {a2:} Md Vp; {aT:} Lu P; {k:} Eh. – **(16) Pars numeri** (nu()merida *(sic!)* Xa) :: {a1:} Xa Sg Wd; {a2:} Cz Cj; {e:} Ek3 Vj Ej. – **(17) Partes** :: {a1:} Ps Fh; {d:} Pa A Fj Fd2 Ok. – **(18: none)** :: Fc(50v) Xw2.

Versions. Normally the table contains 40 stars, omitting no. 20a. The latter is present in **a:** Fc(82v) Xw2; **d:** Pa A Fj Fd2, in the place shown.[1] These, then, have 41 stars as listed below. In Fj, 3 more stars are appended at the end: these look like repetitions of no. 02, 03 and 05, though with different labels. – Of the rest, **e:** Gr Eq lack no. 40. Other irregularities are in P Cj Ok, singly.

Parallel tables, and dating. Our table has a close cognate in an Arabic star-list published by Kunitzsch from Istanbul Aya Sofya 2671, 148v (Kunitzsch 1980 p. 196-200). It has 37 stars, which are the same as those below except no. 29 and 38-40 (but including no. 20a); and the longitudes and latitudes are the same as here. It occurs in an anonymous treatise on the astrolabe, and carries the date *AH 459 = AD 1066-67*. The treatise has been ascribed to Azarchel on account of the dating; there is, however, much

---

1 Also present in the copy of LA11 in Wien 5311 (Wg),130ra (Kunitzsch 1966, XIIm, p.75), with the longitude Cnc 18;57° to be expected from the Almagest value (see apparatus to LA11 (c20a)). I have not seen this longitude elsewhere. For two other occurrences, see LA11c.

conflicting evidence on observations by Azarchel from about this time, not useful to repeat here.[1] — The Istanbul manuscript is here designated as **$s.** For similar witnesses, see "Text" below, $s.PC.

If the increment of 14°7′ over Ptolemy is taken as a "Thebit" trepidation value since AD 138, this would take us to AD 1062 (Gingerich / Welther 1977 p. 152), which fits the dating of the Istanbul table well enough. There is, however, no evidence that the increment has been obtained in this manner.

Text. Collated for values: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** Lu; **{d}** Pa A; **{e}** Eq Xc. — Headings and star-names according to Xa.

Layout, etc.: The tables of Ct Oo Xa Cq Pz Xc are in two parts, 20 items to each. Pa divides after no.32. The table of Eq is in one piece, but to judge from the displaced items collected after no. 20, an earlier version was in two equal parts.

Compared for tabular values: **$s** = Istanbul Aya Sofya 2671, 148v, as reported by Kunitzsch; see "Parallel tables" above. For each star I add the number it has in Kunitzsch's edition.

$s.PC: copies similar to $s, namely: **$s.P:** Paris BN ar. 4824, 4v, printed in Kunitzsch 1966 p. 83 as Type XII A; cf. *ibid.* p.78, "A)". **$s.C:** Cairo, Dar al-Kutub, miqat 647. The longitudes in both of these are incremented by 13′ or 15′ relative to $s and the present table. The readings are reproduced from Kunitzsch's apparatus, *loc. cit.* (1980) p. 199-200; the longitudes are noted as for $d, below. Readings (or reduced longitudes) that agree with $s are not quoted.

Also quoted: **$d** = the majority of the Arabic tradition of the Almagest according to Kunitzsch 1986+ vol. III (1991). Longitude values are quoted as "*variant* (*ex* 99°99′)", where 99°99′ is the longitude listed by Kunitzsch, and *variant* is the longitude expected here, found by adding 14°7′ to Kunitzsch's value. Minority readings among Kunitzsch's sources, whether from Arabic sources or from elsewhere, are noted if they agree with our text; otherwise they are ignored. Such minorities are noted as "$d.xyz", where "xyz" are Kunitzsch's symbols for sources.

Readings chosen. For the values I generally follow the majority of Ct Oo Pz Xa Cq. I underscore readings that disagree with all versions of $d, or with all versions of $s, or with both.[2] One reading adopted against the majority of Ct Oo Pz Xa Cq is italicized.

The names of the stars show very many variants. I reproduce the names shown by Xa and (in the appendix) the names in Ct, ignoring the rest, except that names that differ from those of Xa (not just abridgments or variants in spelling) are recorded in the apparatus.

For "Sep, Mer" Ct has "septentrionalis, meridiana"; Pz has "minuta, secunda" (!) for no. 1-20, just "m, s" for the rest. Xa Lu Cq Pa show varying abridgments. I have not checked the rest.

References to Baily's catalogue are added; they are rarely in doubt, except that no. 20a, 32, 39, 40 are unidentifiable from their longitudes. I cannot explain these cases.

Variant groups. The translation of the star names in *Ct*, printed at the end of the present section, is independent of the rest of the Latin witnesses.[3] In addition, Ct's numbers are a little more correct than the others. Thus, Ct may be an independent transcription from the Arabic as concerns the numbers too. However, Ct and the rest of the collated witnesses still have many errors in common, mostly of Abjad type; these, then, are likely to have been in the Arabic archetype.

---

1 In a copy of Azarchel's Saphea in the Istanbul manuscript, a note says that the author composed a star table for AH 459 by adding 2°37′ to the values of Albattani (so that they would be the Almagest ones plus 13°47′: see Kunitzsch 1980 p. 192). This value neither fits the present table nor the one that actually accompanies the Saphea in the manuscript mentioned. — For other attempts at dating, and other precession values ascribed to Azarchel, see, e.g., Zinner 1936 p. 762 and 766-67; Millás 1950 p. 11 (on Abu-l-Hassan of Marrakesh); *ibid.*, p. 296, 298, 305; Mercier 1976 p.201-4, 209-10; Mercier 1977 p. 71; Richter-Bernburg 1987 p. 388 and note 88.

2 Thus, incidentally, (e11) is underscored although the reading is correct.

3 Kunitzsch, privately.

Generally the witnesses agree well, leaving no doubt about what the majority readings are. Two readings where *Ct (Oo Pz)* are confirmed as valid from $d are adopted and italicized. Slight traces of error groups comprise *Cq Eq* (d14-15), *Eq Xc* (e13-14), and *Pa A* (e03).

Compared to the witnesses adduced by Kunitzsch for his concordance (1986+, vol. III p. 8 ff.), the text, not surprisingly, turns out to follow the Arabic tradition rather than the Greek one. Of the Arabic witnesses, Kunitzsch's "b" and "d" (of al-Hajjaj's Almagest translation) have several errors in common with our text (c16, d26, e24; less significantly, d14, f23). The witness "d", at least, is Western Arabic (Kunitzsch, *op. cit.* I (1986) pp. 6, 9), but so are some of the others adduced, so conclusions must be postponed.

	Nomina stellarum	Signa	Longitudo Gr	Longitudo Mi	Latitudo Gr	Latitudo Mi	Pars	Baily	$s	
(01)	Cor tauri	Tau	26	47	5	10	Mer	393	01	α Tau
(02)	Pes Orionis	Gem	3	57	31	50	Mer	768	02	β Ori
(03)	Alaaioh	Gem	9	7	22	50	Sep	222	03	α Aur
(04)	Humerus Orionis	Gem	16	7	17	0	Mer	735	04	α Ori
(05)	Alaabor	Cnc	1	47	39	10	Mer	818	05	α CMa
(06)	Algomeisa	Cnc	13	17	16	10	Mer	848	06	α CMi
(07)	Cor leonis	Leo	16	37	0	10	Sep	469	07	α Leo
(08)	Cauda leonis [?]	Vir	8	37	11	50	Sep	488	08	β Leo
(09)	Arameh id est lanceator	Lib	*11*	7	31	30	Sep	110	10	α Boo
(10)	Alahzel id est inermis	Lib	10	47	2	0	Mer	510	09	α Vir
(11)	Vultur cadens	Cap	1	27	62	0	Sep	149	11	α Lyr
(12)	Vultur volans	Cap	17	0	29	10	Sep	288	27	α Aql
(13)	Os piscis meridiani	Aqr	21	7	23	0	Mer	670	12	α PsA
(14)	Caput mulieris	Ari	1	37	26	0	Sep	315	13	α And
(15)	Caput algol	Tau	13	47	23	0	Sep	202	14	β Per
(16)	Humerus Orionis sinister	Gem	4	27	17	50	Mer	736	16	γ Ori
(17)	Palma retinentis habenam	Gem	16	37	20	0	Sep	223	17	β Aur
(18)	Caput geminorum antecedens	Cnc	7	27	9	40	Sep	424	18	α Gem
(19)	Caput geminorum subsequens	Cnc	10	47	6	15	Sep	425	19	β Gem
(20)	Collum leonis	Leo	16	17	8	50	Sep	467	20	γ Leo
(20a)	Latus levantis caput gol	Tau	19	20	30	0	Sep	197	15	α Per
(21)	Alfard id est singularis	Leo	14	7	20	50	Mer	905	21	α Hya
(22)	Praecedens azubeneyn	Sco	2	7	0	40	Sep	529	22	α^2Lib
(23)	Subsequens eius	Sco	6	17	8	30	Sep	531	23	β Lib
(24)	Cor scorpionis	Sco	26	47	3	0	Mer	553	24	α Sco
(25)	Genu sagittarii	Cap	1	7	18	0	Mer	593	25	α Sgr
(26)	Cavilla sagittarii	Cap	1	52	23	0	Mer	592	26	β^1Sgr
(27)	Cauda gallinae	Aqr	23	17	60	0	Sep	163	28	α Cyg
(28)	Humerus equi	Psc	16	17	31	0	Sep	317	29	β Peg
(29)	Collum corvi	Vir	28	27	19	40	Mer	929		ε Crv
(30)	Cor piscis	Ari	18	0	26	20	Sep	346	30	β And
(31)	Septentrionale cornu anath	Ari	21	47	8	20	Sep	363	31	β Ari
(32)	Onath terre	Tau	1	2	28	0	Sep	349	32	γ And
(33)	Cavilla dextera	Gem	9	47	8	0	Sep	230	33	β Tau
(34)	Lucidum alhanna	Gem	28	47	10	50	Mer	441	34	ξ Gem
(35)	Caput alkau	Sgr	8	37	36	0	Sep	234	35	α Oph
(36)	Cageala equi	Aqr	19	20	22	50	Sep	331	36	ε Peg
(37)	Summitas caudae caitoz	Psc	19	47	20	20	Mer	733	37	β Cet
(38)	Cauda scorpionis	Sgr	11	37	13	7	Mer	565		λ Sco
(39)	Sagitta sagittarii	Sgr	16	28	2	50	Sep	574		μ Sgr
(40)	Oculus sagittarii	Sgr	25	58	0	*45*	Sep	577		ν^2Sgr
	(a)	(b)	(c)	(d)	(e)	(f)	(g)			

(07-09) *post (20)* Eq. **(20a)** Pa A; *om.cett.* **(40)** *om.* Eq.

(a10-20) ala.i.e.i. -- c.g.s., col.l.: lanceator, ala. -- c.g.s. Eq; lanceator, ala. -- (c.g.s. + col.l.) Xc. **(a18)** cor g.a. Eq. **(a20a)** caput gol: *in mg.* Pa. **(a29)** oculum (!) c. A. **(a25-36)** gen.sag. -- cag.equ., sum.cau.cai.: genu scorpionis, gen.sag. -- cag.equ. Cq. **(a34)** a.: allianna Xa. **(b24-40)** Sco, Cap--Sgr: Cap--Sgr, Sco Oo. **(c01)** 16 Cq. **(c02)** 13 Cq. **(c09)** 11: Ct Oo Pz, $d (*ex* Vir 27°0′), $s; 21 *cett.*

(c10) 20 Lu. **(c16)** 4°(27′): *omnes, ut* $d.bdL (*ex* Tau 20°20′; 24°0′ $d *plerumque*), $s. **(c20a)** 18°(57′) $d (*ex* 4°50′); 19°(0′) $s. **(c24)** 16 Xc. **(c30)** 18°(0′): $s, *cett.;* 17°(57′) $d (*ex* 3°50′). **(c32)** 0°(57′) $d (*ex* Ari 16°50′); 1°(0′) $s. **(c39)** 20°(47′) $d (*ex* 6°40′). **(c40)** 29°(17′) $d (*ex* 15°10′). **(d01)** 17 Pz. **(d12)** 0: $s, *cett.;* 7 Cq.?ac; 57 $d (*ex* 3°50′). **(d13)** xxxvii Cq.ac. **(d14)** 37: *ut* $d.bd (*ex* Psc 17°30′; 17°50′ $d *plerumque*), $s; 47 Cq Eq; 57 *ut vid.* $s.PC (*ex* ?). **(d15)** 27 Cq.ac; 37 Cq.pc Eq. **(d16)** *cf. ad (c16);* 37 Cq.?ac. **(d17)** 37: $s $s.P (*ex* 50), *cett.;* 57 $d (*ex* 2°50′); *alia* $s.C. **(d20a)** *cf. (c20a).* **(d26)** 52: *ut* $d.bd (*ex* Sgr 17°45′; 17°40′ $d *plerumque*), $s. **(d30)** *cf. (c30).* **(d31)** 47: *in ras.* Pa. **(d32)** *cf. (c32).* **(d35)** 37: $s, *cett.;* 57 $d (*ex* Sco 24°50′). **(d36)** 20: $s, *cett.;* 27 $d (*ex* 5°20′), $s.PC (*ex* 19°40′). **(d39)** *cf. (c39).* **(d40)** *cf. (c40).* **(e03)** 32 Cq; 27 Pa A. **(e05)** 19 A. **(e09)** 31: Ct Oo Pz Lu $d $s; 21 Xa Cq Pa A Eq Xc $d.BC.mg. **(e11)** 62: *recte;* 42 $s $s.PC. **(e13)** 33 A Eq Xc. **(e14)** 36 Eq.?pc Xc. **(e16)** 27 Pz. **(e24)** 3: *ut* $d.bd, $s; 4 $d *plerumque.* **(e32)** 20 Pa *ut vid.* **(e33)** 5°(0′) $d $s.PC; 5°(8′) $d.d; 0°(0′) $s. **(f02)** 30 $d $s. **(f03)** 30 $d $s. **(f16)** 30 $d $s. **(f19)** *n.l.* Cq. **(f20)** 30 $d $s. **(f21)** 30 $d $s. **(f23)** 30: *ut* $d.bdL, $s; 50 $d *plerumque.* **(f34)** 30 $d $s. **(f36)** 30 $d $s. **(f37)** *n.l.* Cq. **(f38)** 20 $d. **(f40)** 45: Ct $d; 47 Cq; 42 *cett.* **(g10)** mer: $s.PC, *cett.;* (sep) $s. **(g38)** sep Oo.

LA11: Star-names in ms. Ct. — Ct,25v shows a fuller version of the star-names than that reproduced above. It is listed here for reference; for the tabular values see above. Incorporating several readings suggested by Kunitzsch (privately, 1994).

```
(01)  Addabaran                    id est cor tauri
(02)  Regl Algebbar                id est pes Herculis
(03)  Alaaioc
(04)  Mankab Algebbar              id est humerus Herculis
(05)  Alaabor                      id est filius (!) moriens
(06)  Algumeisa                    id est vivens
(07)  Calb alaced                  id est cor leonis
(08)  Assarfah                     id est cauda leonis
(09)  Arramih                      id est arthophilax id est lanceator
(10)  Alaazal
(11)  Annecr aluache               id est vultur cadens
(12)  Annecr atthair               id est vultur volans
(13)  Os piscis meridiani
(14)  Ras almarah                  id est caput mulieris
(15)  Ras algol                    id est caput algol
(16)  Menkab algebhar alisar       id est humerus Herculis sinister
(17)  Kaf mumcic aliinen           id est palma retinentis habenas
(18)  Caput geminorum precedens
(19)  Caput geminorum subsequens
(20)  Onoc alced                   id est collum leonis
(21)  Alfard                       id est singularis
(22)  Mucaddam azubenain           id est praecedens
(23)  Almuagbar minhu              id est succedens
(24)  Cor scorpionis
(25)  Rocbat arrami                id est genu sagittarii
(26)  Orcob arrami                 id est cavilla sagittarii
(27)  Cauda galline
(28)  Menkab alfaras               id est humerus equi
(29)  Onoc algurab                 id est collum corvi
(30)  Cor piscis
(31)  Cornu arietis septentrional(is)
(32)  Onac alard
(33)  Alorcob alaima()             id est cavilla dextera
(34)  Munir alhanaa
(35)  Ras alhawi                   id est caput effeminati
(36)  Kagealat alferaz
(37)  Tharf deneb caithos          id est summitas caude eius
(38)  Saulat alaacrab              id est acus scorpionis
(39)  Nussebat arrami,             sagitta sagittarii
(40)  Ain arrami                   id est oculus sagittarii.
```

LA11*. Tables with the same values as LA11.

LA11a. Vd2,61r "Tabula locorum stellarum fixarum in longitudine et latitudine secundum 9 caelum". Not in Kunitzsch. 38 stars, arranged according to their signs though unordered within each sign. The inventory, the star-names and the values are essentially as in LA11, but (29) has faulty coordinates, and (33-34) are missing. A repeated error in the longitudes is "47" for "17", suggesting an original in Roman numerals. — Vd2 appears nondescript, offering no clues for attribution.

LA11b. Lw,120r "Tabula stellarum fixarum secundum Azarchelem". Described by Kunitzsch (1966, XIIx, p.77). 20 stars, being (1-2, 5-9, 11-12, 14-16, 20, 24, 27-30, 38-39) from LA11, re-arranged according to their longitudes so as to form the series (14, 30, 15, 1-2, 16, 5-6, 20, 7-8, 29?, 9, 24, 38-39, 11-12, 27-28). The coordinates are faulty. The table is from William of England's treatise on the Saphea, and is printed in Millás 1942 p. 181, and in Gunther, Early Science II, 1923, p. 201 (Kunitzsch, *ibid.*).

LA11c. Vd,43v; Pb,38r: "Tabula locorum stellarum fixarum in longitudine et latitudine secundum 9 caelum" Vd; "Tabula stellarum fixarum" Pb. Not in Kunitzsch. 30 stars, being (14-15, A, 1-2, 16, 3-4, 17, 5, 18-19, 6, 20, 7-8, 10, 9, 11, 13, B, 21-22, C, 12, D-E, 29, 30, 32) of LA11, in this order. I transcribe (A-E), which are difficult to recognize in LA11. The values are the same in Vd and in Pb.

(A)	Latus levantis Cap. Gol	Tau	19	0	30	0	Sep	(α Per)
(B)	<*>	Tau	5	57	31	50	Sep	(?)
(C)	Cor scorpionis	Sco	27	39	3	0	Mer	(α Sco)
(D)	<*>	Aqr	27	9	31	0	Sep	(?)
(E)	Humerus equi	Psc	17	9	31	0	Sep	(β Peg)

(A): cf. LA11 no.20a, LA13 no.16 and LA13a no.16, and see LA11, "Versions". — **(C,E)** are the same as LA11 no. (24,28), but the longitudes are peculiar.

LA11d. Two further parallels (astrolabe by Raymond of Marseilles, Par.lat. 10266, 111v-112 and Stuttgart mat. 4°33, 48+; "Arialdus", Par.lat. 16652, 32v) are noted by Poulle 1956 p. 309-12; Poulle 1964 p. 887-888; Kunitzsch 1966 p. 76-77 (XIIs-u). Both types are ordered according to longitudes.

LA12. Kunitzsch Type XIII, 35 stars, ecliptical (+14;55° or +15;7°), equatorial, etc..

Toomer 1968, no. 82a (printed in full on p. 128-133, from mss. Oc and Ow, his "C" and "S".). — List of 35 stars, showing: (a) name of star and Latin name (occasionally in separate columns), (b-d) longitude, (e-f) latitude, (g) direction of latitude, (h-j) declination, (k) direction of declination, (L-m) "mediation" (really perhaps right ascension; see note to LA13). The values are generally as in LA13, though some longitudes have been incremented by 12'.

Other editions: Harris 1846 p. 188-189, from ms. Lb. Kunitzsch 1966 p. 90-91, from ms. B (his "a") with variants from 15 other manuscripts as listed on p. 88-89.

Witnesses: {d} Lb,60v. — {e} Ek2,50r. — {x} Oc,93v; X,170v; Vz,73v; Mv,109v; Cm,151r; B,161v; T,298v; Lf,111r; Lg,189v; Lh,157v; Xj,292v; Xg,74r; G,78r; Xb,93r; Es,199v; Fb,84r; Pq,203r; Oy,90v; Wa,80r (some names only, no headings or figures); Ow,171v; Nu,158v. — {?} Da3,137v (:?). — One more copy is in Madrid BN 3349 (L.96), 8v, accompanying an almanac of the 14th c. which is partly in Portuguese (Millás 1950 p. 403).

Headings. — General:

(1) Loca stellarum fixarum et (ad Vz.ac Cm Oy) **latitudines earum** (e.l.ea.: cum ea. lat() X) **et** (ab Vz Cm Oy) **distantia ab aequinoctio, et cum quo** (*om.* Oc) **gradu caelum mediant, anno Arabum 577** (+verificat() Vz) :: {x:} Oc X Vz Cm Xb Oy; {?:} Da3.

(2) Tabula locorum stellarum fixarum et earum latitudinum ab ecliptica et declinationum ab aequinoctio (-tiali Ek2), **et graduum cum quo** (quibus Ek2 Mv) **caelum mediant, anno Arabum 577 verificata** :: {e:} Ek2; {x:} Mv B Lf Lg Lh Xj Xg G Es Pq Ow Nu.
(3: other) :: Lb ("Tabula stellarum fixarum et latitudinis earum et quantum distent ab aequinoctio, et cum quo gradu caelum medient[[i]]"); T ("Tabula stellarum fixarum cum gradibus quibus caelum mediant, anno Arabum 577"); Fb ("Nomina stellarum fixarum cum nominibus suarum imaginum...").

Names: normally, **(4) Nomina stellarum fixarum** (=Vz(pc), *etc.; om.* X Mv Lh Xg Es Pq Ow) **cum suis imaginibus** (c.s.i.: c.i.s. Es; c.i. earum Oc Da3; et earum imagines Xb) :: {e:} Ek2; {x-}; {?:} Da3. — **(5) Nomina stellarum fixarum; Imagines earum** (for two separate columns, of Arabic and Latin names) :: {x:} B Lf. — **(6: other)** :: Lb ("Nomina stellarum fixarum", no separate column for Latin names); (none:) Vz.ac.

Sign in zodiac: **(7) Signa** :: normally; alone or as a sub-heading for the following. — **(8) Nomina signorum** :: {x:} Mv B Xg Fb.

Degrees of longitude and latitude: **(9) Longitudo earum; Latitudo** :: {x:} Oc Vz Cm Xb Oy. — **(10) Longitudo stellarum; Latitudo earum** (*om.* T) :: {x:} X Mv B T Lf Lg Lh Xj Xg G Es! Pq Ow Nu. — **(11) Longitudo; Latitudo** :: {e:} Ek2; {x:} Fb. — **(12: other)** :: Lb ("Loca stellarum; Latitudines earum"); Da3 (secondary only).

Latitude, direction: **(13) Pars latitudinis** (l.p. Fb) :: everywhere.

Declination, degrees and direction:
(14) Longitudo ab aequinoctio (=Oc Xb; -tiali Cm; **/aequatore** Vz T); **Pars longitudinis** :: {x:} Oc Vz Cm T Xb Oy!.
(15) Declinatio ab aequinoctio (**/-tiali** Ek2 Xj Xg Nu); **Pars declinationis** (+ab aequinoctiali Ek2) :: {e:} Ek2; {x:} X Mv B Lf Lg! Lh! Xj Xg G Es Pq Ow Nu.
(16: other) Lb ("Latitudo (!) stellarum ab aequinoctio; Pars longitudinis"); (none:) Fb Da3.

Mediation: **(17) Gradus cum** (*om.* B Lf Lh Xj Xg Pq Ow Nu) **quo** (**/quibus** Lb Oc X Vz Cm T Xb; /quo b() Oy) **caelum mediant** (c.m.: m.c. Lb; *om.* Cm) :: normally. — **(18: other)** :: Ek2 ("Gradus altitudinis"). (None, or secondary:) Fb Da3.

Version and values. The table shows the stars in the same order as in LA13, but omits those which are there numbered 08, 16-17, 20-23, 30, 33, 41-44, 47, 49-50, and adds one at the end (which may be Beta Leonis, no. (08) of LA13, cf. Toomer 1968 p.132 n.35, or h Comae Berenices, Kunitzsch 1966 p. 94 n. 35).

The values are generally those of the relevant sub-tables in LA13. The longitudes and latitudes show most of the oddities that characterize LA13 as against the common tradition (underscored in the text of LA13), though few or none of the manuscript errors of LA13 that are likely to be scribal (corrected values in italics in the text of LA13). — Independently of LA13, our table appears to add an extra 12′ to some 12 of the 35 longitude values, so that they show an increment of 15;7° over the Almagest. This change has been made at a late stage: indeed, the right ascensions and the declinations have not been updated accordingly but are still the same as in LA13.

All told, LA12 is likely to be an abridgment, with slight revision, of a table closely similar to that preserved in LA13.

Dating. The longitude increment of 14;55°, same as in LA13, should be dated as is LA13, thus probably somewhere during the 1110s. The increment of 15;7° may be conjecturally dated to AH 527 (corrected from "577"), i.e., to *AD 1132-33*. See the notes to LA above for the reasons for this.

Text. Collated for values: **{d}** Lb; **{x}** Es Xg Lg. — Headings and star-names according to Xg; corrections have not been attempted. — Layout, etc.: Xg Lg place the explanations above the star-names, as shown here; Lb has them in the reverse order. Es omits the explanations, showing only a few marginal glosses, differently worded. "Sep, Mer" stand for various abridgments of "septentrionalis, meridionalis".

Also quoted for values: **$c** = value expected for consistency or from recomputation; for specifications, see notes to LA13. Not quoted for the "mediation" values (columns L-m). In the other cases, $c is not quoted where it differs by less than 3′ from the adopted value, not even where it agrees with other readings that have not been adopted.

$ct = value adopted for LA13 that differs from the one adopted here. Quoted in full. Does not quote cases where the main manuscript of LA13 (=Ct) has been corrected by me, and the correct value is the one present here; nor cases where ms. Ct has errors which are present here too; for the latter, see the underscored values in LA13. For the longitude values that presuppose the increment of 15;7° (asterisked in the edited text), "$ct" is only quoted if the incrementation appears faulty.

The star-names of Lb differ somewhat from those of Es Xg Lg. I reproduce the star-names according to Xg, since this version is more common, and I only quote an arbitrary selection of major variants from Lb and Lg. The names in Xg certainly require emendation, but since they are recognizable enough, I have left them as they are.

In the column (L-m) for right ascensions, Lb has some alternative readings, not explained (cf. Toomer 1968 p. 128 n.4). They are listed in the apparatus.

Notation. For italics and underscoring, see Pr:02(4). Italics are also used in col. (a) for drawing attention to the apparatus. Longitude values that are based on the increment of 15;7° are *asterisked.

Variant groups. — *Es Xg Lg* are often in error against *Lb,* rarely vice versa. Occasionally Lb has the reading of $ct but is corrected to follow the majority reading, or vice versa. — The consensus of the witnesses once shares an error (f15) with mss. O Pd of LA13a (cf. apparatus to LA13).

Tabula locorum stellarum fixarum et earum latitudinum ab ecliptica et declinationum ab aequinoctio, et graduum cum quo caelum mediant, anno Arabum 577 verificata.

	Nomina stellarum cum suis imaginibus	Nomina signorum	Longitudo stellarum Gr	Mi	Latitudo earum Gr	Mi	Pars latitudinis	Decl. ab æquinoctiali Gr	Mi	Pars declinationis	Gradus <cum> quo caelum mediant Gr	Mi		Baily	
(01)	id est vespera *oculus vel cor tauri* Aldebaran	*Tau	27	47	5	10	Mer	14	41	Sep	56	24	(01)	393	α Tau
(02)	In pede Orionis Rigil Algebar	*Gem	4	57	31	50	Mer	10	10	Mer	64	49	(02)	768	β Ori
(03)	*In humero agitatoris* Alhaioch	*Gem	10	7	22	50	Sep	44	34	Sep	63	28	(03)	222	α Aur
(04)	In humero Orionis Mankib Algebar	Gem	16	57	17	0	Mer	5	59	Sep	78	30	(04)	735	α Ori
(05)	Canis Sirius primus, *et est meridionalis* Ascare Alhabor	*Cnc	2	47	39	10	Mer	15	38	Mer	92	5	(05)	818	α CMa
(06)	Sirius 2'us, *et est septentrionalis* Ascare Algumaice	*Cnc	14	17	16	10	Mer	6	43	Sep	102	17	(06)	848	α CMi
(07)	Cor leonis Calbalacer	*Leo	17	*37*	0	10	Sep	15	51	Sep	140	13	(07)	469	α Leo
(08)	Iaculum tollens Alchimech Alazel	*Lib	11	47	2	0	Mer	6	26	Mer	189	36	(08)	510	α Vir
(09)	Iaculum feriens Alchimec Alramec	*Lib	12	7	31	50	Sep	24	25	Sep	204	56	(09)	110	α Boo
(10)	Vultur cadens Annazel Aluuaza	*Cap	2	27	62	0	Sep	38	27	Sep	271	20	(10)	149	α Lyr
(11)	Vultur volans Nazel Althair	Cap	17	48	29	10	Sep	6	34	Sep	285	35	(11)	288	α Aql
(12)	Os piscis meridiani Fomahout Algenubi	Aqr	21	57	23	0	Mer	35	49	Mer	334	21	(12)	670	α PsA
(13)	Caput speculi Razelmire	Ari	2	25	26	0	Sep	24	39	Sep	350	4	(13)	315	α And
(14)	Caput gorgonis Razagul	Tau	14	35	23	0	Sep	38	4	Sep	32	44	(14)	202	β Per
(15)	Caput geminorum postremum Razathoum Almualhar	Cnc	8	15	9	0	Sep	32	57	Sep	99	42	(15)	424	α Gem
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)			

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)			
(16)	Caput eius anterius Razathomon almu(a)	Cnc	11	35	6	15	Sep	29	16	Sep	103	15	(16)	425	β Gem
(17)	Cor scorpionis Calbalacrab	*Sco	27	47	3	0	Mer	22	38	Mer	234	24	(17)	553	α Sco
(18)	Genu sagittarii Racbat aram	Cap	1	55	18	0	Mer	41	33	Mer	272	26	(18)	593	α Sgr
(19)	Talus eiusdem Arcob aram	Cap	2	40	23	0	Mer	46	32	Mer	273	35	(19)	592	β^1Sgr
(20)	Cauda gallinae Deheb Adigeba	*Aqr	24	17	60	0	Sep	42	35	Sep	302	*50*	(20)	163	α Cyg
(21)	Humerus equi Mankab Alferaz	*Psc	17	17	31	0	Sep	23	18	Sep	334	*41*	(21)	317	β Peg
(22)	Cor piscis Kalbalhouz	Ari	18	48	26	20	Sep	31	28	Sep	4	33	(22)	346	β And
(23)	Collum corvi Haune Algurab	Vir	29	15	19	40	Mer	17	39	Mer	170	*30*	(23)	929	ε Crv
(24)	Australe decamediam Scemel Mennannata	Ari	22	35	8	20	Sep	16	32	Sep	17	5	(24)	363	β Ari
(25)	Talus dexter Arcob Eleimen	Gem	10	35	8	0	Sep	30	4	Sep	67	35	(25)	230	β Tau
(26)	Monir alhennahar	Gem	29	35	10	50	Mer	12	43	Sep	89	39	(26)	441	ξ Gem
(27)	Caput colubri Razalam	Sgr	9	25	36	0	Sep	13	39	Sep	253	0	(27)	234	α Oph
(28)	Iube equi Iachfelez alferaz	Aqr	20	8	22	50	Sep	6	52	Sep	315	20	(28)	331	ε Peg
(29)	Cauda ceti Deneb caituz	Psc	20	35	20	20	Mer	22	19	Mer	0	51	(29)	733	β Cet
(30)	Spina scorpii Scoulet alacrab	Sgr	12	25	13	0	Mer	35	23	Mer	248	47	(30)	565	λ Sco
(31)	Genua gallinae Rocubez aldigega	Aqr	27	5	*63*	45	Sep	*46*	33	Sep	302	4	(31)	175	ω^2Cyg
(32)	Caput geminorum Razalgauze	Gem	11	55	13	50	*Mer*	8	37	Sep	74	25	(32)	734	λ Ori
(33)	Pectus cancri Cedre alceratan	Cnc	25	15	0	40	*Sep*	21	51	Sep	117	26	(33)	449	ε Cnc
(34)	Oculus sagittarii Aain arram	Cap	0	5	0	45	Sep	22	48	Mer	270	4	(34)	577	ν^2Sgr
(35)	Adarfa finis	Vir	9	27	25	10	Sep	19	0	Sep	164	40	(35)	488?	β Leo

(a01+) "id est vespera..." *et omnes eiusmodi glossas om.* Es.

(a-m 35) *om.* Xg. **(a01)** oc. -- tauri: *om.* Lb. id est: *om.* Lg. vespera: Lb Lg; vespa Xg. **(a03)** in--agit.: *om.* Lb. **(a05)** ascare: Lb Es; ascaie Lg Xg. **(a05)** et est mer.: *om.* Lb. **(a06)** et est sep.: *om.* Lb. **(a08)** alchimech: Lb Es Lg; alchimel Xg. **(a12)** algenubi: Lb; algemista Lg Xg; algenista Es. **(a16)** r.a.: razathoimo() almu Xg: raz athonuam almuh Lb; razatoil a. Es. **(a18)** racbat: Lb; rachat Lg; kachat Es; racat Xg. **(a24)** dec.: de ea medium Lb. scemel m.: Lb; scemes mennann'ta Lg Xg; scemes memiann'ta Es. **(a29)** canuz Lg. **(a31)** roeubez a. Es Xg Lg. **(a34)** a.a.: aainarcam Lg Xg. **(a35)** aldarfa f. Lg; *def.* Xg.

(c-d 11) 9,30 Lg; 19,30 *add.* Lb *s.l.*; 9,30 *add.* Es Xg *s.l.* **(e-f 35)** 11,50 Lg $ct, $c *fere;* 11,50 *add.* Lb *sub lin.*, Es *s.l.*; *def.* Xg. **(L-m 1-11)** *seriem* 59,22 / 73,53 / 65,31 / 80,22 / 93,19 / 103,22 / 138,17 / 190,40 / 206,45 / 273,17 / 286,15 *add.* Lb *s.l.* **(L-m 16)** 233,12 *add.* Lb *s.l.* **(L-m 35)** 166,24 *add.* Lb *sub lin.*, *cf. LA13:p-q08; def.* Xg; *non liquet* $c.

(c11) *v.s. (c-d 11).* **(d04)** 55 $ct. **(d07)** 37: *ex* $ct; 57 *omnes.* **(d12)** 55 $ct. **(d35)** 25 $ct. **(e31)** 63: Lb.?pc $c, *cf. LA13:e40;* 66 *cett.* **(e35)** *v.s. (e-f 35).* **(f15)** 0: *cf. ad LA13:f18 (mss. O Pd);* 40 $ct $c. **(f30)** 0: *omnes;* 7 $ct $c; 20 *alibi, cf. ad LA13:f39.* **(g27)** sep: Lb $ct $c; mer Es Xg Lg. **(g32-33)** mer, sep: $ct $c; sep, mer *omnes.* **(h31)** 46: $ct $c; 36 *omnes.* **(j31)** 34 $ct. **(L12)** 334: Lb $ct; 354 Es Xg Lg. **(L14)** 32: Lb $ct; 302 Es Lg Xg. **(L16)** *v.s. (L-m 16).* **(L17)** 234: Lb $ct; 134 Es Xg Lg. **(L33)** 17\1/7 Xg. **(L35)** *v.s. (L-m 35).* **(m10)** 4 $ct. **(m20)** 50: $ct; 7 Lb.ac, *ex "50" ut vid.;* 51 Lb.pc, *cett.* **(m21)** 41: Lb.ac $ct; 21 Lb.pc, *cett.* **(m23)** 30: Lb $ct; 39 Es Lg Xg. **(m31)** 3 $ct. **(m35)** 49 Lb; *def.* Xg; *v.s. (L-m 35).*

LA13. Cognate of LA12 for Toledo, in ms. Ct: 50 stars, ecliptical (+14;55°), equatorial, etc.

List of 50 stars, showing: (b-d) longitude, (e-g) latitude, (h-k) declination, (L-m) altitude of culmination, (n-o) half daily arc, (p-q) mediation (really perhaps right ascension; see below), (r-s) co-ascending degree, (t-u) co-descending degree.

Printed by F.S. Pedersen, CIMAGL 64 (1994) 59-62. The present edition adds readings of cols. (t-u) from the manuscript, due to Dr. Peter Vejleskov (March-April 1995).

Witness: **{a0}** Ct,4v.

Parallel tables and dating. LA13 is a superset of both LA12 and LA13a, and carries additional information, some of which would only be useful in Toledo. Thus it is hard not to assume that it is the prototype of LA12 and LA13a. The names of the stars show that it is a different translation from either (Kunitzsch).

The copy carries no dating. The longitudes are 14°55′ greater than in the Almagest, as are those of LA13a and most of those of LA12. A likely date for the Arabic exemplar of these tables is *AD 1110-11;* see the notes under LA and LA13a.

Values. The sub-table (L-m) presupposes a terrestrial latitude of 39°54′, which is the normal one for *Toledo;* see appendix to MA11. This also serves to authenticate the express location to Toledo, shown by LA13a though not by the present table. The sub-tables that depend on the latitude have, however, been left out in LA13a, and also in LA12.

The obliquity is 23,33,0°, as often in Toledan material. The declinations and meridian altitudes (cols. (h-m)) can generally be recomputed[1] from the longitudes and latitudes to within 2′, and these cases are not noted in the apparatus. Those of stars no. (16) and (21) deviate more, but each pair is consistent within itself, so the tabular values have not been emended. One notes that the table-maker has computed the declination values in the proper way rather than according to the simplistic rule in Cb230/Cc206.

No recomputations are quoted for sub-tables (n-u). The table of mediation (p-q) may be better understood as showing right ascensions (Toomer 1968 p. 128 n.3) rather than the corresponding arcs of the ecliptic, but it is not very well reproducible on either assumption.

Text. Collated for values: Ct; (from LA13a:) O Pd. – Headings and star-names according to Ct. – Also quoted: **$c** = recomputed values; see "Values", above. Quoted only for longitude, latitude, declination, and meridian altitude, i.e., for cols. (b-m), and only where they deviate from the adopted values by 3′ or more. A few extra values are, however, quoted arbitrarily.

$d = majority value from the Arabic versions of the Almagest. Quoted only for longitude and latitude, i.e., for cols. (b-g). For the references and the manner of quotation, cf. note to LA11. Longitude values are augmented by 14°55′ relative to the Almagest.

---

1 Hints for calculation, special cases ignored: Let N be the angle between the ecliptic and the circle that passes through the star and the vernal point. Then N is given by tan(N) = tan(latitude) / sin(longitude); the right asc(ension), by tan(right_asc) = tan(longitude) * cos(N+obliquity) / cos(N); the declination, by tan(declination) = sin(right_asc) * tan(N+obliquity); and the altitude of culmination, as the declination plus the terrestrial colatitude.

For these expressions, and for the rest of the functions, see Nallino II p. 291-92. Thus, the asc(ensional) dif(ference) is obtained from sin(asc_dif) = tan(declination) * tan(terrestrial_latitude); and half the daily arc is 90°+asc_dif (this being negative if the declination is). For the "mediation", the co-culminating degree of the ecliptic, one has tan(mediation) = tan(right_ascension) / cos(obliquity).

Coverage: Ct (entire table); O,92r and Pd,90v (b-g 1-32).

```
a:            Ct              (uncorrected)
b-g  1-32:    Ct O Pd $c $d
b-g 33-50:    Ct      $c $d
h-m:          Ct      $c
n-u:          Ct              (uncorrected).
```

Readings chosen. For cols. (b-m), as stated above, corrections have been done according to the recomputation, as far as possible. For columns (n-u), Ct is followed, and no corrections are made. Italics are used where the reading of Ct is corrected; the adopted reading is implied to agree with whichever are present of $c $d O Pd. Underscoring is used for longitudes or latitudes (cols. b-g) that disagree with $d. They are implied to be consistent with $c, that is, consistent with the declinations and meridian altitudes in cols. (h-m). Underscoring is also used for a few declinations and meridian altitudes that seem uncorrectable and have been left as they are found in Ct.

Variants, etc.: The values for longitudes and latitudes show a number of deviations from the common Arabic tradition ($d). Most of these are shared with LA11 where both tables are present. Thus the two tables seem to depend on a common source. – Among the parallel texts compiled in Kunitzsch's index (1986+, vol. III), mss. "b, d" of al-Hajjaj's Almagest translation share some specific peculiartites with our table. It is not obvious what this signifies.

Each of Ct and LA13a = (O Pd) has errors against the other, as one would expect from independent transcriptions; see note to LA13a.

Apparatus for LA13 (see next page):

(08) *cum no. 35 tabulae LA12 fortasse correspondet, lectiones hic non afferuntur.* **(41)** ρ Persei, Baily 204 (Tau 12°35′ $d, *ex* Ari 27°40′; +21°) *potius quam* o Persei, Baily 215 (Tau 19°5′ $d, *ex* 4°10′; +12°). **(43)** *aut* ε Leonis, Baily 465 (Leo 9°5′ $d, *ex* Cnc 24°10′; +9°30′) *aut* λ Leonis, Baily 463 (Leo 6°5′ $d, *ex* Cnc 21°10′; +7°30′). **(47)** M7 Scorpionis, Baily 567 (Sgr 16°5′ $d, *ex* 1°10′; -13°15′, *nebul.*) *potius quam* υ Scorpionis, Baily 566 (Sgr 11°55′ $d, *ex* Sco 27°; -13°30′, *mag.* 4).

(b13) Psc O Pd. **(b31)** collum corvi (!) O Pd. **(c10)** 21 O Pd. **(c12)** 18°(45′) $d (*ex* 3°50′). **(c13)** 4 O Pd. **(c17)** 5°(15′): *ut* $d.bdL (*ex* Tau 20°20′; 24°0′ $d *plerumque*). **(c41)** 12 $d *(si est Baily 204).* **(c49)** 21 $d (*ex* 6°40′). **(d12)** 45 $d, *cf. ad (c12).* **(d13)** 21 O Pd. **(d14)** 25: *ut* $d.bd (*ex* Psc 17°30′; 17°50′ $d *plerumque*). **(d17)** *cf. (c17).* **(d26)** 40: *ut* $d.bd (*ex* Sgr 17°45′; 17°40′ $d *plerumque*). **(d29)** 45 $d (*ex* 3°50′). **(d30)** 45 $d (*ex* 2°50′). **(d33)** 45 $d (*ex* Ari 16°50′). **(d36)** 45 $d (*ex* Sco 24°50′). **(d37)** 15 $d (*ex* 5°20′). **(e04)** xiiii Ct.ac? **(e13)** 55 O Pd. **(e24)** 3: *ut* $d.bd; 4 $d *plerumque.* **(e26)** 28 Ct. **(e29)** 25 Ct. **(e34)** 5 $d. **(e36)** 56 Ct. **(e40)** 68 Ct. **(e41)** 21 $d *(si est Baily 204).* **(e43)** 9 $d *(si est Baily 465).* **(e45)** 12 Ct. **(f02)** 30 $d. **(f03)** 30 $d. **(f10)** 30 $d. **(f13)** 23 O Pd. **(f17)** 30 $d. **(f18)** 0 O Pd. **(f19)** x<.> Ct. **(f20)** 30 $d. **(f21)** 30 $d. **(f23)** 30: *ut* $d.bdL; 50 $d *plerumque.* **(f35)** 30 $d. **(f37)** 30 $d. **(f39)** 20 $d. **(f45)** 50: $d *plerumque;* 30 *Almag.* **(f47)** 15 $d. **(h36)** 13: $c; 18 Ct. **(h47)** 36: $c; 56 Ct. **(j16)** 15 $c. **(j21)** 32 $c. **(j25)** 33: $c; 53 Ct. **(L17)** 53: $c; 52 Ct. **(L24)** 27: $c; 26 Ct. **(m03)** 20: $c; 2 Ct. **(m16)** 39 $c. **(m21)** 34 $c. **(m25)** 33: $c; 32 Ct. **(n23)** 76°: Ct; 85° *fere* $c. **(n44)** 31 Ct, *ex voce Arabica quae "non" valet prave transscriptum, cf. Nallino II p. 271.* **(n50)** 31 Ct, *cf. (n44).* **(o44, o50)** *vacat* Ct. **(p17)** 57°: Ct; 66° *fere* $c. **(p22)** 219°: Ct; 211° *fere* $c. **(p-q50)** *vacat* Ct; 357° *fere* $c. **(r44)** 31 Ct, *cf. (n44).* **(r50)** 31 Ct, *cf. (n44).* **(s06)** <.>v Ct; x′v *haesitanter legit Vejleskov.* **(s44, s50)** *vacat* Ct. **(t44)** 31 Ct, *cf. (n44).* **(t50)** 31 Ct, *cf. (n44).* **(u38)** xxxiiii *aut* cxxiiii *legit Vejleskov.* **(u44)** <non?> occidit Ct. **(u50)** <non?> occidit Ct.

	Nomina stellarum	Gradus longitudinis Nom Sig	Gr	Mi	Gradus latitudinis Gr	Mi	Ptes	Remotio ab aequinoctio diei Gr	Mi	Pars	Altitudo earum in medio celi Gr	Mi	More earum di midium super terram Gr	Mi	Gradus qui sunt in medio celi cum eis Gr	Mi	Gradus qui oriuntur cum eis Gr	Mi	Gradus qui occidunt cum eis Gr	Mi		Baily	
(01)	Aldabaran	Tau	27	35	5	10	Mer	14	41	Sep	64	47	102	39	56	24	61	54	52	49	(01)	393	α Tau
(02)	Pes gem.	Gem	4	45	31	50	Mer	10	10	Mer	39	56	81	23	64	49	92	34	43	0	(02)	768	β Ori
(03)	Alaaioc	Gem	9	55	22	50	Sep	44	34	Sep	85	20	145	27	63	28	14	12	95	9	(03)	222	α Aur
(04)	Humerus dexter	Gem	16	55	17	0	Mer	5	59	Sep	56	5	95	2	78	30	93	27	65	26	(04)	735	α Ori
(05)	Filius vivens	Cnc	2	35	39	10	Mer	15	38	Mer	34	28	76	28	92	5	121	14	62	22	(05)	818	α CMa
(06)	Filius moriens	Cnc	14	5	16	10	Mer	6	43	Sep	56	49	95	39	102	17	114	45	87	51	(06)	848	α CMi
(07)	Cor leonis	Leo	17	25	0	10	Sep	15	51	Sep	65	57	103	44	140	13	139	28	141	38	(07)	469	α Leo
(08)	Cauda leonis	Vir	9	25	11	50	Sep	19	0	Sep	69	6	106	44	166	24	156	42	187	15	(08)	488	β Leo
(09)	Alcimec alaazer	Lib	11	35	2	0	Mer	6	26	Mer	43	40	84	35	189	36	191	22	185	50	(09)	510	α Vir
(10)	Alcimec alramhe	Lib	11	55	31	50	Sep	24	25	Sep	74	31	112	18	204	56	180	38	246	29	(10)	110	α Boo
(11)	Vultur cadens	Cap	2	15	62	0	Sep	38	27	Sep	88	33	131	36	271	4	219	34	322	44	(11)	149	α Lyr
(12)	Vultur volans	Cap	17	48	29	10	Sep	6	34	Sep	56	40	95	32	285	35	261	7	306	31	(12)	288	α Aql
(13)	Os piscis meridiani	Aqr	21	55	23	0	Mer	35	49	Mer	14	17	52	53	334	21	22	29	311	47	(13)	670	α PsA
(14)	Caput mulieris	Ari	2	25	26	0	Sep	24	39	Sep	74	45	112	34	350	4	310	19	10	45	(14)	315	α And
(15)	Caput algol	Tau	14	35	23	0	Sep	38	4	Sep	88	10	130	54	32	44	342	21	56	33	(15)	202	β Per
(16)	Cauda portantis caput algol	Tau	19	45	30	0	Sep	46	23	Sep	83	31	151	21	35	24	315	0	75	12	(16)	197	α Per
(17)	Humerus sinister Herculis	Gem	5	15	17	50	Mer	3	43	Sep	53	49	93	7	57	44	84	33	54	40	(17)	736	γ Ori
(18)	Caput precedens altaume	Cnc	8	15	9	40	Sep	32	57	Sep	83	3	122	49	99	42	89	11	112	8	(18)	424	α Gem
(19)	Caput subsequens	Cnc	11	35	6	15	Sep	29	16	Sep	79	22	117	57	103	15	97	0	111	1	(19)	425	β Gem
(20)	Lucidum q.e. in collo leonis	Leo	17	5	8	50	Sep	24	11	Sep	74	17	112	3	142	57	135	2	158	41	(20)	467	γ Leo
(21)	Singulare q.e. in collo audacis	Leo	14	55	20	50	Mer	3	17	Mer	46	49	87	15	131	0	145	13	109	13	(21)	905	α Hya
(22)	Precedens alzubenien	Sco	2	55	0	40	Sep	11	55	Mer	38	11	79	50	219	47	217	43	223	31	(22)	529	α^2Lib
(23)	Subsequens eiusdem	Sco	7	5	8	30	Sep	5	54	Mer	44	12	76	42	221	36	215	3	232	59	(23)	531	β Lib
(24)	Cor scorpionis	Sco	27	35	3	0	Mer	22	38	Mer	27	28	69	35	234	24	237	21	229	32	(24)	553	α Sco
(25)	Humerus sagittarii	Cap	1	55	18	0	Mer	41	33	Mer	8	33	42	11	272	26	300	22	245	53	(25)	593	α Sgr
(26)	Cavilla sagitt.	Cap	2	40	23	0	Mer	46	32	Mer	3	34	28	6	273	35	320	47	230	6	(26)	592	β^1Sgr
(27)	Cauda galline	Aqr	24	5	60	0	Sep	42	35	Sep	87	19	140	13	302	50	239	20	356	17	(27)	163	α Cyg
(28)	Humerus equi	Psc	17	5	31	0	Sep	23	18	Sep	73	24	111	6	334	41	294	28	358	7	(28)	317	β Peg
(29)	Cor piscis	Ari	18	48	26	20	Sep	31	28	Sep	81	34	119	13	4	33	319	33	26	36	(29)	346	β And
(30)	Humerus dex. retinentis habenas	Gem	17	25	20	0	Sep	42	51	Sep	87	3	140	22	73	45	35	58	100	53	(30)	223	β Aur
(31)	Collum corvi	Vir	29	15	19	40	Mer	17	39	Mer	32	27	74	34	170	30	185	22	140	51	(31)	929	ε Crv
(32)	Cornu arietis septentrionale	Ari	22	35	8	20	Sep	16	32	Sep	66	38	104	23	17	5	2	18	24	0	(32)	363	β Ari
(33)	Pes mulieris sinister	Tau	1	48	28	0	Sep	38	3	Sep	88	9	130	52	16	15	318	18	44	15	(33)	349	γ And
(34)	Cavilla dextera	Gem	10	35	8	0	Sep	30	4	Sep	80	10	118	57	67	35	56	18	75	27	(34)	230	β Tau (γ Aur)
(35)	Lucidum alhenah	Gem	29	35	10	50	Mer	12	43	Sep	62	49	100	53	89	39	98	58	80	22	(35)	441	ξ Gem
(36)	Caput effeminati	Sgr	9	25	36	0	Sep	13	39	Sep	63	45	101	43	253	0	227	24	282	52	(36)	234	α Oph
(37)	<*>	Aqr	20	8	22	50	Sep	6	52	Sep	56	58	95	47	315	20	290	39	331	2	(37)	331	ε Peg
(38)	Summitas caude chaitoz	Psc	20	35	20	20	Mer	22	19	Mer	27	47	69	55	0	51	34	13	344	34	(38)	733	β Cet
(39)	Acus scorpionis	Sgr	12	25	13	7	Mer	35	23	Mer	14	43	53	34	248	47	262	57	218	17	(39)	565	λ Sco
(40)	Genu galline	Aqr	27	5	63	45	Sep	46	34	Sep	83	20	152	1	302	3	229	23	5	6	(40)	175	ω^2Cyg
(41)	Quod precedit caput algol	Tau	9	35	12	0	Sep	26	5	Sep	76	11	114	10	32	20	10	10	43	3	(41)	204	ρ Per
(42)	Stella in capite leonis	Leo	9	15	12	0	Sep	29	34	Sep	79	40	118	19	135	46	124	31	157	23	(42)	464	μ Leo
(43)	<*>	Leo	9	5	7	30	Sep	25	17	Sep	75	23	113	16	134	4	127	11	146	46	(43)	465	ε Leo
(44)	Manus Persei	Tau	11	35	40	30	Sep	52	51	Sep	77	3	*	.	17	27	*	.	*	oc	(44)	191	χ Per
(45)	Caput algebar	Gem	11	55	13	50	Mer	8	37	Sep	58	43	97	16	74	25	87	23	63	40	(45)	734	λ Ori
(46)	Pectus cancri	Cnc	25	15	0	40	Sep	21	51	Sep	71	57	109	39	117	26	116	33	118	42	(46)	449	ε Cnc
(47)	Quod sequitur acum scorpionis	Sgr	16	5	13	50	Mer	36	34	Mer	13	32	51	40	253	4	268	43	231	48	(47)	567	G Sco
(48)	Oculus sagittarii	Cap	0	5	0	45	Sep	22	48	Mer	27	18	69	20	270	4	269	21	270	47	(48)	577	ν^2Sgr
(49)	Sagitta sagittarii	Sgr	20	35	2	50	Sep	20	24	Mer	29	42	71	53	262	45	260	7	265	40	(49)	574	μ Sgr
(50)	Cauda urse minoris	Gem	15	5	66	0	Sep	84	1	Sep	45	53	*	.	<*>	<*>	*	.	*	oc	(50)	001	α UMi
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)			

LA13a. Kunitzsch Type XIV, 32 stars, ecliptical (+14;55°). Apparently a segment of LA13.

Toomer 1968 p.123 (noted from ms. O, Toomer's "L"). Printed by Kunitzsch (1966 p.95-97) from Pd with variants from O. – This table appears to be an extract of LA13, with the same values, though in another translation. It shows stars no. 1-32 of LA13, in the same order, with values for longitudes and latitudes only.

Witnesses: O,92r; Pd,90v. – *Heading:* **Tabula locorum stellarum fixarum verificatorum in civitate Toleti, anni** (sic!) **Alexandri 1422 secundum Arzachelem** O Pd.

Dating and location. The longitudes are 48′ greater than in LA11. The express dating, to year "1422" of Alexander, corresponds to *AD 1110-11.* Using the common precession rate of 1° per 68 lunar years (66 solar years), the 48′ increment over LA11 would correspond to 54 lunar years, taking the date from AH 459 (in LA11) to AH 512, or ca. AD 1118. This, if not a perfect fit, appears to confirm the ostensible dating; at least one may reject Millás's emendation of the dating "1422" into "1492", or AD 1180-81 (Millás 1950 p. 69 n. 1). See also the notes under LA.

The location to Toledo finds support in LA13, since this uses the latitude of 39°54′. It can no longer be confirmed from the present table, as it lacks the values that are based on that latitude.

Sample. The values in mss. O and Pd have been collated under LA13. The two copies are almost identical; Pd may have one or two fewer errors than O. The longitudes and latitudes are the same as in LA13 except for those of no. (13) and a few lesser variants.

The names of the stars are, however, different. Nos. (05, 06, 08, 24, 27, 32) have Arabic names not in Ct. An arbitrary choice of other names, according to Pd, numbers as in LA13:

(16) Cauda levantis
(17) Humerus sinister petentis
(18) Caput ataom de lat(ere)
(19) Caput ataom retro
(21) Unum quod est in collo fortissimi
(25) Genu ballistarii
(26) Corbeillo del balestiero (vulgar!)
(27) Manu tenens lora

This translation is independent of LA13 in its present Latin form. Our table may, of course, have been excerpted from an Arabic exemplar of LA13, or else from another Latin translation.

LA14. 17 stars, ecliptical etc., unfamiliar longitudes, not in Kunitzsch.

Witnesses: **{a0}** Oo,35r; Cq2,108.

Headings. General: as reproduced below, Cq2; none in Oo. – Sub-headings: **Stellae...**, etc., as below, Oo Cq2. Before "Gradus cum quo...", Oo has three blank columns with the titles "Sinus eius versus; Altitudo medii diei; Sinus eius aequalis"; these columns and titles are absent from Cq2.

Values. Of the items for half the daily arc,[1] numbers (3)-(5) are compatible with an obliquity of ca. 23°33′ and a terrestrial latitude between 33°30′ and 34°, whereas no. 1-2 require a higher latitude and no. 6 a lower one. For an obliquity of 23°51′ the typical latitude will be a little greater than 34°, but the pattern will be even less consistent. I have not tried to check the values of co-ascending degrees.

---

1 Recomputation: see note to LA13.

Text. Collated for values: Oo Cq2. — Headings and star-names from Cq2. — The table has not been emended apart from the correction of one Abjad error, at (e4), in both witnesses. — Star number (8) has a name like α Gem and a position somewhat like α Hya, as is common (Kunitzsch 1966 p. 18 note 8).

Tabula de ortu stellarum fixarum in signis.

	Stellae fixae	Longitudo Si	Gr	Mi	Latitudo Gr	Mi	Pars	Dimidium arcus diei Gr	Mi	Se	Gradus cum quo oritur stella Si	Gr	Mi	Se	
(01)	Caput Algol	Ari	27	0	25	0	Sep	117	40	58	Psc	25	51	59	β Per
(02)	Cor tauri	Tau	19	20	5	10	Mer	100	24	39	Tau	23	44		α Tau
(03)	Alahiohc	Tau	27	0	22	0	Sep	125	31	42	Ari	28	31	51	α Aur
(04)	Pes geminorum	Gem	3	0	32	0	Mer	*82*	49	40	Gem	24	6	54	β Ori
(05)	Humerus geminorum	Gem	10	30	16	0	Mer	94	10	47	Gem	21	52	42	α Ori
(06)	Canis meridianus	Gem	24	0	39	0	Mer	79	46	29	Cnc	17	7	27	α CMa
(07)	Canis sept'alis	Cnc	4	0	17	0	Mer				Cnc	15	37	36	α CMi
(08)	Praecedens brachiorum	Leo	3	52	16	0	Mer				Leo	12	8	6	?
(09)	Cor leonis	Leo	9	10	0	6	Sep				Leo	9	53	40	α Leo
(10)	Lanceator	Lib	19	0	34	0	Sep				Vir	28	51	2	α Boo
(11)	Lucidum sidus coronae	Sco	12	0	19	0	Sep				Lib	9	7	3	α CrB?
(12)	Cor scorpionis	Sco	19	20	4	20	Mer				Sco	22	2	35	α Sco
(13)	Vultur cadens	Sgr	25	0	59	0	Sep				Sco	17	58	24	α Lyr
(14)	Volans	Cap	9	10	33	0	Sep				Sgr	16	53	16	α Aql
(15)	Cauda gallinae	Cap	27	0	40	0	Sep				Cap	19	3	42	α Cyg
(16)	Humerus equi	Aqr	24	30	30	30	Sep				Aqr	12	57	6	β Peg
(17)	Palma tincti	Psc	10	0	29	0	Sep				<**>				β Cas
	(a)	(b)			(c)		(d)	(e)			(f)				

(a03) maihoc Oo. **(a11)** sidus: *om.* Oo. **(a13)** wulturcius c. Cq2. **(a14)** wulturcius v. Cq2. **(b08)** 52′: Oo; 53 Cq2. **(b12)** sco.: *vacat* Oo. 20′: Oo; 30 Cq2. **(b13)** 25°: Cq2 Oo.pc; 15 Oo.ac. **(c08)** 16°: Oo; 15 Cq2. **(d12)** mer.: Cq2; sep. Oo. **(e01)** 117°: Oo; 116 Cq2. **(e02)** 100°: Oo; 108 Cq2. **(e03)** 31′: Oo; 08(!) Cq2. **(e04)** 102 Oo Cq2 *(cf., e.g., MA11(b12,b30)).* **(e05)** 94°: Cq2 Oo.pc?; 194 Oo.ac. 47″: Oo; 17 Cq2. **(e06)** 46′: Oo; 16 Cq2. 29″: Oo; 39 Cq2. **(f01)** 25°: Oo; 20 Cq2. **(f02)** 44′: Oo; 43 Cq2. *desunt secunda* Cq2 Oo. **(f06)** 17°: Oo; 16 Cq2. 27″: Oo; 17 Cq2. **(f07)** 36″: Oo; x.xv Cq2. **(f08)** 8′: Oo; 7 Cq2. **(f10)** 51′2″: Oo; liiii Cq2. **(f12)** 22°: Oo; 12 Cq2. **(f15)** 19°: Oo; 31 Cq2.

LA15. Kunitzsch type VI, 40 stars, ecliptical (no fixed increment over Almagest)

Similar to a table ascribed to John of London, made in Paris in AD 1246. This has been printed by Kunitzsch (1966 p. 39-46) as Type VI, from ms. Wien 5311 (=Wg, Kunitzsch's "a", f.130v) and 6 other manuscripts. Kunitzsch's reproduction includes columns of mediation and declination; these are only present in ms. Ek, 217r. — A list of the values is in Poulle 1956 p.314, table II, based on Par.lat. 7413(2),36v (cf. *op.cit.* p.313 n.3) and on three others (Par. lat. 7413(1),11; 7416B (=Pp),86; 7195,55: cf. p.313 n.1).

Witnesses: **{a0}** Ey,73r. — **{a2}** Md,116v. — **{d}** Mh,16v. — **{?}** Gr2,88r (:?). —— Some extra manuscripts are noted above.

Headings. — General: **(1) Tabula ad inveniendum loca stellarum fixarum magis famosarum** :: Ey. — **(2) Tabula stellarum fixarum quae ponuntur in astrolabio** :: Mh Gr2. — **(3: none)** except the gloss mentioned below :: Md. — *Sub-headings:* **(4) Signa** (:Ey only); **Nomina stellarum; Expositio nominum stellarum** (Gr2 has "nomina imaginum in quibus sunt stellae fixae"); **Longitudo; Latitudo; Pars** (partes Ey) **mundi; Magnitudo.** — **(5)** Mh only shows the last two sub-headings.

Gloss (Md Mh Gr2; in Md this is placed as main heading): "Tabula stellarum fixarum verificata per instrumentum armillarum in civitate Parisius. Et est longitudo earum arcus orbis signorum interceptus inter circulum magnum transeuntem per polos orbis signorum et per principium arietis, et (+per Md) circulum transeuntem per eosdem polos et stellam; latitudo vero earum est (e.e.: earundem Gr2) distantia earum ab orbe (a.o.: ad orbem Gr2) signorum, et est (+cum Mh) arcus cuiusvis circuli transeuntis per polos (+cuiusvis Md) orbis signorum, interceptus inter orbem signorum et circulum transeuntem per stellam, aequidistanter (-tem Gr2) orbi signorum."

Text. Collated for values: Ey Md. – Headings and star-names from Md. Modern names from Kunitzsch. The numbers on the outer right show the placement of the star in Kunitzsch's edition.

The stars are ordered according to their signs. The witnesses show an outer left column containing sign-names alone; in the reproduction below, this column has been merged with the star-name column.

	Nomina stellarum	Expositio nominum stellarum	Longitudo Gr	Longitudo Mi	Latitudo Gr	Latitudo Mi	Pars	Magnitudo		Kunitzsch
	ARIES									
(01)	Alderaymin	.i. dextrum adiutorium Cephei	1	0	70	0	Sep	2	α Cep	01
(02)	Alfaraz	.i. equus, scilicet umbilicus eius	4	0	26	0	Sep	2	δ Peg	02
(03)	Mirac Andromade	[.i. cor piscis]	20	0	27	0	Sep	2	β And	04
(04)	Eras	.i. musida arietis, et ipsa secundum Ptolomaeum est super caput arietis	27	0	10	0	Sep	2	α Ari	06
(05)	Scedher	.i. pectus Casepie	26	0	46	40	Sep	2	α Cas	05
(06)	Bacne caytos	.i. venter ceti	10	0	20	0	Mer	3	ζ Cet	03
	TAURUS									
(07)	Algebinim	.i. latus dextrum Persei	20	0	30	0	Sep	2	α Per	08
(08)	Aldebaran	.i. oculus [vel cor] tauri	28	0	5	12	Mer	1	α Tau	10
(09)	Menkhar	.i. naris ceti	2	0	12	0	Mer	2	α Cet	07
(10)	Alugetanhar	.i. flumen, et ipsa est etiam in reflexione Euridani fluminis	12	0	33	0	Mer	3	γ Eri	09
	GEMINI									
(11)	Ragle Alguza	.i. pes Orionis	5	0	30	0	Mer	1	β Ori	11
(12)	Alhayoch	.i. hircus	10	0	22	40	Sep	1	α Aur	12
(13)	Menqueb Algeuze	.i. humerus dexter Orionis	15	0	15	30	Mer	2	α Ori	13
	CANCER									
(14)	Raz Algeuze	.i. caput geminorum, scilicet obscurius caput	8	0	10	0	Sep	2	α Gem	15
(15)	Alhgabor	.i. transiens, et est in ore caniculae	3	0	39	10	Mer	1	α CMa	14
(16)	Algomeyza	.i. <***> et haec est in collario minoris canis	14	0	15	30	Mer	1	α CMi	16
(17)	Maryeb	.i. navis	29	0	43	40	Mer	3	ρ Pup	17
	LEO									
(18)	Dubhe	.i. ursa, et est in quadrato maioris ursae scilicet super dorsum eius	4	0	49	10	Sep	2	α UMa	18
(19)	Calb Alazed	.i. cor leonis	18	0	0	10	Mer	1	α Leo	21
(20)	Alfard vel Alferat	.i. singularis, et est in hydra serpente	15	0	22	30	Mer	1	α Hya	20
(21)	Sella	.i. <***> quae est sub sinistro pede posteriore maioris ursae, et sunt duae stellae coniunctae	10	0	28	0	Sep	2	μ UMa	19
	VIRGO									
(22)	Denab Alazad	.i. cauda leonis	9	0	12	0	Sep	1	β Leo	22
(23)	Alkhorab	.i. corvus, et est in quadrangulo corvi meridiana orientalis	29	0	15	0	Mer	3	γ Crv	24
(24)	Benetnaghx	.i. filiae feretri, et est finis caudae maioris ursae	16	0	53	30	Sep	3	η UMa	23
	LIBRA									
(25)	Alrameh	.i. lanceator, nec est in forma alicuius imaginis	13	0	31	30	Sep	2	α Boo	26
(26)	Alcymech	.i. inermis, et est mamma sinistra virginis	11	30	2	30	Mer	1	α Vir	25
	(a)	(b)	(c)		(d)		(e)	(f)		

	(a)	(b)	(c)		(d)		(e)	(f)		
	SCORPIUS									
(27)	Alpheca	.i. corona vel cavilla	1	30	44	30	Sep	2	α CrB	27
(28)	Alcalb Alzachab	.i. cor scorpionis	28	0	4	20	Mer	1	α Sco	29
(29)	Alyad	.i. manus sinistra serpentarii, scilicet qua tenet serpentem, et sunt duae stellae coniunctae	22	0	17	0	Sep	3	δ Oph	28
	SAGITTARIUS									
(30)	Razalthogben	.i. caput draconis, vel Raz Altumyn	12	0	74	30	Sep	3	γ Dra	31
(31)	Razalguene	.i. caput serpentarii	10	0	36	0	Sep	2	α Oph	30
	CAPRICORNUS									
(32)	Nazrul Almaqueg	.i. vultur cadens	3	0	62	0	Sep	1	α Lyr	32
(33)	Nazru Alcayr	.i. vultur volans	20	0	29	30	Sep	2	α Aql	33
	AQUARIUS									
(34)	Aldygeya	.i. gallina, et est in cauda eius	21	0	60	30	Sep	1	α Cyg	36
(35)	Delfyn	.i. <**> et est in rumbo eius orientalior	6	0	32	30	Sep	3	γ Del	34
(36)	Denab Algedy	.i. cauda capricorni	13	0	2	30	Mer	3	δ Cap	35
(37)	Enif Alfaratz	.i. musida equi Pegasi	21	0	23	0	Sep	2	ε Peg	37
(38)	Scenach	.i. crus, et est meridiana duarum in crure Aquarii	27	0	7	40	Mer	3	δ Aqr	38
	PISCIS									
(39)	Menqueb Alfaraz	.i. humerus equi	20	0	31	0	Sep	2	β Peg	39
(40)	Denebcaytos	.i. cauda ceti, et est in ramo caudae meridiano	21	0	20	0	Mer	2	β Cet	40

(34) *Capricorno assignant* Ey Md. — **(a1)** -mina Ey. **(a2)** alpheraz Ey. **(a4)** enif Ey. **(a5)** scederh Ey. **(a6)** batakartoyz Ey. **(a7)** -bnim Ey. **(a9)** menkar Ey. **(a10)** -nar Ey. **(a11)** ragel algeuze Ey. **(a13)** bedelgeuze Ey. **(a15)** alhabor Ey. **(a19)** cabalezed Ey. **(a20)** a.v.a.: alfard Ey. **(a22)** denebalezed Ey. **(a23)** algurab Ey. **(a24)** benednaz Ey. **(a25)** -mech Ey. **(a26)** azimech Ey. **(a27)** elfeca Ey. **(a28)** calbalacrab Ey. **(a29)** sed Ey. **(a30)** raztaben Ey. **(a31)** razalagne Ey. **(a32)** alguegua Ey. **(a33)** altayr Ey. **(a34)** aldigege Ey. **(a35)** delphin Ey. **(a36)** denebaligedi Ey. **(a37)** emfalferaz Ey. **(a39)** euenq(ue)b a. Md; menchebalferaz Ey. **(a40)** denebkartoz Ey. **(b3)** c.p.: Ey; *ras.* Md. **(b10)** erid.: -da() Ey. **(b16)** <**> et: *(vacat)* et Ey; *om.* Md. **(b21)** <**>: *(vacat)* Ey; *om.* Md. **(b27)** c.v.c.: corona Ey. **(b30)** i.c.d. Ey. **(b35)** <**>: *vacat* Ey; *om.* Md. in rumbo: Md; rumbor Ey. **(b38)** crus: Md; crux Ey. crure: cruce Ey Md. **(b40)** ramo caude: roma cauda Ey. **(c11)** 0′: Md; 30 Ey. **(c28)** 0′: Md; 20 Ey. **(c33)** 20°: 17 Ey.pc. **(c34)** 21°: 24 Ey.?pc. **(c39)** 20°: 16 17 (!) Ey.pc. **(f37)** 2: Ey Md.?pc.

LA15a. Kunitzsch type VII, 31 stars, ecliptical, extract of preceding.

Wa,83v: "Tabula stellarum fixarum verificatarum per armillas Parisius, et est longitudo earum gradus circuli signorum per circulum transeuntem <polos> zodiaci et stellas, latitudo vero earum est arcus eiusdem circuli cadens inter stellas et gra() longitudinis earum". 31 stars. Same columns as LA15, except for the column of magnitudes. — Printed by Kunitzsch 1966, p. 47-50, from ms. Darmstadt 2661, 157r (dated to the 12th-13th c.; I have not verified this) and 13 other mss. — Sample, not emended:

Nomina stellarum fixarum cum imaginibus in quibus sunt		<<Imagines stellarum>>	Longi tudo Gr	Mi	Lati tudo Gr	Mi	Pars latitu dinis	
Aries	Panthakartos	Venter cethi	10	0	20	0	Mer	ζ Cet
Taurus	Aldrebran	Oculus vel cor tauri	20	0	5	0	+Sep+	α Tau
......	....	....	.....		.....		.....	
Pisces	Alferazmencel	Humerus equi	20	0	31	0	Sep	β Peg
	Denebkaytos	Cauda cethi	21	0	20	0	Mer	ι Cet

LA16. Kunitzsch Type I, 21 stars, ecliptical (+12;40°), etc. Connected with Maslama.

Lw,119v: "Tabula locorum stellarum fixarum in ultimo anno 367 annorum Maumet (i()aumet Lw)". – 21 stars, longitudes 12;40° greater than in the Almagest.

Printed by Kunitzsch 1966, p. 15-18, from ms. Lw, together with an Arabic exemplar where it is attributed to Maslama ibn Ahmad (al-Majriti) and dated to the end of AH 367 (~AD 978). The present table was also noted by Zinner 1936 p. 761-62, cf. Toomer 1968 p. 123. – Sample, not emended:

	Nomina stellarum	Longi tudo		Lati tudo		Pars	Medi atio		Dista ntia ab equ atore		Pars	
		Gr	Mi	Gr	<*>	Pars	Gr	Mi	Gr	Mi	Pars	
(01)	Capud allgol	42	20	23	0	Sep	56	34	14	12	Sep	β Per
(02)	Aldebaran	55	20	5	10	Mer	62	55	43	50	Sep	α Tau
(03)	Alaioc	67	40	22	30	Sep	90	20	15	35	Mer	α Aur
	....	...	...	...	...	.....	...	...	...	...	.....	
(19)	Benennos	162	40	55	0	Sep	197	35	55	30	Sep	η UMa
(20)	Cauda leonis	156	40	11	50	Sep	161	40	20	4	Sep	β Leo
(21)	Capud serpentarii	255	30	36	0	Sep	264	0	4	30	Sep	α Oph

LA17. 49 stars, ecliptical (+16;30°).

Vo,69v-70r, no main heading. – List of 49 stars, arranged according to signs. Giving longitude, latitude, magnitude, and "naturae stellarum". The longitudes show an increment of 16;30° over the Ptolemaic ones, a value not found among Kunitzsch's tables. It may fit a date in the early 14th century; cf. the parallels below.

Parallels. A similar increment, of 16°40′, is shown by a table of 67 stars in Cambr. U.L. Gg.VI.3, 127r-128r. It has the dating AD 1316 and is ascribed to J. Mau(di)t; cf. North 1976, II p.243, III p.157. – A further table, of 24 stars, also dated 1316 and with the increment of 16°40′, has been printed by Poulle 1964b, 192; cf. Kunitzsch 1966 p. 77-78 (copy, e.g., Erfurt CA 4° 351, 55). I have not looked into the relationship of these two tables.

Sample. From Vo. Not emended. There is an Abjad-type error in item (01).

		Signa	Longi tudo		Pars	Lati tudo		Magni tudo	Nature stellarum	
			Gr	Mi		Gr	Mi			
(01)	Stella lucida que est in postremo fluminis	Ari	16	40	Mer	*13*	30	1	Iovis solius	θ Eri
(02)	Stella que est in sum(itat)e equi secundi, et est communis ei et capiti mulieris que non novit maritum	Ari	4	20	Sep	26	0	2	Martis Iovis	δ Peg =α And
(03)	Meridionalis trium que est super mizar mulieris que non novit maritum	Ari	20	20	Sep	27	20	2	Veneris	β And
(04)	Aldebaran, quidam dicunt quod sit oculus tauri et quidam cor tauri	Tau	29	10	Mer	5	10	1	Martis	α Tau

(05)	Lucida que est in capite algol	Tau 16 10	Sep 23 0	2	Iovis Saturni	β Per
	....	....	....	...	......	
(45)	Stella que est in postremo <->s equi et super os piscis meridionalis	Aqr 23 30	Mer 23 0	1	Veneris Mercurii	α PsA
(46)	Stella lucida que est in caudagalline et est arid()	Aqr 25 40	Sep 60 0	2	Veneris Mercurii	α Cyg
(47)	Stella que est super renes equi secundi qui est alatus et est ea que est super extremitatem <->.	Psc 28 40	+Sep+22 30	2	Martis Iovis	ε Peg?
(48)	Stella que est super humerum dextrum eiusdem equi et est super radicem manus	Psc 18 40	Sep 31 0	2	Martis Iovis	β Peg
(49)	Stella que est inter duas spatulas eiusdem et inter spatula ale	Psc 13 10	Sep 19 40	2	Martis Iovis	α Peg

(01 Latit.) 13°: 53 Vo.

LA21. Kunitzsch type XI, 29 stars, equatorial.

Printed by Kunitzsch 1966, p. 67-71, from ms. Ch ("fol. 236", perhaps really =f.199r+),[1] with selected variants from 11 other witnesses. – List of 29 stars, often found with with the astrolabe tract ascribed to Messahallah. Some headings date our table to AD 1223, which may be too early (Kunitzsch 1966 p. 67), and place it in Paris, at the latitude 48°30′. The terrestrial latitude to be obtained from the meridian altitudes is uncertain: when applying the declinations from LA15 or from ms. Vm, below, the resulting values cluster around 48° or 48;30°. Thus, Paris is a likely location.

Lw,120v: "Tabula stellarum fixarum quae ponuntur in astrolabio, certificata ad civitatem Parisius (piri(us) Lw)". The manuscript is Kunitzsch's XIIc, and the version of the table is the first of two versions indicated by Kunitzsch. The table contains mediation and "latitudo ex utraque parte"[2] (col. (c) and col. (d) below), both in integral degrees, then the meridian altitude (cols. (e-f)). – Sample:

	Pancancaitoz,	(Gr	Gr	Gr	Mi)		
Aries	Pes caitoz	20	39	28	0	In pede cuiusdam animalis	ζ Cet
	Algon	7	71	88	0	in fronte algonis	α Per
......	....	....	....	......		....	
(Aqr)	Humerus equi	17	71	71	0	Ultra cenith in equo alato	β Peg
Pisces	Denecaitoz	22	36	32	0	In cauda caitoz	ι Cet
(a)	(b)	(c)	(d)	(e)	(f)	(g)	

Vm,14r (m2) shows a different table, "Tabula stellarum que ponuntur in astrolabio, cum lo(ngitudine) et la(titudine) in circulo signorum /ab equinoctiali\". This is like the second of the two versions indicated by Kunitzsch. The star-names and other labels are almost the same as in ms. Lw. The values, however, are different from those above: they consist of a column of mediations in integral degrees (not

---

1 Quoted by Kunitzsch p. 68 from a printing by W.W. Skeat, *A Treatise on the Astrolabe by Geoffrey Chaucer*, London 1872, p. XLIII f.

2 This function is discussed by North 1976, III, Appendix 26. It is an auxiliary function for placing a star on the rete of the astrolabe, the same as in Kunitzsch Type III, "altitudo"; cf. Kunitzsch 1966 p.25 with note 9.

like (c) above but like the "longitudo" column in Kunitzsch's edition, not shown here), plus a column of declinations (not shown above but like Kunitzsch's "latitudo" column).

LA22. Kunitzsch Type VIII, 49 stars, equatorial.

Printed by Kunitzsch 1956, p. 51-58, from ms. Cm,70v, and 15 other witnesses. – Giving mediation and declination. Stars are ordered according to mediation. The table often occurs together with the astrolabe tract ascribed to Messahallah.

Wa,80v: "Tabula stellarum quae ponuntur in astrolabio per gradum longitudinis earum, et est gradus cum quo stella mediat caelum et qui ponit eam in signo, et per gradum latitudinis earum, qui est earum distantia ab aequinoctiali", repeated in much the same wording. 49 stars.

Ej2,99v (Novara tables): "Tabula stellarum fixarum astrolabii cum longitudine earum in signis et distantia ab aequinoctiali". Same inventory as in Wa, but 2 stars are missing or conflated with adjacent ones.

Sample. From Wa Ej2; labels according to Wa. Not emended. Modern names from Kunitzsch.

				(Med.)		(Decl.)			
5:	Aries	Myrath	5		7	0	22 30	Sep	β And
		Bathenkaytor			18	30	13 30	Mer	ζ Cet
		Panthakakaitor	5	Venter ceti	20	0	14 0	Mer	ζ Cet(!)
		Enyf			22	0	32 30	Sep	α Ari
		Finis fluxus	5		25	0	4 30	Aus	θ Eri
..	......	....	...	....	...	..	....	...	
4:	Pisces	Alferaz	5	In Pegaso	6	0	24 0	Sep	β Peg
		Mentuchyl	5	Humerus equi alati	18	0	25 0	Sep	β Peg(!)
		Denebkaytor	5	Cauda cethy	22	0	10 0	Aus	ι Cet
49		Sceder			18	0	53 0	Sep	α Cas
	(a)	(b)		(c)	(d)	(e)	(f) (g)	(h)	

Variants in numbers: **(Panthak.)** *om.* Ej2. **(d Bathen.)** 16 Ej2. **(f Bathen.)** 10 Ej2. **(f Myrath)** 32 Ej2 Kunitzsch. **(f Enif)** 23 Ej2.

LA31. "Tabula de dispositionibus stellarum fixarum...". Purpose uncertain; astrological?

C,377-382: "Incipit tabula de dispositionibus stellarum fixarum existentibus ad terminum complementi radicis mediarum coniunctionum solis et lunae quae alibi signantur. Et primo de dispositionibus illarum stellarum quae sunt prope viam solis". In three sections. – Sample from the first section, which has 52 sub-sections:

	Longitudo Si Gr Mi	Latitudo Gr Mi	Partes latitudinum stellarum fixarum	Magnitudines	
1'a, Martis Saturni:	0 24 32	7 20	Sept.	3	
	0 25 32	8 20	Sept.	3	
2'a, Mercurii Saturni:	0 28 52	7 40	Sept.	<*>	Flamai (?)
	0 29 22	6 0	Sept.	<*>	Hercules
	....	......	....	....	

51, Sa Iu:	0 13 32	14 20	Sept.	4
	0 14 12	13 0	Sept.	4
	0 15 32	12 0	Sept.	4
52, Mar Mer:	0 20 22	8 30	Merid.	3

Then follow two further sections, of northern and of southern stars, consisting of 19 sub-sections each. – There are only a dozen actual star-names to be seen, e.g.,

2 0 32	5 10	Merid.	1	Aldebaran
6 14 32	2 0	Merid.	1	Alcimech
7 2 32	44 30	Sept.	2	Alfeca
2 12 52	22 30	Sept.	1	Alhaioch
9 21 42	19 10	Sept.	2	Vultur

The longitudes of Aldebaran, Alchimech and Alhaioc show an increment of 2;57 over LA13, thus one of 17;52° over Ptolemy. This corresponds to nothing in Kunitzsch; the nearest comparable value is late 14th c., but the manuscript is probably not so late as this.

I do not know the purpose of this table. A gloss on p.382 has: "Nota quod dispositiones stellarum fixarum, denotatae in praecedentibus, ad terminum complementi radicis mediarum coniunctionum, disignatae (dis-!) in praecedentibus, ordinantur secundum earum naturalem dispositionem; et quod longitudines earum incipiunt a principio arietis, et fiant secundum successionem signorum; sed latitudines earum sunt distantiae earum a via solis".

M. Geographical.

MA. Lists of cities.

MA11. Principal version.

Toomer 1968 no. 83 (edition with full commentary). — List of 62 localities (or 60 if no. 57 and 61 are secondary). The coordinates are most often as in Ibn Yunus or in the Alkhwarizmian tables, but many values are unfamiliar, partly because of corruption.

The list has been printed by Wright (1923 p.87-88) from the collection of Marseilles tables in Par. lat. 14704 (*ibid.*, p.84 n.6). It has been further examined by Toomer (1968 p.134-39), and has been excerpted for E.S. & M.H. Kennedy's "Geographical coordinates..." **(K&K),** printed 1987 but used already by Toomer. The present section can add little to the earlier findings, except some clarification on what are typical manuscript readings.

Witnesses: **{a0}** Oo,35r; Cq2,108; Ey,73v. — **{a1}** Xa,36v; Ad,84v; Cq,64; Fc,51r; Fc,83r; Ps,79r-v; Sg,184-185; Wd,36v; Fh,66r; Xw2,37v. — **{a2}** Cz,93r; Cj,164v; Md,102r; <Mp, see below>; Vp,138v. — **{aX}** R,58v; Vd,33r; Ov,109r. — **{aT}** Lu,81r; Oj,150r; P,113r. — **{k}** Eh,111v; Lw,121r; (Ou,67r, see MA11a); Co,175r. — **{d}** Lb,61r; Pa,75r; A,250v-251r; Fj,92v; Nc,116v; Pb,38v; Fd2,59v (abridged); Ok,67r. — **{e}** Gr,68r; Eq,87r; Ek3,113r; Xc,81v; Vj,105r; Ej,88r; Vm,16v. — **{x}** Oc,94r; X,171r; Vz,77r; Mv,110r; Cm,214v; B,162r; T,300r; Lf,111v; Lg,190r; Lh,158r; Xj,293r; Xg,74v; G,78v; Xb,93v; Es,200r; Fb,87v; Pq,203v; Oy,92v; Wa,78r; Ow,172r; Nu,159r. — **{p}** O,91v; Pd,90r; Ch2,184r. — **{?}** Py,47r; Ch,38v-39r (:Savasorda 1); Da2,214r (with CE40); Fd,2v (:Novara); Da1,132r (:?); Da3,137r (:?; headings only); Vd2,62r (:?). — Double version in {a1} Fc. — Probably lost from {a2} Mp; see T:04(2:Mp).

Copies in other contexts. I have found no copies that have notably better readings than the witnesses listed above.

Madrid BN 10016 (=Mg), 70v, 13th c. Within a collection located between Alkhwarizmian tables (Suter's ms. N: until 68v) and tables for Hereford (from 73r on), in a different hand from either. Has an entry for *Hereford* (after no. 11: 24° / 52°), in a secondary but contemporary hand. Otherwise it is quite similar to ms. Xa.

Cambridge U.L. Hh.6.8 (=Ch), 38v-39r, early 13th c. Within the "Savasorda" collection for Toulouse described in T:03(2,Ch). Some items are intercalated (Majorca, Pisa, Bourges; extra item for Toledo (28°30′, 39°54′(!)); "Bagdoe, Chemred"; cf. "Additions" below. The table has the same gross errors as Cq2, and adds a few more of its own. Not collated.

Par. lat. 14704 (=Xu), 119v, 13th c., printed by Wright 1923, p. 87-88; cf. *ibid.* p. 84 n. 6. Prefixed to the tables of Raymond of *Marseilles,* apparently in the same hand. Heading: "Mahomet Algoarismi hanc abstraxit tabulam de libro \Ptolomei/ qui dicitur Alieoraphie \id est ?terrena/, licet de quibusdam \urbibus istis/ aliter sit res". Collated below.

Not further treated: Paris Arsenal 1128 (=Pc), 28v (in tables for Ferrara; has standard values, leaves out (57) and (61));[1] Par. lat. 7411 (=Xn), 60r (in Novara tables; has standard values). A different table is Paris Arsenal 8322, 42v, in an Albatenian collection; both the inventory and the coordinates are unfamiliar.

Canons: Only Cb210, which is trivial. Ca091 "scito longitudinem illius (regionis)" may be an allusion to a table like this.

Headings.

General, vulgate. In the common form, listed as (1), witnesses are only quoted for a few conspicuous variants, and rare variants are ignored. Alternative readings where witnesses are not quoted mainly belong to the late parts of the tradition. Heading (1) is much like the archaic (2), though with "elongatio" for "longitudo". —

---

1 Pc,28v has a further table with extra cities plus a gloss saying that here the longitudes are 17°30′ greater than in MA11 "...et credo tertie tabule magis quam primis duabus quia concordat cum canone de A<r>ym et Toleto".

(1) Tabula longitudinum (/-nis; /latit- Cz Md**) regionum, quae est elongatio earum** (eorum Ad Lu P) **ab occidente, et latitudinis (/-nes** Xa Fc Sg Fh Lu P; **/-num** Ps Md Wd Lb; *alia* Oj Cz Cj) **earum** (*om.* Cj, {x--}, Da3)**, cuius (/cui** {x--}) **similis (/-le) (+est) altitudo** (/lati- Fh X Vz Xj; +vel elevatio Vp R) **axis (/poli** Sg Cz Cj Md Wd Vp R Lu Oj P Co Mv T Oy Wa Da1; *om.* Oc Da3; *s.l.* Xb**) septentrionalis super eas** :: {a1:} Xa Ad Fc(51r)! Ps! Sg Wd Fh; {a2}; {aX:} R; {aT}; {k:} Co; {d:} Lb!; {x-}; {?:} Da1! Da3.

(2) Tabula longitudinum regionum, quae est (*om.* Py) **longitudo earum ab occidente, et latitudinis** (-do Da2) **earum, cuius** (cui Cq) **similis est altitudo axis septentrionalis super eas** :: {a0:} Oo; {a1:} Cq; {?:} Da2 Py.

(3) Tabula longitudinum et latitudinum regionum, et est longitudo earum (eorum Ch) **ab occidente et oriente, et latitudo earum** (eorum Ch) **est similis altitudini axis septentrionalis** :: {a0:} Cq2; {?:} Ch.

(4) Tabula longitudinum et latitudinum regionum, *(Xc Vj Ej Vm:)* **quae est** (*om.* Vj) **elongatio earum ab occidente medii mundi,** (+et distantia ab aequinoctiali Vm) **cuius similis est altitudo poli super eas** :: {e:} Gr Eq Xc Vj Ej Vm.

(5: other) :: (Abridgments of (1):) Cm Vz.ac; Eh & Lw ("T. l. r. q. e. elongatio earum (ear. el. Lw) ab occidente (+cum earum latitudinibus Lw; *n.l.* Eh)"); Fb (two headings, "Tab. ... occidente", like (1), then "Tab. ... occidente" like (4)); Ek3 ("T. longitudinum et latitudinum regionum a medio mundi", abridgment of (4)). – (Doubtful:) Ey ("Tabula longitudinum et latitudinum civitatum mundi magis famosarum"); R ("Tabula longitudinis et latitudinis regionum diversarum et etiam civitatum in illis existentium", then heading (1)); Ou (see MA11a); Ov Ok Ch2. – (none:) Vd Pa.

General, form found in classes {d,p}, etc.:

(6) Tabula longitudinum (-nis Fc O Pd) **civitatum** (-tis Nc) **ab occidente et latitudinum** (/-ne O Pd; longitudine Fc; longitudinum Fj) **earum (/ipsarum** Vd2 Fj Nc) **ab aequatore (+diei** Fc O Pd; aequalitate Xw2; aequinoctiali linea Vd2) :: {a1:} Fc(83r) Xw2; {aX:} Vd2; {d:} A Fj Nc! Fd2; {p:} O Pd.

(7: other) :: Pb ("Tabula civitatum").

Names of localities: **(8) Nomina regionum,** normally. – **(9) Nomina civitatum** (-tis Oc; +plurimarum (=?) O) :: {a0:} Ey; {a1:} Fc(83r) Xw2; {aX:} Vd2; {k:} Ou; {d:} Pa A Fj Nc Pb Fd2; {x:} Oc; {p:} O Pd; {?:} Fd. – **(10) Nomina civitatum terrae** (*om.* Es) **sive regionum** :: {x:} X Cm T Xb Es Fb! Oy; {?:} Da3. – **(11) Nomina regionum vel** (seu Vz; et B Lf Xj Wa Nu; *om.* G) **civitatum** :: {x:} Vz Mv B Lf Lg Lh Xj Xg G Pq Wa Ow Nu. – **(12: other)** :: Vd; Eh; Fb (has another sub-hdg. besides (10)).

Coordinates: **(13:) Longitudo; Latitudo,** with hardly any variants.

Versions. For the inventory of {k} Ou,67r, see MA11a. The copy in {a0} Ey has some transpositions and interpolations. – Additions and interpolations are generally numerous and varied, and a comprehensive listing has not been attempted. A few additions are listed in the section "Additions", after the reproduction of the table. They are mainly taken from the witnesses collated for numerical values.

The coordinates for Toledo are discussed at the end of this section. They were originally the same as in Ibn Yunus; another set of values, which resemble those of the Toledan tables, has been introduced imperfectly and at late stages.

Islamic parallels to the coordinates. Toomer (1968) made a thorough comparison of the coordinates in this table to the material later edited in K&K. Another such comparison has been done for the present purpose, with much the same results. The following notes are not intended to repeat Toomer's findings, but just to summarize the very closest parallels to the readings, and to explain a few identifications. – The sources that fit the present table most closely are:

YUN: Ibn Yunus, Al-Zij al-kabir al-Hakimi, Leiden cod. or. 143, p. 133-136, K&K p. xxxvi.
KHU: Alkhwarizmi, Kitab Surat al-ard, ed. Mzik 1926, K&K p. xxii-xxiii
KHZ: Same, table in Istanbul Aya Sofya 4830, K&K p. xxiv

The prime meridian in these sources is the shore of the Western Ocean, or "the pillars of Hercules". – A few parallels are also furnished by

BAT: Albattani, who mostly implies
PTO: Ptolemy's Geography and
HTP: Handy Tables, Halma's edition.

In these cases the prime meridian is the Fortunate Isles, such that the longitudes are normally 10° greater than in the corresponding Alkhwarizmian sources.[1]

A section of YUN (ms. cit. p.136 col. 3-4) shows a concentration of coincidences with our table, including a stretch containing our nos. 1-3, 11, 4-6, in this order. This was noted by Toomer (1968 p. 136). In the sources mentioned here and in half-a-dozen other likely sources from K&K, I have seen no further parallels that involve more than three items in a row. Generally, then, there are no parallels for the ordering.

Ibn Saᶜid's geography (SAA), while showing counterparts to almost all the localities presented here, has few if any non-trivial parallels to the coordinate values; so it can be eliminated as a possible source.

Quotation of parallels. Of the Islamic parallels listed above, I normally quote whichever of YUN and KHU comes closest to the present table, adding a "+" if they are supported by any other witnesses used by K&K. If KHZ fits better than YUN or KHU, I quote KHZ only. All are faulty, so which of them is adduced is often a matter of chance. However, YUN seems to show specific similarity to our values (cf. no. 1-2, 4, 6, ... in the table).

If none of these fits but Albattani (BAT) seems to account for the reading, I quote him alone, merely adding a "+" if there are other such parallels; these, in fact, often include PTO or HTP. If BAT does not fit either, a few other parallels may be cited, but they are likely to be fortuitous; for symbols see K&K.

For any listed parallel, I quote the coordinate(s) that do not agree with those adopted for MA11. If both coordinates agree, an "=" equal sign is appended to the symbol for the parallel.

Text: values of coordinates. Collated: **{a0}** Oo Cq2; **{a1}** Xa Cq; **{aT}** Lu; **{k}** Co; **{d}** Pa A; **{e}** Eq Xc; **{x}** Es Xg. – Headings according to Xa. – Also quoted: **$mrs** = the Marseilles table Par. lat. 14704, 119v; see above. – A collation involving more manuscripts, independent of the present one, is summarized in T:06(15).

Layout. Oo Xa Cq Xc have the table in 4 parts, breaking after no. 15, 31, and 47. Lu Co Pa A Eq Es Xg show two parts, breaking after no. 31, 33, 35, 32, 39, 35, 34, respectively.

Oo Xa Cq Co $mrs show a blank space after (11). This may be original; in the rest, the space has been omitted or filled in with pseudo-entries. In Oo, and partly in Cq2 $mrs, there are blanks or irregularities at (57) and (61), and in the other witnesses the coordinates that appear in these places are imperfect; so these items may be secondary too.

Readings chosen. I prefer the readings shown by the majority of Oo Cq2 Xa Cq Lu $mrs, since these are not obviously interdependent; see "Variant groups" below. Underscoring is used for values that are not in the Islamic parallels, either because of errors on either side, or because no plausible source has been found. Italics are used for readings adopted against the majority of witnesses collated.

Variant groups. See also T:06(15). – Well-defined groups are *Eq Xc* (e.g., b24-31, b44, b46, c05-15), and *Es Xg* (often, with large revisions). *Co* associates with Eq Xc (b15, b47, c47); at (c04), Co Eq Xc Es Xg all share an innovation, which may not be significant. Another independent group is *Pa A* (e.g., b03, b51); Pa A may be partly correct at (c21). – The rest of the collated witnesses (Oo Cq2 Xa Cq Lu $mrs) show no clear relation to those mentioned or to each other.

Text: place-names. The place-names are based on mss. Oo Cq2 Xa Cq $mrs, and only these are quoted fully in the apparatus for col. (a). The rest of the collated witnesses are quoted in a few instances where names are displaced or other names may be intended; lesser variants are numerous, and have been ignored. The identifications of places generally agree with Toomer's, and, since the material compared is the same, many of the notes also agree. Some non-trivial identifications made by North 1986, p. 186-195, are marked "(N)".

---

1 Cf., e.g., Toomer 1968 p. 136.

Tabula longitudinum regionum,
quae est elongatio earum ab occidente,
et latitudines earum, cuius similis est
altitudo axis septentrionalis super eas.

	Nomina regionum	Longitudo Gr	Longitudo Mi	Latitudo Gr	Latitudo Mi	**Name in K&K**		**Selected parallels**
(01)	Tangea	6	30	35	15	Tangier	YUN	=
(02)	Cepta	8	0	35	20	Sibta	YUN	=
(03)	Corduba	9	20	*38*	30	Cordoba	YUN+	lat. 38;50
(04)	Bage .i. Toletum	11	0	40	0	Toledo	YUN	= [mss. Es Xg: 28;30 / 39;51]
(05)	Sigilmessah	15	0	22	0	Sijilmasa	?	[KHU: 31;0 /21;0. Varying elsewhere.]
(06)	Ganah	15	30	10	45	Ghana	YUN	=
(07)	Sedes regis Francorum	23	45	45	50	Reims?	?	HTP: "Dorocot.", lat.45;30. KHU+: Lyon, lat. 45;00.
(08)	Insula Tule	10	0	58	10	Orkney?(N)	?	KHU = "Bali in island". [KHU+, Thule: 30;0 / 62;45.]
(09)	Kartago	27	0	37	0	Carthage	YUN	lat. 32;0 ("52;0")
(10)	Tuniz	29	0	38	0	Tunis	YUN	lat. 33;0, correctly (Toomer)
(11)	Emerita	8	0	41	55	Merida	YUN+	lat. 41;35
(11*)								
(12)	Balgh	108	35	38	40	Balkh	KHU+	lon. 88;35, correctly (Toomer)
(13)	Albeyt	130	0	38	0	Tubbat (Tibet)	KHU+	=
(14)	Civitas *regni Acim*	177	0	18	30	China	YUN	lon. 177;12
(15)	Aracah	73	36	36	0	Raqqa	BAT+	lon. 73;15. — Cf. ms. Oo, "173;35".
(16)	Mecah	67	0	21	0	Mecca	KHU YUN+	=
(17)	Gedda	66	30	20	15	Jidda	YUN	lat. 21;15
(18)	Almedina	65	20	25	0	Madina	KHU+	=
(19)	Algaz	63	50	24	0	Madina?(N) /Qus?	?	TAJ (Qus: lon. 65;30). [KHZ YUN+, Qus: 55;30 / 24;30]
(20)	Yspaen	75	0	34	30	Isfahan	KHU YUN+	lon. 74;40
(21)	Alre	86	0	37	30	Rayy (Tehran)	BAT	lat. 36;30. — Cf. mss. Pa A, "36;0".
(22)	Fargana	86	0	36	0	Farghana	?	LYD: lat. 37;0. [Absent from KHU KHZ YUN]
(23)	Goarizmi	91	50	42	10	Khwarizm	KHU YUN+	=
(24)	Chebil	100	0	28	0	Kabul	KHU YUN+	=
(25)	Albazra	74	0	31	0	Basra	KHU YUN+	=
(26)	Hamen	84	30	19	45	Oman	KHU YUN+	=
(27)	Adramauth	71	0	12	30	Hadramaut	KHU YUN+	=
(28)	Sanaa	*63*	30	14	30	Sana	KHZ YUN+	=
(29)	Armenia	77	0	41	0	Arminiya	BAT	=
(30)	Buchareh	107	20	36	50	Bukhara	KHZ	lon. 87;20, correctly (Toomer)
(31)	Cerendin	125	0	3	0	Sarandib (Ceylon)	YUN	=
	(a)	(b)		(c)				

	(a)	(b)		(c)				
(32)	Almedia .i. Affrica	32	0	36	0	Mahdia, Tunis(N)	?	YAQ_PTO = "Madina Barqa". [Absent from KHU KHZ YUN]
(33)	Cirenen	31	0	35	30	Kairawan?	?	KHU YUN+: lat. 31;40
(34)	Insula Sardania	31	0	38	0	Sardinia	?	ATH_FID =. [Khu+: 42;08 / 36;0]
(35)	Roma	35	25	41	50	Rome	KHU+	=
(36)	Kabiz	36	0	32	0	Qabis	?	[absent from KHU KHZ YUN, coords. varying elsewhere]
(37)	Insula +mozella+	37	0	37	0	Pantelleria?(N)	?	[HTP =, "Panormos". – Coords. do not fit Morea.]
(38)	Insula Sicilie	36	0	39	0	Sicily	?	[BAT: 39;8 / 36;19. YUN: 35;0 / 38;0]
(39)	Malta	38	0	36	0	Malta	?	[HTP: 36;45 / 38;45. No other sources for Malta.]
(40)	Trabuluz Arabum	40	0	33	0	Tripoli Algharb	YUN	lon. 40;40
(41)	Barca	47	3	31	0	Barqa	YUN	lon. 46;3 / lat. 31;8
(42)	Alexandria	51	20	31	0	Alexandria	YUN+	=
(43)	Dimiath	54	0	31	0	Damietta	?	BAG: lon.53;0. SAA+: lat.31;20. [KHU+: 53;55 / 31;25]
(44)	Teniz	54	40	31	0	Tinnis, Egypt(N)	KHU YUN+	lon. 54;0 / lat. 31;40
(45)	Eraclia	53	25	46	35	Heraqla (Eregli)	KHU+	=
(46)	Civitas Anuba	53	0	14	30	Dunqula, Nubia	KHU+	= "in Nubh"
(47)	Bagdet	70	0	33	25	Baghdad	YUN+	=
(48)	Messera .i. Egiptus	55	0	30	0	Egypt	YUN+	=
(49)	Alcuzum	56	30	28	20	Qolzum	KHU YUN+	=
(50)	Assuen	56	0	22	30	Aswan	KHU YUN+	=
(51)	Alkarme	55	40	31	30	Farama	KHU YUN+	lon. 54;40
(52)	Ascalen .i. Scalon	55	40	32	0	Asqalan	KHZ+	=
(53)	*Aramla*	56	0	32	15	Ramla	KHZ+	=
(54)	Ierusalem	56	0	32	0	Jerusalem	KHU+	=
(55)	Sur	57	0	33	0	Tyre	?	KHZ YUN: lon. 59;15. BAT+ (67;0 / 33;20)
(56)	Alconsantina	49	0	45	0	Constantinople	KHU YUN+	lon. 49;50. QBL =.
(57)	Panormi	..	..	38	16	Palermo	?	[no parallels; cf. perhaps (37)]
(58)	Damascum	60	0	33	0	Damascus	KHU YUN+	=
(59)	Trabuluz Assem	60	35	34	0	Tripoli Sham	KHU YUN+	=
(60)	Almozil	69	0	35	30	Mosul	KHU YUN+	=
(61)	Messie	..	..	41	*24*	?	?	ZAD = "Sisajan". KHU YUN+ (Sisajan, 71;0/41;25).
(62)	Alcufa	69	30	31	50	Kufa	KHU YUN+	=

Intercalations in Es Xg:

(13′)	Civitas regis eratha	53	25	46	35	Heraqla	KHU+	= (Cf. (45), and apparatus to (44+45))
(35′)	Constantinopolis	56	40	43	40	Constantinople	BAT	lat. 43;10 (contrast (56))
(50′)	Babilonia nova	78	0	35	0	Babylon?	BAT+	lon. 79;0

MA11: Apparatus.

(11*) *vacat linea* Oo Xa Cq Co $mrs; "balgh 108 0 0 0" Cq2, *cf. (12); om.* Lu, *cett. fere.* **(13′)** *post (13)* Es Xg; *om. cett.* **(25-26)** *om.* Pa A. **(35′)** *post (35)* Es Xg; *om. cett.* **(38)** insula cicilia <* * * *> Xc. **(39-40)** *ordo (40,39)* Es Xg. **(44+45)** eraclia 54;40, 31;0 Es Xg. **(46-48)** *ordo (48,46,47)* Es Xg. **(50)** *post (62)* Co.ac; assue() {{56 30 28 20}} Xc, *cf. (55).* **(50′)** *post (50)* Es Xg; *om. cett.* **(57)** *vacat linea* Oo; "alchon <*> 20 <*> 40" Cq2, *cf. (56); lineam om.* $mrs. **(58)** *lineam* "cesaraugusta <* * * *>" *add.* $mrs.

(59-61) *ita disponit* $mrs:

(59)	Trabuluz	60	35	34	0
(60)	Trabuluz	69	0	35	30
	Almozil	69	0	<*>	
(61)	*(vacat)*				

(+59) *om.* Eq. **(+61)** *vacat linea* Oo $mrs; *lineam om.* Cq2.

(Oo Cq2 Xa Cq $mrs:) **(a01)** Xa Cq $mrs; ga(n)gea Oo; tangeta Cq2. **(a02)** Oo Xa Cq $mrs; sc\h/epta Cq2. **(a04)** b.i.t.: Oo Xa; b.\i.t./ $mrs; i.t.b. Cq Cq2; bagez t. Co; toletum Pa A. **(a05)** Oo Cq2 $mrs; s-massa Cq; s-messaho Xa; bagesim Pa A, *cf. (a04).* **(a06)** Oo Xa; gahah Cq2; gana<-> Cq; gana $mrs. **(a07)** Oo Cq2 Xa $mrs: s. r. <<f.>> Cq. **(a08)** Xa $mrs; i. tyle Oo; i. thile Cq2; ynsuiatule Cq. **(a09)** Oo Xa Cq; cartago Cq2 $mrs. **(a10)** Oo Cq2 Xa $mrs; curis Cq. **(a13-15)** *n.l.* Oo. **(+a14)** Cq2 Cq; c. regia cim Xa; c.\regia ciei/ $mrs; *n.l.* Oo; acim Es Xg. **(+a15)** Cq2 $mrs; aracha (?) Cq; aragah Xa; *n.l.* Oo. **(a16)** Oo Xa; mechah Cq2; meca/h\ Cq; mecha $mrs. **(a17)** Cq2 Cq Xa $mrs; geda Oo. **(a19)** Oo Cq2; algahz Cq; alglaz Xa; algoz $mrs. **(a20)** Oo Cq Xa $mrs; yspahen Cq2. **(a21)** Cq Xa $mrs; alye Oo Cq2. **(a22)** Cq2 Cq $mrs; fargara Xa; frangana Oo. **(a23)** Oo Xa $mrs; ghoarizmi Cq2 Cq. **(a24)** Xa $mrs; chehyl Oo; chehil Cq2; ehebil Cq. **(a25)** Oo; albazy Cq2; albart Cq; albazara Xa; albahra $mrs. **(a26)** Oo Cq $mrs; amen Cq2; hame/i\ Xa. **(a27)** Oo Xa; adramahut Cq2; adramaut Cq; adramauht $mrs. **(a28)** Oo Cq2 Cq $mrs; sanaan Xa. **(a30)** Oo Xa Cq; buchayrech Cq2; buchare $mrs. **(a31)** Oo Cq Xa $mrs; che()ain Cq2. **(a32-33)** almea, affrica cyrenya Xc. **(a32)** a.i.a.: Oo Cq2 Xa; a. i. africa Cq; almedia $mrs. **(a33)** Oo Cq2 $mrs; cirene() Xa; cyrene Cq. **(a34-35)** saderina, insula ro() Eq. **(a34)** Oo $mrs; i. sardenia Cq2; i. serdennia Xa; i. s<-> Cq. **(a36)** Oo Cq Xa $mrs; ragiz Cq2. **(a37)** Xa; i. mozera Oo; i. moselan Cq2; i. moze<-> Cq; i. morelani $mrs. **(a38)** Cq2 Cq $mrs; i. scicilie Oo Xa. **(a40)** t()bulaz a. Oo; t-lus a. Cq2; t-luz arabu Xa; t-luz $mrs; *vacat* Cq. **(a43)** Oo Xa Cq $mrs; bimiath Cq2. **(a44)** Oo Cq2 Xa; tenit Cq; reniz $mrs; germez Xc. **(a45)** Cq Xa $mrs; heraclia Oo; erachia Cq2. **(a46)** Oo Cq2 Xa; c. enubat Cq; urbs anuba $mrs. **(a47)** Oo Cq2 Xa; bagdeth $mrs; baddet (?) Cq. **(a48)** Oo; missera \i. egyptus/ Cq2; i. egiptus messara Xa; i. egip<-> messera Cq; messera $mrs. **(a49)** Cq2; alcuzu() Cq $mrs; alcuzun Oo; alizu() Xa; albiru() Eq; albru() Xc. **(a50-62)** *vacat* Cq. – *(Oo Cq2 Xa $mrs:)* **(a51)** Cq2 Xa; alcharme Oo; alcarme $mrs. **(a52)** a. i. scalo() Oo; ascalen \i. ascalon/ Cq2; ascale() \i. scalo/ Xa; aschale() $mrs; *vacat* A. **(a53)** am(en)da Oo; ara(m)la Cq2; am(en)la *aut* ara()la Xa; aranida $mrs. **(a54)** Cq2 Xa $mrs; iherus- Oo. **(a56)** Oo Xa $mrs; /alchon\sa(n)tina Cq2, *partim ex (a57).* **(a58)** Cq2 Xa; damascu() (?) Oo; damascus $mrs. **(a59)** Xa; t()bucuz asden Oo; t-lus a. Cq2; trabuluz $mrs. **(a60)** Oo; almozin almozil Cq2; almozii Xa; (trabuluz + almozil) $mrs *(cf. (59-61), (a59)).* **(a62)** Oo Xa $mrs; alculfa Cq2.

(Omnes:) **(b01)** 20′ Cq. **(b03)** 30′ Pa A. **(b04)** 11°0′: Xg*s.l.*, Es*s.l.*. *cett.;* 28°30′ Es Xg. **(b07)** 23°: xx4 Oo; 27 Cq2. 40′ Es Xg. **(b08)** 50′ Es Xg. **(b09)** 10′ Es Xg. **(b12)** 109° Es. **(b13)** 130°: *n.l.* Cq. **(b15)** 173°35′ Oo. 13° Co Eq Xc. **(b16)** 30′ Oo. **(b18)** 55° Cq. 30′ Eq. **(b19)** 73° Oo. **(b21)** 76° ("lxxv\i/") Cq2. **(b22-31)** 86°, 91--125: 91--125, 0 Cq2. **(b23)** 5′ A. **(+b24-31)** 100°--125°: *vacant* Xc Eq*m1*, *(b25-31) supplet* Eq*(m2).* **(+b25)** 84° Oo; 24 Xa. **(+b26)** 74° Cq2 *(ad b25).* **(+b28)** 63°: Xa Lu Co Pa A Eq*(m2)*, Cq2 *(ad b27);* 73 Oo Es Xg; <.>xiii Cq; *def.* Xc Eq.m1. **(b30)** 30′ Cq2. **(+b31)** 25° Eq*(m2).* **(b33)** 32° Oo.ac. **(b35)** 36° Es Xg. 25′: xxo (=28) Oo. **(b39)** 37° Cq. **(b41-46)** 3′--0′, 0′: 0, 3--0 Cq. **(b41)** 42° Oo. 31′ Es Xg. **(b43)** 50° Xc. 40′ $mrs. **(b44)** 53° Eq; 13 Xc. **(+b45)** 52° $mrs. 28′ ("xxo") Cq2; 20′ Cq *(ad b46).* **(b46)** 70° Eq Xc. **(b47)** 7° Xa; 30 Co Eq Xc; 80 $mrs. **(b48)** 51° $mrs. **(b50)** 40′ Es Xg. **(b51)** 43′ Pa A. **(b52)** 0′ Es Xg. **(b54)** 56°: A.ac, cett.; 57 Oo.ac; 67 A.pc; 66 Es Xg. **(b56)** 59° Oo; x′n (=49°) $mrs. **(b57)** *vac., vac.* Xa Pa A.ac; *vac.*, 0′ Cq Lu Co Eq Xc; 37°30′ Es Xg; 37°37′ A.pc; *def.* Oo Cq2. **(b59)** 31′ Oo; 0 Cq. **(b60)** 59°35′ Cq; <*>°30′ Cq2; lxn (=69°) $mrs. **(b61)** *vac., vac.* Xa Lu Co Pa A Eq Xc Es Xg; *vac.*, 0′ Cq; *def.* Oo Cq2. **(b62)** 59° Cq; lxn (=69°) $mrs. 0′ Cq2. **(c03)** 38°: Oo ("to"), Cq2 A.pc? $mrs; 27 Es Xg; 37 *cett.* **(c04)** 39°51′ Co.ac Eq Es Xg; 39°(51+0)′ Xc. **(c05-15)** 22°--38°, 18, 36: 40, 22--38, <*> Eq Xc, *cf. (c04).* **(c06)** 15′ Oo; *n.l.* Cq2. **(c08)** 50′ Eq. **(+c09)** 37°: *n.l.* Cq. 0′: 3<-> A.ac. **(+c12)** 0′ Pa A. **(c13)** 30′ Eq. **(+c14)** 28° Oo; 0 Cq2; 14 A. **(c15)** 0° Cq2. **(c16)** 40′ Es Xg. **(c20)** 24° Cq. **(c21)** 36°0′ Pa A. **(c22)** 42° Es Xg. **(c23)** 0′ Eq. **(c24)** 38° Es Xg. **(c26)** 29° Oo. 15′ Cq. **(c33)** 35°: xxx<-> Cq. **(c36-47)** 0′--25′: *vacat* Oo. **(c36)** 32°: xxx/ii\ $mrs. **(c39)** 32° Cq2. **(c44)** 31°: x (?) Cq2. **(c45)** 39′ Cq2; *def.* Oo, Es Xg. **(c46)** 44° Oo Cq2. **(c47)** 35′ Co Eq Xc; *def.* Oo. **(c48)** 9′ Es Xg. **(c50)** 31° Es Xg; *alia* Xc. **(c53)** 25′ Oo; 0 Eq. **(c54-56)** 0′,0′,0′: "3,3,3" (=30, 30, 30) Oo. **(c55)** 32° Eq. **(c56)** 40° Cq2. **(c58)** 33°: *vacat* $mrs. 0′: "3ô" (=30) Oo. **(c61)** 24′: Cq Lu Co Pa A Eq Xc; 34 Xa Es Xg; *def.* Oo Cq2. **(c62)** 9°10′ Cq2.

MA11: Additions in the collated witnesses. – Including a few characteristic additions from other witnesses. This selection is far from exhaustive; cf. Wright 1923 p. 91 n. 2 for more instances.

Es Xg.

(A)	Tholosa	40 47	49 6
(B)	Parisius	40 30	48 50
(C)	Marsilia	<*>	<*>
(D)	Novaria	30 15	45 0
(E)	Cremona	<*>	<*>
	(a)	(b)	(c)

(bC) 45,0 \37,30/ Es; *vac.* Xg. **(bE)** *vac.* Es Xg. **(cA)** 46° Es. **(cC)** 45,0 Es. **(cE)** 45,30 Es; *vac.* Xg.

Pa A, first hand. There are several additions in later hands.

Cremona	31 0	45 0

Eq, first hand. Counterparts in K&K are unconvincing or absent. There are several additions in later hands.

Parisius	44 30	48 48	
Cremona	31 0	45 0	
Marcoli	27 0	44 0	Marseilles
Naptali()	36 38	42 20	Naples
Ianua	29 0	41 30	Genoa

Cq2, first hand. Also in ms. **Ch,** 39r (:Savasorda 1). Not recognized in K&K.

Bagdoe *(sic!)*	<*> 10	12 0	?	(lat. 21;0 Ch)
Chemered (-mred Ch)	69 30	22 50	?	(59;30 / 31;50 Ch)

Ps, first hand. This characteristic ending is also in Vat.gr. 212 (from which some notable readings are quoted as "**$P**" below; see Pingree 1976 p.125). I have not tried to correct the readings or to identify the places.

Almeria	17 0	36 50	
Valentia	30 20	39 36	
Scibilia	25 35	37 30	
Marrochus	21 0	31 0	
Insula gm()sirat	176 30	5 45	insula +mstae? $P.
Suseth	168 45	4 45	musac $P.
Mineta	177 0	18 30	
Retha	73 0	36 36	
Carsen	90 0	30 0	
Adeso	45 0	13 0	lat. 16;0 $P.
Mansora	93 0	22 0	
Albuth	53 0	14 30	
Tholetum	27 45	39 34	
Betagna(us)	25 23	39 30	bertagriam $P.
(vacat)			*om.* $P.
Serragoza	29 55	- -	

MA11: coordinates of Toledo. See also the collation of latitude values in T:06(15.3).

Besides the original set of coordinates (long. 11°, lat. 40°), which are the same as in Ibn Yunus, a later set has: long. 28°30′, lat. 39°51′ (rarely, 39°54′). Either or both values in the latter set may be found as scattered secondary corrections all through the tradition. However, the manuscripts that show one or both in the text-hand all belong to the late vulgate classes {a2 e x}; the only exceptions are {k:} Co, showing the latitude 39°51′, and {a0:} Ey, showing the latitude 39°54′. For details see T:06(15.3).

The longitude of 28°30′ fits as 90° minus the distance to Arin of 4 1/10 hours, or 61°30′, transmitted by canons Ca (Ca82, Ca90) and Cb (Cb133 = CcD133).[1] This was noted by Wright 1923 p. 90. For other values of the distance between Arin and Toledo, see T:01(7d) and the notes to CB*.

The latitude of 39°54′ is well attested elsewhere, since it is the only one used in other Toledan tables (cf. T:01(6.1)) and in canons Cb (Cb133 = CcD133). Among the copies of the present table, however, it only occurs in Ey Oc Lf, as a correction in Ej Fc Fj, and in an addition in Ch (for this, see "Copies in other contexts" above). These instances are no doubt taken over from the canons or from the other tables.

The latitude of 39°51′ is common in the later vulgate tradition of the present table, but not outside it (except in ms. Co, as mentioned), nor is it familiar from other tables or parallel texts. It resembles the latitude in Ibn Sa^cid's *Tabaqat*, stated to be about 39°50′ (ch.13, p.59 Salem; cf. Richter-Bernburg 1986 p. 389), but it cannot be derived from this value.[2]

Thus, the original coordinates in the present table do not fit in the context of Toledan tables, whereas the late coordinates are likely to have been taken over from the context or the canons. However, the latitude of 39°51′ is not easy to explain.

MA11*. Variants of MA11.

MA11a. Ou,67r, "Tabula regionum cum longitudine ab occidente et cum latitudine ab aequinoctiali". 30 cities (including Cremona and Marseilles) ordered according to ascending longitude; then 36 cities (ending in Northampton, lat. 52°50′, and London) in no obvious order. Names and coordinates are much the same as in MA11; Toledo has (11°,40°).

MA11b. Da4,146r (for Toulouse tables): mainly the same cities and values as in MA11, but in disorder and with some omissions and additions (Londrenie Maiorica Parisius Tolosa Marsilia Cremona Pisa).

MA11c. C,376: much abridged; with additional cities in the first hand (such as Oxonia, Berwic, and some others) and in a later hand, including some distinctive English cities.

MA11d. Ey2,100v-101r (secondary hand, after the Novara tables GC11-12): "Incipiunt nomina civitatum". 14th-15th c. Italian hand, prefixed with a longish gloss. The places are ordered according to ascending longitude, and many are foreign to MA11.

---

1 The longitude may also be that presupposed by canons Cc. Indeed, in Cc244 the distance to Aracca is said to be 3;2h = 45°30′. The longitude of 28°30′ for Toledo would then entail a longitude of 74° for Aracca, as against 73°15′ in Albattani and 73°36′ in MA11 no. 15. The cause of this deviation may be difficult to pin down, but at least it is certain that Cc does not presuppose the Ibn Yunus longitude. The Toledan mean motion tables seem to imply a distance of just about 3 hours; see the note under CA*, "Radices compared to Albattani".

2 Ibn Sa^cid reports the longitude as "approximately 28°" (Salem p. 59), imprecisely; so the precision of the latitude he reports is also open to doubt.

MA11e. Da1,132va. Secondary hand, 13th-14th century. 33 cities ordered according to ascending latitude, most of them recognizable in MA11. Then, starting within latitude 38°, 51 places with longitudes and latitudes in degrees only, ending in "Norveya 36 62". This part includes many cities in Spain, Italy, and France. The page is worn and partly illegible.

MA12. 6 cities, values as in MA11.

In all the witnesses, the entries are presented in 6 separate boxes across the page. The values and the relative order are the same as in MA11, so perhaps this list is an extract of MA11.

Witnesses: **{a0}** Pz,129r; Mc,27r; Mb,55r. – *Context:* before or after OA11-12; coupled with OB11 in Pz. – *Heading:* **Latitudo et longitudo civitatum Ro, Ie, Sci** Mc. – Pz, in a secondary but contemporary hand, has "Tabula longitudinum et latitudinum regionum, et est longitudo eorum ab occidente et oriente, et latitudo eorum est similis altitudini axis septentrionalis"; this is the same as the heading of MA11 in Cq2 Ch. No heading in Mb.

Text. Transcribed from Pz, where the names have supplements in a contemporary hand, here shown in parentheses. Mc Mb abridge the names in various ways. There are no variants in the numerical values. The prefixed numbers refer to table MA11.

(35)	Roma	longitudo 35 gr 25 mi	latitudo 41 50
(38)	Sicilia	longitudo 36 gr	latitudo 39 gr
(42)	Ale(xandria)	longitudo 51 gr 20 mi	latitudo 31 gr
(48)	Eg(ipti)	longitudo 55 gr 0 mi	latitudo 30 gr
(54)	Je(rusalem)	longitudo 56 gr	latitudo 32 gr
(55)	Sur	longitudo 57 gr	latitudo 33 gr

MA13. 18 cities, values in degrees only.

Ch,38v (:Savasorda 1), close to MA11. List of 18 places, ordered according to decreasing longitudes. Within a collection ascribable to Savasorda; cf. description T:03(2,Ch). The left side is damaged; supplements are in <..>. Dubious values are underscored.

Among the Islamic sources listed by K&K (see to MA11), none convincingly fits these coordinates, nor does MA11 or such additions to MA11 as I have happened to note. For some of the well-known places, one may assume a prime meridian like that of Albattani, rather than the Alkhwarizmian meridian prevalent in MA11. I have not tried to compare the table to Jewish sources.

A parallel, though not a very close one, may be observed in a list of 23 places in Robert of Chester's canons "iuxta Albateni Haracensis sententiam", Oxf. Bodl. Savile 21, 86r+ (cf. T:01(07g); the table is on 89r). It has much the same incipit as our table, but apart from this, there are numerous differences in values and inventory. Below I show the items that are comparable to ours, adding their placement in the table.

A similar table in another copy of Robert of Chester's canons (ms. Hc,25r) was printed by Mercier (1991 p. 64). It shows 13 places, not in the same order as in Savile 21, and no closer to our table.

<Hanc> tabulam inveni
in alio libro.

Nomina regionum	Lo	La	**Savile 21, 89r**		Lo	La	**Dubious locations**
Bagdet	80	35	1	Baldac	81	33	
< >ran	72	36	2	Aracca	73	38	Harran? *or* Raqqa
<Ie>rhusalem	65	33	3	Ierusalem	55	33	
<E>giptus	54	30					Egypt, 55°/30° YUN+
< >echa	51	34					? [Mecca, 71°/21° BAT]
<A>t(ra)bal()	40	36	4	Tripol. barla	39	30	Tripolis ...
<A>frica	36	35	6	Africa	36	35	
< >chi< >era	35	37					?
<B>ogia	32	35	18	Bugea	32	34	Bijaya, Algeria
<R>oma	33	41	10	Roma	35	41	
<P>isa	32	45	11	Pisa	33	45	
<V>erona	31	46					
<A>lma<r>ia	30	36	13	Almaria	30	36	
<C>orduba	29	38	14	Corduba	28	38	
<C>esar<a>ugusta	27	41	17	Aug'ti cesar	29	42	
<T>ol()ta	28	40	16	Toletum	28;30	30	
< >arci< >naio	33	41					? Barcelona, 24°/42° SAA
Tolosa	33	43					
(a)	(b)	(c)					

(b Inscr) latitudo Ch.

MB. Tables of climates.

MB11. Values of Alfargani. – *Witnesses:* Ea,21v(m2); Fj,15v (m2); Fd2,59v.

The latitudes and mileages for climates 1-7 are a tabulation from Alfargani ch. 8. The translation by Gerard of Cremona, which has been used for comparison here (from ms. O, 191ra+), presents the latitude values in the prose context, expressed with common fractions as in ms. Ea. It also shows values for hours, latitudes and mileages in a table where the latitudes are repeated in degrees and minutes. The mileages presuppose 56 2/3 miles per degree but are rounded.

One more set of latitudes of the 7 climates, added to an Albatenian rota, is in JF11, mss. Fc1 Fc2. The latitude values could have been truncated from the present ones. There is also a table of mileages, mainly the same as those of the present list.

The tabular values shown here for climates 1-7 reproduce those of Alfargani ms. O (above), with variants from Ea Fj Fd2 as far as they are present. Corrections relative to Ea are in *italics.*

The form of the table imitates Ea. This is in a secondary hand, of the mid 13th century like the main hand, and is rather faulty. In the numbers I write "et" as "+", "m(edium)" or "dimidium" as "/2", etc.

Variants, besides those of Ea, are recorded from Fj and Fd2. These two witnesses use sexagesimals, and variants in notation are not listed except to confirm readings.

Coverage:	(a-d)	"Linea equalis"	Ea		
		Clim. 1, start	Ea		
		Clim. 1-7, middle	Ea	Fj	Fd2
		Clim. 1-7, end	Ea		Fd2
		Clim. "0", end	Ea		
	(e)	"Linea equalis"	Ea		
		Clim. 1-7	Ea	Fj	
		Clim. "0"	Ea		

The last entry in the table (Climate "0") is not in Alfargani. It concerns the arctic region at a latitude of 66°25′,[1] i.e., based on the Albatenian obliquity of 23°35′. The rest of the latitude values are also compatible with Albattani's, for which cf. the notes for BG21.

Haec sunt climata	Haec sunt latitudi nes 7'les	0	Finis longitudi nis diei	Numerus omnium climatum
Linea equalis	0		12 h	0
Primum clima	*12°+/2+/4* *16°+2/3* *20°+/2*	Initium Medietas Finis	*12h+/2+/4* 13h 13h+/4	*440* miliaria
Secundum cl.	24°+/4 27°+/2	Medium Finis	13h+/2 13h+/2+/4	*400* miliaria
Tertium cl.	30°+/2+/5 33°+2/3	Medium Finis	*14h* *14h+/4*	*350* miliaria
Quartum cl.	*36°+2/5* *39°*	Medium Finis	*14h+/2* 14h+/2+/4	300 miliaria
Quintum cl.	41°+/3 43°+/2	Medium Finis	15h 15h+/4	255 miliaria
Sextum clima	45°+2/5 47°+/4	Medium Finis	15h+/2 15h+/2+/4	210 miliaria
Septimum cl.	*48°+2/3* 50°+/2	Medium Finem	16h 16h+/4	185 miliaria
0	*66°+/4+/6*	Finis	24h	+944+ miliaria
(a)	(b)	(c)	(d)	(e)

(b 1 init) 12 gradus Ea; *def. cett.* **(b 1 med)** 16 gradus et m() Ea; 16;0 Fj; 16;40 Fd2. **(b 1 fin)** 20;30 Fd2; 20 gradus Ea. **(b 2 med)** 24;15 Fd2; 27;30 Fj. **(b 3 med)** 30;41 Fj; 30;45 Fd2. **(b 4 med)** 36;14 Fj; 36;24 Fd2; 41 gr et tertia Ea. **(b 4 fin)** 39;0 Fd2; 43 gr et m() Ea. **(b 6 med)** 45 gr et \2?/ 5'ta Ea; 45;24 Fj; 45;45 Fd2. **(b 7 med)** 48;40 Fj Fd2; 48 gr et due 4'te Ea. **(b 0)** 66 gr et quartum 6'te gradus unius Ea. **(d 1 init)** 12 hore et m() Ea; *def. cett.* **(d 2 med)** 13 et s() Fj; 13;35 Fd2. **(d 2 fin)** 13;35 Fd2. **(d 3 med)** 14;0 Fj; 14 hore et 4'ta Ea; 14;15 Fd2. **(d 3 fin)** 14 hore et m() Ea; 14;15 Fd2. **(d 4 med)** 14 hore et m() et 4'ta Ea; 14 et s() Fj; 14;30 Fd2. **(e 1)** 440: Fj; 44 Ea. **(e 2)** 400: Fj; 44 Ea. **(e 3)** 350: Fj; 35 Ea.

MB12. Cj,164v (m2, rudimentary): a set of latitudes 15°, 23°, 30°, 36°, 41°, 45°, 48° assigned to the climates.

MB13. Md(119v) has an entry for each integral degree of latitude from 12° until 50°, arranged in 7 columns, one for each climate, beginning at 12°, 21°, 28°, 34°, 40°, 44°, 48°. Each entry shows day-length plus distance from the beginning of the climate in question, 87 1/2 miles per degree. – Another copy, apparently out of context, is in Mp,296r; see notes to JA54.

---

1 Emending Ea's "et quartum sexte gradus unius" to 1/4° + 1/6° = 25′.

N. Projections of rays.

NA.

NA11. Projections of rays, principal version. Alkhwarizmian.

Toomer 1968, no. 85, extract with full commentary on p. 147-151. – Attested as Alkhwarizmian from Ibn Hibinta,[1] though not present in Alkhwarizmi / Maslama; this contains NA12, which may be attributed to Maslama. – The table has been examined by Toomer (ref. above), and by Hogendijk 1989.

Witnesses: {**a0**} Ct,5r-6r; Oo,35v-37r; Cq2,109-112; Pz,133r-134v; Mb,66r-67r (9 signs only); Ey,74r-76v. – {**a1**} Xa,37r-38v; Ad,85r-v, 94r-v; Cq,65-68; Fc,74v-76r (numbers deficient); Ps,80r-81v; Sg,194-199; Wd,37r-38v; Fh,66v-69r. – {**a2**} Cz,94v-97r; Cj,165v-168r; Md,102v-105r; Mp,228r-230v. – {**aX**} R,109r-111v; Cu,80r (last 3 signs only); Ov,109v-110v (part gone); Fj2,112r-113v; Vd,41r-42v. – {**aT**} Lu,81v-83r; Oj,147r-148r (last 6 signs only); P,110r-111v. – {**k**} Eh,119r-121v(m2?); Lw,121v-127r. – {**d**} Lb,62r-63v; A,253v-255r; Ok,68r-70v. – {**e**} Gr,68v-71r; Eq,87v-90r; Ek3,113v-115r; Xc,82r-83v; Vj,105v-107r; Ej,88v-90r; Vm,29r-30v. – {**x**} Oc,94v-97r; X,171v-174r; Vz,74r-76v; Mv,110v-113r; Cm,151v-152v, 213r-214r; B,162v-164r; T,299r-v; Lf,112r-114v; Lg,190v-193r; Lh,158v-161r; Xj,293v-296r; Xg,75r-77v; G,79r-81v; Xb,94r-96v; Es,200v-203r; Fb,84v-87r; Pq,204r-206v; Oy,91r-92r; Wa,79r (fgt.); Wa,81v-82v (whole table, garbled); Ow,172v-(174v) (last 2 signs gone); Nu,159v-162r. – {**p**} O,92v-94r.

Canons: Cc213, and Cb211 (= CcD211). The reference is "tabula proiectionis radiorum" in all cases, and the rest of the terms are also much the same as in the common headings.

Headings. – General:

(1: none) :: {a0:} Oo Pz Mb; {a1:} Xa Ad Cq Fc Sg Wd Fh; {a2:} Md; {aX:} R Vd; {d:} Lb A Ok.
(2) Tabula (-ae Ct) **proiectionis** (-num Ct Ey Lw {e}) **radiorum** (**+planetarum** Mp Eh Lw {e} {x}) :: {a0:} Ct Ey; {a2:} Cz Mp!; {aT}; {aX:} Cu Fj2; {k:} Eh Lw; {e}; {x}.
(3: other) :: Cq2 ("Tabula respectus planetarum per divisiones circuli questionalis"); Ov ("T. de proiectione radiorum planetarum"); Ps ("T. de faciebus signorum"); Fh (secondary, like Ct); Cj ("Hic incipiunt tt. de proiectionibus radiorum planetarum"); O (hdg. for each sign, "Tabulae de faciebus arietis", etc.).

First decan of Aries: **(4) Facies arietis prima** in most of the early witnesses (Pz Mb Oo Xa Ad Cq Sg Fh Wd Fj2; Xc Vm), otherwise normally **(5) Prima facies arietis.** – **(6)** Ct has headings like "Prima facies arietis, Martis; Secunda, solis; ..." throughout Aries and Taurus, none elsewhere.

Versions. There are 36 sub-tables in total, i.e., 3 sub-tables for each sign, each sub-table being valid for the case where a "face" (=10°) of the sign is in the ascendent. These sub-tables are differently arranged, perhaps for convenience in particular cases rather than because of a split in the tradition. There are three main types of layout:

(A) {**a:** Pz Mb Oo Xa Ad Cq Cq2 Fc Ps Wd Cu Fj2 Vd; **aT:** Lu P; **d:** Lb A; **e:** Gr Eq Ek3 Xc Vj Ej Vm; **p:** O; **x:** T Oy}

The 3 face-tables for each sign are written in one column, top to bottom. Each page normally holds 3 such columns, so the whole table covers 4 pages (6 columns in T, so 2 pages; 4 columns in Oy, so 3 pages; 2 columns in Gr Eq, so 6 pages).

(B) {**a:** Ey Ov Cz Cj Md R; **aT:** Oj}

As above, but there are only 2 face-tables to a column; the tables for the third faces occupy half of the next page (or else the tables for the first faces occupy half of the preceding page). The whole table covers 6 pages.

---

1 Kennedy / Krikorian-Preisler (1972, reprinted in Kennedy & all. 1983 p. 372-84); cf. van Dalen 1996 p. 209-10.

(C) {**a:** Ct Sg Fh Mp; **k:** Eh; **d:** Ok; **x:** Oc X Vz Mv Cm B Lf Lg Lh Xj Xg G Xb Es Fb Pq Ow Nu}

The 3 face-tables for each sign are written in one row, across the width of the page. Each page normally holds 2 such rows, so the whole table covers 6 pages (4 rows in Ct, so 3 pages; 3 rows in B, so 4 pages).

Other: Lw (12 pages, 1 face-table to a column, 3 signs across page); Wa (79r: incomplete, 3 columns for Aries-Gemini, each column with 2 faces; there seems to be space for the third faces on the page); Wa (81v-82v: type (A) originally, but transcribed with 4 face-tables across the page, in 3 rows; thus the face-tables for each sign are out of alignment).

Values. Toomer's findings are sufficient for reconstructing the table almost precisely. From these, I summarize what is needed for recomputation.

(1) *First values of sub-tables for Face 1* (Ari1:Ari, Tau1:Tau, ..., Psc1:Psc). These values reflect a situation where the sign in question is ascending, and they are conceived as oblique ascensions. They are set to:

```
Ari Psc : 20; 5
Tau Aqr : 23;34
Gem Cap : 29;40
Cnc Sgr : 34;52
Leo Sco : 36;14
Vir Lib : 35;35
```

These oblique ascensions, taken for each sign separately, are valid for an obliquity of 23°51′ and a latitude of about 33° (most closely 33°3′), perhaps for Baghdad (Toomer 1968 p. 144 n. 7).

(2) *First values of sub-tables for Faces 2-3* (e.g., Ari2:Ari, Ari3:Ari). Found by linear interpolation between the first values for Face 1 of the current sign and Face 1 of the next sign. Thus, e.g., (Ari1:Ari, Ari2:Ari, Ari3:Ari, Tau1:Tau) form a difference series where the outer terms are known from (1).

(3) *Fourth value of all sub-tables* (e.g., Ari1:Cnc, Ari2:Cnc, Ari3:Cnc, Tau1:Leo, ...). These values reflect a situation where the sign used as entrance ("Cnc" or "Leo") is near the meridian, at lower culmination of the ecliptic, and they are conceived as right ascensions of these signs. They are set to:

```
Ari Vir Lib Psc : 27;50
Tau Leo Sco Aqr : 29;54
Gem Cnc Sgr Cap : 32;16
```

These right ascensions, taken for each sign separately, can be found from Almagest II,8, and are thus valid for obliquity 23°51′(20″). It is notable that, for any one sign, all the three face-tables show the same value.

(4) *Series of values for a given sign,* throughout the sub-tables for a given face (e.g., Gem2:Gem, Cnc2:Gem, ..., Tau2:Gem). Each such series is to start from the sub-table where the sign ("Gem" in the example) stands against the first value. The first item ("Gem2:Gem") is known from (1) or (2), and the fourth item ("Vir2:Gem") is known from (3). From these, the other items up to and including the seventh one should be found by linear interpolation, such that the seven items form a difference series. Items 8-12 are set equal to items 2-6 in reverse, item 8 being equal to item 6, etc.

Even if many values are thus repeated, there is no obvious symmetry in the table as it stands, except that the 4th and 10th rows show the same value for each sign, and the first-face tables are self-repeating. On these points one may expect some accidental self-correction or duplication of errors.

Values: arcs of aspects. The three values (for sextile, quartile, and trine aspect) are in the proportion 60:90:120 (Neugebauer 1962 p. 130; Toomer 1968 p. 149). They also show some obvious symmetry and antisymmetry. This is enough for emending them.

Text. Collated for values: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** Lu; **{d}** A; **{e}** Eq Xc; **{x}** Es Xg. – Headings from Ct.

The layout of Ct, rather than Oo Xa, has been adopted for convenience. Where Ct has no headings, I supplement with a set of headings imitating Class {x} and shown in <angular brackets>. Ct has no column-headings "si, gr, mi", and from Aries to Cancer Ct leaves out most sign-names in the left entrances; both have been supplemented for readability.

Also quoted: **$c:** Recomputation of tabular values, and of arcs of aspects, as described in "Values" above. This is only quoted where it has been accepted against all witnesses; cf. below. The arcs of aspects (especially for quartile and trine) often deviate by just 1′ from the value expected from the sextile, or from their symmetrical counterparts. In these cases the asymmetrical values are printed as they are, and $c is not quoted.

With this exception, the text reproduced is the recomputed one, according to $c. *Italics* are used for readings where $c disagrees with the majority of Ct Oo Pz Xa Cq. In most of these cases, $c agrees with Ct but with no others. In eight cases all witnesses are in error; see the following.

Variant groups. The tradition is clear-cut in its main features. *Ct* is largely independent of *all the other witnesses* collated. Indeed, there are only three errors common to Ct and the rest, all of them Abjad ones (Leo:c07, Aqr:h12, and Cap:h03 with a further error in part of the vulgate). There are five more cases where all witnesses are in error (Tau:j10, Leo:j10, Sgr:c06, Aqr:h09, Psc:h12), but these are such that Ct has one error and the rest have one or more other errors which are unlikely to derive from the error in Ct.

On the other hand, Ct alone has some 30 errors against the rest; and conversely, the rest have 90-odd errors where Ct alone is correct. The latter set largely covers the places *italicized* below; the former set is not marked but only noted in the apparatus. Each of these two sets of independent errors predominantly consists of Abjad errors. Thus, the common ancestor of Ct and the others was an Arabic one, and of high quality; indeed, as has been seen, there are very few general errors.

The version in *Ct* is thus quite sharply delimited against the others. It never seems to share errors with any subset of them. In a few instances it shares a correct reading with one or a few others, thus with *Pz* (Sgr:m08, Cap:c10), with *Oo* (Cap:m11), with *Eq* (Leo:b10), and with corrections in *Xa Cq Lu* (Cap:h11), but these cases seem too scattered to be of use.

The structure of the vulgate is the usual one. – *Eq Xc* and *Es Xg* are two distinct error groups; examples of either are easy to find. – *((Eq Xc) (Es Xg))* may be a larger group; cf. Leo:g05, Sgr:m08, Aqr:b08. – *Xa A* may be an error group too; cf. Sco:n06, Aqr:g10. – There is not much evidence for any further large groups. Eq Xc Es Xg form loose connections with Xa A (Sco:d10), with Lu (Cap:h03), with all except Ct Pz (Oo) (*ibid.*, if the errors are cascading; and see above). There are no striking Abjad errors which are proper to part of the vulgate (most closely, Cap:h12, in Lu alone), so there is no need to assume further independent imports from Arabic exemplars.

Tabulae proiectionum radiorum <-->.

	(Ari1)					**(Ari2)**					**(Ari3)**				
	Prima facies arietis, Martis					Secunda, solis					Tertia, Veneris				
	Si	Gr	Mi			Si	Gr	Mi			Si	Gr	Mi		
(01)	ARI	20	5	53	Se	ARI	21	15	53	Se	ARI	22	24	54	Se
(02)	Tau	25	41	*18*	xt	Tau	27	2	52	xt	Tau	28	23	26	xt
(03)	Gem	31	24		il	Gem	31	59		il	Gem	32	33		il
(04)	Cnc	32	*16*		is	Cnc	32	16		is	Cnc	32	*16*		is
(05)	Leo	27	47	79	Qu	Leo	27	52	80	Qu	Leo	27	*56*	81	Qu
(06)	Vir	22	40	57	ar	Vir	22	40	48	ar	Vir	22	40	40	ar
(07)	Lib	20	5		tu	Lib	19	52		tu	Lib	19	39		tu
(08)	Sco	25	41		s	Sco	25	58		s	Sco	26	*17*		s
(09)	Sgr	31	24	106	Tr	Sgr	31	59	107	Tr	Sgr	32	33	108	Tr
(10)	Cap	32	*16*	35	i	Cap	32	*16*	44	i	Cap	32	*16*	53	i
(11)	Aqr	27	47		nu	Aqr	27	24		nu	Aqr	27	1		nu
(12)	Psc	22	40		s	Psc	22	40		s	Psc	22	40		s
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)

(b05) 26 Ct. **(b07)** 40 Oo. **(b08)** 15 Oo. **(b10)** 22 A. **(c04)** 16: Ct; 56 *cett.* **(c10)** 16: Ct; 56 *cett.* **(c11)** 24 Eq Xc. **(c12)** 50 Eq Xc; 4 Es Xg. **(d01)** 58 A. **(d02)** 18: Ct; 53 A; 58 *cett.* **(d05-06)** 57, 79 A. **(g05)** 25 Oo. **(g08)** 26 Es Xg. **(h08-12)** 40 52 58 59 56 Eq Xc, *cf. (h06-10).* **(+h10)** 16: Ct; 56 Eq Xc *(ad h12), cett.* **(+h11)** 44 Oo; *def.* Eq Xc. **(j09)** 112 Oo.ac. **(m06)** 21 Pz. **(n02)** 27 Pz. **(n04)** 16: Ct; 56 *cett.* **(n05)** 56: Ct; 15 Eq Xc; 16 *cett.* **(n07)** 30 Eq Xc. **(n08)** 17: Ct; 57 *cett.* **(n10)** 16: Ct; 56 *cett.* **(n12)** 4 Es Xg. **(o06)** x Cq. **(o10)** 56 Pz.

	(Tau1)					**(Tau2)**					**(Tau3)**				
	Prima tauri, Mercurii					Secunda, lunae					Tertia, Saturni				
	Si	Gr	Mi			Si	Gr	Mi			Si	Gr	Mi		
(01)	TAU	23	34	*55*	Se	TAU	25	36	56	Se	TAU	27	38	57	Se
(02)	Gem	30	32	1	xt	Gem	31	41	4	xt	Gem	32	51	6	xt
(03)	Cnc	33	8		il	Cnc	33	*17*		il	Cnc	33	26		il
(04)	Leo	29	54		is	Leo	29	54		is	Leo	29	54		is
(05)	Vir	25	*15*	*82*	Qu	Vir	25	*15*	*84*	Qu	Vir	25	*15*	*85*	Qu
(06)	Lib	22	40	32	ar	Lib	22	31	5	ar	Lib	22	23	40	ar
(07)	Sco	23	34		tu	Sco	*24*	1		tu	Sco	24	29		tu
(08)	Sgr	30	32		s	Sgr	31	41		s	Sgr	32	51		s
(09)	Cap	33	8	110	Tr	Cap	33	49	112	Tr	Cap	34	29	114	Tr
(10)	Aqr	29	54	2	i	Aqr	29	54	7	i	Aqr	29	54	13	i
(11)	Psc	25	*15*		nu	Psc	25	*15*		nu	Psc	25	*15*		nu
(12)	Ari	22	40		s	Ari	23	27		s	Ari	24	*13*		s
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)

(b01) 28 Ct. **(b06)** 29 Oo.ac; 23 Eq Xc. **(b07)** 33 Pz. **(b12)** 21 Es. **(c05)** 15: Ct; 55 *cett.* **(c11)** 15: Ct; 55 *cett.* **(d01)** 55: Ct; 51 *cett.* **(d02)** 50 Oo. **(d05)** 82: Ct; 121 Es Xg; 102 *cett.* **(d09)** 101 Pz. **(g07)** 24: Ct; 25 *cett.* **(g12)** 33 Es Xg. **(h03)** 17: Ct; 57 *cett.* **(h05)** 15: Ct; 55 *cett.* **(h11)** 15: Ct; 55 *cett.* **(h12)** 25 Oo. **(j05)** 84: Ct; 104 *cett.* **(j10)** 7: $c; 4 Ct; 50 *cett.* **(m01)** 36 Pz. **(m06)** 21 Pz. **(n03)** 25 Pz. **(n05)** 15: Ct; 55 *cett.* **(n09)** 25 Ct. **(n11)** 15: Ct; 55 *cett.* **(n12)** 13: Ct; 59 Eq; 53 *cett.* **(o02)** 7 Ct; *om.* Xc. **(o05)** 85: Ct; 105 *cett.* **(o06)** 4 Xc. **(o09)** 104 Es.

	(Gem1)					**(Gem2)**					**(Gem3)**				
	<1'a facies geminorum>					<2'a facies geminorum>					<3'a fac. geminorum>				
	Si	Gr	Mi			Si	Gr	Mi			Si	Gr	Mi		
(01)	GEM	29	40	58	Se	GEM	31	24	59	Se	GEM	33	8	60	Se
(02)	Cnc	34	0	9	xt	Cnc	34	*18*	23	xt	Cnc	34	37	37	xt
(03)	Leo	32	1		il	Leo	31	56		il	Leo	31	52		il
(04)	Vir	27	50		is	Vir	*27*	50		is	Vir	27	50		is
(05)	Lib	25	*15*	87	Qu	Lib	25	11	89	Qu	Lib	25	6	*90*	Qu
(06)	Sco	25	41	*14*	ar	Sco	25	58	*4*	ar	Sco	26	*17*	56	ar
(07)	Sgr	29	40		tu	Sgr	31	24		tu	Sgr	*33*	8		tu
(08)	Cap	34	0		s	Cap	35	21		s	Cap	36	43		s
(09)	Aqr	32	1	116	Tr	Aqr	32	*24*	*118*	Tr	Aqr	32	47	121	Tr
(10)	Psc	27	50	18	i	Psc	27	*50*	45	i	Psc	27	*50*	14	i
(11)	Ari	25	*15*		nu	Ari	25	38		nu	Ari	26	1		nu
(12)	Tau	25	41		s	Tau	27	2		s	Tau	28	23		s
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)

(b01) 27 Eq Xc. **(b09)** 39 Oo.ac. **(c04)** 40 Pz; 51 Eq Xc. **(c05)** 15: Ct; 55 *cett.* **(c09)** 0 A. **(c10)** 0 Eq. **(c11)** 15: Ct; 55 *cett.* **(c12)** 40 A. **(d01)** leo *(sic!)* Oo; 54 Es Xg. **(d05)** 8 Xa. **(d06)** 14: Ct; 54 *cett.* **(d10)** 28 Oo. **(g02)** 44 Oo. **(g04)** 27: Ct; 25 Pz; 26 *cett.* **(g12)** 27: 22 Eq Xc. **(h01-12)** *vacat* Cq. **(h02)** 18: Ct; 58 *cett.* **(h05)** 51 Ct. **(h06)** 18 Ct. **(h09)** 24: Ct; 27 *cett.* **(h10)** 50: Ct; 1 Es Xg; 7 *cett.* **(j02)** <-->iii Ct. **(j06)** 4: Ct; 3 *cett.;* 5 $c *ut vid.* **(j09)** 118: Ct; 108 *cett.* **(m03)** 41 Eq Xc. **(m07)** 33: Ct; 34 *cett.* **(m10)** 37 Xc. **(m11)** 36 Eq Xc. **(n01)** 7 Pz. **(n02)** 17 Ct. **(n06)** 17: Ct; 40 *cett.* **(n10)** 50: Ct; 8 Cq; 7 *cett.* **(o05)** 90: Ct; 97 *cett.* **(o10)** 24 Oo.ac; 13 Cq.

	(Cnc1)					**(Cnc2)**					**(Cnc3)**				
	<1'a facies cancri>					<2'a facies cancri>					<3'a facies cancri>				
	Si	Gr	Mi			Si	Gr	Mi			Si	Gr	Mi		
(01)	CNC	34	52	61	Se	CNC	35	*19*	62	Se	CNC	35	47	63	Se
(02)	Leo	34	7	51	xt	Leo	33	*59*	54	xt	Leo	33	*50*	57	xt
(03)	Vir	30	25		il	Vir	30	*25*		il	Vir	30	25		il
(04)	Lib	27	50		is	Lib	*27*	50		is	Lib	*27*	50		is
(05)	Sco	27	47	*92*	Qu	Sco	27	*56*	94	Qu	Sco	*28*	6	95	Qu
(06)	Sgr	30	32	47	ar	Sgr	31	41	21	ar	Sgr	32	51	55	ar
(07)	Cap	34	52		tu	Cap	36	54		tu	Cap	38	56		tu
(08)	Aqr	34	7		s	Aqr	34	54		s	Aqr	35	*40*		s
(09)	Psc	30	25	123	Tr	Psc	30	25	125	Tr	Psc	30	25	127	Tr
(10)	Ari	27	50	42	i	Ari	27	*50*	47	i	Ari	27	*50*	53	i
(11)	Tau	27	47		nu	Tau	28	*28*		nu	Tau	29	9		nu
(12)	Gem	30	32		s	Gem	31	41		s	Gem	32	51		s
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)

(b04-05) 21, 21 A. **(b06)** 27 Oo.ac; 30 *aut* 25 Oo.pc. **(b10-11)** 21, 21 A. **(b10)** 37 Oo.ac. **(b12)** 1 Ct. **(c02)** 7: Ct; 50 *cett.* **(c03)** 35 Eq Xc. **(c05)** 41 A. **(c07)** 51 Oo; 32 Xg. **(c08)** 7: Ct; 50 *cett.* **(c11)** 41 A. **(c12)** 39 Oo. **(d05)** 92: 91 Oo; 90 Xa; lx'<->vii Cq. **(g01)** 33 Cq. **(g02)** 38 Ct. **(g04)** 27: Ct; 39 Oo; 32 *cett.* **(g05)** 37 A. **(g09)** 37 Xc. **(h01)** 19: Ct; 59 *cett.* **(h02)** 59: Ct; 19 *cett.* **(h03)** 25: Ct; 35 *cett.* **(h04)** 59 Xc. **(h05)** 56: Ct; 54 *cett.* **(h06)** 40 Eq Xc. **(h07)** 44 Eq Xc. **(h10)** 50: Ct; 7 *cett.* **(h11)** 28: Ct; 33 Oo A.pc; 23 *cett.; n.l.* A.ac. **(h12)** 51 Ct. **(j02)** 59 Es Xg. **(j05)** 93 Cq.pc; 88 Cq.ac. **(j09-10)** 63, 57 Cq, *cf. (o01-02)* **(j09)** 115 Oo. **(m02)** 38 Ct; 34 Pz. **(m04)** 27: Ct; 37 *cett.* **(m05)** 28: Ct; 38 *cett.* **(n02)** 50: Ct; 7 *cett.* **(n03)** 27 Es Xg. **(n08)** 40: Ct; 10 Oo; 5 *cett.* **(n10)** 50: Ct; 47 *cett.* **(n12)** 41 Eq. **(o01-02)** lxv, lv Cq, *cf. (o05-06).* **(+o01)** 53 Xg.

	(Leo1)					(Leo2)					(Leo3)				
	<1'a facies leonis>					<2'a facies leonis>					<3'a facies leonis>				
	Si	Gr	Mi			Si	Gr	Mi			Si	Gr	Mi		
(01)	LEO	36	*14*	64	Se	LEO	36	1	65	Se	LEO	35	48	66	Se
(02)	Vir	33	0	59	xt	Vir	33	0	34	xt	Vir	33	0	8	xt
(03)	Lib	30	25		il	Lib	30	29		il	Lib	30	34		il
(04)	Sco	29	54		is	Sco	29	54		is	Sco	29	54		is
(05)	Sgr	31	24	97	Qu	Sgr	31	59	98	Qu	Sgr	32	33	99	Qu
(06)	Cap	34	0	29	ar	Cap	35	21	20	ar	Cap	36	43	12	ar
(07)	Aqr	36	*14*		tu	Aqr	37	24		tu	Aqr	38	33		tu
(08)	Psc	33	0		s	Psc	33	0		s	Psc	33	0		s
(09)	Ari	30	25	129	Tr	Ari	30	2	131	Tr	Ari	29	39	132	Tr
(10)	Tau	*29*	*54*	58	i	Tau	29	54	7	i	Tau	29	54	16	i
(11)	Gem	31	*24*		nu	Gem	31	*59*		nu	Gem	32	33		nu
(12)	Cnc	34	0		s	Cnc	34	*18*		s	Cnc	34	37		s
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)

(m-o) *omnes numeros ex tabula 3'ae faciei Cancri desumpserunt* Eq Xc. – **(b10)** 29: Ct Eq; 39 *cett.* **(c01)** 14: Ct; 54 *cett.* **(c03)** 55 A. **(c07)** 14: $c; 54 *omnes.* **(c10)** 54: Ct; 24 Cq; 14 *cett.* **(c11)** 24: Ct; 28 Pz; 27 *cett.* **(d01)** 60 Pz. **(d02)** 69 Oo. **(g05)** 32 Eq Xc Es Xg. **(g06)** 25 Xc. **(g07)** 27 Xc. **(g09)** 34 Eq Xc. **(g10)** 39 Pz; 30 Es Xg. **(g12)** 24 Oo. **(h07)** 54 Eq Xc. **(h11)** 59: Ct; 19 *cett.* **(h12)** 18: Ct; 58 *cett.* **(j06)** 2 Pz. **(j09)** 121 Pz. **(j10)** 7: $c; 50 Ct; 9 Pz; 40 A; 90 (!) *cett.* **(L)** Tau ... Ari Cq. **(m04)** 37 Eq Xc. **(m05)** 22 Pz. **(m06)** 39 Cq.ac. **(m10)** 39 Es Xg. **(m12)** 24 Pz. **(n)** 38 51 36 54 55 23 29 51 29 54 55 53 Cq, *cf. tabulam Tauri, col. (n).* **(o02)** ix Cq. **(o09-10)** 107, 43 Cq.

	(Vir1)					(Vir2)					(Vir3)				
	<1'a facies virginis>					<2'a facies virginis>					<3'a fac. virginis>				
	Si	Gr	Mi			Si	Gr	Mi			Si	Gr	Mi		
(01)	VIR	35	35	66	Se	VIR	35	35	66	Se	VIR	35	35	66	Se
(02)	Lib	33	0	42	xt	Lib	33	9	43	xt	Lib	33	*17*	42	xt
(03)	Sco	32	1		il	Sco	31	52		il	Sco	31	42		il
(04)	Sgr	32	16		is	Sgr	32	16		is	Sgr	32	16		is
(05)	Cap	33	8	100	Qu	Cap	33	49	100	Qu	Cap	34	29	100	Qu
(06)	Aqr	34	7	4	ar	Aqr	34	54	4	ar	Aqr	35	40	3	ar
(07)	Psc	35	35		tu	Psc	35	35		tu	Psc	35	35		tu
(08)	Ari	33	0		s	Ari	*32*	13		s	Ari	31	27		s
(09)	Tau	32	1	133	Tr	Tau	31	*20*	133	Tr	Tau	30	39	133	Tr
(10)	Gem	32	16	25	i	Gem	32	16	25	i	Gem	32	16	24	i
(11)	Cnc	33	8		nu	Cnc	33	*17*		nu	Cnc	33	*26*		nu
(12)	Leo	34	7		s	Leo	33	59		s	Leo	33	50		s
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)

(b02) 38 Ct; 32 Eq. **(b05)** 32 Pz. **(b08)** 32 Pz.?pc. **(b10)** 33 Pz.ac. **(b12)** 24 Cq. **(c01)** 25 Oo. **(d01)** 67 *vel* 97 Cq. **(d02)** 82 Eq Xc. **(d09)** 132 Eq. **(f)** <*>, Vir...Cnc A. **(g03)** 32 Xc. **(g04)** 33 A. **(g05)** <->3 Xa. **(g08-11)** 35 33 31 32 Es Xg, *cf. (g07-10).* **(+g08)** 32: Ct; 38 Pz; 33 Es Xg *(ad g09), cett.* **(+g09)** 32 Xc. **(g12)** 34 Xc. **(h)** 35 0 1 16 8 7 35 0 1 16 8 7 Xc, *cf. col. (c).* **(h02)** 0 A Es. **(h03)** 55 Pz. **(h05)** 59 Ct. **(h08)** 53 Ct. **(h09)** 20: Ct; 33 *cett.* **(h11)** 17: Ct; 57 *cett.* **(h12)** 19 Ct. **(j01-02)** 100, 4 Oo, *cf. (j05-06).* **(j02)** 82 Xc. **(j05-06)** 133, 25 Oo, *cf. (j09-10).* **(j09)** 33 Eq. **(m)** 33 22 29 32 31 25 20 22 28 32 30 24 Cq, *cf. tabulam Piscium, col. (m).* **(m11)** *n.l.* Oo. **(n)** *vacat* Cq. **(n02)** 17: Ct; 57 *cett.* **(n04)** 46 Oo. **(n10)** 10 Es Xg. **(n11)** 26: Ct; 37 *cett.* **(o01)** 56 Oo. **(o02)** 82 Eq Xc.

	(Lib1)					**(Lib2)**					**(Lib3)**				
	<1'a facies librae>					<2'a facies librae>					<3'a facies librae>				
	Si	Gr	Mi			Si	Gr	Mi			Si	Gr	Mi		
(01)	LIB	35	35	66	Se	LIB	35	48	66	Se	LIB	36	1	65	Se
(02)	Sco	34	7	42	xt	Sco	33	49	8	xt	Sco	33	31	34	xt
(03)	Sgr	33	8		il	Sgr	32	33		il	Sgr	31	59		il
(04)	Cap	32	16		is	Cap	32	16		is	Cap	32	*16*		is
(05)	Aqr	32	1	100	Qu	Aqr	32	*24*	99	Qu	Aqr	32	47	98	Qu
(06)	Psc	33	0	4	ar	Psc	33	0	*12*	ar	Psc	33	0	21	ar
(07)	Ari	35	35		tu	Ari	34	25		tu	Ari	33	16		tu
(08)	Tau	34	7		s	Tau	32	46		s	Tau	31	25		s
(09)	Gem	33	8	133	Tr	Gem	32	33	132	Tr	Gem	31	*59*	131	Tr
(10)	Cnc	32	16	25	i	Cnc	32	16	15	i	Cnc	32	16	7	i
(11)	Leo	32	1		nu	Leo	31	*56*		nu	Leo	31	52		nu
(12)	Vir	33	0		s	Vir	33	0		s	Vir	33	0		s
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)

(b05-06) 33, 32 Eq Xc. **(c09)** 9 Cq. **(c10)** 15 Oo. **(d02)** 82 Eq Xc. **(d09)** 123 Oo; 131 Cq. **(g10)** 33 Pz. **(g11)** 32 Oo. **(g12)** 31 A; 32 Eq Xc. **(h03)** 43 A. **(h05)** 24: Ct; 44 Pz; 34 *cett.* **(h07)** 26 Ct; 35 Es. **(h09)** 43 A. **(h11)** 56: Ct; 16 *cett.* **(j06)** 12: Ct; 52 *cett.* **(m02)** 32 Eq Xc. **(m03)** 33 Es Xg. **(m05)** 3 Eq; 31 Xc. **(m06-07)** 32, 32 Eq; 3, 3 Xc. **(m08)** 36 Oo. **(n02)** 32 Pz; 11 A. **(n04)** 16: Ct; 56 *cett.* **(n08)** 36 Oo; 2 Xc. **(n09)** 59: Ct; 49 *cett.* **(o01)** 6 Xg. **(o05)** 88 Pz. **(o10)** 7: Ct; 30 *cett.*

	(Sco1)					**(Sco2)**					**(Sco3)**				
	<1'a facies scorpionis>					<2'a facies scorpionis>					<3'a fac. scorpionis>				
	Si	Gr	Mi			Si	Gr	Mi			Si	Gr	Mi		
(01)	SCO	36	14	64	Se	SCO	35	47	63	Se	SCO	35	19	62	Se
(02)	Sgr	34	0	59	xt	Sgr	32	51	57	xt	Sgr	31	41	54	xt
(03)	Cap	31	24		il	Cap	30	43		il	Cap	30	3		il
(04)	Aqr	29	54		is	Aqr	29	54		is	Aqr	29	54		is
(05)	Psc	30	25	97	Qu	Psc	30	25	95	Qu	Psc	30	25	94	Qu
(06)	Ari	33	0	29	ar	Ari	32	13	55	ar	Ari	31	27	21	ar
(07)	Tau	36	14		tu	Tau	34	*12*		tu	Tau	32	10		tu
(08)	Gem	34	0		s	Gem	32	*51*		s	Gem	31	41		s
(09)	Cnc	31	*24*	129	Tr	Cnc	31	*15*	127	Tr	Cnc	31	6	125	Tr
(10)	Leo	29	*54*	58	i	Leo	29	*54*	53	i	Leo	29	54	47	i
(11)	Vir	30	*25*		nu	Vir	30	25		nu	Vir	30	25		nu
(12)	Lib	33	0		s	Lib	33	9		s	Lib	33	17		s
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)

(b04) 39 Cq. **(c05)** 26 Pz. **(c09)** 24: Ct; 34 *cett.* **(c10)** 54: Ct; 14 *cett.* **(c11)** 25: Ct; 24 *cett.* **(d10)** 57 Xa A Eq Xc Es Xg. **(f03-12)** Aqr...Lib, Sco Pz. **(g05)** 35 Pz. **(g06-08)** 31 32 31 Ct. **(g09)** 37 Es Xg. **(h03)** 42 Ct. **(h05)** *vacat* Pz. **(h06)** 22 Oo. **(h07)** 12: Ct; 52 *cett.* **(h08)** 51: Ct; 11 *cett.* **(h09)** 15: Ct; 55 *cett.* **(h10)** 54: Ct; 14 *cett.* **(h12)** 59 Es Xg. **(j02)** 59 Eq. **(j09)** 137 Oo. **(m01)** 33 Xc. **(m05)** 25 Es; 35 Xg. **(m12)** 32 Oo. **(n01)** 59 Ct. **(n05)** 24 Es Xg. **(n06)** 17 Xa A. **(o05)** 64 Oo; 84 Es Xg.

	(Sgr1)					**(Sgr2)**					**(Sgr3)**				
	<1'a facies sagittarii>					<2'a facies sagittarii>					<3'a fac. sagittarii>				
	Si	Gr	Mi			Si	Gr	Mi			Si	Gr	Mi		
(01)	SGR	34	52	61	Se	SGR	33	8	60	Se	SGR	31	24	59	Se
(02)	Cap	30	32	51	xt	Cap	29	11	37	xt	Cap	27	49	23	xt
(03)	Aqr	27	47		il	Aqr	27	24		il	Aqr	27	1		il
(04)	Psc	27	50		is	Psc	27	50		is	Psc	27	50		is
(05)	Ari	30	25	92	Qu	Ari	30	*2*	*90*	Qu	Ari	29	39	89	Qu
(06)	Tau	34	7	47	ar	Tau	32	46	*56*	ar	Tau	31	25	5	ar
(07)	Gem	34	52		tu	Gem	33	8		tu	Gem	31	*24*		tu
(08)	Cnc	30	32		s	Cnc	30	14		s	Cnc	*29*	55		s
(09)	Leo	27	47	123	Tr	Leo	27	52	121	Tr	Leo	27	56	118	Tr
(10)	Vir	27	*50*	42	i	Vir	27	50	14	i	Vir	27	50	46	i
(11)	Lib	30	25		nu	Lib	30	29		nu	Lib	30	34		nu
(12)	Sco	34	7		s	Sco	33	49		s	Sco	33	31		s
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)

(c06) 7: $c; 47 Ct; 5 *cett.* **(c10)** 50: Ct; 47 Pz; 7 *cett.* **(d09)** 132 Eq. **(g01)** 32 Cq, *ut vid.* **(g02)** 39 Eq Xc. **(g09)** 37 Oo. **(g10)** 27: 37 Eq Xc.pc. **(h05)** 2: Ct; 7 *cett.* **(h12)** 19 Oo. **(j05)** 90: Ct; 47 Xg; 97 *cett.* **(j06)** 56: Ct; 46 *cett.* **(L02-12)** Aqr...Sgr Eq. **(m06)** *n.l.* A. **(m08)** 29: Ct Pz; 27 Oo; 23 Xa Cq Lu A; 33 Eq Xc Es Xg. **(m09)** 28 Cq; 24 Lu. **(m11)** 3<-> A. **(n05)** 49 Pz; 33 Es.ac. **(n07)** 24: Ct; 34 *cett.* **(n08-12)** *n.l.* A. **(o02)** 33 Pz. **(o10)** 47 Oo.

	(Cap1)					**(Cap2)**					**(Cap3)**				
	<1'a facies capricorni>					<2'a facies capricorni>					<3'a fac. capricorni>				
	Si	Gr	Mi			Si	Gr	Mi			Si	Gr	Mi		
(01)	CAP	29	40	58	Se	CAP	27	38	57	Se	CAP	25	36	56	Se
(02)	Aqr	25	41	9	xt	Aqr	24	54	6	xt	Aqr	24	8	3	xt
(03)	Psc	25	15		il	Psc	25	*15*		il	Psc	25	15		il
(04)	Ari	27	50		is	Ari	27	50		is	Ari	27	50		is
(05)	Tau	32	1	87	Qu	Tau	31	20	85	Qu	Tau	30	39	84	Qu
(06)	Gem	34	0	14	ar	Gem	32	51	40	ar	Gem	31	41	5	ar
(07)	Cnc	29	40		tu	Cnc	29	*13*		tu	Cnc	28	45		tu
(08)	Leo	25	41		s	Leo	25	49		s	Leo	25	58		s
(09)	Vir	25	15	116	Tr	Vir	25	*15*	114	Tr	Vir	25	15	112	Tr
(10)	Lib	27	*50*	18	i	Lib	27	50	*13*	i	Lib	27	*50*	7	i
(11)	Sco	32	1		nu	Sco	31	*52*		nu	Sco	*31*	42		nu
(12)	Sgr	34	0		s	Sgr	32	51		s	Sgr	31	41		s
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)

(b05) 33 A. **(b09)** 29 Ct; 2 A. **(b10)** 25 Eq Xc. **(c02)** 40 A. **(c10)** 50: Ct Pz; 7 *cett.* **(d10)** 6 Cq. **(g02)** 34 Es Xg. **(g04)** 25 Es Xg. **(g06)** 31 Lu. **(h03)** 15: $c; 55 Ct Oo Pz Xa Cq A; 50 Lu Eq Xc Es Xg. **(h05)** 9 Ct. **(h07)** 13: Ct; 33 *cett.* **(h08)** 59 Eq Xc. **(h09)** 15: Ct; 55 *cett.* **(h10)** 59 Es Xg. **(h11)** 52: Ct *in contextu*, Xa *et* Cq *et* Lu *v.l., m1;* 39 Xa Cq Lu *in contextu, cett.* **(h12)** 31 Lu. **(j05)** 45 Xg. **(j06)** *om.* Cq. **(j10)** 13: Ct; 53 *cett.* **(m06)** 39 Es Xg. **(m10)** 20 Pz. **(m11)** 31: Ct Oo; 27 Cq; 26 *cett.* **(n07)** 43 Es Xg. **(n08-09)** 18, 55 Ct. **(n10)** 50: Ct; 7 *cett.*

	(Aqr1)					**(Aqr2)**					**(Aqr3)**				
	<1'a facies aquarii>					<2'a facies aquarii>					<3'a facies aquarii>				
	Si	Gr	Mi			Si	Gr	Mi			Si	Gr	Mi		
(01)	AQR	23	34	55	Se	AQR	22	24	54	Se	AQR	21	*15*	53	Se
(02)	Psc	22	40	1	xt	Psc	22	40	*27*	xt	Psc	22	40	*52*	xt
(03)	Ari	25	*15*		il	Ari	25	38		il	Ari	*26*	1		il
(04)	Tau	29	*54*		is	Tau	29	54		is	Tau	29	*54*		is
(05)	Gem	33	8	82	Qu	Gem	32	33	81	Qu	Gem	31	59	80	Qu
(06)	Cnc	30	32	32	ar	Cnc	30	*14*	40	ar	Cnc	29	*55*	*48*	ar
(07)	Leo	23	34		tu	Leo	23	47		tu	Leo	24	0		tu
(08)	Vir	22	40		s	Vir	22	40		s	Vir	22	40		s
(09)	Lib	25	*15*	110	Tr	Lib	25	*11*	108	Tr	Lib	25	6	107	Tr
(10)	Sco	29	*54*	2	i	Sco	29	54	53	i	Sco	29	54	44	i
(11)	Sgr	33	8		nu	Sgr	32	33		nu	Sgr	31	59		nu
(12)	Cap	30	32		s	Cap	29	*11*		s	Cap	27	49		s
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)

(b01) 22 Cq; 18 Pz. **(b08)** 72 Pz; 20 Eq Xc Es Xg. **(b11)** 23 Pz. **(c03)** 15: Ct; 55 *cett.* **(c04)** 54: Ct; 14 *cett.* **(c06)** 31 Oo. **(c07)** 38 Es Xg. **(c09)** 15: Ct; 55 *cett.* **(c10)** 54: Ct; 14 *cett.* **(d09)** 101 Pz; 100 A. **(g07)** 22 Eq; 33 Es Xg. **(g08)** 23 Eq.pc; 33 Eq.ac; 32 Es. **(g10)** 25 Xa A. **(h03)** 48 Pz. **(h04)** 34 Ct. **(h05)** 36 Eq Xc. **(h06)** 14: Ct; 54 *cett.* **(h07)** 40 Ct. **(h09)** 11: $c; 21 Ct; 51 *cett.* **(h10)** 34 Ct. **(h12)** 11: $c; 51 *omnes.* **(j02)** 27: Ct; 47 *cett.* **(m03)** 26: Ct; 27 *cett.* **(n01)** 15: Ct; 55 *cett.* **(n04)** 54: Ct; 4 *cett.* **(n06)** 55: Ct; 54 *cett.* **(n09)** 40 Ct. **(n12)** 59 Eq Xc. **(o02)** 52: Ct; 12 *cett.* **(o05)** 8 Pz. **(o06)** 48: Ct; 40 *cett.* **(o09)** 117 Oo.

	(Psc1)					**(Psc2)**					**(Psc3)**				
	<1'a facies piscium>					<2'a facies piscium>					<3'a facies piscium>				
	Si	Gr	Mi			Si	Gr	Mi			Si	Gr	Mi		
(01)	PSC	20	5	53	Se	PSC	20	5	53	Se	PSC	*20*	5	53	Se
(02)	Ari	22	40	18	xt	Ari	23	27	18	xt	Ari	*24*	13	18	xt
(03)	Tau	27	47		il	Tau	28	28		il	Tau	29	9		il
(04)	Gem	32	*16*		is	Gem	32	16		is	Gem	32	*16*		is
(05)	Cnc	31	*24*	79	Qu	Cnc	31	*15*	79	Qu	Cnc	31	6	79	Qu
(06)	Leo	25	41	57	ar	Leo	25	49	56	ar	Leo	25	*58*	57	ar
(07)	Vir	20	5		tu	Vir	20	5		tu	Vir	20	5		tu
(08)	Lib	22	40		s	Lib	22	31		s	Lib	22	23		s
(09)	Sco	27	47	106	Tr	Sco	27	56	106	Tr	Sco	28	6	106	Tr
(10)	Sgr	32	*16*	35	i	Sgr	32	16	35	i	Sgr	32	*16*	36	i
(11)	Cap	31	24		nu	Cap	30	43		nu	Cap	30	3		nu
(12)	Aqr	25	41		s	Aqr	24	*54*		s	Aqr	24	8		s
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)

(b04) 22 Oo. **(b06)** <->5 A. **(b12)** 25: Xc, *cett.;* 35 Eq Es Xg. **(c04)** 16: Ct; 56 *cett.* **(c05)** 24: Ct; 34 *cett.* **(c08)** 4 Xc. **(c10)** 16: Ct; 56 *cett.* **(d05)** 69 Pz. **(d09)** 103 Oo.ac. **(g01)** 27 A. **(g02)** 33 Es Xg. **(g03)** 38 Xg. **(g06)** 35 A. **(h05)** 15: Ct; 55 *cett.* **(h09)** 16 Ct. **(h12)** 54: $c; 44 Ct; 14 *cett.* **(m01)** 20: Ct; 33 *cett.* **(m02)** 24: Ct; 22 *cett.* **(m04)** 26 Oo; 33 A. **(m11)** 0 Es Xg. **(m12)** 28 Es Xg. **(n02)** 53 Ct. **(n04)** 16: Ct; 56 *cett.* **(n06)** 18 Ct; 50 Oo; 51 Pz. **(n07)** 9 Es Xg. **(n10)** 16: Ct; 56 *cett.*

NA12. Projections of rays, by Maslama.

Pd,40v-46r: 12 tables, from Aries to Pisces, one per page, with headings similar to those quoted in the sample below. Each table has 6 sections, one for every 5 degrees of each sign.

This is the table of projections from the Alkhwarizmi / Maslama collection, printed in Suter 1914, Tab. 91-114, p. 206-29. It is stated to be for latitude 38°30′ (heading of Suter Tab. 91), so presumably for Cordoba, no doubt the work of Maslama. It has been examined by Hogendijk 1989, who confirms the latitude and finds that the Ptolemaic / Alkhwarizmian obliquity of 23;51° has been used (*op.cit.* p.196).

Sample. First section of first table. From Pd. Numbers compared to (**$km**=) Suter, *v.s.*, mss. "C" and "O" only. Not emended.

Tabula proiectionis radiorum ad 5 gradus arietis.

Gra dus ae qua les	Ari Lib	Tau Sco	Gem Sgr	Cnc Cap	Leo Aqr	Vir Psc
	Ascensiones		Ascensiones		Ascensiones	
	Sextilis 49 11		Quartus 73 34		Trinus 98 6	
	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi
5	2 58	21 50	45 20	76 0	107 32	134 9
10	5 56	25 15	49 50	81 10	111 43	134 27
15	8 55	28 50	54 49	86 13	115 35	138 29
20	11 53	32 25	60 10	91 17	120 11	141 43
25	15 7	36 33	65 13	96 7	124 6	143 56
30	18 25	40 45	70 25	102 58	127 49	147 9
(a)	(b) (c)	(d) (e)	(f) (g)	(h) (j)	(k) (L)	(m) (n)

(Inscr) 49°11′: 49°3′ $km. **(e20)** 28 $km. **(g30)** 35 $km. **(j25)** =7 $km.O; 6 $km.C. **(k5)** =107 $km.O; 106 $km.C. **(k15)** 116 $km. **(k30)** =127 $km.O; 126 $km.C. **(m5)** 131 $km. **(n25)** 46 $km.

O. Planetary visibility and retrogradation.

Visibility of lunar crescent: see Section K.

Mean arguments for computing retrograde motions: see Section DG.

Tables of stations, excerpted from the planetary equation tables: see Section EB.

OA11-12. Visibility of 5 planets.

Toomer 1968, no. 49 (upper planets) and no. 50 (lower planets). – The table is ultimately from the Handy Tables, and it has been transmitted via Albattani. Textually it is closest to copies in Azarchel's Almanac or in the Arabo-Latin Almagest. For details on these parallels, see below.

A copy found in Richard of Wallingford's *Exafrenon* was reproduced by North 1976, p. 222-23. This table reads like the majority of the Toledan tables considered here.

Witnesses: **{a0}** Ct,24r; Oo,25v; Cq2,89; Pz,129r; Mc,27r; Mb,55v; Ey,60v. – **{a1}** Xa,39r; Ad,95r; Cq,69; Fc,93v; Ps,82r; Sg,187/188; Wd,39r; Fh,69v/70r; Xw2,36v. – **{a2}** Cz,97v; Cj,168v/169r; Md,105v; Mp,231r; Vp,139v/140r. – **{aX}** R,54v; Cu,80v; Vd,23r. – **{aT}** Lu,83v; Oj,146v; P,125v. – **{k}** Eh,122r(m2); Lw,129r/v; Co,175v. – **{d}** Op,61r; C,343; Lb,32r; Pa,71v/72r; A,237r; Fj,58r; Gr3,130v; Mh,14v. – **{e}** Gr,71v; Eq,90v; Ek3,115v; Xc,84r; Vj,107v; Ej,90v; Vm,31r. – **{x}** Oc,97v; X,174v; Vz,77v; Mv,113v; Cm,215r; B,164v; T,300v; Lf,115r; Lg,193v; Lh,161v/162r; Xj,296v; Xg,78r; G,82r; Xb,97r; Es,203v; Fb,88r; Pq,207r; Oy,93r; Wa,79v; <Ow, see below>; Nu,162v. – **{p}** O,94v/95r; Pd,25r/v; Ch2,184v. – **{?}** Py,48r/v; Pn,54v (:Jo. Lin.); Fc2,110v (:Jo. Lin.); Vd2,62v (:?). — Probably lost from ms. Ow, in a lacuna between ff. 174 and 175; cf. T:03(2,Ow).

Canons: Cc232-233 and Cb218-219. References found:

All planets: ...tabulam occasus ... vespertini (Cb; vespere Cc)
...tabulam ortus ... matutini (Cb; in mane Cc)

Lower planets: ...tabulam ortus ... vespertini (Cb; vespere Cc)
...tabulam occasus ... matutini (Cb; in mane Cc).

These may be compared to the sub-headings listed under each of OA11 and OA12. The wording of Cb is like the common sub-headings, though abridged. Cc reads like the manuscripts of group {d} in one respect, but this is not the case in general.

Headings common to OA11 and OA12. These are present in {aT}, {d}, some of {x}, and sporadically elsewhere, but absent from most early witnesses; so they are unlikely to be original.

(1: none) :: normally.
(2) Tabula apparitionis et occultationis 5 planetarum :: {a0:} Ey; {a2:} Mp; {x:} Oc X Vz Cm T Xb Es Fb Oy. – *Added:* (nothing) Ey; **+et primo 3 superiorum** Mp Es; **+et primo Saturni** Oc X Vz Cm T Xb Fb Oy.
(3) Tabula apparitionis 5 planetarum (p.5 A; +erraticarum *(sic!)* Vd Vd2) **et eorum absconsionis** (**/-nes** Pa A Gr3; +in omni die Vd) :: {aX:} Vd Vd2; {d:} Pa A Fj Gr3.
(4) Tabula de exitu planetarum de sub radiis solis et (+de Fc2) **eorum ingressu** :: {aT:} Lu P; {?:} Pn Fc2.
(5) Tabula visionis et occultationis (+5 Oj) planetarum :: {aX:} R; {aT:} Oj.
(6: other) :: Cq2 ("T. visionum et occultationum pl."); Ps ("T. de visione pl. et occultatione illorum"); Lb ("T. apparitionis 5 pl.").

Entrance columns: mostly, **(7) Nomina signorum**. These headings, and their position relative to the others, are ignored in the following.

Versions. OA11-12 are meant to be two separate tables; in fact, each one has its own entrance column in all witnesses (except Pn). Mostly they occur on the same page (on successive pages in Sg Fh Cj Vp Pa Lw O Pd Lh Py, as indicated in the list of witnesses).

Parallel tables. The values are the same as in the Handy Tables, partial table for Climate 4, Stahlman table 56-60; Albattani, Nallino II p.142 (rule in Nallino I p. 118 lin. 18, mentioning 4th climate); Habash, Climate 4 (latitude 36°; cf. Nallino II p. 262); Almanac of Azarchel, Millás 1950 p. 219, Tab.68; Almagest XIII,10 (Arabo-Latin version only, ed. Liechtenstein 1515; the Greek version of the Almagest has other values, see Nallino II p. 266).

Albattani (in Nallino's version and in the Castilian one, $ba below) shows the same layout and arrangement as in our tables. Azarchel's Almanac has the following arrangement of sub-tables (for the symbols, see the reproductions of OA11 and OA12. Each symbol stands for a certain set of tabular values, irrespective of the table heading, which may vary):

```
Upper half:  Sat1  Jup1  Mar1  Ven3  Ven1  Mer3  Mer1
Lower half:  Sat2  Jup2  Mar2  Ven4  Ven2  Mer4  Mer2
```

The copy in the Arabo-Latin Almagest is arranged like the Almanac except that the lower-half tables for Venus and Mercury stand in the order "Ven2 Ven4 Mer2 Mer4". In readings, too, the Almagest copy and the Almanac show remarkable agreement. In the Handy Tables, the present sub-tables occur each in its own context, namely, as the 4th-climate table in an array of tables for all seven climates.

Values. There are several studies on the values as they occur in the Handy Tables; see the summaries by Toomer 1968, p. 73 ff., or by Neugebauer 1975, p. 256 ff., 1017f. Here, however, the discussion will be limited to the textual relationship between the Toledan tables and some of the possible sources, and recomputation will not be carried out.

Text. Collated for values: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** Lu; **{k}** Co; **{d}** Pa A; **{e}** Eq Xc; **{x}** Es Xg. — Headings according to Xa.

Also quoted for values: **$bn** = Batt., Nallino II p. 142-143, inclusive of Nallino's readings from his ms., ibid., p. 262-265; these often differ from the values he prints in the table. **$ba** = Batt., Paris Arsenal 8322, 83v. **$aa** = Almanac of Azarchel, Paris Arsenal 8322, 126v. **$ht** = Handy Tables, Vat. gr. 304, 242r-245r, sub-tables for 4th climate (14h;30). **$pl** = Almagest XIII,10, ed. Liechtenstein 1515 f. 152r.

Nallino prints a restoration by Schiaparelli of the tabular values (cf. II, 262), adding an apparatus (II, 262-68) of manuscript readings in his Escorial manuscript and in the Castilian version (=$ba), Habash, the Alfonsine tables, the Arabo-Latin Almagest, and the Handy Tables.

In readings, $ht shows some confusion between 4 (delta) and 1 (alpha), but otherwise the text appears tidy, with much the same readings as Stahlman's, and is here assumed to be representative. In the Arabic texts, Abjad-numeral confusion is rampant, especially between numbers containing 10, 30 and 50.

Readings chosen. I normally adopt $ht if supported by some of the other sources $bn $ba $aa $pl. If the adopted reading differs from the majority among Ct Oo Pz Xa Cq Lu, it is italicized. In some cases where $ht does not explain the other sources and these do not agree among themselves, I adopt the reading of the Toledan-table manuscripts and underscore it. If $ht stands alone against a unanimous tradition and the readings do not seem connected, I normally adopt the common reading without marking it. In this way, some errors have no doubt been introduced.

Variant groups. The Toledan-table witnesses are often in error against all the sources, e.g., at OA11:(b2), OA12:(d1-2, n1, r5). Thus they constitute a uniform tradition.

Occasionally, e.g., at OA11(g11, cf. g3), OA11(g4, j2), OA12(r6, c12, d5, e4), a few witnesses agree with the sources whereas the rest are in error. Such conservative witnesses do not occur in any stable configuration, but repeated instances include *Ct, Oo, Pz, (Pa A),* i.e., the {a0} and {d} classes as usual. On the contrary, ms. Co, the only representative of Class {k} to be examined, does not show any such distinctive readings; once, at OA12:(c12), it even joins a minority.

Of the sources and parallels, *$pl $aa* are often similar to the Toledan tables whereas the Albattani witnesses join the Handy Tables, e.g., at OA11:(n5, n9), OA12(e2); at OA12:(c1), however, the Albattani witnesses have an Abjad error proper to themselves ("0" for "31"; cf. Nallino II p. VI). *$pl $aa* may also form an error group together; cf. OA11:(e3, m2). *$pl* may join the Toledan tables alone, e.g., OA12:(h5, L5). Thus, even if the Toledan tables and $pl $aa are all Albatenian at some remove, the Toledan tables are closest to the Almanac of Azarchel; and $pl, if not Toledan, is at least an interesting remain of, one may guess, Hispano-Arabic influence in the Arabic Almagest.

Among the Toledan witnesses there are the usual error groups, viz., *Pa A,* e.g., OA11:(d2, k6), OA12(f12+g11, o1, o10); *Eq Xc,* e.g., OA12(e6, j5, n8, r8); *Es Xg,* e.g., OA12 (e3, f7, k7). The group Pa A is no doubt independent within the tradition, cf. above; the rest seem derivative, though there is only one apparent superset (OA12:(c12), Eq Xc Es Xg joined by Xa Co).

OA11. Visibility of Saturn, Jupiter and Mars.

Toomer 1968, no. 49. — *Witnesses* and *Parallel tables:* see OA11-12.

Headings. — Common heading for Saturn, Jupiter and Mars. This is mostly absent; a heading common to OA11 and OA12, for which see OA11-12 above, may be present instead. No witness has both, and most early witnesses have neither.

(1: none) :: normally.
(2) Tabula apparitionis (/visionis Cz Vp) **et occultationis** (e.o.: *om.* Ch2) **3 superiorum planetarum (/p.s.** Op C Wa) :: {a2:} Cz Vp; {k:} Eh; {d?:} Op C; {x:} Mv B Lf Lg Lh Xj Xg G Pq Wa Nu; {p:} O Pd Ch2.
(3) Tabula ortus et occasus planetarum trium (t.p. Vj Ej Vm), **scilicet Saturni Iovis Martis** (s.s.i.m.: superiorum Vm), **de sub radiis** (d.s.r.: s.r. Ej Vm; s. radio Xc Vj) **solis** (*om.* Gr Eq; solaribus Vm) :: {e:} Gr Eq Ek3 Xc Vj Ej Vm.
(4: other) :: Cj ("T. de visionibus et occultationibus 3 sup.").

Table of Saturn. The headings for the two other planets are generally similar to these (exception: Mp etc., below).

(5) (Tabula Saturni+ Op; **/S.t.+** C) **[Apparitio Saturni, ortus matutinus; Occultatio eius, occasus vespertinus]** :: {a0:} Ct; {d?:} Op C.
(6) Visio Saturni, ortus (+eius O) **matutinus** (vesp. Vj Ej) (**+ortus** Oo Cq2); **Occultatio eius (/Saturni** Ey Lu Oj P; *om.* Pz R Vm), **occasus vespertinus (+occasus** Oo Cq2) :: {a0:} Oo Cq2 Pz Mc Mb Ey; {a1:} Xa Ad Cq Fc Ps Sg Wd Fh Xw2; {a2:} Cz Cj Md Vp; {aX:} R Cu; {aT:} Lu Oj P; {e:} Xc Vj Ej Vm!; {k:} Co; {p:} O Pd Ch2; {?:} Fc2 Py.
(7) Visio Saturni; Occultatio eius :: {e:} Gr Eq. — Abridgment of preceding.
(8) Visio Saturni, ortus matutinus; Occasus eius vespertinus :: {a2:} Mp; {k:} Eh; {x:} Mv B Lf Lg Lh Xj! Xg G Es Pq Wa Nu. — The other two headings are "Ortus Iovis/Martis matutinus; Occasus eius vespertinus", similar to Oc etc.
(9) Ortus Saturni matutinus; Occasus eius vespertinus :: {x:} Oc X! Vz Cm T Xb Fb Oy!.
(10) Visio Saturni, elevatio mane; Absconsio Saturni, occasus vespere (mane Vd) :: {aX:} Vd Vd2; {d:} Lb Pa A Fj Gr3 Mh!.
(11: other) :: Pn ("Visio Sat. et occultatio eius [Ortus matutinus; Occ. vesp.]); Ek3 ("Ortus Sat. matutinus; ortus (!) Sat. vesp."); Lw ("Visio Sat. occasus (!) matutinus; occult., vesp. occ.").

Text. Collated for values: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** Lu; **{k}** Co; **{d}** Pa A; **{e}** Eq Xc; **{x}** Es Xg. — Headings according to Xa. — Also quoted for values: **$bn $ba $aa $ht $pl;** see OA11-12.

		(Sat1)		**(Sat2)**		**(Iup1)**		**(Iup2)**		**(Mar1)**		**(Mar2)**	
	Nom ina sig no rum	Visio Saturni Ortus matu tinus		Occul tatio eius Occasus vesper.		Visio Iovis Ortus matu tinus		Occul tatio eius Occasus vesper.		Visio Martis Ortus matu tinus		Occul tatio eius Occasus vesper.	
		Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi
(1)	Ari	29	28	13	46	19	*53*	9	28	29	0	14	*52*
(2)	Tau	*27*	26	14	7	18	21	9	38	27	11	15	8
(3)	Gem	22	10	15	5	14	*54*	10	16	22	*54*	16	7
(4)	Cnc	17	18	17	9	11	*44*	11	44	18	*55*	18	*55*
(5)	Leo	14	8	19	48	9	44	13	32	16	7	22	*54*
(6)	Vir	13	8	22	0	9	7	15	23	15	8	27	11
(7)	Lib	12	*55*	22	32	9	0	16	7	14	*52*	29	0
(8)	Sco	13	1	21	20	9	7	15	23	15	8	27	11
(9)	Sgr	13	47	18	*54*	9	44	13	32	16	7	22	*54*
(10)	Cap	16	36	16	36	11	44	11	44	18	*55*	18	*55*
(11)	Aqr	21	16	14	40	14	*54*	10	16	22	*54*	16	7
(12)	Psc	26	46	14	0	18	*21*	9	38	27	11	15	8
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)

(a) Ar, Ta, Ge, Cn--Aq, Ps: Ar+Ta+Ge, Cn--Aq, *vac.*, Ps, *vac.* Oo. **(a5-9)** Vir...Aqr Co.ac. **(b2)** 27: $bn $ba $aa $ht $pl; 26 *omnes.* **(b7)** 13 $ba. **(c4)** 14 Oo; 38 $bn. **(c7)** 55: $bn $ba; 54 $ht; 15 $aa $pl, *omnes.* **(c9)** 46 $aa. **(c10)** 38 Co. **(c11)** 21 A; 36 $ba; 26 $aa. **(c12)** 26 A; 47 $ba. **(d2)** 17 Pa A. **(d4)** 16 $aa. **(d6)** 21 Oo $ht. **(d9)** 24 Oo. **(d11)** 15 $aa. **(e2)** 30 $bn. **(e3)** 8 $aa $pl. **(e9)** 54: $aa $ht $pl; 15 $ba; 35 $bn, *omnes.* **(e10)** 26 Pz; 32 $aa. **(f3)** 17 $aa. **(f5)** 13 Cq. **(f12)** 19 Cq; 21 $bn. **(g1)** 53: $ht; 13 $bn $ba; 34 Ct; 33 $aa, *omnes.* **(g3)** 54: $ht; 14 $aa $pl; 55 $bn $ba; 15 *omnes.* **(g4)** 44: Eq Xc $aa $ht $pl; 41 $ba $bn, *omnes.* **(g5)** 34 $aa; 41 $ht. **(g9)** 41 $ht. **(g11)** 54: $ba $bn $ht; 14 Pz Cq Lu Pa A, Oo.pc?, $aa $pl; 44 *cett.* **(g12)** 21: $aa $pl; 24 $ht; 51 $ba; 11 *vel* 41 Cq; 11 $bn, *cett.* **(h7-9)** 13, 11, 12 $aa. **(j2)** 28 Pz Pa A $ht; 18 $bn. **(j7)** 30 $ba. **(j8)** 33 Xc. **(j9)** 30 $aa. **(j11)** 36 $ht. **(j12)** 28 Pz; 39 $ht. **(k6)** 18 Pa A. **(k10)** 38 $ba. **(k12)** 22 $bn. **(L2)** 51 *aut* 11 $bn; 51 $ba. **(L3)** 54: $ba; 54 *aut* 14 $bn; 51 $ht; 14 $aa $pl, *omnes.* **(L4)** 55: $ba $ht; 55 *aut* 15 $bn; 15 $aa $pl, *omnes.* **(L7)** 52: $bn $ba $ht; 12 $aa $pl, *omnes.* **(L8)** 7 Eq. **(L9)** 8 Eq; 4 $bn $ba; 12 $aa. **(L10)** 55: $ba $ht; 35 $bn; 5 $aa; 15 $pl, *omnes.* **(L11-12)** 16, 15 A, *cf. col. (m).* **(+L11)** 54: $ba; 34 $bn; 51 $ht; 14 $aa $pl, *omnes.* **(+L12)** 10 $bn; 51 $ba. **(m1-2)** *n.l.* $ba. **(+m2)** 16 $aa $pl. **(m3)** 17 $pl. **(m6)** 22 Eq. **(m10)** 28 Co.ac. **(n1)** 52: $ht; 7 $bn; 2 $ba; 12 $aa $pl, *omnes.* **(n4)** 55: $ht; 5 Oo; *n.l.* $ba; 15 $bn $aa $pl, *omnes.* **(n5)** 54: $bn $ba $ht; 14 $aa $pl, *omnes.* **(n6)** 51 $bn $ba. **(n8)** 51 $bn. **(n9)** 54: $bn $ba $ht; 14 $aa $pl, *omnes.* **(n10)** 55: $bn $ba $ht; 15 $aa $pl, *omnes.*

OA12. Visibility of Venus and Mercury.

Toomer 1968, no. 50. – *Witnesses* and *Parallel tables:* see OA11-12.

Headings common to several sub-tables. Outer headings common to OA11 and OA12: see notes to OA11-12. – A general heading, common to all tables for Venus and Mercury, is mostly absent, even where OA11 has the analogous heading. The instances are:

(1: none) :: normally.
(2) Tabula apparitionis et occultationis 2 planetarum inferiorum :: {a2:} Vp; {d?:} Op C.
(3) Tabula ortus et occasus Veneris et Mercurii de sub radiis (**/-io** Xc Vj) **solis** :: {e:} Gr Eq Ek3! Xc Vj Ej Vm.

Tables for Venus, or pairs of such tables:

(4) Visio Veneris et occultatio eius (o.e.: **/e.o.** Mp Lh Py; **/o. eiusdem** Oc X Vz T Xb Es Fb Oy; o. ipsius Vm; +haec est Mp) :: normally.
(5) Tabula visionis Veneris et occultationis (-tio Pd) **eiusdem** :: {p:} O Pd.
(6) Visio Veneris; Occultatio eius (Veneris Md) :: {a0:} Pz; {a1:} Sg; {a2:} Md; {aX:} Cu. – Two headings, one for each pair of sub-tables in Sg Md Cu. In Pz they are attached to the two first sub-tables whereas the last pair lacks any such headings.
(7) Visio Veneris et eius absconsio :: {d:} Lb Pa A Fj Gr3.
(8) Tabula Veneris :: {d?:} Op C.
(9: other) :: Ct ("Apparitio Veneris; Occultatio eius", each for its own pair of sub-tables); Mh (not filled in); Wa ("T. ortus et occasus Veneris de sub radiis solis", cf. (3) above).
(10: none) :: Cq2 Sg R Vd Vd2 Lw. (Secondary, like Oc:) Cm.

Tables for Mercury, or pairs of such tables:

(11) Visio Mercurii et occultatio eius (occ. e.: /e. occ. Py; **/occ.** Oc X Xb; **/occ. eiusdem** Mp Eh Mv B T Lf Lg G Es Pq Nu; occ. ipsius Vm) :: normally.
(12) Tabula visionis Mercurii et occultationis (-tio Pd) **eiusdem** :: {p:} O Pd.
(13) Visio Mercurii; Occultatio eius :: {a0:} Pz; {a1:} Sg; {aX:} Cu. – Two headings, one for each pair of sub-tables in Sg Cu. In Pz they are attached to the two first sub-tables whereas the last pair lacks any such headings.
(14) Visio Mercurii et eius absconsio :: {d:} Lb Pa A Fj Gr3.
(15) Tabula Mercurii :: {d?:} Op C.
(16: other) :: Ct ("Apparitio Mercurii; Occultatio eius", each for its own pair of sub-tables); Mh (not filled in); Wa ("T. ortus et occasus Mercurii de sub radiis solis"; cf. (3) above).
(17: none) :: Cq2 R Vd Vd2 Lw Vz Cm. (Secondary, like normal hdg.:) Xc.

Headings for single sub-tables: overview and sources. Symbols for manuscripts and sources are listed under OA11-12.

In the list below, each sub-table is identified by its symbol and its first and last value. Then it is shown what phase is associated with it in the table headings, both in the sources and in the Toledan tables. The phase is indicated with its name (**Oc**(casus)**M**(atutinus) = setting in the morning, **Or**(tus)**V**(espertinus) = rising in the evening, etc., cf. the canons) and the stated interval in the planetary argument. The symbols for sources ("$ht", etc.) are as under OA11-12 above.

The headings are misplaced in all the sources, as has been shown by van der Waerden; cf. Toomer 1968 p. 75, from where I report what heading would have been correct for each sub-table.

Tables for Venus:	**(Ven1)**	**(Ven2)**	**(Ven3)**	**(Ven4)**
First value:	15;51	7;25	3;36	2;27
Last value:	15;28	7;43	2;43	1;31
Correct headings:	**OcM** 223-360	**OrV** 1-137	**OcV** 137-180	**OrM** 180-223
$ht	OrV *1*-137	<*>	OcM 223-360	OrM 180-223
$bn	OrV 0-137	OcM 223-360	OrM 180-223	OcV 137-180
$ba	OrV 0-137	OcM 223-360	OrM 180-223	OcV 137-180
$aa	OrV <>	OcM <>	OrM <>	OcV <>
$pl	OrV *1*-137	OcM *224*-360	OrM 180-223	OcV *138*-180
Toledan, main type	OrV *1*-137	OcM *224*-360	OrM 180-223	OcV *138*-180

Tables for Mercury:	**(Mer1)**	**(Mer2)**	**(Mer3)**	**(Mer4)**
First value:	24;10	12;20	22;43	12;9
Last value:	24;35	12;54	18;22	11;47
Correct headings:	**OcM** 248-360	**OrV** 1-112	**OrM** 180-248	**OcV** 112-180
$ht	OrV *1*-112	OcM 248-360	OrM 180-248	OcV 112-180
$bn	OrV 0-112	OcM 248-360	OrM 180-248	OcV 112-180
$ba	OrV 0-112	OcM 248-<u>347</u>	OrM 180-248	OcV 112-180
$aa	OrV <>	OcM <>	OrM <>	OcV <>
$pl	OrV *1*-112	OcM *249*-360	OrM 180-248	OcV *153*-180
Toledan, main type	OrV *1*-112	OcM *249*-360	OrM 180-248	OcV *153*-180

Headings for single sub-tables: types. Interchanges of "ortus / occasus" and "matutinus / vespertinus" occur unsystematically in single witnesses, and are not noted. For variants in degree values, see next paragraph.

Main type. – Witnesses: {a0:} Ct Oo Pz Mc Mb Ey; {a1:} Xa Cq Fc Ps Sg Wd Fh Xw2; {a2:} Cz Cj Md Vp; {aX:} Cu; {aT:} Lu Oj P; {k:} Co; {e:} Gr Eq Ek3 Xc Vj Ej Vm; {p:} O Pd Ch2; {?:} Pn Fc2; Py ((Ven3) absent).

(Ven1)	Ortus vespertinus,	ab uno (gra) in 137;
(Ven2)	Occasus matutinus,	a 224 in 360;
(Ven3)	Ortus matutinus,	a 180 in 223;
(Ven4)	Occasus vespertinus,	a 138 in 180.
(Mer1)	Ortus vespertinus,	ab uno (gra) in 112;
(Mer2)	Occasus matutinus,	a 249 in 360;
(Mer3)	Ortus matutinus,	a 180 in 248;
(Mer4)	Occasus vespertinus,	a 153 in 180.

Denominations like "gra(dus)" are added sporadically by Vp Gr Eq Ek3 O Pd, in the places indicated and once or twice elsewhere. – O Pd, but not Ch2, read (Ven1:) "ortus eius v.", (Mer1:) "o.v. Mercurii". In (Ven2), O prefixes "occultatio eius", about as in R.

Various late variants of the main type. – Witnesses: {a2:} Mp; {k:} Eh; {x}. – Nearly all the additions shown in parentheses are present in {k:} Eh; {x:} Mv B Lf Lg Xj Xg G Pq Wa Nu; the rest show varying selections.

(Ven1)	Ortus (Veneris) vespertinus,	ab uno	gra	in 137	(gra);
(Ven2)	Occasus (eius) matutinus,	a 224	gra	in 360	(gra);
(Ven3)	Ortus (eius) matutinus,	a 180	gra	in 223	(gra);
(Ven4)	Occasus eius vespertinus,	a 138	gra	in 180	(gra).
(Mer1)	Ortus Mercurii vespertinus,	ab uno	gra	in 112	(gra);
(Mer2)	Occasus (eius) matutinus,	a 249	gra	in 360	(gra);
(Mer3)	Ortus (eius) matutinus,	a 180	(gra)	in 248	(gra);
(Mer4)	Occasus (eius) vespertinus,	a 153	gra	in 180	(gra).

Other types. Showing the headings for Venus; those for Mercury are much the same in all cases. – Witnesses: {aX:} R; {k:} Lw. – Degree numbers missing, inserted in R.

(Ven1)	Visio Veneris, ortus vespertinus;
(Ven2)	Occultatio, occasus matutinus (m.o. Lw);
(Ven3)	Eiusdem ortus matutinus;
(Ven4)	Occultatio eiusdem et (e.e. *om.* Lw) occasus vespertinus.

{d?:} Op C. – The order of the sub-tables is the same for Venus and for Mercury, and differs from the normal one.

(Ven1)	Apparitio, ortus vespertinus,	ab uno usque 137;
(Ven4)	Occultatio, occasus vespertinus,	a 138 usque 180;
(Ven3)	Occultatio, ortus matutinus,	a 180 usque 223;
(Ven2)	Apparitio, occasus matutinus,	a 224 usque 360.

{aX:} Vd Vd2; {d:} Lb Pa A Fj Gr3; Mh (incomplete). – This looks like a translation different from all those above.

(Ven1)	Visio Veneris, elevatio vespere,	de uno usque	ad 47 (*om.* Lb);
(Ven2)	Absconsio Veneris, occasus mane,	de 224	ad 360;
(Ven3)	Visio Veneris, elevatio mane,	de 180	ad 223;
(Ven4)	Absconsio Veneris, occasus vespere,	de 138	ad 180.

Other: Ad (main type but only showing the last degree value in each heading); Cq2 ("Visio Ven., ort. vesp., ab uno in 137", etc., with "visio" and "occultatio" alternating. Cf., most closely, the type of R Lw above.).

Headings of single sub-tables: apparatus of degree-values. Variants that occur in single witnesses are mostly placed to the outer right, in parentheses. Pz Ad Mh Lw Py are partly or wholly absent, and are only quoted for the numbers they show.

(Ven1) 137:	47	{aX:} Vd Vd2 {d:} Lb Pa A Fj Gr3;	
	138	{p:} O Pd Ch2;	(127 G; 132 Gr; 139 T).
(Ven2) 224:	223	{e:} Gr Eq Ek3;	
	23	{e:} Vj Ej Vm;	
	227	{e:} Xc;	(124 Cm; 128 Fc2; 228 Pn).
(Ven3) 180:			(138 Cj).
(Ven3) 223:	222	{aX:} R(pc); {?:} Fc2;	
	224	{a0:} Cq2.ac Ey;	(180 Cj; 233 Oj; 333 Ad).
(Ven4) 138:	137	{a0:} Ey {e:} Gr Eq Ek3 Xc Vj Ej Vm;	(130 Mc).
(Ven4) 180:			(140 Oj; 152 Cj).
(Mer1) 112:	152	{a0:} Ey {a1:} Xa Ad Cq Fc Ps Sg Wd Fh Xw2 {a2:} Cj Md, {aX:} R(pc) {aT:} Lu Oj P {k:} Co {d?:} Op C, {e:} Gr Eq Ek3 Vj Ej.ac Vm {x:} T Fb {?:} Pn Fc2;	
	150	{?:} Py;	
	161	{p:} O Pd Ch2;	(122 Cz).
(Mer2) 249:	240	{d?:} Op C {e:} Vj;	
	248	{a0:} Ey {e:} Xc;	(1 Fc; 229? Cm; 289 A).
(Mer2) 360:	300	{a0:} Oo {x:} T;	
	180	{x:} Oc X Vz Xb;	(160 Fc).
(Mer3) 248:	24	{x:} Vz Cm;	
	240	{d:} Op C;	(148 T; 208 Mc; 218 Fc; 242 Vd; 244 Ad; 288 Fh; 348 Wa).
(Mer4) 153:	112	{a2:} Mp {k:} Eh {e:} Xc, {x:} Oc X Vz Mv Cm B Lf Lg Lh Xj Xg G Xb Es Pq Wa Nu;	
	113	{a0:} Mb.pc {a2:} Cz Cj Vp {e:} Ej.pc {x:} T Fb Oy;	
	115	{a1:} Xw2(pc);	
	133	{aX:} Vd Vd2 {d:} Lb Pa A Fj Gr3 Mh;	
	152	{a0:} Ey; {a2:} Md;	(150 Pn; 154 Fc).

In (Mer1) and (Mer4) the correct values are 112 and 113, respectively (Toomer p.74 n.1), but in (Mer4) the preserved reading is no doubt 153. Readings such as 152 in (Mer1) and 112 / 113 in (Mer4) are likely to be scribal emendations.

Versions. The eight sub-tables, 4 for Venus and 4 for Mercury, occur in the order indicated except that Op C show each set in the order 1-4-3-2.

Text. Collated for values: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** Lu; **{k}** Co; **{d}** Pa A; **{e}** Eq Xc; **{x}** Es Xg. – Headings according to Xa, including the degree-values in the headings. Variants for headings and degree-values can be obtained from the lists above. – Also quoted for tabular values: **$bn $ba $aa $ht $pl;** see OA11-12 above.

Visio Veneris et occultatio eius. — Visio Mercurii et occultatio eius.

		(Ven1)		**(Ven2)**		**(Ven3)**		**(Ven4)**		**(Mer1)**		**(Mer2)**		**(Mer3)**		**(Mer4)**	
	Nomina signorum	Ortus vespertinus ab uno in 137		Occasus matutinus a 224 in 360		Ortus matutinus a 180 in 223		Occasus vespertinus a 138 in 180		Ortus vespertinus ab uno in 112		Occasus matutinus a 249 in 360		Ortus matutinus a 180 in 248		Occasus vespertinus a 153 in 180	
		Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi	Gr	Mi
(1)	Ari	15	*51*	7	25	3	36	2	27	24	10	12	*20*	22	43	12	9
(2)	Tau	13	48	*7*	*25*	4	9	3	30	21	15	12	18	24	23	12	*52*
(3)	Gem	10	39	7	38	5	*54*	8	47	17	10	12	37	22	28	14	44
(4)	Cnc	8	*18*	8	*18*	10	12	10	44	14	9	14	9	18	48	19	48
(5)	Leo	7	5	*9*	*19*	17	45	*9*	30	12	*33*	16	*59*	15	8	23	*29*
(6)	Vir	6	53	10	46	23	40	7	43	12	8	20	23	13	15	26	*36*
(7)	Lib	6	57	11	9	22	27	6	40	12	10	23	50	12	29	25	38
(8)	Sco	7	11	11	26	15	14	6	17	12	41	23	49	12	10	20	35
(9)	Sgr	7	56	12	27	7	1	5	12	14	3	20	44	11	*56*	17	41
(10)	Cap	9	*58*	9	*58*	2	18	2	18	16	*59*	16	*59*	12	*56*	12	30
(11)	Aqr	12	47	8	29	1	36	1	*54*	20	*55*	14	7	14	25	11	32
(12)	Psc	15	28	7	43	2	43	1	31	24	38	12	*54*	18	22	11	47
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)	(r)

(a2-12) *vacat* Co. **(b3)** 8 $bn $ba. **(b10)** 8 Pz. **(b12)** 14 $bn. **(c1)** 51: $ht; 0 $bn $ba; 21 Co; 31 $aa $pl, *cett.* **(c3)** 59 $bn $ba. **(c4)** 18: $ht; 28 $bn; 58 $ba; 38 $aa $pl, *omnes.* **(c6)** 33 $aa. **(c7)** 7 $bn. **(c8)** 16 $ht; 51 $bn $ba $aa $pl. **(c9)** 26 $bn. **(c10)** 58: $ba $aa $ht $pl; 38 $bn; 48 Oo.ac; 18 *cett.* **(c12)** 20 Xa Co Eq Xc Es Xg; 23 $ba. **(d1-2)** 7, 7: $bn $ba $aa $ht $pl; 4, 4 *omnes.* **(d5)** 9: Ct Oo Pa A $bn $ba $aa $ht $pl; 8 *cett.* **(d7)** 10 Pa A. **(d9)** 10 $aa. **(e2)** 25: $bn $ba $ht; 29 $aa $pl, *omnes.* **(e3)** 28 Es Xg. **(e4)** 18: $aa $ht $pl; 38 $bn $ba; 48 Oo; 59 Eq Xc; 58 *cett.* **(e5)** 19: $aa $ht $pl; 39 $bn; 59 $ba, *omnes.* **(e6)** 56 Eq Xc. **(e10)** 58: $ba $ht; 38 $bn; 18 $aa $pl, *omnes.* **(f)** 25--43, *ut col. (e),* Co. **(f1)** 4 Pz. **(f7)** 23 Es Xg. **(f10)** 7 $bn. **(f11)** 0 A; 8 $bn. **(f12)** 36 Pa A, *cf. (g11);* 7 $bn. **(g1)** 6 Pz. **(g2)** 51 $aa. **(g3)** 54: $ba $ht; 34 $bn; 4 $aa $pl; 14 *omnes.* **(g4)** 42 $bn $ba; 54 $ht *(44 ex Stahlman).* **(g5)** 25 $bn. **(g6)** 15 $ht; 17 $bn $ba; 46 Pa A. **(g7)** 47 Pa; 21 $aa. **(g8)** 44 Oo, *ac?.* **(g10)** 38 $ba. **(g11)** 2 Pa A; 59 $bn. **(g12)** 53 Pz; 44 *vel* 43 Cq; 48 $ba $aa. **(h1)** 7 $bn. **(h2)** 4 $aa. **(h5)** 9: $bn $ba $aa $ht; 11 $pl, *omnes.* **(h9)** 6 $bn. **(h10)** 5 Pz; 7 $bn; 4 $aa. **(h11)** 3 $aa $pl. **(h12)** 4 $ht; 6 $pl. **(j1)** 37 Lu. **(j2)** 4 $ht. **(j3)** 57 $ht. **(j5)** 43 Eq Xc. **(j6)** 33 Xg. **(j8)** 47 Cq. **(j9)** 52 $ba. **(j10)** 14 Oo; 16 Xg; 38 $ba. **(j11)** 54: $ba $ht; 52 $bn; 24 $pl; 14 $aa, *omnes.* **(k2)** 20 $ba. **(k7)** 13 Es Xg; 14 $aa. **(k8)** 14 $aa. **(k11)** 13 $bn; 24 $aa. **(k12)** 25 $aa. **(L5)** 33: $ht; 13 $bn $ba $aa; 53 $pl, *omnes.* **(L7)** 18 $ht. **(L8)** 11 $aa; 44 $ht. **(L10)** 59: $bn $ba $ht; 19 $aa $pl, *omnes.* **(L11)** 55: $ht; 35 $bn $ba; 25 Pa A; 15 $aa $pl, *cett.* **(L12)** 35 $ht; 18 $pl. **(m7)** 22 Eq. **(n1)** 20: $bn $ba $aa $ht $pl; 24 *omnes.* **(n2)** 38 $bn. **(n3)** 38 Cq; 36 $bn; 57 $aa. **(n5)** 59: $ht; 39 $bn $ba $aa $pl, *omnes.* **(n6)** 33 Xa. **(n7)** 7 $bn. **(n8)** 59 Eq Xc. **(n9)** 14 $aa. **(n10)** 59: $bn $ba $ht; 19 $aa $pl, *omnes.* **(n12)** 54: $ba $ht; 14 $bn $aa $pl, *omnes.* **(o1)** 23 Pa A. **(o2)** 25 $bn. **(o7)** 14 $bn. **(o10)** 22 Pa A. **(p2)** 22 Oo. **(p6)** 12 $aa. **(p9)** 56: $bn $ba $ht; 17 $aa; 16 $pl, *omnes.* **(p10)** 56: $ba $ht; 36 $bn; 16 $aa $pl; 15 *omnes.* **(p11)** 20 Pz; 24 $aa. **(q1)** 14 $bn. **(q5)** 22 Pz. **(q8)** 22 Oo. **(r2)** 52: $ba $aa $ht; 12 $aa $pl, *omnes.* **(r5)** 29: $bn $ba $aa $ht $pl; 25 *omnes.* **(r6)** 36: Ct $bn $ba $aa $ht; 56 $pl; 27 Oo; 37 *cett.* **(r7)** 18 $ht. **(r8)** 45 Eq Xc. **(r12)** 46 Ct; 55 Oo; 37 Xg; 4 $aa.

OB-OC. Retrogradation, etc.

OB11. "Tabula retrogradationis planetarum".

Toomer 1968, no. 51 (printed in full, from Wd O). Zinner 1936 p. 756 no. 127 (printed from Wd). – The values of arcs and of days are from Almagest XII,2-6 (Toomer p.77). I have not seen them tabulated anywhere except here.

In Xa,39r, the table is glossed "Haec tabula non scribatur", in a hand that may be as early as the main hand. For whatever reason, the table is present in classes {a0, a1} and absent from next to all of the later vulgate tradition.

Witnesses: **{a0}** Ct,25r; Oo,25v; Cq2,89; Pz,129r; Mc,27r; Mb,55v. – **{a1}** Xa,39r; Ad,95r; Cq,69; Fc,55v; Ps,73r; Sg,188; Fh,69v; Wd,39v. – **{aT}** Lu,79r. – **{k}** Co,175v. – **{p}** O,94v; Pd,25r; Ch2,184r.

Headings.

General: **(1) Tabula retrogradationis** (grad. retro Ad; -num Cq2 Lu Co; +5 Cq2) **planetarum** :: {a0:} Ct Oo Cq2 Pz Mc Mb; {a1:} Xa Ad Cq Sg Fh; {aT:} Lu; {k:} Co; {p:} O Pd. – **(2: other)** :: Fc ("Ista est t.r.p."); Ps ("R-nes p."); Wd ("T. de r-nibus p."); Ch2 (incomplete).

Entrance column: **(3) Nomina planetarum** ("N. stellarum" Ps; blank in Sg).

Other columns:
(4) Longitudo (lat. Pz) **maior** (longior Ct; *s.l.* Ad); **Dies; Longitudo media; Dies; Longitudo minor** (mediocris Pz); **Dies** :: {a0:} Ct Oo Cq2 Pz Mc Mb; {a1:} Xa Ad Cq Fc Ps Sg Wd; {aT:} Lu; {k:} Co; {p:} O Pd.
(5: other) :: Fh (normal hdgs. in the order "L. minor -- media -- maior", though the numbers stand as usual); Ch2 (incomplete).

Text. Collated for values: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** Lu; **{k}** Co. Also, from OB11a: **{d:}** A Gr3. – Headings according to Xa. – Also quoted: **$pm** = Almagest XII,2-XII,6, Toomer 1984. The values occur singly in separate contexts. They are the same as in the Arabo-Latin Almagest (Liechtenstein printing, 1515). The sixtieths occurring in some of the day-values in the present table are expressed as fractions in the Almagest.

I reproduce the numbers of the Almagest ($pm), italicizing where they differ from the majority of Ct Oo Pz Xa Cq.

There are two general errors (c Sat, o Sat), nondescript. The witnesses *Ct Oo Pz Cq Lu A Gr3* appear to form an error group against Xa Co (though Oo and Lu vacillate a little); they show at least one Abjad-type error (h Ven). Further, *A Gr3* have an Abjad error which is probably derived from an error in the group (n Ven), plus one common error of their own (L Mer), and they are correct against the group at (m Mer); so they may be independently transcribed from an Arabic exemplar similar to the ancestor of the whole group.

Xa Co are more correct, though they too have errors of their own (n Mer; j Ven, with Lu). Neither of these need be Abjad errors; thus it cannot be said whether Xa Co are an independent version, or whether, e.g., they have been corrected from a source close to the Almagest.

Tabula retrogradationis planetarum.

Nomina planetarum	Longi tudo maior	Dies	Longi tudo media	Dies	Longi tudo minor	Dies
Retrogradatio Saturni	7 *4* 10	*140 40*	7 16 20	138	7 18 *10*	136
Retrogradatio Iovis	*9* 49 14	123	9 *52* 16	121	9 54 40	118
Retrogradatio Martis	19 53 32	80	16 18 44	73	11 12 14	64 30
Retrogradatio Veneris	16 25 26	43	*15* 17 34	41 40	14 *4* 38	40 40
Retrogradatio Mercurii	7 54 22	21	12 17 10	22 30	*15* 12 *46*	*23*
(a)	(b) (c) (d)	(e) (f)	(g) (h) (j)	(k) (L)	(m) (n) (o)	(p) (q)

(b Iov) 7 Ct Pz Cq Lu, Co*gl.*, A Gr3. **(c Sat)** 4: $pm; 14 *omnes.* **(e Sat)** 147 Ct Oo Cq, A.ac?, Gr3; "14.7" Lu; 148 Pz. **(e Ven)** 4 55 *ut vid.* Lu, *fort.* 43. **(f Sat)** 47 Ct Oo Pz Cq Lu A Gr3. **(g Ven)** 12 Ct Oo Pz Cq Lu A Gr3. **(h Iov)** 12 Ct Oo Cq Lu A Gr3; 22 Pz. **(j Sat)** 28 Co. **(j Ven)** 38 Xa Lu Co. **(k Ven)** v'a *ut vid.* Oo. **(L Mer)** 32 A Gr3. **(m Mer)** 10 Ct; 12 Oo Pz Cq Lu. **(n Sat)** xviii *vel* x viii Cq. **(n Ven)** 7 Ct Oo Pz Cq Lu; 50 A Gr3. **(n Mer)** 16 Xa Co. **(o Sat)** 10: $pm; 0 A Gr3; *vacant cett.* **(o Ven)** 34 Cq. **(o Mer)** 0 Ct Oo Pz Cq Lu A Gr3. **(p-q Mer)** 66, 48 Ct Oo Pz Cq Lu A Gr3.

OB11a. Retrogradation: transposition of OB11.

Printed by Harris 1846 p.185, from ms. Lb. – The values are as in OB11, but the columns are the same as the rows of OB11, and vice versa, as shown in the sample below.

Witnesses: **{d}** Lb,51v; A,232v; Fj,54v; Nc,131v; Fd2,55v; Gr3,126v; Ok,71r; Mh,17r.

Placed after JE11 in all witnesses except Ok Mh.

Headings.

General: **Tabula** (-ae A Fd2 Nc) **retrogradationis** *(Lb A Fj Fd2 Gr3:)* **5** (*om.* Lb.ac) **planetarum** :: Lb A Fj Nc Fd2 Gr3 Ok. – **(none)** :: Mh.

Label for sub-headings: **Nomina planetarum** :: Lb Nc Fd2, absent in the rest. – Cf. the entrance-column heading in OB11.

Sub-headings: **Retrogradus Saturnus; ... Retrogradus Mercurius** :: Lb A Fj Fd2 Gr3. – **Saturnus; ... Mercurius** :: Nc Ok Mh.

Text. The readings of mss. A Gr3, collated under OB11, generally show the same peculiarities as the vulgate of OB11; still they may have been transcribed from the Arabic independently of the vulgate. It cannot be said whether the peculiar layout of OB11a is from the Arabic too. – Sample to show the layout, from Fd2:

Tabula retrogradationis 5 planetarum.

Nomina planetarum:	Retrogr. Saturnus	Retrogr. Iuppiter	Retrogr. Mars	Retrogr. Venus	Retrogr. Mercurius
Longitudo maior	7.14.10	7.49.14	....	....	....
Dies	147.47	123	....		
Longitudo media	....	....			
Dies	....				
Longitudo minor	....				
Dies	....				

OC11. Stations, etc., extracted from EA41-81?

The values are equal to the first and last values in the sub-tables for stations in EA41-EA81. They are also similar to Almagest XII,8 or Albattani. — A copy found in Richard of Wallingford's *Exafrenon* was reproduced by North 1976 p. 212. This copy has the values shown below, even those which disagree with the Almagest.

Witnesses: **{aT}** P,83v; Lu,79r; Da4,154r. — **{d}** Fj,54v(m2). — **{?:}** Ef,72v; Ch,57v (:Savasorda 2); Pn,53v (:Jo. Lin.); Fc2,110r (:Jo. Lin.). — Another copy is in Py,20r, where the table is in a gloss to the mean motion tables CE20. It is accompanied by a banal rule; see CbA.O11.

In the tables of Raymond of Marseilles, CE33 (Cambr. Fitzw. McClean 165, 56r ff.) single values are attached to the equation tables EA* for each planet. The whole table is in the same ms., on 64v, in a layout like that used here.

Headings.

General: **Tabula retrogradationum** (-nis Fc2) **et stationum et directionum** (+quinque Fj) **planetarum** (e.s.e.d.p.: pl. (+et) s. et d. Pn Fc2) :: {aT:} Lu P; {d:} Fj; {?:} Pn Fc2. — **(other)** :: Da4 ("Tabula ad sciendum s-nem et r-nem et d-nem planetarum"); Ch ("T. ad sciendum d-nes planetarum et s-nes et r-nes in omni die"); Ef (no main hdg.).

Sub-headings: **Directiones et stationes et retrogradationes, portiones aequatae [Stationes et directiones** (d.e.s. Lu) **et retrogradationes Saturni, portio aequata** (p-nes ae-tae Fj); ...(etc.)... **]** :: {aT:} Lu P; {d:} Fj. — **(other)** :: Pn ("<*>; Portio aequata; <*>"); Da4 ("Tabula Saturni Iovis et <*> Veneris Mercurii"); Fc2 (none); Ch ("Tabula Saturni; ..."); Ef ("Saturnus; ...").

Values. The values should fulfil the relation (1)+(4) = (2)+(3) = 360°. — The values in sets **(1)** and **(2)** are equal to the first and last values (for arguments 0s1° and 6s0°) of the sub-tables for stations in the planetary equation tables EA41-81. Values (1) and (2) are interchanged in the case of Mercury. The reading (d4) appears to be derived from (d1); generally, the values in sets (3) and (4) may have been constructed from (1) and (2) in the way just indicated.

The values, in all of sets **(1-4)**, are also similar to the outer values in the tables Almagest XII,8 or Albattani, Nallino II, 138-39. Indeed, all the values in question should coincide for arguments 0° and 180°, though the Almagest table would be different for the intervening arguments; cf. note under EA41-81, "Sub-tables .Sta". However, the reading "44" at (d1) in the present table is the same as in EA41:(q0,1), whereas it differs from the Almagest value and from Albattani; and there are several other deviations from either one. Thus it is probable that our table is based on a source like the EA* tables (or Alkhwarizmi / Maslama), rather than on those just mentioned.

Text. Collated for values: **{aT}** Lu P; **{?}** Ch Pn. — Headings according to Lu.

Layout: In mss. P Lu Ch there is a table for each planet; these tables are juxtaposed and prefixed with an entrance table containing the labels for each of the four rows, as reproduced below. In ms. Pn the tables form a column, with the labels repeated for each table.

Also quoted: **$pl** = Almagest XII,8, Arabo-Latin version (Liechtenstein printing of 1515, f. 139r), values for 6° and 180°; **$pm** = Almagest, *ibid.*, Greek version (from Toomer 1984 p. 588), values for 0° and 180°; **$bn** = Albattani, Nallino II, 138-39, values for 6° and 180°; **$fz** = table in Cambr. Fitzw. McClean 165, 64v; cf. "Witnesses".

Italics are used for readings that have been corrected against a majority of P Lu Pn Ch, to satisfy the relation above. Underscoring is used for the readings (d1, d4), mentioned above; they are kept against the consensus of the parallel tables because they fulfil the relation.

Of the witnesses, P Lu Pn are once (c1) in error against Ch and the parallel texts; this may be insignificant.

Tabula retrogradationum et stationum et directionum planetarum.

	Directiones et stationes et retrogra dationes	Directi ones et station es et re trograda tiones Saturni			Directi ones et station es et re trograda tiones Iovis			Directi ones et station es et re trograda tiones Martis			Directi ones et station es et re trograda tiones Veneris			Directi ones et station es et re trograda tiones Mercurii		
	Portiones aequatas(!)	Portio aequata			Portio aequata			Portio aequata			Portio aequata			Portio aequata		
	Nomina	Si	Gr	Mi	Si	Gr	Mi	Si	Gr	Mi	Si	Gr	Mi	Si	Gr	Mi
(1)	Stationis primae initium	3	*22*	<u>44</u>	4	4	5	5	7	28	5	15	51	4	24	42
(2)	Retrogradationis initium	3	25	30	4	7	11	5	19	15	5	18	21	4	27	14
(3)	Retrogradationis finis	8	4	30	7	22	49	6	10	45	6	11	39	7	2	46
(4)	Stationis secundae finis	8	7	<u>16</u>	7	25	55	6	22	32	6	*14*	9	7	5	18
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)	(n)	(o)	(p)	(q)

(c1) 24 Pn P Lu. **(d1)** 45 $pl $pm $bn. **(d2)** 29 $pm $bn. **(d3)** 31 $pm $bn. **(d4)** 15 $pl $pm $bn. **(e-g 1-4)** *n.l.* Ch. **(j3)** 20 Pn. **(k1)** 33 $pl $bn. **(k2)** 25 Ch; 9 $pm; 14 $bn. **(k3)** 51 $pm; 46 $bn. **(k4)** 27 $pl $bn. **(L-n 1-4)** *n.l.* Ch. **(L-m 3)** 291° *(pro* 191*)* $pl. **(m4)** 14°: $pl *("294°" pro 194°)*, $pm $bn $fz; 24 P Lu Pn; *def.* Ch. **(n1-4)** 51 21 39 9: 28 15 45 32 P *(cf. tab. Martis)*. **(n1)** 52 $pl; 53 $bn. **(n4)** 8 $pl; 7 $bn. **(q1)** 40 $pm $bn *(ad 180° ambo)*. **(q2)** 12 $pl *(ad 6°)*; 13 $bn *(ad 6°)*. **(q3)** 44 Ch; 48 $pl *(ad 6°)*; 47 $bn *(ad 6°)*. **(q4)** 20 $pm $bn *(ad 180° ambo)*.

P. Eighth sphere.

For tables of simple precession, and the precession value of 51" per solar year, see DB21-22.

Of the tables reproduced here, the only ones proper to the Toledan collections are the trepidation tables PA11 and PB11*. These are the same as in the tract *De Motu octavae sphaerae*, "Imaginabor sphaeram", which is ascribed to "Thebit" (Thabit ibn Qurra). However, when our tables occur in Toledan table collections, they never carry ascriptions.

The tract *De Motu* has been edited by Carmody (1960; these tables on p.93)[1] and several times by Millás, and has been translated by Neugebauer; see Toomer 1968 p.118 n.1. An early edition of the tables is Delambre 1819 p. 75.[2] A list of a few copies of the Thebit text, with notes on the tables they contain, is in PB* below, and is summarized in Pr:04(2.8).

In modern times much doubt has been raised about the attribution to Thebit, and currently there is a strong presumption that at least the tables, and perhaps also the text of De Motu, are Toledan work; see Pr:04(2.8) for references to the discussion.

The present examination seems, if anything, to strengthen the suspicion that the tables of De Motu are not prior to the Toledan tables. Indeed, the copies that occur in De Motu show a variety of forms not unlike those to be enumerated here; and as concerns the quality of the manuscript readings, the De Motu tables do not seem superior to their counterparts in Toledan collections, as will be plain in the following.

The trepidation theories ascribed to Thebit and Azarchel have been treated in a number of works, which are summarized in Samsó 1994h; see also PB* below.

PA. Mean motion of eighth sphere.

PA11. Mean motion of eighth sphere: values of ?Thebit.

Toomer 1968, no. 81(i), tables printed with commentary p.118-122. – For other treatments, see note under P* above.

Witnesses: **{a0}** Ct,24v; Oo,25r; Cq2,88; Pz,132v; Mc,30v; Mb,65r; Ey,53v. – **{a1}** Xa,39v; Ad,95v; Cq,70; Fc,50r; Fc,51v; Ps,82v; Sg,185; Sg,189-190; Wd,39v; Fh,70v; Xw2,35v. – **{a2}** Cz,92r; Cj,163v; Md,106r; Vp,138r. – **{aX}** Vo,70v; R,55r; Cu,81r; Fj2,111r; S,103r; Vd,20r. – **{aT}** Oj,149v; P,134r (:Toledan). – **{k}** Eh,122v (m2?); Lw,131r; Ou,76v; Eg,24v; Co,174r; Cn,105r. – **{d}** Op,59v; C,339; Lb,53r; Pa,45r; A,224r; Fj,48v; Nc,114r; Pv,30r; Fd2,46r; Fd2,59r; Gr3,120v; Ok,71v. – **{e}** Gr,72r; Eq,91r; Ek3,116r; Xc,84v; Vj,108r; Ej,91r; Vm,31v. – **{x}** Oc,98r; X,175r; Vz,79r; Mv,114r; Cm,215v; B,165r; T,301r; Lf,115v; Lg,194r; Lh,156v-157r; Xj,297r; Xg,78v; G,82v; Xb,97v; Es,199r; Fb,88v; Pq,207v; Oy,93v; Wa,80r; Ow,171r; Nu,163r. – **{p}** O,90v; Pd,89v; Ch2,180v. – **{?}** Py,47v. — Duplicates in {a1} Fc Sg, {d} Fd2. – Probably lost from ms. {a2} Mp; see T:03(2,Mp).

Canons: Cc235 and Cb221. The heading implied by the text of the canons is "tabula (-lae Cc) (+motus Cc) accessionis et recessionis ...", like the common headings below.

---

1 Carmody, in his remarks on the table of Thebit (pp. 85, 87-88, 90) does not clarify the textual basis of the table he prints on p.93-94. He states that az-Zarqali extended the tables "by addition from 840 to 870 ("970" Carmody) years" (p. 85). In fact Carmody's table ends in AH 870, and its headings are similar to some in class {x} of Toledan tables. Thus it may be suspected that Carmody's exemplar is from a Toledan collection, though perhaps at some remove.
2 Presumably from ms. Par.lat. 7195; cf. Delambre p. 73.

Headings. Lesser variants ignored. – General:

(1) (Tabula+ Ch2 O) **Motus accessionis et recessionis** (**+stellarum fixarum** Pz Mc Mb; **+8'ae** (/4 Sg) **sphaerae** (/circuli Ps) Ps Sg Cz Vp O) **super** (secundum Cu Ok) **annos Arabum** (*om.* Cz; +sive Vo) **lunares** (*om.* Mc Mb Vp R Ok Pd Ch2) :: {a0:} Oo Cq2 Pz Mc Mb; {a1:} Xa! Ad Cq Fc(50r, 51v) Ps Sg(189) Wd Fh; {a2:} Cz Vp; {aX:} Vo R Cu Fj2; {d:} Ok; {p:} O Pd Ch2; {?:} Py. – *Added:* **+qui scilicet est motus firmamenti et vocatur motus 8'ae sphaerae** Pz; **+et dicitur motus 8'ae sphaerae** Fc(50r).

(2) Tabula (*om.* Md) **motus accessionis et recessionis 8'ae sphaerae, id est caeli stellati, super axes proprios** :: {a2:} Md; {k:} Eh; {x:} Mv B Lf Lg Lh Xj Xg G Pq Wa Nu. – *Added:* **+super annos Arabum lunares** Md; **+in annis Arabum collectis et expansis** *cett.*

(3) Tabula motus accessionis et recessionis 8'ae sphaerae super annos Arabum collectos et expansos ad Toletum (ad t.: *om.* Es) :: {x:} Oc X Vz Cm T Xb Es Fb Oy.

(4) Tabula motus (*om.* Nc) **adventus et recessus** (a. et r.: ascensionis et r. Lb; accessionis et recessionis Fd2) :: {aX:} Xw2; {d:} Lb A Fj Nc Pv Fd2(46r). – *Added:* **+super annis Elhigra lunaribus** Lb Fj Pv; **+id est** (i.e.: primi Nc) **motus octavae sphaerae** *(Nc Fd2:)* **ad meridiem Toleti** Xw2 A Nc Fd2(46r).

(5) Tabula medii motus 8'ae sphaerae in annis Arabum :: {d?:} Op C.

(6: none) :: {a0:} Ct; {e:} Gr Eq Ek3 Xc Vj Ej Vm; {k:} Eg.

(7: other) (mostly shorter forms of some of the preceding) :: Ey Sg(185) Cj S Vd, Oj P, Cn, Pa Fd2(59r), Ow; Ou & Co ("... et est motus ... capitis arietis et librae in duobus circulis ...").

– Heading (4), in manuscript group {d}, is surely an independent translation.

Collected years. Quoting some typical headings for the body of the table. The witnesses that are not mentioned have no heading, or only short headings, mostly of the type **(8)** "Anni (Arabum) collecti", placed above the entrance or above the body of the table.

(9) Anni (**+Arabum** Fc(50r) Wd Sg; +Arabum id est Sg) **lunares collecti** (coniuncti Co) :: {a0:} Ct Oo Cq2; {a1:} Xa Ad Cq Fc(50r,51v) Ps Sg(189) Wd Fh; {aX:} Cu Fj2; {k:} Co; {?:} Py.

(10) Tabula accessus et recessus 8'i circuli ad annos Arabum collectos :: {e:} Gr Eq Ek3 Xc Vj Ej Vm.

(11) (medius+ Op C Vz Fb) **Motus 8'ae sphaerae** (+medius Oc X Cm T Xb Oy) **in annis Arabum** (*om.* Ey Ow) **collectis** :: {a0:} Ey; {a2:} Vp; {d?:} Op C; {x-}.

(12) Motus 8'ae sphaerae :: {k:} Eh; {x:} G Nu.

(13) Motus adventus et recessus in annis lunaribus (*om.* Fd2) **coniunctis** (collectis Xw2 Lb Fd2) :: {aX:} Xw2 Vd; {d:} Lb Pa A Fj Pv Fd2(46r) Gr3. – *Added:* **+ad meridiem** (medietatem Xw2) **Toleti** Xw2 A Fj Gr3.

(14: other) :: Sg(185) Vo Lw O show headings "Motus accessionis et recessionis...", perhaps transformed from general headings.

Ranges. Start and end of coherent series in the table of collected years, ignoring any outlying entries for AH 0 and AH 30.

570-630:	{aX:} S; {k:} Lw.
0-720:	{k:} Ou Co Eg.
0-840:	{a0:} Ct Oo Cq2 Pz Mc Mb; {a1:} Xa Ad Cq Fc(50r,51v) Ps Sg(189) Wd Fh Xw2; {a2:} Cz; {aX} Vo Fj2 Vd; {d:} Lb Pa A Fj Nc Pv Fd2(46r,59r) Gr3; {p:} O.
570-840:	{a1:} Sg(185); {k:} Cn; {p:} Pd.
0-870:	{a0:} Ey; {a2:} Cj Md; {aX:} Cu; {aT:} Oj P; {d:} Ok; {e:} Gr Eq Ek3 Vm; {x:} Mv Lh Xg Pq Wa Ow.
0-900:	{e:} Xc Vj Ej.
0-930:	{k:} Eh; {x:} Oc X Vz Cm B Lf Lg Xj G Xb Es Fb Oy Nu.
690-930:	{d:} Op C.
Other:	R (570-660); Ch2 (690-750); Py (600-840); Vp (660-930); T (0-960).

Versions. A few Toledan witnesses show tables for units smaller than years: thus, Ey Op C Ok have month-tables;[1] Lh has month- and day-tables, unfinished and in a secondary hand; and Xc Vj Ej show rudimentary month-tables with their values blank. This may be due to influence from the Toulouse or Novara collections, where such tables occur regularly; see PA21 and PA31.

---

1 Noted by Toomer 1968 p.112 from ms. Op (Toomer's "D").

Values. The apparent increment of .Clc is 2;34,58° per 30 lunar years, except at AH 300/330 and AH 600/630, where it is 2;34,59°. Assuming that hidden sexagesimals have been discarded without rounding, a velocity in the interval **0;0,0,52,28,38,7-9** °/day will account for all the values of .Clc as they stand. This corresponds to a tabular difference of about 2;34,58,5,42-48° degrees per 30 lunar years, or about 309.9365" per lunar year (Carmody p.90 estimates 309.933") or to one revolution in about 4182 lunar years. It is tolerably similar to the velocity of 0;0,0,52,28,37,54° in PA21; and it agrees perfectly with the parameter 0;0,0,52,28,38,7,24,46,10 shown by the Novara table PA31. See also CD* and CG11.

If the tabular values are assumed to be rounded in the normal way, the likely tabular increments will be about 2;34,58,3-5, but in all cases this entails irregularities in .Clc unless one also assumes that the radix value has hidden sexagesimals; this assumption is avoided here.

A recomputation using a velocity of 0;0,0,52,28,38,8 °/day, and assuming truncation of excess sexagesimals, will reproduce .Clc as it stands. In .Exp there are some deviations of 1", regardless of the rounding method.

Text. Collated for values: **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{aT}** P; **{k}** Ou Co; **{d}** Pa A; **{e}** Eq Xc; **{x}** Es Xg Lg. — Headings according to Xa. — The copy in ms. Co is accompanied by the Thebit canon "Imaginabor", and it is unclear whether it represents Thebit or the Toledan tables.

Arrangement of columns: The zero-filled column (g), asterisked, is present in Ct Oo Pz Xa Cq Pa A Eq Es, present but blank in Co, absent in Ou Xg Lg.

Tables assigned to Thebit, collated for tabular values: **$ts** = Oxford Bodl. Savile 21 (=ms. S), 155v, mid 13th c.; **$tmh** = Madrid 10053 (=ms. Mh), 2vb; **$tb** = Basel O.II.7, 68r. In all instances the table accompanies the tract "Imaginabor".

$c = recomputation; see "Values" above. Quoted where it differs from the adopted text. Assumes truncation of excess sexagesimals both in .Clc and .Exp. Has not been used for selecting readings in .Exp.

Coverage of values in collected-year table:

```
AH 0-720:                Ct Oo Pz Xa Cq P Ou Co Pa A Eq Xc Es Xg Lg $ts $tmh $tb.
AH 750-840:              Ct Oo Pz Xa Cq P       Pa A Eq Xc Es Xg Lg          $tb.
AH 870 (asterisked):                    P            Eq Xc Es Xg Lg          $tb.
AH 900 (same):                                          Xc Es    Lg          $tb.
AH 930 (same):                                             Es    Lg          $tb.
```

Readings chosen. I mostly adopt the reading shown by the majority of Ct Oo Pz Cq Pa A, using *italics* where this has not been done. The result leaves some unevenness in the values of .Exp; these are not marked.

Variant groups. The evidence of error groups is scanty. *Pz $ts* share some errors (d240, d360, d570, d720, k30), most of them of Abjad type, some shared with the ?Thebit text in *Co* too; cf. also e330. A wider group might include *Oo Cq Ou Pa A*, but evidence (k15, k27) is weak, as it is for the group *Pa A* (j11).

Es (Xg) Lg $tb are no doubt a group (j24, c-d930), which may be joined by some or all of *Xa $tmh Eq Xc* (k26, k29). Evidence for either of *Xa $tmh* (k24) and *Eq Xc* (k10) is weak.

Thus, of the Thebit witnesses considered, *$ts (Co)* are mainly coupled with the witnesses of Classes {a0,d} whereas *$tb ($tmh)* have affinities to Xa and those of Class {e,x}. In the latter case, one may assume that the Toledan tables have influenced the Thebit tract.

Of the remaining witnesses, *Ct* could be independent. *P* shows scattered agreement with various others (k20, k23, k28); otherwise it reads much like standard.

Motus accessionis et recessionis super annos Arabum lunares.

(Clc)

Lineae numeri	Anni lunares collecti Si	Gr	Mi	2a
Radix	0	1	34	2
30	0	4	9	0
60	0	6	43	58
90	0	9	18	56
120	0	11	53	54
150	0	14	28	52
180	0	17	3	50
210	0	19	38	48
240	0	22	13	46
270	0	24	48	44
300	0	27	23	42
330	0	29	58	41
360	1	2	33	39
390	1	5	8	37
420	1	7	43	35
450	1	10	18	33
480	1	12	53	31
510	1	15	28	29
540	1	18	3	27
570	1	20	38	25
600	1	23	13	23
630	1	25	48	22
660	1	28	23	20
690	2	0	58	18
720	2	3	33	16
750 +	2	6	8	14
780 +	2	8	43	12
810 +	2	11	18	10
840 +	2	13	53	8
870 *	2	16	28	6
900 *	2	19	3	4
930 *	2	*21*	38	2
(a)	(b)	(c)	(d)	(e)

(Exp)

Lineae numeri Nus	Anni lunares expansi Si	Gr	Mi	2a
1	0	0	5	9
2	0	0	10	20
3	0	0	15	29
4	0	0	20	39
5	0	0	25	49
6	0	0	30	59
7	0	0	36	10
8	0	0	41	19
9	0	0	46	29
10	0	0	51	39
11	0	0	56	49
12	0	1	1	59
13	0	1	7	9
14	0	1	12	19
15	0	1	17	28
16	0	1	22	39
17	0	1	27	49
18	0	1	32	59
19	0	1	38	9
20	0	1	43	18
21	0	1	48	29
22	0	1	53	39
23	0	1	58	48
24	0	2	3	59
25	0	2	9	8
26	0	2	14	19
27	0	2	19	29
28	0	2	24	38
29	0	2	29	49
30	0	2	34	58
(f)	(g) *	(h)	(j)	(k)

(c-e R) *om. & ins.* $ts. — **(b660)** 2 Eq. **(b690)** 1 Cq. **(c180)** 16 Oo. **(c930)** 21: $c; 22 Es Lg $tb; *def. cett.* **(d Rad)** 24 Pz. **(d30)** 8 P. **(d90)** 37 Pz *(m2, in ras.?)*; 81 Co; 38 $ts. **(d240)** 18 Pz Co $ts. **(d300)** 33 Pz. **(d360)** 53 Pz.?pc Co $ts; 23 Ou. **(d570)** 58 Pz.?pc $ts.ac; 28 $ts.pc. **(d660)** 33 Cq.pc. **(d720)** 53 Pz.?pc $ts. **(d930)** 38: 18 Es Lg $tb; *def. cett.* **(e90)** 57 Co. **(e240)** 40 Ou. **(e300)** 43 $tb. **(e330)** 40 Ct Co $ts. **(e510)** 19 Co. **(e570)** 24 Ou. **(e600)** 24 P. **(f)** *ante hanc columnam exhibent* Eq Xc *columnam notarum* b' *ad annos 2, 5, 7,... appositarum.* **(g1-30)** *om.* Ou Xg Lg $tb; *vacat* Co, $ts $tmh *fere.* **(j4)** 28 $ts. **(j11)** 16 Pa A. **(j14)** *n.l.* Ou; 15 $ts. **(j24)** 2 Es Xg Lg $tb. **(k4)** 29 Xa; 33 Co. **(k7)** 9 $c. **(k8)** 9 Pz; 11 Cq.ac; 21 Cq.pc; 20 Co. **(k10)** 30 Eq Xc. **(k12)** 58 $c. **(k13)** 11 Co. **(k14)** *n.l.* Ou. **(k15)** 28: Oo Pz Cq Ou Co Pa A $ts $c; 29 Ct Xa P Eq Xc Eq Xc Es Xg Lg $tmh $tb. **(k17,19)** 48,8 $c. **(k20)** 19 P Es. **(k21)** 22 Co; 39 Es.ac; 28 $c. **(k22)** 38 $c. **(k23)** 49 Ct P. **(k24)** 58 Xa $tmh $c. **(k26)** 18 Xa Eq Xc Es Xg Lg $tmh $tb $c. **(k27)** 29: Oo Pz Cq P Ou Pa A Es Xg Lg $ts $tb; 28 Ct Xa Eq Xc $tmh $c; 39 Co. **(k28)** 39 P Ou; 37 $c. **(k29)** 48 Xa Ou Eq Xc Es Xg Lg $tmh $tb $c. **(k30)** 59 Pz Ou $ts.

PA21. Mean motion of eighth sphere, for Christian years, in Toulouse tables.

Features of the Toulouse tables: see Section CC. – The present sub-tables .Clc, .Exp and .Mns have been printed by Poulle, *Mél. Beaujouan,* 1994, pp. 72 and 75.

Witnesses: **{aT}** Lu,84r-v; Oj,145r-v; P,82v-83r. – **{k}** Lw,130r-v. — Also in N,238v+ and (among Novara tables) in Xn,50v; these witnesses are not used here. – *Headings* of Lu(84r): see sample below. They vary in the other witnesses. – *Ranges of collected-year table:* AD 0(24)1512 Oj P Lw; 0(24)1656 Lu.

Version. The present table has standard tables for collected years and expanded years; in addition, all witnesses show tables for months and days. The latter, being typical though practically useless, are quoted in samples. – The equation tables that belong with the present table have the normal values, but their layout is characteristic; see PB11f.

Values. – In Lu, a hand that may be the text-hand adds the gloss "Radix 10s 6;25,41,45,51,29,0°" to the collected-year table. It also supplements the last values for expanded years and for months with "5 11 29" and "10 33 30", standing for 4ths, 5ths and 6ths. Thus the velocity posited by the glossator is

```
2; 7,46,55, 5,11,29 °/ 24 years (8766 days), or
0; 5,19,14,10,33,30 °/  1 year   (365 days).
```

These can be derived from the value for 1 day in the table of days, which is

```
0; 0, 0,52,28,37,54 °/day,
```

if one reads 24 sixths instead of "29" in the 24-year value (underscored above). Whichever reading is used, if the 24-year value is used as a tabular difference and applied to the stated radix, the .Clc table is reproduced exactly, with the following two exceptions.

(1) The radix has to read "10s 6;25,41,45,*31*,29°" (not "...51,29"), if one assumes normal rounding of tabular values. If truncation is assumed, 30 fourths should be added to this value, but the result ("...46,1,29") is unlikely as a source of the glossator's value for the radix.

(2) If this corrected radix is used, the values of .Clc up to and including AD 648 are reproduced exactly. However, the tabular values from 672 on are exactly 1 second lower than calculated, and those from 1512 on are exactly 2 seconds lower. The last-mentioned may be dismissed as secondary, but it should still be assessed whether the values until 648 or the later ones agree better with PA11. So I have tried, arbitrarily, to reproduce some values using PA11, as follows:

	From PA11	Found here
"AD 624" (= AD 625 March 1)	0s 1;48, 1°	0s 1;48, 1,38°
"AD 1104"	1s14;23,39°	1s14;23,39, 0°
"AD 1200"	1s22;54,47°(or ,46).	1s22;54,46,40°

This seems to show that the values for AD 1104 and 1200 are more likely to be those intended than is the value for AD 624. If so, the correct values are in fact those on the interval AD 672-1288; further, the radix value is a construct from one of the other values. Such a base value would be likely to be a round one, but if so, I have not been able to find it.

Thus, without much conviction, I reproduce the values for AD 672-1288 as the normal ones, and underscore the second values in the remaining items. – In any case, our table is comparable to PA11, though the velocity parameter is not quite the same.

Sample. From Lu P Lw; headings according to Lu.

Coverage of collected years: 0-24, 600-624, 1152-1512: P Lu Lw; 1632-1656 (asterisked) Lu. – Some unexpected values are underscored; see "Values" above.

Motus portionis accessionis et recessionis 8'ae sphaerae
ad annos domini nostri Ihesu Christi solares.

(Clc)

Anni d.n. Ihesu Chr. collecti	Portio accessionis et recessionis in annis collectis Si	Gr	Mi	Se	Te
Radix	10	6	25	41	46
24	10	8	33	28	41
....	...	...	...	...	...
600	11	29	40	14	43
624	0	1	48	1	38
648	0	3	55	48	33
672	0	6	3	34	28
....	...	...	...	...	...
1104	1	14	23	39	0
1128	1	16	31	25	55
1152	1	18	39	12	50
1176	1	20	46	59	45
1200	1	22	54	46	40
1224	1	25	2	33	35
1248	1	27	10	20	30
1272	1	29	18	7	25
1296	2	1	25	54	20
1320	2	3	33	41	15
1344	2	5	41	28	10
1368	2	7	49	15	5
1392	2	9	57	2	1
1416	2	12	4	48	56
1440	2	14	12	35	51
1464	2	16	20	22	46
1488	2	18	28	9	41
1512	2	20	35	55	36
....	...	...	...	...	...
1632 *	3	1	14	50	11
1656 *	3	3	22	37	6
(a)	(b)	(c)	(d)	(e)	(f)

(Exp)

Anni d.n. Ihesu Chr. expansi	Portio accessionis et recessionis in annis expansis Si	Gr	Mi	Se	Te
1	0	0	5	19	14
2	0	0	10	38	28
3	0	0	15	58	35
4	0	0	21	17	49
5	0	0	26	37	3
6	0	0	31	56	17
7	0	0	37	16	24
8	0	0	42	35	38
9	0	0	47	54	52
10	0	0	53	14	6
11	0	0	58	34	13
12	0	1	3	53	27
13	0	1	9	12	41
14	0	1	14	31	55
15	0	1	19	52	2
16	0	1	25	11	16
17	0	1	30	30	30
18	0	1	35	49	45
19	0	1	41	9	51
20	0	1	46	29	5
21	0	1	51	48	20
22	0	1	57	7	34
23	0	2	2	27	40
24	0	2	7	46	55
(g)	(h)	(j)	(k)	(L)	(m)

(Mns)

Menses	Portio accessionis et recessionis ad menses solares Si	Gr	Mi	Se	Te
Mar	0	0	0	27	6
Apr	0	0	0	53	21
...	...	...	...	...	...
Ian	0	0	4	54	44
Feb	0	0	5	19	14
(n)	(o)	(p)	(q)	(r)	(s)

(Die)

Dies	Portio accessionis et recessionis ad dies mensium 2a	3a	4a	5a	6a
1	0	52	28	37	54
2	1	44	57	15	48
..	...	...	...	...	...
30	26	14	18	57	0
31 *	27	6	47	34	54
(n)	(o)	(p)	(q)	(r)	(s)

(e0-24, 600-648) 40,27,13,0,47 *vere.* **(e672)** 34: Lu; 24 P Lw. **(e1512, 1632-56)** 56,51,38 *vere.* **(f1104)** 0: Lw.pc, *cett.; n.l.* Lw.ac. **(L12)** 54 Lu. **(s Feb)** 14: Lu; 11 P Lw. **(n-s 31)** Lu; *om.* P Lw.

PA31. Mean motion of eighth sphere for Christian years, in Novara tables.

Tables for collected years, expanded years, months (beginning in March), and days. The full form of the tables is in Fd; in R Ej2, the values of the tables for expanded years and for months are rounded to seconds. Fd includes a table of days, which is secondary and aberrant in Ej2 and absent in R.

Witnesses: **{aX}** R,88v-89r (:Novara). — **{?}** Fd,13v-14r (:Novara); Ej2,92r-v (:Novara).

A copy whose values are essentially the same, but with more significant figures, is in the Novarese collection Par. lat. 7411 (=Xn), 12r. It has tables down to months only.

Heading: **Tabula medii motus octavae sphaerae, et** (qui R Ej2) **est accessus et recessus eius** (ei. et r. R) **in annis domini nostri** (*om.* Ej2) **Ihesu Christi** (+coniunctis Ej2) **ad meridiem Novariae** (a.m.n. *om.* Fd).

Ranges: AD 0(28)1512 Ej2; 756(28)1512 Fd; 1204(28)1512 R. The range and increment resemble those of the planetary mean motion tables for Novara.

Values. The exact velocity used in ms. Xn is

    0;0,0,52,28,38,7,24,46,10 °/d.

See CD* above, and CG11 (ms. Ey only). This also fits as a velocity in PA11, q.v. Unlike most of the other velocity constants in the Novara tables, it does not, however, yield a round value when multiplied by 10631, cf. note to CG11; so it is doubtful whether it has been derived from a system that used Arabic chronology.

Sample. From R Fd Ej2. For the headings, see above.

```
         Si Gr Mi Se Te
 ______  ______________
    0y: 10  6 25 42       (only in Ej2, labelled "radix")
 .....  ...........
  756y:  0 13 30 50       (Fd Ej2; labelled "radix" in Fd)
 .....  ...........
 1176y:  1 20 47  1
 1204y:  1 23 16  6       (R begins here)
 1232y:  1 25 45 10
 .....  ...........
 1512y:  2 20 35 58

    1y:     0  5 19 14
 .....     ...........
   28y:     2 29  4 45
 ______  ______________
   (a)   (b)(c)(d)(e)(f)
```

(f 1y) *om.* R Ej2. **(e 28y)** 5 R Ej2. **(f 28y)** *om.* R Ej2.

PA40+. Mean motion of eighth sphere, other tables.

PA40. Ey2,96v; Lw,131r: "Motus accessionis et recessionis capitis eorum (!) ab aequatore in annis Christi, q() motus dicitur 8'ae sphaerae" Lw. — Tables for collected years and for expanded years, range AD 1160(20)1260 (Lw; 1280 Ey2). Ey2 also has an empty month-table. No location, but the range and increment is the same as for the planetary tables (CE35) adjacent in Ey2,92r+ with ascription to William of *Marseilles.* — Sample, from Lw Ey2, not emended:

1160y:	1	19	13	42	
1180y:	1	21	2	52	
1200y:	1	22	52	2	
1220y:	1	24	41	12	
1240y:	1	26	30	22	
1260y:	1	28	19	32	(19: 29 Lw)
1280y:	2	0	8	42	(Ey2 only).
1y:		0	5	30	
.....		....			
20y:		1	49	10	

PA45. Ov,86v: "Medius motus octavae sphaerae in annis Christi ad meridiem *Parisius*". — Tables for collected years and for expanded years, last one repeated; range AD 1179(20)1419. Belongs with the tables CE10, also said to be for Paris, and with PB13. — Sample, not emended:

1179y:	1	20	59	34	(labelled "radix")
1199y:	1	22	47	34	
1219y:	1	24	35	34	
.....	....				
1419y:	2	12	35	34	
1y:	0	0	5	24	
.....	....				
20y:	0	1	48	0	

PA50. Ch,39v-40r (:Savasorda 1): "Tabula incessus medii motus accessionis et recessionis in annis diluvii fericia (=?), et est motus capitis arietis et librae in duobus circulis". — No location. Belongs to a collection that may be ascribed to *Abraham bar Hiyya;* see CE15.

Comprises four tables, for thousands down to ones. The tabular differences in all tables except the last one are precise multiples of the value given for 10 years. These are perhaps Egyptian years of 365 days. If so, the daily motion will be 0;0,0,52,28,53... °/d, not very similar to that of PA11. — Sample, not emended:

		Si	Gr	Pc	Se	Te	Qu	
(1)	0y:	1	1	8	21	19	13	(labelled "radix")
	1000y:	3	29	49	23	50	53	
	.....	....						
	10000y:	6	17	58	45	34	53	
(2)	100y:	0	8	52	6	15	10	
	.....	....						
	1000y:	2	28	41	2	31	40	
(3)	10y:	0	0	53	12	37	31	
	.....	....						
	100y:	0	8	52	6	15	10	
(4)	1y:	0	0	5	19	15	45	
	.....	....						
	10y:	0	0	53	12	37	31	

PB (with the partial tables .Ddc and .Lca). Equation of eighth sphere.

Toomer 1968, no. 81(ii) (=.Ddc); no. 81(iii) (=.Lca). – Two tables, ordinarily occurring together. They will be treated together, under the ad-hoc labels

(.Ddc): 81.ii Toomer, "Aequatio dimidii diametri circuli", first value 0;22,40, max. 4;18,43, and

(.Lca): 81.iii Toomer, "Aequatio diversitatis longitudinis capitis arietis...", first value 0;55,52, max. 10;45,0.

Canons.

.Ddc: Cc236, "de aequatione dimidii diametri circuli accessionis et recessionis". – Cb221, "tabulam aequationis dimidiae diametri circuli".

.Lca: Cc235, "in tabula aequationis diversitatis longitudinis <**?> a linea aequinoctiali", value: "de aequatione accessionis et recessionis". – Cb221, "ad aequationem diversitatis longitudinis capitis arietis ab aequinoctiali linea".

Both sets roughly fit the headings of version PB11. The phrase (.Lca:) "ab aequinoctiali linea" is not normal for PB11 but is often found elsewhere.

A rule is in the tract "De Motu", version "Imaginabor", which is ascribed to Thebit; see under P* above. A separate rule, unlike the canons or the "Thebit" rules, is CbA.P11, in mss. Ma Vf Vy Sg. It is written for a table like PB11h, present in Sg and others.

Versions. Whereas these tables are based on a common set of values, they differ much as to headings and layout. I attempt a rough classification based on layout, while sometimes ignoring details on headings. Nearly all tables have entrances incremented by 5°.

For clarity, tables that ascend to 90° are called "single-length"; those which ascend to 180° (the values being then symmetrical about 90°) are called "double-length". The latter may be in one piece, or they may be cut into two halves, for 5°-90° and 95°-180°. – Apart from lesser variants, one may distinguish

PB11: Principal version: .Ddc and .Lca apart, single-length, each with a single entrance 5-90. – Occurs in **{a0 a1 a2 x}**, i.e., in most of the vulgate.
– Seen in two late copies of Thebit's "Imaginabor" (Mp,112r; Par. lat. 7195, 143ra). Thus it is possible that this type is a loan from the Toledan tables into the Thebit tract.

PB11a: .Lca with a double entrance (5,180)-(90,95), perhaps a faulty attempt to furnish PB11 with an extra entrance. .Ddc may or may not be present. – Occurs in **{p}** and in R.

PB11b: .Ddc and .Lca apart, double-length, each with a double entrance (5,355)-(180,180). – Occurs in **Ct**, in some of **{k}**, and in a few others. The headings are disparate, and several traditions may be represented.
– I have seen some such tables together with the Thebit tract "Imaginabor" in fairly old copies (S,155v-156r; Co,174r-v; Mh,3ra; Vm,28r-v; in a different context, Ps,2r-v) and also in witnesses of the late 13th century (B,68r; Es,83v-84r; Lh,52v; T,219va; Pp,94v (.Ddc only)). This type seems to be the commonest one in the "Thebit" tracts.

PB11d: Two single-length tables, each with a double entrance (5,355)-(90,270), thus missing half a revolution; filled in with values from the double-length .Lca. – .Ddc has left traces in some witnesses. – Occurs mainly in **{d}**.

PB11f: .Lca + .Ddc connected, single-length, with a common quadruple entrance (5,355,175,185)-(90,270,90,270). May have been folded from PB11b. – Occurs with the **Toulouse** tables.
– Seen in copies of Thebit's "Imaginabor" from the late 13th or the 14th century (Cm,89r; Xb,104r; Lf,119r; Lg,91r; G,208v; Ha,108v; Oe,5v).

PB11g: Like PB11f, but with entrance (5,175,185,355)-(90,90,270,270). Headings rather similar to PB11f. – Occurs with some Novara tables and in {**e**}.

PB11h: .Ddc + .Lca connected, with a quadruple entrance in signs and degrees (0s0,6s0,6s0,0s0)-(3s0,3s0,9s0,9s0), with peculiar headings. – Only in Ps Sg Cn.

PB11j-k: Rare tables with entrances in signs and degrees, headings like PB11.

Parallel tables. The values are the same as in the tables which accompany Thebit, De Motu, version "Imaginabor", Carmody 1960 p.94. See PA* above.

Values. The tables have been treated by Carmody 1960 p. 95-96; Goldstein 1964-5 p. 234 (.Ddc), 235-37 (.Lca); Toomer 1968 p. 120-121; Samsó 1985 p. 177 and 1994h p. 4-5 (.Lca), also referring to treatments by Dobrzycki (1965) and by Mercier (1976). I only repeat what is necessary for assessing whether recomputation is realistic.

Table .Ddc may be meant as a sine function (Goldstein, Toomer) with unit radius 4;18,43, which is the radius of the small circles of the trepidation model. It is true that the value for 30° is half of that for 90°, as it ought to be for a sine function. The other values are, however, not much like the expected ones, but mostly lower, by some 20 seconds on average, without any apparent pattern. – If instead one tries to find the .Ddc value from the relation

```
sin(value of .Ddc) = sin(argument) * sin (4;18,43°),
```

i.e., as a cathete in a right-angled triangle that is spherical (as appears proper) instead of plane (as was assumed for the sine function above), one gets approximations that are better but still far from perfect.

Table .Lca is not well reproduced as a sine function either (except that here, too, the 30° value is exactly half the 90° value). A better approximation can be obtained from the relation

```
sin(value of .Lca) = sin(argument) * sin(10;45°),
```

cf. just above. This (cf. Samsó 1994h p. 4 with references) will reproduce .Lca to within 5" in 8 cases of the 17 non-trivial ones (namely, for arguments 5 20 25 40 60 65 75 80). In other cases, however, the expected value may be 1′ or more off that found, again in no obvious pattern.

In both cases, if the suggested model is realistic, at least the tables are too disfigured to be emended from the recomputed values except as concerns very gross errors. In particular, the values for 30° may be secondary constructs, and there may be other such. Accordingly, the recomputed values are not quoted here.

Obliquity: According to Samsó 1994h, 4-5, one should have

```
sin (max. precession) = tan(radius of small circle) / sin(obliquity),
```

cf. Mercier 1976 as quoted by Samsó 1985 p. 177. If so, one gets

```
sin(obliquity) = tan(4;18,43°) / sin(10;45°),
```

which yields an obliquity of 23;50,36°, thus close to the Ptolemaic 23;51°, instead of the 23;33° presupposed by the Thebit tract.

Samsó concludes that the tables are not by Thebit, but Toledan work added to a Thebit tract that came without tables. It may cause some hesitation that the preferred obliquity seems to have been 23;33° in Toledan work as well as in the Thebit tract (see notes to BA21). In any case the obliquity value found is not easy to attribute to chance.

Collation. For practical reasons, samples for single-length tables have been collated together under PB11, and samples for double-length tables under PB11b. Thus they should be looked for as follows:

Single-length, collated under PB11: **PB11 PB11a PB11f-k**
Double-length, collated under PB11b: **PB11b-d.**

A comparison of a few variants in all witnesses may also be found under PB11b.

Variant groups. Variants are scattered, with a high incidence of Abjad-type errors. This suggests that there are in fact several versions, independently derived from Arabic exemplars. – The comparison carried out under PB11b shows that PB11h-j may join PB11b and PB11d, so that we have at least two main versions,

(1) PB11, PB11a,f,g?,k (cf. under PB11)
(2) PB11b,d,h,j (cf. under PB11b).

However, PB11b is badly defined, and the tradition may be split as stated there; in general, conclusions building on these few variants are unsafe.

Readings chosen. Since no way has been found to recompute the tables precisely, it cannot generally be said whether variants in second values are errors or not. Thus some form of majority readings have been chosen, as stated in each case.

PB11. Eighth sphere: .Ddc and .Lca, single entrances.

Each of .Ddc and .Lca has a single entrance column, 5°(5)90°. In the early witnesses they are placed side by side, mostly with .Ddc to the left. In most of Class {x} one is above the other. All headings are of one type.

Witnesses. (a) Tables placed side by side. .Ddc is to the left except in Fh Vo Wa.

{a0} Ct,24v; Oo,25r; Cq2,88; Pz,132v; Mc,30v; Mb,65v. – **{a1}** Xa,39v; Ad,95v; Cq,70; Fc,50r; Ps,84r; Sg,190; Wd,39v; Fh,71r. – **{a2}** Cz,92v; Cj,164r; Md,106r. – **{aX}** Vo,71r; Fj2,111r. – **{x}** Wa,80r. – **{?}** Py,48r.

(b) Tables placed one above the other. Witnesses where .Lca is uppermost are asterisked.

{a2} Vp,138r. – **{k}** Eh,122v* (m2?). – **{x}** Oc,98r; X,175r; Vz,79r; Mv,114r*; Cm,215v; B,165r*; T,300v; Lf,115v*; Lg,194r*; Lh,157r*; Xj,297r*; Xg,78v*; G,82v*; Xb,97v; Es,199r; Fb,88v; Pq,207v*; Oy,93v; Ow,171r*; Nu,163r*.

Probably lost from ms. {a2:} Mp; see T:03(2,Mp).

Headings.

Entrance columns: **(1) Lineae** (linea Ct) **numeri.**

.Ddc: **(2) Aequatio** (tabula ae-onis Wa) **dimidii diametri circuli** (dim.dia.c.: **/dia.dim.c.** Fc Wd Md Py; **/dia.c.** Oc X Vz Cm T Xb Fb Oy; c.dim.dia. Ct; dia.c.dim. Sg; dim.dia. Ad; c.dia. Vo) :: everywhere. – *Added:* **+parvi** {a2:} Md; {k:} Eh; {x:} Vz Mv B Lf Lg Lh Xj Xg G Pq Wa Ow Nu.

.Lca: **(3) Aequatio diversitatis longitudinis capitis arietis** (+et librae Fj2) **ab aequante** (/aequinoctio Ct) **diei** :: {a0:} Ct Oo Cq2 Mc Mb; {a1:} Xa Ad Cq; {aX:} Fj2. – *Added:* **+et haec addenda quia septentrionalis** Cq2.

(4) Aequatio (**/Tabula ae-onis** Eh, Mv B Lf Lg Xj Xg G Pq Wa Ow Nu; /coaeq- Wd) **diversitatis** (diversae Oc X Vz Cm T Xb Fb Oy) **longitudinis capitis arietis ab aequatore** (aequatione Fh Oc X Vz Xb Oy) **diei** (*om.* Wd Cz Cj Mv Fb Lh) :: {a1:} Fc Ps! Sg Wd Fh; {a2:} Cz Cj Md; {aX:} Vo; {k:} Eh; {x}; {?:} Pz.m2 Py.

(5: other) :: Vp ("Aequatio capitis arietis"); Pz.m1 (none).

Text. Collated for values, from the present section:

(PB11:) **{a0}** Ct Oo Pz; **{a1}** Xa Cq; **{x}** Xg Es. Headings according to Xa.

Also collated, from other sections:

(PB11a:) **{p}** O(91r), Pd(89v);
(PB11f:) **{aT}** Lu P(83v) Lw;
(PB11g:) **{e}** Eq(91v), Xc(78v), Vj(108v);
(PB11h:) **{a1}** Ps(83r), Sg(186);
(PB11j:) **{a0}** Ey(54r);
(PB11k:) **{d?}** Op(59v), C(339).

The copy at P(134v) has the same readings as P(83v). The .Ddc tables of O Pd are probably added at a late stage, cf. notes to PB11a; that of Pd is visibly secondary.

Thebit tables collated for tabular values:

(layout like PB11:) **$tmp** = Mp,111v-112r; **$t5** = Par. lat. 7195, 143r;
(layout like PB11f:) **$txb** = Xb,104r; **$toe** = Oe,5v.

Novara tables collated for comparison with PB11g:

$du = Du,65v; **$xn** = Xn,51v; **$r** = R,89r.

Recomputed values are not listed, for the reasons given under PB above. The values adopted in the text are, however, normally closer to the recomputed values than any of the variants are.

Readings chosen: majority among Ct Oo Pz Xa Cq.

Variant groups among PB11, PB11a,f-k. Generally, the evidence for distinguishing between groups is slight.

The only distinctive variant (k60, computed value 3;44,3 if taken just as a sine) seems to show that one error group is formed by the late PB11-like tables *Es Xg $tmp $t5 (Xc O Pd Op C $du $r)*, another one by the PB11f-like ones *Lu P Lw $txb $toe (Ps Sg)*, and a third one by *Xa Cq*. There is no indication that either set of "Thebit" copies has any priority over the Toledan ones. *Pz* has one or two Abjad-type variants, alone or together with a few others (w40, x85).

Type PB11a: *O Pd* have standard readings everywhere, and cannot be distinguished from the common version of PB11. At (k60), mentioned above, they join the late grouping.

Type PB11k: *Op C*, apart from two errors of their own (L30, x85), have standard readings too; at (k60) they join the late grouping.

Type PB11g: Evidence is scanty. *Eq Vj* have an Abjad-like error (k65) in common. *Xc* joins Es Xg in k60; but the copy in Xc may be secondarily added, cf. note to PB11g. The Novara-table samples *$du*, *$xn*, *$r* mostly have standard readings. At (k60) they join different sub-groups, with the effect that $du $r coincide with Xc; but in general there are too few variants to show whether they are connected with Eq Vj Xc.

Type PB11h-j: *Ps Sg, Ey* appear isolated: they share a few errors with each other (Abjad: x25, x85), but also with the double-length tables collated under PB11b. They may thus be related to some version of PB11b, rather than to any of the witnesses listed here. See the appendix to PB11b for a conspectus of the readings in question.

(Ddc)

Li ne ae nu me ri	Aequatio dimidii diametri circuli		
Gr	Gr	Mi	Se
5	0	22	40
10	0	44	31
15	1	6	45
20	1	27	20
25	1	48	4
30	2	9	21
35	2	28	6
40	2	45	55
45	3	2	38
50	3	17	45
55	3	31	40
60	3	*43*	46
65	3	54	19
70	4	2	48
75	4	9	8
80	4	14	28
85	4	17	30
90	4	18	43
(a)	(j)	(k)	(L)

(Lca)

Li ne ae nu me ri	Aequatio diversita tis longi tudinis capitis arietis ab aequa nte diei		
Gr	Gr	Mi	Se
5	0	55	52
10	1	50	36
15	2	45	16
20	3	39	23
25	4	31	12
30	5	22	30
35	6	9	6
40	6	53	12
45	7	36	35
50	8	14	0
55	8	47	48
60	9	17	44
65	9	43	53
70	10	5	30
75	10	22	47
80	10	35	1
85	10	42	13
90	10	45	0
(n)	(v)	(w)	(x)

(k10) 24 Ps. **(k15)** 0 Ps. **(k20)** 28 Ps Sg. **(k35)** 25 Ps Sg. **(k40)** 49 $toe. **(k45)** 3 Sg. **(k60)** 48 Pz.pc Lu P Lw Ps Sg $txb $toe $xn; *n.l.* Pz.ac; 13 Xa Cq; 44 Es Xg Xc O Pd Op C $tmp $t5 $du $r. **(k65)** 14 Eq Vj; 52 Xc; 58 Ps Sg. **(k85)** 24 Pz.pc; *n.l.* Pz.ac; 18 Cq.pc. **(k90)** 19 Cq.pc. **(L10)** 33 Ps Sg. **(L15)** 35 Vj. **(L30)** 20 $toe; 22 Op C. **(L40)** 50 $txb $toe. **(L45)** 28 Ps. **(L50)** 48 Ps Sg. **(L55)** 45 Ey. **(L60)** 38 Lw $txb $toe; 36 $xn. **(L75)** 0 Ey. **(L85)** 20 $t5. **(w5)** lo (=58) Oo. **(w30)** 32 Pz.ac. **(w40)** 13 Pz; 3 Ps. **(w65)** 4 $t5; 49 Ps. **(x5)** 2 Ps Sg. **(x10)** 30 Oo. **(x15)** 36 Vj. **(x20)** 22 Lw. **(x25)** 55 Ps Sg; 52 Ey. **(x35)** 2 Ps Sg Ey. **(x40)** 2 Ps Sg. **(x45)** 15 $toe; 25 Ps Sg. **(x75)** 42 Ps Sg. **(x80)** 3 Vj. **(x85)** 53 Pz.?pc Ps Sg Ey; 33 Xc; 30 Op C.

PB11a. Eighth sphere: .Lca, faulty double entrance; .Ddc varying or absent.

.Lca shows a faulty double entrance (5,180)-(90,95). The headings are short, but close to that of PB11, so perhaps this is the source.

.Ddc is absent from R. It is present in ms.O, with the same faulty entrance as for .Lca; in Pd there is such a table with a single entrance, secondarily added; and Ch2 has one secondarily attached without its own entrance. None of these is likely to be original.

Witnesses: **{aX}** R,55r. — **{p}** O,91r; Pd,89v; Ch2,180v.

Headings.

.Lca: "Aequatio (-ones Pd) capitis arietis" R Pd Ch2; "Tabula aequationis capitis arietis [Aequatio]" O. — Entrance: "Numeri graduum" Ch2, otherwise "Lineae numeri".

.Ddc (for types see above): "Tabula aequationis dimidii diametri circuli [Aequatio]" O; "Aequatio diametri circuli" Pd, perhaps Ch2.

Sample of .Lca. From R. The incorrect entrance values are underscored. — Mss. O Pd have been collated under PB11.

Lineae numeri		Aequatio capitis arietis		
Gr	Gr	Gr	Mi	Se
5	<u>180</u>	0	55	52
10	<u>175</u>	1	50	36
...	...	...	...	...
85	<u>100</u>	10	42	13
90	<u>95</u>	10	45	0

PB11b. Eighth sphere: .Lca and .Ddc, double-length, double entrances.

Each table has its own double entrance, (5,355)-(180,180), with column headings of the type "Septentrionalis augens; Meridiana minuens". Other headings are disparate, and will be treated individually.

PB11b:Ct. Ct,25r. Each table is in two halves, side by side, with identical headings. .Lca is uppermost. For the headings, see the transcription of the table.

PB11b:{k}. Ou,77r; Eg,24v; Co,174r-v. Each table is in one piece; .Lca comes first. — Headings:

General, only in Ou: "Tabula aequationis motus accessionis et recessionis 8'ae sphaerae, et est elongatio capitis arietis ab aequinoctio vernali". — *Entrances:* "Areae numerorum [Septentrio additur; Meridies minuitur]" Ou Co; "Septentrio addatur; Meridies minuatur" Eg. — *.Lca:* "Tabula aequationis prima; Aequationes capitis arietis" Ou; "Aequatio accessionis et recessionis" Eg; "Aequatio accessionum et recessionum et est longitudo capitis arietis" Co. — *.Ddc:* "Tabula aequationis secunda; Aequatio accessionis et recessionis" Ou; "Aequatio accessionis et recessionis" Eg Co.

In Co, the tables are accompanied by the text of Thebit's De Motu, though still within the context of the Toledan tables.

PB11b:S. S,103r: Each table is in one piece; .Ddc comes first. — Headings:

Entrances: .Ddc has a single entrance only, headed "Addatur, linea numerus (sic!)". .Lca has a double entrance, headed "Septentrio, l.n., addatur; Meridies, l.n., minuatur". — *.Ddc:* "Tabula aequationis dimidiae diametri circuli". — *.Lca:* "Tabula aequationis diversitatis longitudinis capitis arietis a linea aequinoctiali", much as in PB11.

These tables are much like the Thebit tables that occur in $ts (for which see below). There are some differences in readings; most often the readings in S are more likely than those in $ts.

Text of PB11b-d. Collated for values, from the present section:

(PB11b:) **{a0}** Ct(25r): **{aX}** S(103r); **{k}** Ou(77r) Co(174r-v). – Headings according to Ct.

Also collated, from other sections:

(PB11d:) **{d}** Lb(53v) Pa(45v) A(224v).
(PB11c:) $tch (see below).

Double-length tables assigned to Thebit, collated for tabular values: **$ts** = S,155v-156r, mid 13th c.; **$tmh** = Mh,3ra; **$tb** = B,68r. All these show each table in one piece. It is in two halves in **$tps** = Ps,2r-v, and in **$tch** = Ch,40v (:Savasorda 1?; = PB11c), which only shows .Lca.

Coverage, irregularities:

.Lca 5°-180°, entrances 95°-180° faulty:	Pa	A	
.Ddc absent:	Pa		$tch
.Ddc 5°-90°, secondary:		A	

Readings chosen. I adopt the majority of the readings that are prevalent (1) in the place in question, (2) in the place which is symmetrical to it by virtue of the symmetry about 90°, (3) in the corresponding place in PB11. All readings chosen in this way are as in PB11. The readings that have been corrected against a significant part of the witnesses are *italicized.* They represent old asymmetries, all of which are found in Ct and (for .Lca) Co $tb. Some of them are listed below.

Variant readings. In both the symmetrical places (k85) and (k95), Ou Co have the error "18" against "17" in the rest; but this seems to be the only case where several witnesses show a symmetrical pair of readings that disagree with PB11. Asymmetrical pairs where both readings disagree with PB11 only occur in single witnesses each. Thus perhaps the double-length tables under consideration are descended from a symmetrical table (or in effect, a single-length table) that had values like those adopted for PB11.

Note: Conspectus of shared readings in all collated tables. Comprising the witnesses collated under section PB11 as well as under the present section. Only including variants where two or more readings are shown by some witness under each section. – Columns: **PB11+:** variants collated under section PB11 (q.v. for symbols not found above); **PB11b+ (5°-90°):** variants collated in the present section, for the first half-table of .Ddc or .Lca; **PB11b+ (95°-180°):** same, for the second half-table. The reference **(k60/120)** means that the reference "k60" is valid for the two first columns and "k120" for the last one. A dot "." means "no instances of this reading".

		PB11+	**PB11b+ (5°-90°)**	**PB11b+ (95°-180°)**
(k60/120)	**43:**	Ct Oo Eq Vj Ey	S Ou Co Lb $tps	*omnes*
	48:	Pz.pc Lu P Lw Ps Sg $txb $toe $xn	Ct $ts $tmh	.
	13:	Xa Cq	A(m2)	.
	44:	Es Xg Xc O Pd Op C $tmp $t5 $du $r	.	.
	vari ous:	Pz.ac	$tb	.

		PB11+	**PB11b+ (5°-90°)**	**PB11b+ (95°-180°)**
(x5/175)	**52:**	*plerique*	*plerique*	S Ou $tps $tch
	2:	Ps Sg	.	Ct Co Lb Pa A $tmh $tb
	22:	.	Pa A	.
	5:	.	.	$ts
(x25/155)	**12:**	*plerique*	*plerique*	*omnes*
	52:	Ey	Co Ou.?ac $tmh $tb	.
	55:	Ps Sg	.	.
	32:	.	$ts	.
(x35/145)	**6:**	*plerique*	S Ou $tps $tch	*omnes*
	2:	Ps Sg Ey	Ct Co Lb Pa A $tb $tmh	.
	5:	.	$ts	.
(x85/95)	**13:**	*plerique*	S Lb Pa A $tps	*plerique*
	53:	Pz.?pc Ps Sg Ey	Ct Co $ts $tmh $tb	$ts.?pc
	30:	Op C	.	.
	various:	Xc	Ou, $tch	$tb

Thus, *Ct Co $tb* (and others) show some cases of asymmetry between the two half-tables, and some of the minority readings involved are shared by *Ps Sg (Ey)*. In the place below, however, Ps Sg join the consensus of PB11:

		PB11+	**PB11b+ (5°-90°)**	**PB11b+ (95°-180°)**
(x80/100)	**1:**	*plerique*	S Lb Pa A ?Ou $ts $tmh.pc $tps $tch	*omnes*
	51:	.	Ct	.
	50:	.	Co $tb	.
	various:	Vj	$tmh.ac	.

Conversely, Ps Sg have several errors which are not in Ct Co $tb. All told, Ps Sg (Ey) may be affiliated with certain versions of PB11b rather than with PB11, though the interdependence is not well defined.

Variant groups in PB11b-d. There are many variants of Abjad type.

.Lca: The examples listed in the conspectus above show that *(PB11b:) Ct Co [$tb, $tmh]* are sometimes asymmetrical at places where *(PB11b:) S Ou [$tps, $tch]* are symmetrical. Perhaps, however, the errors are primitive whereas the symmetry is due to corrections or to mirroring of single-length tables, so it cannot be said which of these classes is the primitive one. *(PB11d:) Lb (Pa A)* form an error group (w150, w155, and elsewhere), and vacillate in the cases above. Strangely enough, Ou Co do not seem interrelated as concerns variants in .Lca.

As is seen from the conspectus, Ct Co are often joined by *(PB11h-j:) (Ps Sg) Ey*, which may, then, belong here.

.Ddc: The only witnesses collated are Ct S Ou Co Lb, A(m2). Of these, *Ou Co* form an error group; cf. (k85, k95). The rest have no definite affinities except that A(m2) once joins Xa Cq (k60, above).

(Lca)

Aequatio accessionis et recessionis, quae est diversitas longitudinis capitis arietis et libre ab aequinoctio diei.

Linea numeri				
Septentrionalis augens	Meridiana minuens	Gr	Mi	Se
5	355	0	55	52
10	350	1	50	36
15	345	2	45	16
20	340	3	39	23
25	335	4	31	12
30	330	5	22	30
35	325	6	9	*6*
40	320	6	53	12
45	315	7	36	35
50	310	8	14	0
55	305	8	47	48
60	300	9	17	44
65	295	9	43	53
70	290	10	5	30
75	285	10	22	47
80	280	10	35	*1*
85	275	10	42	*13*
90	270	10	45	0
(n)	(t)	(v)	(w)	(x)

(Lca)

Aequatio accessionis et recessionis, quae est diversitas longitudinis capitis arietis et libre ab aequinoctio diei.

Linea numeri				
Septentrionalis augens	Meridiana minuens	Gr	Mi	Se
95	265	10	42	13
100	260	10	35	1
105	255	10	22	47
110	250	10	5	30
115	245	9	43	53
120	240	9	17	44
125	235	8	47	48
130	230	8	14	0
135	225	7	36	35
140	220	6	53	12
145	215	6	9	6
150	210	5	22	30
155	205	4	31	12
160	200	3	39	23
165	195	2	45	16
170	190	1	50	36
175	185	0	55	*52*
180	180	0	0	0
(n)	(t)	(v)	(w)	(x)

(v150) 6 Lb Pa A. **(v160)** 4 $tch. **(v175)** 1 Lb Pa A. **(w10)** 40 $ts. **(w20)** 45 $tps. **(w40)** 13 $ts.ac $tmh. **(w65)** 44 $tch. **(w95)** 44 $tb. **(w120)** 57 Co $ts $tmh $tb.pc. **(w125)** 44 $tps. **(w130)** 44 Co $tb.ac; 4 $ts.pc *ut vid.;* =14 $tb.pc $ts.ac, *cett.* **(w135)** 46 $tmh.ac. **(w155)** 41 Lb Pa A. **(w165)** 25 Pa A. **(w170)** 55 $tps. **(x5)** 22 Pa A. **(x10)** 16 Lb Pa A; 30 $tb. **(x25)** 52 Co, Ou.?ac $tmh $tb; 32 $ts. **(x30)** 50 $ts $tch. **(x35)** 6: S Ou $tps $tch; 2 Ct Co Lb Pa A $tb $tmh; 5 $ts. **(x40)** 15 $ts. **(x80)** 1: S Lb Pa A, Ou *ut vid.,* $ts $tmh.pc $tps $tch; 51 Ct; 50 Co $tb; 0 $tmh.ac. **(x85)** 13: S Lb Pa A $tps; 53 Ct Co $ts $tmh $tb; *n.l.* Ou; 10 $tch. **(x95)** 53 $ts.?pc; 12 $tb. **(x120)** 43 Co $ts $tmh $tb $tps. **(x140)** 13 $ts. **(x150)** 50 $tch. **(x160)** 33 Lb Pa A. **(x170)** 56 $tch. **(x175)** 52: S Ou $tps $tch; 2 Ct Co Lb Pa A $tmh $tb; 5 $ts.

(Ddc)

Linea numeri Septentrionalis augens	Meridiana minuens	Aequatio accessionis et recessionis Gr	Mi	Se
5	355	0	22	40
10	350	0	44	31
15	345	1	6	45
20	340	1	27	20
25	335	1	48	4
30	330	2	9	21
35	325	2	28	6
40	320	2	45	55
45	315	3	2	38
50	310	3	17	45
55	305	3	31	40
60	300	3	*43*	46
65	295	3	54	19
70	290	4	2	48
75	285	4	9	8
80	280	4	14	28
85	275	4	17	30
90	270	4	18	43
(a)	(g)	(j)	(k)	(L)

(Ddc)

Linea numeri Septentrionalis augens	Meridiana minuens	Aequatio accessionis et recessionis Gr	Mi	Se
95	265	4	17	30
100	260	4	14	28
105	255	4	9	8
110	250	4	2	48
115	245	3	54	19
120	240	3	43	46
125	235	3	31	40
130	230	3	17	45
135	225	3	2	38
140	220	2	45	55
145	215	2	28	6
150	210	2	9	21
155	205	1	48	4
160	200	1	20	20
165	195	1	6	45
170	190	0	44	31
175	185	0	22	40
180	180	0	0	0
(a)	(g)	(j)	(k)	(L)

A = A.m2 *(5°-90°; absunt 95°-180°).* — **(g5-180)** *om.* S. **(j5)** 1 Lb. **(j110)** 9 $ts. **(j140)** 3 Co, Ou.ac? **(j155-160)** *ras.* S. **(j170)** 1 Lb. **(k15)** 6: $ts.pc, *cett.; n.l.* $ts.ac. **(k25)** 28 $tps. **(k45)** 7 A. **(k60)** 43: S Ou Co Lb $tps; 48 Ct $ts $tmh; 13 A; 42 $tb. **(k65)** 14 Lb. **(k85)** 18 Ou, Co.ac; *n.l.* Co.pc. **(k90)** 47 Ou.ac Co.ac; *n.l.* Co.pc. **(k95)** 18 Ou Co. **(k115)** 58 Ou.ac. **(k150)** 4 $tps. **(k160)** 27: S Ou Co Lb $ts $tmh $tb $tps; 20 Ct. **(L30)** 12 $tmh.ac; 22 $tps. **(L45)** 48 Ou $tb; 88 (?) Co. **(L60)** 36(?) $tb.ac. **(L65)** 41 Ou. **(L70)** 28 Ou Co $tb. **(L85)** 38 $tps.pc? **(L90)** 44 Ou.ac Co.ac; *n.l.* Co.pc. **(L100)** 23 Lb. **(L110)** 42 $tb. **(L120)** 47 Lb. **(L130)** 49 $tmh.ac. **(L140)** 35 $tmh. **(L145-150)** 26, 1 $ts.

PB11c. Variants of PB11b.

Ch,40v, has a copy of .Lca only, double-length and in two halves, both headed "Septentrio, additur aequatio; Meridies, minuitur aequatio; Rectitudo motus capitis arietis, rectitudo accessionis et recessionis". This table belongs to a collection connected with Abraham bar Hiyya (see notes to CE15). It accompanies a mean motion table for the era of the Deluge. It is collated under PB11b, as "$tch".

Lb(53v): see PB11d. — Pd(48v): see PB11e.

PB11d. Eighth sphere. Double-length .Lca in two parts, with faulty entrance.

Witnesses: **{a1}** Fc,60r; Xw2,36r. – **{aX}** Vd,20r. – **{d}** Lb,53v (version B); Pa,45v; A,224v; Fj,49r; Nc,114r-v; Pv,30v; Fd2,46v; Fd2,59r (lacks second part of .Lca); Gr3,121r. – Duplicates in {d} Fd2. – {a1} Fc also contains a copy of PB11, on f. 50r.

Versions.

(A) The common version is that reproduced below. It is a double-length .Lca laid out as two single-length parts, but, erroneously, the entrance columns of the first part have been copied into the second part. In most cases the two tables have similar headings, appropriate to .Lca. In Nc Fd2(46v), however, the second table has a heading as if for .Ddc.
– .Ddc has been secondarily introduced in A Fd2(59r) Nc. In A it has been attached, by a later hand, to the second of the single-length tables just described; in Fd2 Nc it has a single entrance and a heading much as in PB11.

(B) Manuscript Lb has a double-length .Lca table in two parts, showing a correct double entrance for 5°-180° and 355°-180°. It is accompanied by a corresponding .Ddc table.
– This witness is assigned to the present section rather than to PB11b because the table headings are like the (A) version, and because, in .Lca, it is textually affiliated with the witnesses Pa A (see PB11b).

Headings. Lesser variants ignored. – General heading, whichever tables are present:

(1) Tabula aequationis adventus et recessus, et est diversitas longitudinis capitis (*om.* Pa Fj Fd2 Gr3) **arietis et librae de aequatore diei** (*om.* Xw2 Fd2) :: {a1:} Xw2; {d:} Lb Pa A Fj Pv Fd2 Gr3.
(2: other) :: Fc ("Tabula -- longitudinis", truncated); Vd ("Tabula aequationis motus adventus et recessus capitis arietis et librae", perhaps abridged).
(3: none) :: Nc.

.Lca, entrances: **(4) Lineae numeri communes [Septentrio addens; Meridies minuens]** :: normally. – **(5) L.n.c. [Addens; Minuens]** :: Nc Fd2(46v). – **(6) Addens sep.; Min. mer.** :: Lb.

.Lca, body of table: **(7) Aequatio diversitatis longitudinis capitis arietis et librae de aequatore** (-tione Fc Xw2) **diei** (*om.* Nc) :: normally. – **(8: other)** :: Fd2(59r) ("...arietis ab aequatore"); Fd2(46v) ("... a.e.l. ab aequatore").
– Most witnesses show this heading twice, once for each half-table. However, *Lb* and *Fd2(59r)* show it once (common to both half-tables, and for the sole occurring half-table, respectively). *Nc* and *Fd2(46v)* have "Aequatio dimidii diametri (+circuli Nc)" for the second half-table, as if for .Ddc.

.Ddc, version of Lb: **(8)** *(in frame:)* **Tabula aequationis medietatis diametri circuli, et est aequatio adventus et recessus;** *(above table:)* **Aequatio medietatis diametri circuli, et est modus alius de aequatione adventus et recessus.** Entrances as for .Lca.

.Ddc, versions of A (attached), and of Nc Fd2(59r) (single-entrance): **(9) Aequatio dimidii diametri circuli,** as for PB11.

Text. Lb Pa A were collated under PB11b above. They form a group, with several characteristic readings in common.

Sample of .Lca. From A Fc; headings according to A. The values shown are the same in A and Fc. Values that differ from PB11 are underscored.

Tabula aequationis adventus et recessus, et est diversitas longitudinis capitis arietis et librae de aequatore diei.

(Lca)

Lineae numeri communes		Aequatio diversita tis longi tudinis a rietis ca pitis et librae de aequatore diei		
Sep ten trio add ens	Meri dies minu ens	Gr	Mi	Se
5	355	0	55	22
10	350	1	50	16
15	345	2	45	16
.....	.....	.....	.....	.....
80	280	10	35	1
85	275	10	42	13
90	270	10	45	0
(n)	(t)	(v)	(w)	(x)

(Lca), entrances faulty

Lineae numeri communes		Aequatio diversita tis longi tudinis capitis a rietis et librae de aequatore diei		
Sep ten trio add ens	Meri dies minu ens	Gr	Mi	Se
5	355	10	42	13
10	350	10	35	1
15	345	10	22	47
.....	.....	.....	.....	.....
80	280	1	50	36
85	275	1	55	2
90	270	0	0	0
(n)	(t)	(v)	(w)	(x)

PB11e. Eighth sphere. .Lca, double-length, perhaps a variant of PB11d.

Pd,48v: .Lca alone. In two halves, one beside the other, with a double entrance as in Lb, and the values intact.

Upper heading (as if for .Ddc): "Tabula aequationis medietatis diametri circuli, et est aequatio 8'vae sphaerae". — Heading of entrances: "Lineae numeri [Septentrio addens; Meridies minuens]". — Heading of body of table (apparently a mixture of .Ddc and .Lca): "Aequatio medietatis diametri circuli, scilicet diversitatis longitudinis capitis arietis et librae de aequatore diei", copied for second half until "... et librae".

The headings are mixed; some but not all are characteristic of PB11d. The tabular values have not been collated.

PB11f. Eighth sphere. .Lca+.Ddc, single-length, one quadruple entrance. With Toulouse tables.

The tables are joined in the order .Lca+.Ddc, and are prefixed with a common quadruple entrance (5,355,175,185)-(90,270,90,270). — The headings of the two first entrance columns state that the arguments are, respectively, ascending (from 5° upwards) and descending (from 355° downwards). This is typical of a double-entrance table. In the quadruple entrance of the present tables, these headings are merely repeated for the two extra columns, in spite of the fact that these columns have been folded up so as to stand upside down. The error is general, and may be connected with a similar error in the Novara tables, etc., under PB11g.

Witnesses: **{aT}** Lu,85r; Oj,146r; P,83v; P,134v (:Toledan). — **{k}** Lw,131v.

Context. The copies in Lu Oj P(83v) are all attached to mean motion tables for Toulouse. P(134v) is for a Toledan table, but it may be imitating its counterpart in P(83v). Lw is attached both to a Toledan table and to an unknown mean motion table, perhaps for Marseilles (see PA40). So the Toulouse tables are the best guess at a source.

Headings. Homogeneous in all witnesses, including P(134v), which is in a Toledan context.

General: (Lu Oj P(83v,134v) Lw:) **Tabula aequationis** (*om.* Lw) **accessionis et recessionis 8'ae sphaerae in duobus circulis parvis** (i.d.c.p.: **/super duos circulos parvos** Oj Lw) *(Oj:)* **qui sunt in capite arietis et librae** *(Lu Oj P(83v,134v):)* **et est diversitas longitudinis** (*om.* Oj) **capitis arietis et librae ab aequatore diei.**

Entrance columns: **Lineae numeri** (+lineae arcus Lw) **[Arcus qui augmentatur** (-antur Lw; augentur Oj) **in septentrione; Arcus qui minuitur** (minuuntur Oj; augmentantur Lw) **in meridie; A.q.a.** (-antur Lw; augentur Oj) **i.s.; A.q.m.** (minuuntur Oj Lw) **i.m.].** – For the error in the sub-headings, see above.

.Lca: **Aequatio accessionis et recessionis octavae sphaerae, et est diversitas longitudinis capitis arietis et librae** (e.l.: *om.* Oj Lw) **ab aequinoctiali circulo** (a.c.: aequatore diei Oj P(83v); aequatore Lw).

.Ddc: **Aequatio dimidii diametri circuli,** as in PB11, no variants.

Text. Lu P Lw were collated under PB11, above. They do not differ much from the majority of the witnesses.

Sample. From Lu Lw; headings according to Lu. Lu Lw agree about the values shown. The faulty parts of the column headings are underscored.

Tabula aequationis accessionis et recessionis 8'ae sphaerae in 2'bus circulis parvis, et est diversitas longitudinis capitis arietis et librae ab aequatore diei.

Lineae numeri				(Lca) Aequatio accessionis et recessionis octavae sphaerae, et est diversitas longitudinis capitis arietis et librae ab aequinoctiali circulo			(Ddc) Aequatio dimidii diametri circuli		
Arcus qui augmentatur in septentrione	Arcus qui minuitur in meridie	Arcus qui augmentatur in septentrione	Arcus qui minuitur in meridie						
Gr	Gr	Gr	Gr	Gr	Mi	Se	Gr	Mi	Se
5	355	175	185	0	55	52	0	22	40
10	350	170	190	1	50	36	0	44	31
15	345	165	195	2	45	16	1	6	45
...	...	...	...	...	...	...	...	...	...
80	280	100	260	10	35	1	4	14	28
85	275	95	265	10	42	13	4	17	30
90	270	90	270	10	45	0	4	18	43
(a)	(g)	(c)	(e)	(v)	(w)	(x)	(j)	(k)	(L)

PB11g. Eighth sphere. .Lca+.Ddc, single-length, one quadruple entrance. With Novara tables and Class {e}.

The tables are joined in the order .Lca+.Ddc, prefixed with a common quadruple entrance (5,175,185,355)-(90,90,270,270). The entrance column headings are worded as in PB11f; here they serve two columns each, and are partly erroneous, in much the same way as noted there. Some of the other headings are also similar to those of PB11f.

Witnesses. In R Fd Ej2, the present tables are attached to mean motion tables for Novara. — **{aX}** R,89r (:Novara). — **{d}** Ok,71v. — **{e}** Gr,72v; Eq,91v; Ek3,116v; Xc,78v (added but perhaps by main hand; not in a frame); Vj,108v; Ej,91v; Vm,31v. — **{?}** Fd,14r (:Novara); Ej2,93r (:Novara).

Headings.

General heading (in {d:} Ok; {e:} Gr Eq Ek3 Xc Vj! Ej Vm; {?:} Fd), or outer heading for .Lca (in R Ej2) :: **Tabula aequationis** (t.ae.: **/aequatio** Gr Eq; **+motus** R Fd Ej2) **accessionis et recessionis** (a.e.r.: **/accessus et recessus** Gr Eq Vm Ej2) **8'ae sphaerae.** — *Added:* (nothing) Ok; **+super capita arietis et** (vel Vj Ej) **librae** {e}; **+et est distantia arietis et** (vel R) **librae** *(R Fd:)* **ab aequatore** R Fd Ej2.

Outer heading for .Ddc (in R Ej2) :: **Tabula aequationis 8'ae sphaerae, et est declinatio capitis arietis vel librae ab aequatore.**

Entrance columns: **Arcus qui augmentatur** (-antur R Gr Eq Ek3 Vm) **in septentrione; Arcus qui minuitur** (-uuntur R Gr Eq Ek3 Vm; augmentatur Ok Xc) **in meridie.** — Each heading covers two columns.

.Lca: **Longitudo capitis** (*om.* R Fd Ej2) **arietis ab aequatore** :: in all except Ok, which has "Aequatio diversitatis longitudinis capitis arietis ab aequatore", much as in PB11.

.Ddc: **Aequatio diametri dimidii** (!) **circuli** :: {d:} Ok; {e}. — **Declinatio capitis arietis ab aequatore** :: R Fd Ej2.

Versions. In ms. Vm the two tables are separate, and the first two entrance columns have been attached to .Lca, the last two to .Ddc. Either set of entrances keeps its proper heading.

Text. Eq Xc Vj and two Novara-table samples have been collated under PB11, above. Eq Vj have some distinctive features in common, whereas the affiliation of the rest is doubtful.

Sample. From R Eq Xc; headings according to Xc.

Tabula aequationis accessionis et recessionis
octavae sphaerae super capita arietis et librae.

Arcus qui aug mentatur in septe ntrionem		Arcus qui *aug mentatur* in meri die		**(Lca)** Longitudo capitis arietis ab aequa tore			**(Ddc)** Aequatio diametri dimidii circuli		
Gr	Gr	Gr	Gr	Gr	Mi	Se	Gr	Mi	Se
5	175	185	355	0	55	52	0	22	40
10	170	190	350	1	50	36	0	44	31
15	165	195	345	2	45	16	1	6	45
...	...	...	...	...	...	...	...	...	...
80	100	260	280	10	35	1	4	14	28
85	95	265	275	10	42	13	4	17	30
90	90	270	270	10	45	0	4	18	43
(a)	(c)	(e)	(g)	(v)	(w)	(x)	(j)	(k)	(L)

(e+g Inscr.) augmentatur: Xc; minuitur / minuuntur *plerique.* **(x85)** 13: 33 Xc.

PB11h. Eighth sphere. .Ddc+.Lca, single-length, one quadruple entrance in signs and degrees. Infrequent.

The tables are joined in the order .Ddc+.Lca, and are prefixed with a common quadruple entrance (0s0,6s0,6s0,0s0)-(3s0,3s0,9s0,9s0). This arrangement is similar to PB11g; still, there are four separate headings for the entrance columns, all different, and without the error pointed out under PB11f and PB11g. The headings seem unrelated to all others considered here.

Witnesses: **{a1}** Ps,83r; Sg,186. – **{k}** Cn,105r.

Context. In Ps Sg, these tables show signs of being additions. Ps (on 82v,84r) contains a normal pair of PA11 and PB11, q.v.; our tables occur alone on an added leaf, though in the text-hand, and with a gloss "Haec tabula non est de hoc libro". In Sg (189-190) the tables are attached to their proper copy of PA11, but there is also an entire alternative pair of PA11 and PB11. The copies of PA11 that accompany our tables in Sg Cn have the range AH 570-840, seen only here and in Pd; so probably all these tables are from another source than the normal ones for PA11.

Canon: CbA.P11, in Sg and others, meant for a table like PB11h.Lca.

Headings. – General: "Tabula motus 8'ae sphaerae" Ps; "Tabula aequationis distantiae capitis arietis mobilis ab aequinoctiali in longitudine et latitudine" Cn; none in Sg. These are probably late individual additions. – *Entrance columns:* **Boreale et proclive; Boreale et declive; Australe et proclive; Australe et declive.** Cn interchanges the last two items. Ps omits "et". Ps Sg add "Lineae numeri" in different ways. – .Ddc: **Distantia capitis arietis ab aequatore diei** (*om.* Ps; +secundum latitudinem Cn). – .Lca: **Distantia capitis arietis a sectione** Ps Sg; **Distantia capitis arietis ab aequatore diei secundum longitudinem** Cn.

Sample. From Sg Cn. Headings according to Sg. – Ps and Sg have been collated under PB11, and some of their readings are compared to those of several other types under PB11b, "Conspectus...". These comparisons indicate that Ps Sg form a class of their own, perhaps connected to some early witnesses for PB11b.[1]

Lineae numeri				Lineae numeri				**(Ddc)**			**(Lca)**		
Bore ale et pro clive		Bore ale et de clive		Aust rale et pro clive		Aust rale et de clive		Distantia capitis a rietis ab aequatore diei			Distantia capitis a rietis a sectione		
Si	Gr	Si	Gr	Si	Gr	Si	Gr	Gr	Mi	Se	Gr	Mi	Se
0	0	6	0	6	0	0	0	0	0	0	0	0	0
0	5	5	25	6	5	11	25	0	22	40	0	55	*2*
0	10	5	20	6	10	11	20	0	44	31	1	50	36
0	15	5	15	6	15	11	15	1	6	45	2	45	16
...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	20	3	10	8	20	9	10	4	14	28	10	35	1
2	25	3	5	8	25	9	5	4	17	30	10	42	*53*
3	0	3	0	9	0	9	0	4	18	43	10	45	0
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(v)	(w)	(x)

(d0,5) 20 Sg. **(f2,20)** 25 Sg. **(h0,5)** 20 Sg. **(L0,10)** 31: Cn; 33 Ps Sg. **(L3,0)** 48 Cn. **(x0,5)** 2: Ps Sg; 52 Cn. **(x2,25)** 53: Ps Sg Cn.

PB11j-k. Eighth sphere: rare tables, with entrances in signs and degrees.

PB11j. Ey,54r: "Tabula aequationis motus 8'ae sphaerae", with a quadruple entrance (0s5, 5s25, 6s5, 11s25)-(3s0, 3s0, 9s0, 9s0) common to .Ddc and .Lca, which are coupled in this order. Sub-headings: "Lineae numeri; L.n.; (.Ddc:) Aequatio dimidii diametri circuli; (.Lca:) Aequatio diversitatis longitudinis capitis arietis ab aequinoctiali linea", much as in PB11.

1 Among the places listed in PB11b, "Conspectus...", ms. Cn shows 3 readings that agree with Ps Sg more or less specifically, namely, (k60) 48; (x35) 2; (x85) 53. In the three remaining places, however, Cn has the readings (x5) 52; (x25) 51; (x80) 1, which disagree with Ps Sg or are unspecific.

PB11k. Op,59v; C,339. "Tabula aequationis motus 8'ae sphaerae", like Ey. There is a single entrance, 0s5°-3s0°, common to .Lca and .Ddc, which are coupled in this order. Each table has a heading like PB11, headings (2) and (3), except that .Lca reads "Aequatio longitudinis...".

Ey Op C were collated above, under PB11. Op C do not deviate much from the standard readings of PB11. Ey has features in common with some of the witnesses for PB11b, q.v. for details.

PB12-13. Eighth sphere: tables with increment 1°.

PB12. Ey,54v-55v: "Tabula aequationis motus octavae sphaerae". Entrance quadruple, stepping by 1°, (0s1, 5s29, 6s1, 11s29) - (3s0, 3s0, 9s0, 9s0), thus on the same principle as in PB11j. Only values analogous to PB11.Lca are present; they are equal to those of PB11.Lca where this has corresponding arguments, and the rest have no doubt been found by linear interpolation.

PB13. Ov,87r-v: "Tabula prima aequationis 8 sphaerae", plus a second and a third table. Belongs with the tables CE10 and PA45, said to be for *Paris.*

Same structure and contents as in PB12, thus values for .Lca only; but the values are in degrees and minutes only, and some are a few minutes off the values of PB12 and the common tables. Noted by Toomer p. 122 (ms. "Sb"). — Sample:

0s 1°:	0 10	1s 1°:	5 32	2s 1°:	9 24
0s10°:	1 52	1s10°:	6 54	2s10°:	10 4
0s20°:	3 40	1s20°:	8 14	2s20°:	10 33
1s 0°:	5 24	2s 0°:	9 15	3s 0°:	10 45

PC. Motion of eighth sphere, lists and single values. As usual, secondary notes are normally ignored.

PC11. Motion of eighth sphere, value 9;17,44°.

Toomer 1968 p.12, from Ow (his S). — This item occurs among eclipse tables everywhere, after JA21 except in Wa; so it is apparently meant to be used for obtaining the equation of time. See Cb173 and cf., e.g., John of Sicily J411 (Pedersen 1986b).

Witnesses: **{a2}** Md,94r; Mp,223r. — **{x}** Vz,70v; Mv,99r; Cm,144v; B,155r; T,296r; Lf,104v; Lg,183v; Lh,149r; Xj,286v; Xg,67v; G,72r; Fb,77v; Pq,196v; Oy,84v; Wa,73r; Ow,166v; Nu,152v. — Several further copies are connected with the eclipse tract "Ut Annos"; see CbB02:PC11.

Parallel. — A note in Mp,162vb, connected with the tract "Ut annos", says, "Motus 8'e spere *anno Arabum 679 et Christi 1281* est iste, 9 17 44 1".

Value. The value is the same as the entry for 60° in PB11.Lca, so it is probably an approximation (Toomer 1968 p. 12). The argument of 60°, if found from PA11, would correspond to AH 678-679, or about AD 1280; cf. the parallel quoted.

Text: "Motus 8'ae sphaerae in tempore nostro addendus (a.i.t.n. Wa) 9;17,44°".

Other values: 10<*><*> Lf; 10;17° Lf,34r (copy attached to "Ut Annos"). — Xg ("Motus 8'ae sphaerae addendus tempore nostro vero <loco> solis et lunae et aliorum planetarum 9 20 45").

PC20+. Motion of eighth sphere, other lists and values.

This section only lists a few items that are attached to Toledan canons or tables. Other lesser notes are abundant; some can be found in the descriptions of manuscripts, Pr:06.

PC20. Ea,16r, close to AA21, text-hand note: "Motus 8'ae sphaerae 8°50". This may correspond to about AD 1220, but calculations are unsafe.

PC25. Pz,132v, secondary hand: "Anno Arabum 597 motus octavae sphaerae 8 gr 46 mi 34 s'a 15 t'a".

PC30. Fh,63v (small leaf but in text-hand): "Motus duorum polorum orbis signorum ad annos Arabos (sic!) perfectos; Haec est tabula motus accessionis et recessionis octavi circuli". Values for each year of "anni Arabum completi" 645 (9;0,20,1,30,24°) until 660 (9;8,2,29,42,24°); the values show a constant difference of 0;0,30,49,52,48°, as also noted by a secondary hand.

PC32. Xw2,36r, added to PB11d in text-hand: "Motus octavae sphaerae" (heading partly hidden). For AD 1287 (9;20,52°) until AD 1292 (9;23,16°).

PC35. Nc,117v: "Motus 8'ae sphaerae incipientes 8'o die Aug. in annis Christi 1271, et sunt hic scripti pro 12 annis futuris ita quod quaelibet linea serviat suo anno". There is no entrance column showing the years. The date mentioned is in fact the first day in AH 670, so probably the values belong to AH 669 elapsed (9;13,14,30,1°) until 680 elapsed (9;18,45,48,4°). The value for AH 678 and 679 (on this assumption) are 9;17,51,45,28° and 9;18,18,41,32°, and the table contains no value similar to PC11.

PC40. Da3,134r: "Tabula aequationis motus 8'ae sphaerae" with values for every 10th year from AD 1300 (2;1,46,29°) to 1390 (2;9,40,48°). – On the same page is another table "Verus motus", for every 10th year from AD 1300 (9;37,37,2,50°) to 1390 (incomplete). This table has been crossed out.

The table has been treated by Knorr 1993, on the basis of Oxford Bodl. Bodley 464, 150v (photo, fig. 5; discussion, p. 272-74, 278-79).

The starting year AD 1300 suggests *Profatius'* Almanac, and in fact two copies occur in such a context, namely, in ms. Fb,177v and Vat. lat. 3125, 76r. Other copies are found in a quadrant treatise perhaps attributable to John Maudith; cf. F.S. Pedersen 1984 p. 739, 777. A copy in an uncertain context: Bodl. Ashm. 1796, 40r (North 1976, II p. 314). – The table is not in Boffito and Melzi D'Eril's edition of the Almanac from Firenze Laur. plut.18 sin.1.

PC45. Fd,14r (with Novara tables): "Tabula veri motus 8'ae sphaerae super annos domini nostri Ihesu Christi". Values for each year of AD 1320 (9;36,23°) until 1350 (9;49,12°); there is an extra column for differences between successive values.

Q. Revolution of years, etc.

During a solar year, which may be sidereal or tropical, the heavens revolve 365 times plus an extra angle corresponding to the time by which the solar year exceeds 365 days. This angle is here to be termed the "excess revolution". The following list shows the values of the excess revolution reported or implied by the sources considered. The "Degrees" column shows the angle mentioned. The "Time" columns show the angle translated into hours (1 hour corresponding to 15 degrees) and into 60ths of a day. Thus the "Time" values indicate the length of the solar year (tropical if less than 365 days 6 hours, sidereal if greater). Values visible in a source, or extracted from it, are asterisked; values derived from these are unmarked.

	Degrees	Time (365d +)	Time (365d;...)	
QB31-32	*86;36°	5h;46,24	;14,26	Albattani (Nall.II 295)
QB53	86;52,30°	*5h;47,30	;14,28,45	?, cf. Malines tab.
QB64		*5h;49,15,59...		Alfonsine?
QB63	87;19°	*5h;49,16	;14,33,10	same?
QB61	*87;19, 6°	5h;49,16,24	;14,33,11	same?
QB62	87;19,11°	*5h;49,16,44	;14,33,11,50	same?
QB41	*88;38,37,47°	5h;54,34,31...	;14,46,26,17...	"Savasorda"
QB11(a)	*92;15,30°	6h; 9, 2	;15,22,35	faulty? cf. next
QB11(b)	92;18°	6h; 9,12	*;15,23	"Azarchel"
CG11	92;20,55...°	6h; 9,23,43...	;15,23,29,17...	same as for CA01?
QA11-12	*92;20,59, 6°	*6h; 9,23,56,24	;15,23,29,51	Toulouse tables, 1?
QB51	*92;21,30°	6h; 9,26	;15,23,35	Toulouse tables, 2?
QB52	*92;21,36°	6h; 9,26,24	;15,23,36	
Kammad	*92;24°	6h; 9,36	;15,24	"Azarchel"; see below
QB21	*93; 2,15°	*6h;12, 9	;15,30,22,30	Alkhwarizmian

The sources are scattered, and none of the values, except CG11, are likely to be native to the tradition of the Toledan tables. – The solar mean motion implicit in CA01, if it is 0;59,8,11,28,27,29,49 °/d as read off CG11, implies the values labelled "CG11" above. As could be expected, they are essentially the same as the Toulouse table values of QA11-12; but they do not agree as well with any of the other values.

QB11(b) may belong to common lore about Thebit or Azarchel; see the notes *ad loc.*

Other parallels may be looked for, e.g., in Nallino I p. 204 ff. (sidereal years), Kennedy, "Survey" 1956 p. 147, and generally in the Kennedy database,[1] and in Carmody 1960 p. 54-56. None of the values above turns out to be well known except the Albatenian and Alkhwarizmian ones. The degree value from the latter was common since the Brahmasphutasiddhanta and is quoted, e.g., in canons Cb229; cf. note to QB21.

Other values assigned to Azarchel: an excess revolution of 92;24° ("Kammad" above) occurs in a table in Ibn al-Kammad ascribed to Azarchel;[2] Abraham ibn Ezra (Millás 1947 p. 76 and 82) attributes the corresponding length of the sidereal year (365d + 1/4 + 1/150) to Thebit, with the approval of "Abencine" and Azarchel. Values for the tropical year, assigned to Azarchel and others, are in Abraham ibn Ezra, such as an excess revolution of 87;21°, which is common, and the length of the tropical year known from Albattani.[3] None of these values are characteristic of the Toledan tables as we know them.

---

1 Benno van Dalen, privately, 1998.

2 ms. Madrid 10023, table f. 57v; see Chabás & Goldstein 1995 p. 35. Here the excess revolution is expressed as 92;24° or 6h;9<,36>.

3 87;21°: Abraham ibn Ezra, Millás 1947 p.83, cf. p. 35. Tropical year of 365d + 1/4 - 1/106 (=365d;14,26,2..., same as QB31+ above), ascribed to Albattani, Azarchel and others: *ibid.* p.76 lin.12-15, cf. p. 95 lin. 13-15 and p. 34.

QA. Entrance of sun into cardinal points.

QA11-12. Entrance of sun into cardinal points, time and arc, for Toulouse.

Stated to be for Toulouse (in A1, concerning QA11), or to be for a longitude of 50° west of "medium mundi" (Oj Vz). The witnesses, except Vz, contain Toulouse tables of the GB* type. Probably, then, our tables were made for such a context. See also Pedersen 1998 p. 6-7.

Witnesses: **{aT}** Lu,92r-93v; Oj,156r-157v; A1,194v. – **{k}** Lw,132r-v. – **{x}** Vz,81v-82v.

In Lw, each of QA11 and QA12 lack the table for Capricorn and the single-year table. In Vz, QA12 lacks the table for Capricorn and the single-year table. A1 contains QA11 only. – In Lu Lw Vz, the tables occur at the end of the respective collections; thus they may be recent additions. Lu Lw also contain the GB* Toulouse tables, so the present tables may have their origin in such a context.

Other copies, not further treated: Du (see T:03(3)), f.24r,[1] before some mixed tables including GB* (for Toulouse), but in another hand. Range, 1200(24)1320. In the headings, Toulouse is mentioned as being "40°30′ ab occidente". – Ek,142v-144r, at the end of a miscellany including GB* tables (which are on 127r-128v). Range, AD 600(24)1296 as here.

Another version: Xn, 49v-50r, in a miscellany including Novara tables. Range, 600(24)1344. The values of QA11 are rounded to the closest minute of an hour, and those of QA12, to degrees and minutes. Title of QA11 (49v), "Tabulae revolutionis solis ad extrahendum dominum cuiuslibet quartae anni secundum distantiam a medio mundi versus occidentem 5<0> g() et a Toleto versus orientem 11 g() et 48 minuta, et incipiunt in primo die Martii". Toulouse is not mentioned.

Headings: see the sections for each of QA11 and QA12.

Ranges.

600(24)1296:	Lu Oj Lw (QA11-12); Vz (QA11-12, QA12 broken off after Libra)
1200(24)1320:	A1 (QA11 only).

Values. It is not obvious how these tables have been constructed. The values are, however, largely consistent and compatible with well-known parameters, as will be seen.

The times shown by QA11 are meant to be those for which the sun enters the cardinal points according to true motion. For a quick demonstration, one may find the mean longitudes corresponding to the time values in QA11 for AD 600, using the Toulouse tables CC01 (Poulle's edition; CA01 is used for lower-denomination tables). One gets,

```
AD 600, Ari:  11s28; 3,29°
AD 600, Cnc:   3s 0;25, 7°
AD 600, Lib:   6s 1;56,32°
AD 600, Cap:   8s29;34,56°
```

These are the mean longitudes for which the true sun is in the cardinal points. They are essentially the same as those listed in QA31, which are based on the Toledan solar apogee DA01 and solar equation EA01. Thus, the times in question are no doubt for Toulouse, and the solar parameters are the standard ones.

QA12 shows the arc corresponding to the value for hours in QA11, though normed so as to start in Capricorn. Thus, e.g., to find the time value of QA11 corresponding to QA12.Cnc for year 600, take the arc value in QA12 (194°) and subtract 180° to make the arc start in Cancer instead of Capricorn. The

1 Seen by North 1976, p. 128.

resulting arc is 14°, which corresponds to 56 minutes of time. This is in fact the value of QA11.Cnc, as concerns hours and fractions of hours.

Since all the values of QA12 at AD 600 are round ones, it may be thought that they are in fact the basic values, though I do not know what procedure of computation this would correspond to.

All the tables are essentially linear. To find the tabular differences of the collected-year tables, one notes that the excess revolution presupposed by QA12 is 92;20,59,6° per year, as shown by QA12.Exp at 1 year; this is the exact tabular difference throughout QA12. In time, it corresponds to 6;9,23,56,24 hours for one (sidereal) year. In 24 years, this will yield 6 days, which are discarded, plus 3;45,34,33,36 hours. This is the value indicated by ms. Lu in a gloss to QA11.Exp (shown in its place, below), and it is no doubt the true tabular difference in QA11.Ari, etc.

In QA11.Ari, at AD 600, the reading 26" and the rest of the second values are consistent among themselves, but the set is inconsistent with the values of QA12.Ari, which implies the reading 16" and the corresponding ones in QA11. I do not know which set is in error.

The sidereal year presupposed, which is 365d 6h;9,23,56,24 according to the above, comes tolerably close to that implied by the Toledan mean motion tables; see Q* above.

Text. Using tabular differences, one can reproduce all tables almost precisely. Manuscript Lu seems sufficient for constituting the text, so I have not collated the others.

QA11. Entrance of sun into cardinal points: time.

Witnesses: Lu Oj A1 Lw Vz. See QA11-12, above.

Headings. — General:

(1) Tabula ad inveniendum diem et horam introitus solis (i.s.: *om.* A1) **in imaginem arietis, cancri, librae et capricorni** (a.c.l.e.c.: a. et c. et l. atque c. Oj) :: Oj Lw A1. — *Added:* **+ad meridiem Tolosae** A1; **+secundum distantiam 50 graduum versus occidentem a medio mundi** Oj.

(2: other) :: Lu (no main hdg.); Vz ("Tabula ... in y(magines) 4 signorum principalium secundum distantiam 50 gr et versus occidentem").

Collected-year tables: **(3) Anni Christi** (domini Lw) **collecti; Ad horam introitus solis in imaginem arietis** (and the corresponding pairs for Cancer, Libra, and Capricorn (*om.* Lw)) :: Oj Lw. — **(4) Anni domini collecti; Ad arietem** (etc.) :: Lu. — **(5: other)** :: A1 Vz.

Parameters. See QA11-12, "Values". Tabular difference for 24 years, presumably 3;45,34,33,36 hours; cf. the addition to .Exp in ms. Lu, reproduced below. If so, the tabular difference in .Exp is 6;9,23,56,24 hours. With these parameters, all tables are reproduced to within 1 second.

Text: Values and headings from Lu,92r-v. The values are precise; cf. just above.

(Ari)

Anni dni. coll.	Ad arietem Me	Di	Ho	Mi	Se
600	0	18	7	54	26
624	0	18	11	40	0
648	0	18	15	25	35
672	0	18	19	11	10
696	0	18	22	56	44
720	0	19	2	42	19
744	0	19	6	27	53
768	0	19	10	13	28
792	0	19	13	59	2
816	0	19	17	44	37
840	0	19	21	30	11
864	0	20	1	15	46
888	0	20	5	1	21
912	0	20	8	46	55
936	0	20	12	32	30
960	0	20	16	18	4
984	0	20	20	3	39
1008	0	20	23	49	13
1032	0	21	3	34	48
1056	0	21	7	20	22
1080	0	21	11	5	57
1104	0	21	14	51	32
1128	0	21	18	37	6
1152	0	21	22	22	41
1176	0	22	2	8	15
1200	0	22	5	53	50
1224	0	22	9	39	24
1248	0	22	13	24	59
1272	0	22	17	10	34
1296	0	22	20	56	8

(Cnc)

Anni dni. coll.	Ad cancrum Me	Di	Ho	Mi	Se
600	3	20	0	56	0
624	3	20	4	41	34
648	3	20	8	27	9
672	3	20	12	12	44
696	3	20	15	58	18
720	3	20	19	43	53
744	3	20	23	29	27
768	3	21	3	15	2
792	3	21	7	0	36
816	3	21	10	46	11
840	3	21	14	31	45
864	3	21	18	17	20
888	3	21	22	2	55
912	3	22	1	48	29
936	3	22	5	34	4
960	3	22	9	19	38
984	3	22	13	5	13
1008	3	22	16	50	47
1032	3	22	20	36	22
1056	3	23	0	21	56
1080	3	23	4	7	31
1104	3	23	7	53	6
1128	3	23	11	38	40
1152	3	23	15	24	15
1176	3	23	19	9	49
1200	3	23	22	55	24
1224	3	24	2	40	58
1248	3	24	6	26	33
1272	3	24	10	12	8
1296	3	24	13	57	42

(Lib)

Anni dni. coll.	Ad libram Me	Di	Ho	Mi	Se
600	6	20	21	34	0
624	6	21	1	19	34
648	6	21	5	5	9
672	6	21	8	50	44
696	6	21	12	36	18
720	6	21	16	21	53
744	6	21	20	7	27
768	6	21	23	53	2
792	6	22	3	38	36
816	6	22	7	24	11
840	6	22	11	9	45
864	6	22	14	55	20
888	6	22	18	40	55
912	6	22	22	26	29
936	6	23	2	12	4
960	6	23	5	57	38
984	6	23	9	43	13
1008	6	23	13	28	47
1032	6	23	17	14	22
1056	6	23	20	59	56
1080	6	24	0	45	31
1104	6	24	4	31	6
1128	6	24	8	16	40
1152	6	24	12	2	15
1176	6	24	15	47	49
1200	6	24	19	33	24
1224	6	24	23	18	58
1248	6	25	3	4	33
1272	6	25	6	50	8
1296	6	25	10	35	42

(Cap)

Anni dni. coll.	Ad capricornum Me	Di	Ho	Mi	Se
600	9	18	19	38	0
624	9	18	23	23	34
648	9	19	3	9	9
672	9	19	6	54	44
696	9	19	10	40	18
720	9	19	14	25	53
744	9	19	18	11	27
768	9	19	21	57	2
792	9	20	1	42	36
816	9	20	5	28	11
840	9	20	9	13	45
864	9	20	12	59	20
888	9	20	16	44	55
912	9	20	20	30	29
936	9	21	0	16	4
960	9	21	4	1	38
984	9	21	7	47	13
1008	9	21	11	32	47
1032	9	21	15	18	22
1056	9	21	19	3	56
1080	9	21	22	49	31
1104	9	22	2	35	6
1128	9	22	6	20	40
1152	9	22	10	6	15
1176	9	22	13	51	49
1200	9	22	17	37	24
1224	9	22	21	22	58
1248	9	23	1	8	33
1272	9	23	4	54	8
1296	9	23	8	39	42

(Exp)

Anni expa nsi	Communis ad omnes quartas Me	Di	Ho	Mi	Se
1	0	0	6	9	24
2	0	0	12	18	48
3	0	0	18	28	12
4	0	0	0	37	36
5	0	0	6	46	59
6	0	0	12	56	23
7	0	0	19	5	47
8	0	0	1	15	11
9	0	0	7	24	35
10	0	0	13	33	59
11	0	0	19	43	23
12	0	0	1	52	47
13	0	0	8	2	11
14	0	0	14	11	35
15	0	0	20	20	59
16	0	0	2	30	23
17	0	0	8	39	47
18	0	0	14	49	11
19	0	0	20	58	35
20	0	0	3	7	59
21	0	0	9	17	23
22	0	0	15	26	46
23	0	0	21	36	10
24	0	0	3	45	34

33 tertia, 36 quarta.

QA12. Entrance of sun into cardinal points: arc.

Witnesses: Lu Oj Lw Vz. See QA11-12, above.

Headings. — General:

(1) Tabula ad inveniendum ascendens ad horam introitus solis in imaginem arietis, librae, cancri et capricorni (a.l.c.e.c.: a. et l. c. atque c. Oj) :: Oj Lw. — *Added:* **+secundum distantiam 50 graduum a medio mundi versus occidentem** Oj.

(2: other) :: Lu (no main hdg.); Vz ("Inventio ascendentis in introitu solis in 4 signa principalia secundum distantiam 50 gra.").

Collected-year tables: **(3) Anni domini** (Christi Vz) **collecti; Ascensiones ad arietem** (and the corresponding pairs for Cancer, Libra, and Capricorn (*om.* Lw Vz)) :: Oj Lw Vz. — **(4) Anni domini collecti; Ascensiones ad horam introitus solis in arietem** (etc.) :: Lu.

Parameters. The tabular difference in .Exp is 92;20,59,6 °/y, and the difference for 24 years is 56;23,38,24°. These occur as the first and the last value in .Exp. For the purpose of constructing the table, they were treated as exact values, without hidden sexagesimals. For the values for AD 600, which give the appearance of being the basic ones, see QA11-12 above.

With these values, the readings of ms. Lu are reproduced exactly. I have not collated the other witnesses.

Text. Values and headings from Lu.

(Ari)

Anni dni. coll ecti	Ascensiones ad horam introitus solis in arietem Gra	Mi	Se	Te
600	208	34	0	0
624	264	57	38	24
648	321	21	16	48
672	17	44	55	12
696	74	8	33	36
720	130	32	12	0
744	186	55	50	24
768	243	19	28	48
792	299	43	7	12
816	356	6	45	36
840	52	30	24	0
864	108	54	2	24
888	165	17	40	48
912	221	41	19	12
936	278	4	57	36
960	334	28	36	0
984	30	52	14	24
1008	87	15	52	48
1032	143	39	31	12
1056	200	3	9	36
1080	256	26	48	0
1104	312	50	26	24
1128	9	14	4	48
1152	65	37	43	12
1176	122	1	21	36
1200	178	25	0	0
1224	234	48	38	24
1248	291	12	16	48
1272	347	35	55	12
1296	43	59	33	36

(Cnc)

Anni dni. coll ecti	Ascensiones ad horam introitus solis in imagi-ne<m> cancri Gra	Mi	Se	Te
600	194	0	0	0
624	250	23	38	24
648	306	47	16	48
672	3	10	55	12
696	59	34	33	36
720	115	58	12	0
744	172	21	50	24
768	228	45	28	48
792	285	9	7	12
816	341	32	45	36
840	37	56	24	0
864	94	20	2	24
888	150	43	40	48
912	207	7	19	12
936	263	30	57	36
960	319	54	36	0
984	16	18	14	24
1008	72	41	52	48
1032	129	5	31	12
1056	185	29	9	36
1080	241	52	48	0
1104	298	16	26	24
1128	354	40	4	48
1152	51	3	43	12
1176	107	27	21	36
1200	163	51	0	0
1224	220	14	38	24
1248	276	38	16	48
1272	333	1	55	12
1296	29	25	33	36

(Lib)

Anni dni. coll ecti	Ascensiones ad horam introitus solis in imagi-ne<m> librae Gra	Mi	Se	Te
600	233	30	0	0
624	289	53	38	24
648	346	17	16	48
672	42	40	55	12
696	99	4	33	36
720	155	28	12	0
744	211	51	50	24
768	268	15	28	48
792	324	39	7	12
816	21	2	45	36
840	77	26	24	0
864	133	50	2	24
888	190	13	40	48
912	246	37	19	12
936	303	0	57	36
960	359	24	36	0
984	55	48	14	24
1008	112	11	52	48
1032	168	35	31	12
1056	224	59	9	36
1080	281	22	48	0
1104	337	46	26	24
1128	34	10	4	48
1152	90	33	43	12
1176	146	57	21	36
1200	203	21	0	0
1224	259	44	38	24
1248	316	8	16	48
1272	12	31	55	12
1296	68	55	33	36

(Cap)

Anni dni. coll ecti	Ascensiones ad horam introitus solis in imagi-ne<m> capricorni Gra	Mi	Se	Te
600	294	30	0	0
624	350	53	38	24
648	47	17	16	48
672	103	40	55	12
696	160	4	33	36
720	216	28	12	0
744	272	51	50	24
768	329	15	28	48
792	25	39	7	12
816	82	2	45	36
840	138	26	24	0
864	194	50	2	24
888	251	13	40	48
912	307	37	19	12
936	4	0	57	36
960	60	24	36	0
984	116	48	14	24
1008	173	11	52	48
1032	229	35	31	12
1056	285	59	9	36
1080	342	22	48	0
1104	38	46	26	24
1128	95	10	4	48
1152	151	33	43	12
1176	207	57	21	36
1200	264	21	0	0
1224	320	44	38	24
1248	17	8	16	48
1272	73	31	55	12
1296	129	55	33	36

(Exp)

Anni expa nsi		Ascensiones communes Gra	Mi	Se	Te
1		92	20	59	6
2		184	41	58	12
3	B	277	2	57	18
4		9	23	56	24
5		101	44	55	30
6		194	5	54	36
7	B	286	26	53	42
8		18	47	52	48
9		111	8	51	54
10		203	29	51	0
11	B	295	50	50	6
12		28	11	49	12
13		120	32	48	18
14		212	53	47	24
15	B	305	14	46	30
16		37	35	45	36
17		129	56	44	42
18		222	17	43	48
19	B	314	38	42	54
20		46	59	42	0
21		139	20	41	6
22		231	41	40	12
23	B	324	2	39	18
24		56	23	38	24

QA21. Entrance of sun into cardinal points, mean longitude, Alkhwarizmian.

Same as Alkhwarizmi / Maslama, Suter Tab.4 "medialitas solis in primis signorum locis", examined by Neugebauer 1962, p. 90-91.

Witnesses: **{a0}** Cq2,118; Pz,100v (m2, 13th c., "Motus centri solaris corporis quando sol intrat primum punctum uniuscuiusque signi". Layout: see the following).

Versions. Cq2 has the four entries shown below. Pz has an entry for each sign, but only the four values in question are filled in; the rest are blank.

Of the Alkhwarizmian tables, Suter's mss. "C" and "O" show values for all 12 signs. Mss. "CC" (Neugebauer 1962 p. 146) and Lambeth Palace 67, 65v, have 12 entries too, but only four values, like ms. Pz above.

Values. The table shows the mean longitude of the sun when the true longitude has one of the values 0°, 90°, 180°, 270°. To check, e.g., the value for Aries (see Neugebauer 1962 p. 91), subtract the Alkhwarizmian solar apogee (2s17;55°) from the mean longitude listed (11s27;48,12°), and use the mean centrum resulting (9s9;53,12°) for finding the solar equation in Suter Tab. 21-26. This (+2;11,48°) yields exactly 12 signs when applied to the mean longitude. The results in the other three cases are exact too.

Text. Values from Pz Cq2. Headings from Cq2. – Also collated: **$km** = the relevant values in Khw/M, Suter p. 115 Tab.4 lower right (mss. "C,O"). – There are no variants of note.

Tabula de introitu solis in quadrantes anni.

Nomina signorum	Si	Gr	Pc	Se
Ari	11	27	48	12
Cnc	3	0	28	20
Lib	6	2	9	37
Cap	8	29	33	42
(a)	(b)	(c)	(d)	(e)

(c Ari) 27: Pz $km; 28 Cq2. **(c Cnc)** 4 Pz.

QA31. Entrance of sun into cardinal points, mean longitude.

Witnesses: **{a2}** Mp,189r. – **{aT}** Lu,31v(m2?); Oj,104r; P,70r(m3?). – **{k}** Lw,41v (among Toulouse mean motion tables). – **{d}** Lb,40v. – **{x}** Vx,130v; Oc,53r; X,129r; Vz,44r; Xb,51v; Es,153r; Wa,53r.

Some other copies are appended to canons Ca, and are faulty or independently computed; see CaA00. Gloss with values: see CbA.Q12. Variant lists: see QA32-33.

Context. The table follows on CA01 (or CC01, its Toulouse equivalent; mean solar motion) everywhere except in Lb.

Headings. — General:

(1) Tabula medii (t.m.: /**Medius** Lb Vx Oc Vz Xb; *om.* X) **motus** (/**cursus** Lb Es Wa) **solis** (*om.* Es) **noti** (=Mp Lb Es; non Wa; motus Oc; *om.* Vx X Vz Xb) **in introitu eius in aliquod punctorum aequatoris** (sue equalitatis Lb) **vel tropicorum** (v.t.: t. Lb; *om.* X Wa) :: {a2:} Mp; {d:} Lb; {x:} Vx Oc X Vz! Xb Es Wa!.
(2) Tropica signa (-norum Lw) :: {aT:} Oj P; {k:} Lw.
(3: none) :: Lu.

Entrance: **(4) Numerus signorum** :: Mp Vx Oc Vz Xb. — **(5) Nomina signorum** :: Es Wa. — **(6: none)** :: Lu Oj P Lb Lw X.

Versions. In Mp Vx X Vz Xb Wa there is an extra entrance column to the outer left, with numbers 1-4 for the signs mentioned.

Values. The values can be checked in the same way as for QA21. Except for one imprecision, noted below, they may be reproduced from the solar apogee of 2s 17°50′ (DA01) and the solar equation table EA01. Thus they are no doubt based on common Toledan material.

Text. Collated for values: **{a2}** Mp; **{aT}** Lu; **{x}** Oc X Es. — Headings according to Mp.

Tabula medii motus solis noti in introitu eius
in aliquod punctorum aequatoris vel tropicorum.

Numerus	signorum	Si	Gr	Mi	2a
1	Aries	11	28	3	30
2	Cancer	3	0	25	7
3	Libra	6	1	56	30
4	Capricornus	8	29	34	57

(2) 25′: Mp Lu Oc; 35 X. **(3)** 56′: Mp Lu; 26 Oc X. 30″: Mp Oc X; 31 Lu. **(4)** 57: 53 *vel* 54 *calculando.*

QA32-33. Variants of QA31.

These, like QA31, are based on standard values. They may or may not have been computed independently of QA31.

QA32. Ef,72v "Tabula medii cursus solis quando intrat primum secundum uniuscuiusque signi". Shows values for all 12 signs. At the cardinal points, they are as in QA31 except that Ef reads 31" in Aries and 55" in Capricorn. — A similar table is among the Novara tables of ms. Xn,43v. At the cardinal points, it reads 33" in Libra and 55" in Capricorn.

QA33. Da4,146v (with Toulouse tables): list for 4 signs, inc. "Medius cursus introitus solis ad arietem, Aries 11 28 3 19", then the values "3 6 28 57", "6 1 56 26", "8 29 34 58" with corresponding labels.

QB. Yearly excess revolution, etc.

QB11. Excess revolution, values.

Witnesses: **{a0}** Oo,25r; Cq2,88; Pz,132v; Mc,30v. — **{a1}** Xa,39v; Ad,95v; Cq,70; Fc,50r; Ps,84r; Sg,190; Fh,71r; Wd,39v. — **{aX}** Vo,71r; Fj2,111r. — **{d}** Nc,114v; **{?}** Py,48r; A2,299v (:?). — Close to PA11 everywhere except in A2.

Text. From Xa Cq Pz Oo.

> *(Xa Cq Pz Oo:)* Quod augetur super ascensiones ascendentis ad revolutionem sequentis (-ti Oo) anni: 92 gr et 15 mi (+et Pz) 30 secunda.
>
> *(Xa Cq Pz:)* Annus (-ni Xa Cq) solaris in canone motus: 365 15 23.

I have not seen any identification of the former value, nor of its equivalent length of the year, which is 365;15,22,35 days. – A solar year of 365;15,23 days, as mentioned in the second note, is ascribed to *Azarchel* in such notable sources as the Parvum Almagestum[1] and the Astrologia Marsiliensis.[2] Another attribution is in a gloss in ms. Ch,98r: "... Secundum *Thebith* 365 dies 15 m'a diei 23 secunda, concordat cum Arzachele...".

QB21. Excess revolution in time and in degrees, Alkhwarizmian.

Like ?Alkhwarizmi / Maslama, table 115 Suter; see comments by Neugebauer 1962 p. 131-32. Two sets of tables: (A) for excess of solar years over 365 days, (B) for excess revolution in degrees.

Witnesses: **{a0}** Ct,31r; Cq2,119 (m2).

Headings. Listing the headings of Cq2, which employ much the same terms as Suter's copy. The headings of Ct are reproduced further below, together with the table; they represent a different translation.

(A): Conversio denorum nati annorum [Numerus annorum; menses; dies; horae; puncta; secundae]; Conversio singulorum nati annorum [...] :: Cq2;

(B): Conversio denorum nati orientium [Numerus annorum; Daracha (!); Dacaicha; Teixem]; Conversio singulorum nati orientium [Numerus annorum; Gradus; Puncta; Secunde] :: Cq2.

Versions. Both our witnesses show entries for 200 and for 300 years, absent from Suter's copy. In table (A), Cq2 has an extra column of seconds, correct, but not present in Ct nor Suter; this, and the values that show variants because of rounding, are shown in italics below.

Parallels. The values are like those of Khw/M, Suter Tab. 115 p.230 (from Suter's ms. "O" only). The parameters are Indian, also attested for Alkhwarizmi; see below. It is true that the table as such is not attested as Alkhwarizmian, except for its occurrence in the single manuscript mentioned.

Table (B), drawn up for the ranges 1y-9y, 10y-90y, 100y-1000y in one sequence, is in the appendix to Ibn al-Kammad, Madrid 10023, 66rb, headed "...secundum Muhad Arcadius"; see Chabás & Goldstein 1994 p. 38. The layout is not significantly similar to the present version or to Khw/M. The table has not been collated.

Values. The sidereal year, assumed to be 365d 6h;12,9, is attested in Hindu sources (Neugebauer 1962 p. 131). The corresponding value for the excess of revolution (93;2,15°) is quoted from a canon of Alkhwarizmi by Ibn Almuthanna, Q86 p. 143-144 Goldstein; the canon is the one underlying Cb229 / Cc178, where the value is present too.

---

1 III,1 (Vat. Reg.lat.1261, 12r) on the sidereal year: "Et hoc quidem tempus anni aequale est ex 365 diebus et 15 minutis et 23 secundis, et super hoc *Arzacel* tabulas motuum *Toleti* novissime composuit". Seen by Birkenmajer 1970 (1922) 44; see also Lorch 1995, V p.410. The value implicit in CA01 is about 365;15,23,29 days, see under Q* above. – A note on the "Parvum Almagestum" is in T:01(07ea).

2 Wien 5311, 43rb: "Arzachel autem per certissimas considerationes, qui etiam de motu octavae sphaerae nos certificat, annum invenit ex 365 diebus et quarta diei et 23 secundis, et secundum hoc ordinavit cursum planetarum."

Text. Values from Ct Cq2. Headings according to Ct. – Also quoted for tabular values: **$ko** = Khw/M, Suter *tab. cit.*

(A). – Figures from Cq2 that are rounded or not present in Ct $ko are italicized. The rows for 200y and 300y, and column (b), are absent from $ko.

Aera revolutionum nativitatum in decimis.

Anni decimarum	Me	Di	Ho	Mi	*Se*
10	0	2	14	1	*30*
20	0	5	4	3	*0*
30	0	7	18	4	*30*
40	0	10	8	6	*0*
50	0	12	22	7	*30*
60	0	15	12	9	*0*
70	0	18	2	10	*30*
80	0	20	16	12	*0*
90	0	23	6	13	*30*
100	0	25	20	15	*0*
200	1	21	16	30	*30*
300	2	17	12	45	*0*
(a)	(b)	(c)	(d)	(e)	(f)

Aera revolutionum nativitatum in unitatibus.

Anni unitatum	Di	Ho	Mi	*Se*
1	0	6	12	*9*
2	0	12	24	*18*
3	0	18	36	*27*
4	1	0	*48*	*36*
5	1	7	*0*	*45*
6	1	13	*12*	*54*
7	1	19	25	*3*
8	2	1	37	*12*
9	2	7	49	*21*
10	2	14	1	*30*
(g)	(h)	(j)	(k)	(L)

(c300) 16 Cq2; *def.* $ko. **(d30)** 19 Cq2. **(j3)** 17 Cq2. **(j7)** 18 Cq2. **(k2)** 14 Cq2. **(k-L4)** 48m 36s: Cq2; 49m Ct; 48m $ko. **(k-L5)** 0m 45s: Cq2; 1m Ct $ko. **(k-L6)** 12m 54s: 11m 54s Cq2; 13m Ct $ko.

(B). – $ko lacks the rows for 200y and 300y.

Ascendens revolutionum nativitatum in decimis.

Anni decimarum	Gr	Mi	Se
10	210	22	30
20	60	45	0
30	271	7	30
40	121	30	0
50	331	52	30
60	182	15	0
70	32	37	30
80	243	0	0
90	93	22	30
100	303	45	0
200	247	30	0
300	191	15	0
(a)	(b)	(c)	(d)

Ascendens revolutionum nativitatum in unitatibus.

Anni unitatum	Gr	Mi	Se
1	93	2	15
2	186	4	30
3	279	6	45
4	12	9	0
5	105	11	15
6	198	13	30
7	291	15	45
8	24	18	0
9	117	20	15
10	210	22	30
(e)	(f)	(g)	(h)

(b60) 181 Cq2. **(b80)** 293 $ko. **(c20)** 46 Cq2. **(c100)** xlv.i Cq2; *def.* $ko. **(d200)** 30 Cq2. **(f6)** 168 $ko. **(f7)** ccxxi Cq2; 93 $ko. **(g3)** 7 Ct. **(g7)** 16 Ct. **(h1)** 35 $ko.

QB31. Excess revolution for planets, 36 years, Albatenian.

Like Albattani, Nallino II p. 187; cf. Nallino's comments, *ibid.* p. 295.

Witnesses: **{k}** Eh,123r-v (photo garbled); Ou,77v-78r; Co,171r. – **{d}** Fj,83r.

Canon: Ca196, citing "in tabulas augmentationis medii cursus planetarum", with values: "ex mediis cursibus ... et ex portionibus", which is tolerably like the headings below. The canon is like Albattani Appendix E (Nallino I p. 148).

Headings.

General: **Tabula augmentationis secundum temporis revolutiones et annorum medios cursus et mensium et dierum et horarum** :: Co Fj. In Ou the table is on two pages headed "Tabula ... horarum in luna et Saturno" and "Tabula ... horarum in reliquis planetis". In my photo of Eh, only "Tabula augmentationis <-->" is visible.

Entrance columns: **Numerus annorum perfectorum,** everywhere.

Sub-tables: "Augmentum medii cursus lunae; Augmentum (+nodi septentrionalis Co) portionis lunae; A. nodi septentrionalis; A. Saturni eiusque portionis diminutio (e.p.d. *om.* Fj); A. Iovis eiusque (eiusdem Eh) portionis diminutio; A. Martis eiusque (eius Eh) portionis diminutio; A. portionis Veneris; A. portionis Mercurii". – Eh shows legible headings for the first and for the last 4 sub-tables.

Versions. In Co Fj there are four entrance columns, each of them common to two sub-tables; Ou has two entrances, for four sub-tables each. Eh is uncertain.

Parallel tables. The first 12 values in each table are the same as in Albattani, Nallino II p.187. I do not know the origin of the remaining values.

Values. The table should show the mean motions during tropical years of 365;14,26 days; cf. Nallino, above. The likely tabular differences (to be applied *modulo* 360° in all cases) are as follows, with reconstructed Albatenian values for comparison:

	Diff. QB31	(Albattani)	
.Lum:	132;33,20°	(132;33,18,39...)	
.Lua:	91;51;42°	(91;51,41,45...)	
.Cpt:	19;20,23°	(19;20,23,22...)	
.Sat:	12;14, 8°	(12;14, 7, 4...)	
.Iup:	30;21,50°	(30;21,49,53...)	
.Mar:	191;24,49°	(191;24,48,43...)	
.Ven:	225;10,50°	(225;10,48, 8...)	
.Mer:	54;41,25°	(54;41,37,32...)	(??)

These tabular differences are here used for recomputation; in this way the tabular values are normally reproduced to within 1 minute.

The "Albattani" values shown above are equal to the reconstructed values of the mean motion per day (listed under CA* above) multiplied by the 365;14,26 days of the tropical year. They agree well with the tabular differences, except in the case of Mercury; but the Mercury table is anyhow imprecise; cf. the following.[1]

Irregularities: In the table for Mars, the values for items 1-10 (well attested in all sources) may presuppose a tabular increment of 191;25° or a trifle less. Items 11-12, which are presumably still by Albattani, disagree with this, as does the rest of the table.

1 The Albatenian value for the motion of Mercury, found under CA*, is suspect too, since it shows a noticeable difference to the Toledan one. However, using the Toledan value instead would give a 1-year value of 54:41,36,59..., so the difference is negligible in the present connection.

The Mercury table has a disturbance on the stretch .Mer:u10-21, here interpreted as a slide and emended accordingly in the transcription. Even then, the table increases irregularly, and is difficult to repair. The edited text is a compromise.

Text. Values from Ou Co Fj. Headings according to Co, with one correction. – Also quoted: **$ba** = Albattani, Paris Arsenal 8322, 93v (years 1-12 only, for all sub-tables). It does not seem to differ systematically from the present tables; for the errors see below. – **$c** = recomputation; see "Values". Deviations of 1′ are not noted in the apparatus.

Coverage:	years 1-12:	`Ou Co Fj $c $ba;`
	years 13-36:	`Ou Co Fj $c.`

Readings chosen. I normally adopt the majority of Ou Co Fj, but I use the reading of $c where it differs from the majority by more than a few minutes. Adopted readings that have no support among Ou Co Fj are italicized. I underscore a few readings that have been left as they are in the manuscripts.

Variant readings. The three collated witnesses have many errors in common. *Ou Fj* clearly form a group against *Co*; either party may or may not be correct against the other. The three together are often in error against *$ba* (e.g., at .Mer:u10-12); in other places (.Lum:b11, etc.) they are correct, in which case $ba mostly shows Abjad-type errors. Further, at .Iup:m8-12,n8-12, $ba shares a conspicuous error with Nallino's manuscript of Albattani (cf. Nallino II p. 295), whereas our witnesses show the correct values.

The errors common to our witnesses do not include any obvious Abjad ones; on the contrary, at Ven:r26, one may suspect a Roman-numeral "lxviiii" for the correct "lx'iiii". Nor do the witnesses seem to share any errors with $ba. Thus it is possible (though perhaps unlikely) that the present table is independently calculated, even on the interval it shares with $ba.

Tabula augmentationis secundum temporis revolutiones et annorum medios cursus et mensium et dierum et horarum.

Numerus annorum perfectorum	(Lum) Augmentum medii cursus lunae Gr	Mi	(Lua) Augmentum portionis lunae Gr	Mi	Numerus annorum perfectorum	(Cpt) Augmentum nodi septentrionalis Gr	Mi	(Sat) Augmentum Saturni eiusque portionis diminutio Gr	Mi
1	132	33	91	52	1	19	20	12	14
2	265	7	183	43	2	38	41	24	28
3	37	40	275	35	3	58	1	36	42
4	170	13	7	27	4	77	22	48	57
5	*302*	47	99	19	5	96	43	61	11
6	75	20	191	*10*	6	116	3	73	25
7	207	53	*283*	2	7	135	23	85	38
8	340	*27*	14	54	8	154	44	97	53
9	113	1	106	45	9	174	3	110	7
10	245	34	198	37	10	193	24	122	21
11	18	7	290	29	11	212	44	*134*	35
12	150	40	22	20	12	*232*	4	146	50
13	283	14	114	12	13	251	25	*159*	4
14	55	47	*206*	4	14	270	45	171	18
15	188	20	*297*	56	15	290	6	183	32
16	320	53	29	47	16	309	26	195	46
17	93	27	121	39	17	328	47	208	0
18	226	0	213	31	18	348	7	220	14
19	358	33	305	22	19	7	28	232	29
20	131	6	37	14	20	26	48	244	43
21	263	40	129	6	21	46	8	256	57
22	36	13	220	57	22	65	29	269	11
23	168	47	312	49	23	84	49	281	25
24	301	20	44	41	24	104	10	293	39
25	73	*54*	136	33	25	123	30	305	53
26	206	*27*	228	23	26	142	51	318	7
27	339	0	320	16	27	162	10	330	22
28	111	33	52	8	28	*181*	31	342	36
29	244	7	143	59	29	200	51	354	50
30	*16*	40	235	51	30	220	12	7	4
31	149	13	327	43	31	239	32	19	18
32	281	46	59	34	32	258	52	31	32
33	54	20	151	26	33	278	13	43	46
34	186	53	*243*	17	34	297	33	56	0
35	319	26	335	9	35	316	54	68	14
36	91	59	67	1	36	336	14	80	29
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)

(b2) 165 Co $ba. **(b5)** 302: $ba $c; 301 *omnes.* **(b10-12)** 244 38 40 $ba. **(b17)** *n.l.* Ou. **(b23)** 168: Co $c; 169 Ou Fj. **(b30)** 16: $c; 15 Co; 111 Ou Fj. **(c1-4)** 133 50 17 53 $ba. **(c8)** 20 Ou Fj. **(c11-12)** 87, 7 $ba. **(c25)** 53 Ou Fj. **(c26)** 27: $c; 37 *omnes.* **(d2)** 173 $ba. **(d7)** 283: $c; 293 Ou Fj; 294 Co; 253 $ba. **(d9)** 86 $ba. **(d11)** 190 $ba. **(d14)** 206: $c; 203 *omnes.* **(d15)** 297: $c; 290 *omnes.* **(d17)** *n.l.* Ou. **(d25)** 196 Ou Fj. **(d34)** 243: $c; 143 *omnes.* **(e2)** 49 Ou Fj. **(e5)** 59 $ba. **(e6)** 10: $ba $c; 20 *omnes.* **(e8)** 14 $ba. **(e9)** 85 (!) Ou. **(e11)** 25 $ba. **(e34)** 10 Ou Fj. **(f)** *columnam om.* Ou. **(g4)** 77: $ba $c; 76 Ou Fj; 72 Co. **(g11)** 140 $ba. **(g12)** 232: $ba $c; 222 *omnes.* **(g28)** 181: $c; 191 *omnes.* **(g34)** 247 Ou Fj. **(h5)** 42 $ba $c. **(h8)** 45 $ba; 43 $c. **(h9)** 8 $ba. **(h15)** *n.l.* Ou. **(j1)** 32 $ba. **(j2)** 14 Co. **(j5)** 62 Ou. **(j7)** 105 $ba. **(j11)** 134: $ba $c; 133 *omnes.* **(j13)** 159: $c; 158 *omnes.* **(j14)** 161 Co. **(j35)** 58 Co. **(k5-6)** 1, 2 $ba. **(k7)** 39 $ba $c. **(k10)** 121 $ba. **(k36)** 39 Co.

	(Iup)		(Mar)			(Ven)		(Mer)	
Numerus annorum perfectorum	Augmentum Iovis eiusque portionis diminutio		Augmentum Martis eiusque portionis diminutio		Numerus annorum perfectorum	Augmentum portionis Veneris		Augmentum portionis Mercurii	
	Gr	Mi	Gr	Mi		Gr	Mi	Gr	Mi
1	30	22	191	25	1	225	11	54	42
2	60	44	22	50	2	90	22	109	23
3	91	6	214	15	3	315	33	164	4
4	121	27	45	40	4	180	43	218	45
5	151	49	237	5	5	45	54	273	27
6	182	11	68	30	6	*271*	5	328	8
7	212	33	259	55	7	136	16	22	50
8	242	55	91	20	8	1	27	77	33
9	273	17	282	45	9	226	38	132	14
10	303	38	114	9	10	91	48	186	*55*
11	334	0	305	33	11	316	59	241	*34*
12	*4*	22	136	57	12	182	10	296	*15*
13	34	44	328	22	13	47	21	350	*57*
14	65	6	*159*	47	14	272	32	45	*39*
15	95	28	351	12	15	137	43	100	*21*
16	125	49	182	37	16	2	53	155	*4*
17	156	11	14	2	17	228	4	209	*45*
18	186	33	205	26	18	93	15	264	*28*
19	216	55	36	51	19	318	26	319	<*>
20	*247*	17	228	16	20	183	37	13	<*>
21	277	38	59	41	21	48	48	68	<*>
22	308	0	251	6	22	273	58	123	11
23	338	22	82	31	23	139	9	177	53
24	8	44	273	56	24	4	20	232	35
25	39	6	105	20	25	229	31	287	16
26	*69*	28	296	45	26	*94*	42	*341*	57
27	99	50	128	10	27	319	53	36	38
28	130	11	319	35	28	185	3	91	19
29	160	33	151	0	29	50	14	146	1
30	190	55	342	25	30	*275*	25	200	42
31	221	17	*173*	50	31	140	36	255	24
32	251	39	5	15	32	5	47	310	5
33	282	1	196	39	33	230	58	4	47
34	312	23	28	4	34	96	8	59	33
35	*342*	44	219	28	35	321	18	114	15
36	13	6	50	54	36	186	29	168	57
(L)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)

(m8) 241 Co; 142 $ba. **(m9-12)** 214, 242, 273, 63 $ba. **(+m12)** 4: $c; 3 *omnes.* **(m20)** 247: $c; 246 *omnes.* **(m26)** 69: $c; 59 *omnes.* **(m28)** 130: Co $c; 129 Ou; 190 Fj. **(m35)** 342: $c; 343 *omnes.* **(n6)** 51 $ba. **(n8)** 15 $ba. **(n9-12)** 33 15 40 38 $ba. **(n15)** *n.l.* Ou. **(n16)** 39 Co. **(n26)** 38 Ou Fj. **(o1)** 141 $ba. **(o5)** 334 $ba. **(o7)** 229 $ba. **(o9)** 222 $ba. **(o11)** 65 $ba. **(o14)** 159: $c; 160 *omnes.* **(o16)** 192 Co. **(o28)** 318 Co. **(o31)** 173: $c; 174 *omnes.* **(p2)** 7 $ba. **(p7)** 35 $ba. **(p9)** 43 $c. **(q)** *columnam om.* Ou. **(r2-3)** 91, 65 $ba. **(r6)** 271: $ba $c; 281 *omnes.* **(r10)** 81 Co. **(r11)** 306 $ba. **(r17)** 128 Ou Fj. **(r25)** 129 Ou Fj. **(r26)** 94: $c; 69 *omnes.* **(r30)** 275: $c; 285 *omnes.* **(s1)** 51 $ba. **(s5)** 14 $ba. **(s7)** 36 $ba. **(s11)** 9 $ba. **(s35)** 14 Ou. **(t2)** 81 $ba. **(t4)** 238 $ba. **(t11)** 251 $ba. **(t26)** 341: $c; 342 *omnes.* **(u3)** 40 $ba. **(u4)** 25 Co. **(u10-12)** 55 34 15 *scripsi;* 15 34 15 $ba; 54 36 17 $c; 50 (5 Ou Fj), 33 (23 Co), 14 *omnes, cf. (u7-9).* **(u13-21)** 55 34 15, 57 39 21 4, 46 (45 Co), 28 *omnes;* 58 40 21 3 44 26 7 48 30 $c. **(u34-36)** 28 10 51 $c.

QB32. Excess revolution in degrees, 108 years, Albatenian.

The first 20 values are the same as in the table of Albattani, Nallino II p. 188, column "anni singuli ... tempora ascensionum".

Witnesses: **{k}** Eh,102r; Ou,78v; Co,171v; **{d}** Fj,83v. — Placed after QB31 in Ou Co Fj. — *Canons:* Ca191, citing "in tabula horarum revolutionis", sub-tables: "in linea annorum perfectorum Romanorum", "ex augmento temporis ascensionum". These references agree well with the headings shown below. The canon is comparable to Albattani E (Nallino I p. 148). — *Headings:* as shown. Variant in Fj: "Augmentum temporum...".

Text. Values from Ou Co Fj. Headings according to Co. — Also quoted: **$ba** = Albattani, Paris Arsenal 8322, 93v (years 1-20 only).

The table ought to show the relevant multiples of 86°36′ *modulo* 360°. I reproduce these values throughout, italicizing where they have no support in the manuscripts.

It is unclear how the witnesses are interrelated. In (b8) *Ou Fj* have an error in common, so the tradition may be the same as for QB31, q.v. The error looks like an Abjad one, so perhaps the present table is from the Arabic, whether or not QB31 is. There are some errors common to all three witnesses collated; none of them is obviously of Abjad type.

Tabulae horarum revolutionis annorum.

Anni Roma norum perf ecti	Aug menta tempo rum ascen sionum Gr	Mi	Anni Roma norum perf ecti	Aug menta tempo rum ascen sionum Gr	Mi	Anni Roma norum perf ecti	Aug menta tempo rum ascen sionum Gr	Mi
1	86	36	37	324	12	73	201	*48*
2	173	12	38	50	48	74	*288*	24
3	259	48	39	137	24	75	15	0
4	346	24	40	224	0	76	101	36
5	73	0	41	310	36	77	188	12
6	159	36	42	37	12	78	274	48
7	246	12	43	123	48	79	1	24
8	332	48	44	210	24	80	88	0
9	59	24	45	297	0	81	174	36
10	146	0	46	23	36	82	261	12
11	232	36	47	110	12	83	347	48
12	319	12	48	196	48	84	74	24
13	45	48	49	283	24	85	161	0
14	132	24	50	10	0	86	*247*	36
15	219	0	51	96	36	87	334	12
16	305	36	52	183	12	88	60	48
17	32	12	53	269	48	89	147	24
18	118	48	54	356	24	90	234	0
19	205	24	55	83	0	91	320	36
20	292	0	56	*169*	36	92	47	12
21	18	36	57	256	12	93	133	48
22	105	12	58	*342*	48	94	220	24
23	191	48	59	69	24	95	307	0
24	278	24	60	156	0	96	33	36
25	5	0	61	242	36	97	120	12
26	91	36	62	*329*	12	98	206	48
27	178	12	63	55	48	99	293	24
28	*264*	48	64	142	24	100	20	0
29	351	24	65	229	0	101	106	36
30	78	0	66	315	36	102	193	12
31	164	36	67	42	12	103	279	48
32	251	12	68	128	48	104	6	24
33	337	48	69	215	24	105	93	0
34	64	24	70	302	0	106	*179*	36
35	151	0	71	28	36	107	266	12
36	237	36	72	115	12	108	352	48
(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)

(b1) 106 $ba. **(b3)** 258 Co. **(b4)** 356 $ba. **(b8)** 352 Ou Fj. **(b11)** 132 $ba. **(b15-16)** 239, 355 $ba. **(b19)** 25 Fj; *n.l.* Ou. **(b28)** 274 *omnes.* **(b43)** 113 Ou. **(b56)** 159 *omnes.* **(b58)** 343 *omnes.* **(b62)** 229 *omnes.* **(b72)** 116 Co. **(b74)** 248 *omnes.* **(b86)** 244 *omnes.* **(b97)** 720 Co. **(b106)** 189 *omnes.* **(c19)** *n.l.* Ou. **(c66)** 26 Co. **(c73)** 49 *omnes.* **(c89)** *n.l.* Ou.

QB41. Excess revolution, "Savasorda".

Ch,15v (:Savasorda 1): "Tabula revolutionum signorum secundum Sevasortha". – Range: years 1 (1) 10 (10) 100, 200. – Sample:

Anni	Gr	Pc	Se	Te
1	88	38	37	46
2	177	17	15	32
....	...	...	...	...
10	166	26	17	52
20	332	52	35	44
....	...	...	...	...
100	224	22	58	40
200	88	45	57	20

The values that correspond to multiples of 10 years are all exact multiples of the 10-year value. If this is accepted as the intended one, the excess revolution will be 88;38,37,47,12°, and this has been listed under Q* above. The values for years 1-6 are, however, close to multiples of the 1-year value, which is likely to be faulty.

In any case the excess revolution is far from that implicit in the Almagest, which is 88;48°.

QB51. Excess revolution in degrees.

Three sub-tables in a row, for years 1(1)10, 10(10)100, 100(100)1000, under a common heading.

Witnesses: **{aX}** Fj2,111r; **{aT}** Lu,86r; P,81v. – *Headings:* as shown. Variant in Lu: "...revolutionis (+annorum Lu) ad extrahendum...". – Headings for sub-tables: "Unitates; Ascensiones; Anni collecti per 10; Ascensiones; Anni collecti per 100; Ascensiones", everywhere.

Text. Values from Fj2 Lu P. Headings according to Lu. – The excess revolution of 92;21,30° per year appears to be a rare value; I have not found it elsewhere. There are no errors in the text as adopted.

Tabula scientiae ascendentis revolutionis annorum ad extrahendum dominum anni.

Uni tates	Ascensiones Gr	Mi	Se	Anni col lecti per decem	Ascensiones Gr	Mi	Se	Anni col lecti per centum	Ascensiones Gr	Mi	Se
1	92	21	30	10	203	35	0	100	235	50	0
2	184	43	0	20	47	10	0	200	111	40	0
3	277	4	30	30	250	45	0	300	347	30	0
4	9	26	0	40	94	20	0	400	223	20	0
5	101	47	30	50	297	55	0	500	99	10	0
6	194	9	0	60	141	30	0	600	335	0	0
7	286	30	30	70	345	5	0	700	210	50	0
8	18	52	0	80	188	40	0	800	86	40	0
9	111	13	30	90	32	15	0	900	322	30	0
10	203	35	0	100	235	50	0	1000	198	20	0
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)

(f50) 247 Lu. **(m)** *columnam om.* Lu.

QB52. Excess revolution in degrees.

Witness: **{d}** Lb,56v (another copy at 64r, without headings and entrances). – Occurs in a framework together with QB53 and QB54. Both the latter are found separately in Ct(m2); in Class {d}, QB54 is attached to JA54.

Text. From Lb,56v. The same values are in Lb,64r. – The excess revolution is 92;21,36° per year, exactly. Emendations have been made accordingly.

Tabula revolutionis annorum.

Revolutio annorum in decenis.				Revolutio annorum in unitatibus.			
Decenae	Gr	Mi	Se	Unitates	Gr	Mi	Se
10	203	36	0	1	92	21	36
20	47	12	0	2	184	43	12
30	*250*	48	0	3	277	4	48
40	94	24	0	4	9	26	24
50	298	0	0	5	101	48	0
60	141	36	0	6	194	9	36
70	345	12	0	7	*286*	31	12
80	188	48	0	8	18	52	48
90	*32*	24	0	9	111	14	24
100	236	0	0	10	203	36	0
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

(b30) 50 Lb. **(b90)** 33 Lb. **(f7)** 186 Lb.

QB53. Time of thirteenths of a year; preceding QB54.

There are two versions, which differ in the same way as do those of QB21(A).

Witnesses: **{a0}** Ct,1v(m2); **{d}** Lb,56v (= Lb2); copy on Lb,64r (= Lb3). – *Context.* Preceding QB54, Ct Lb2 Lb3. In Lb2 and Lb3, QB53 and QB54 belong to a framework together with the revolution table QB52. – *Headings:* as shown. Lb2 has the upper heading "Tabula revolutionis mensium et dierum" which also covers QB54. All headings are blank in Lb3.

Values. Both versions are meant to yield multiples of 28d 2h;17,30. This is unlikely for a lunar month. The 13-"months" value is, on the other hand, a known length of a tropical year: indeed, the same value (excess revolution 86;52,30°, equivalent to a year of 365d 5h;47,30), is in the Malines tables, Xg,80v.

Thus the table may indeed be intended to show thirteenths of a year. If so, it is analogous to QB64 (Alfonsine?), which serves as a "month"-table for a table of revolution of years. I do not know the purpose of such tables.[1]

---

1 I have not been in a position to verify the statement in the preface to Robert Graves' *The Greek Myths*, according to which it was popular usage in the Middle Ages to divide a year into thirteen "common-law months", each of 28 days. His example, from the beginning of the ballad "Robin Hood and the curtal friar", is attested no earlier than the mid 17th century, and appears to present various textual difficulties.

Headings and values of Ct:

Tabula mensium.

Menses	Di	Ho	Mi
1	28	2	17
2	56	4	35
3	84	6	52
4	112	9	10
5	140	11	27
6	168	13	45
7	196	16	2
8	224	18	20
9	252	20	37
10	280	22	55
11	309	1	12
<12>	<337>	3	30
<13>	<365>	*5*	*47*

(13) =*calc.;* <365>.6;46 Ct.

Headings and values of Lb2 + values of Lb3:

Revolutio mensium.

Menses	Di	Ho	Mi	
1	28	2	17	30
2	56	4	35	
3	84	6	52	30
4	112	9	10	
5	140	11	27	30
6	168	13	45	
7	*196*	16	2	30
8	224	18	20	
9	252	*20*	37	30
10	280	22	55	
11	309	1	12	30
12	337	3	30	
13	365	5	47	30
14	393	7	<*>	

(7) 196d: 166 Lb2 Lb3.
(9) 20h: 25 Lb2 Lb3.
(14) 393.8;50 *calc.*

QB54. "Diaetae lunae...", attached to JA54, or "Revolutio dierum", following on QB53.

Discussed by Goldstein / Chabás / Mancha 1994 p.90; values printed, p.93; the parameter is isolated though not identified. — It ought to be investigated whether this table, plus perhaps QB52 and QB53, are from an astrological work.

Witnesses: **{a0}** Ct,1v(m2). — **{d}** Lb,38r (= Lb1); Lb,56v (= Lb2); Lb,64r (= Lb3, perhaps an apograph of Lb2; see below); Pa,56v; A,236r; Fj,57v; Gr3,130r; Mh,9v. — In {d} Lb the table occurs 3 times, in two different contexts; see below.

Headings and versions.

(A) In Ct Lb2 Lb3 our table follows on QB53. In Ct it only has the column-headings **Dies; Horae; Minuta,** which are obviously wrong. — In Lb2 the whole set is headed **Tabula revolutionis mensium et dierum,** and our table has the title **Dies; Revolutio dierum [Horae; Minuta],** much as in Ct. — Lb3 has the same grouping but no titles.

(B) In {d:} Lb1 Pa A Fj Gr3 Mh, the table is attached to JA54, keeping its own entrance column, and has the heading **Dies lunae; Diaetae lunae in circulo signorum** (hdg. absent in Lb1; here it has the mistaken column-headings "Gr Mi Se").

Parallel. A table with the same values (expressed as signs, degrees and minutes) is in a set of tables for Ferrara (Pc,6v), in a secondary hand among some astrological lists. Heading: "Vera loca lunae / Diaeta lunae in circulo signorum", much like those of version (B). A gloss, partly faint, has "adde<....> gradibus solis <...> i dies i".

Values. The table contains the first 29 multiples, modulo 360, of a number close to 13;52,54,25. The value is certainly in degrees and minutes despite the headings of Ct Lb2 Lb3, but it is difficult to take it for any kind of mean lunar motion, as is stated by the headings in {d}. The corresponding period of revolution, a little less than 25;56 days, seems unknown too.

The adopted values are all reproducible as multiples of 13;52,54,25, except that one should have 235;59 at 17 days. No parameter value will reproduce the values exactly.

Text. Values from Ct Pa A; Lb1 = Lb(38r); Lb2 = Lb(56v); Lb3 = Lb(64r). – Headings according to Pa.

It is likely that *Pa A Lb1* form an error group against the rest (correction in A, at (b5)?), and that *Lb2 Lb3* form a different one; Lb3 may be an apograph of Lb2, cf. (b7). In the entry for 29 days, however, all those mentioned, including Lb2-3, have an error against Ct; so either all of them form a group against Ct, or else the entry for 29 days is cross-copied between Lb1 and Lb2+3.

This classification roughly corresponds to versions A-B above. Probably, then, there are two traditions.

Dies lunæ	Diætæ lunæ in circulo signorum Gr	Mi
1	13	53
2	27	46
3	41	39
4	55	32
5	69	25
6	83	17
7	97	10
8	111	3
9	124	56
10	138	49
11	152	42
12	166	35
13	180	28
14	194	21
15	208	14
16	222	7
17	236	0
18	249	52
19	263	45
20	277	38
21	291	31
22	305	24
23	319	17
24	333	10
25	347	3
26	0	56
27	14	48
28	28	41
29	42	34
(a)	(b)	(c)

(b5) 69: Ct A Lb2 Lb3; 99 Pa Lb1. **(b7)** 79 Lb3. **(b13)** 108 Lb1. **(b15)** 204 Lb2 Lb3. **(b22)** 305: Ct Lb2 Lb3; 315 Pa A Lb1. **(b29)** 42: Ct; 30 Pa A Lb1 Lb2 Lb3. **(c5)** 25: Ct Lb2 Lb3; 28 Pa A Lb1. **(c6)** 27 Lb2 Lb3. **(c11)** 45 Lb2 Lb3. **(c12)** 35: Ct Lb2 Lb3; 38 Pa A Lb1. **(c19)** 47 Lb2 Lb3. **(c29)** 34: Ct; 32 Pa A Lb1 Lb2 Lb3.

QB55 Vz,46v, text-hand, note to table of mean lunar motion: "Motus lunae in die in circulo signorum 13 gr 53 mi". This is perhaps an extract from QB54, version B.

QB6*. Excess revolution, etc., Alfonsine?

All these items occur in mss. Cu or Pn. Of these, Pn chiefly consists of tables attributable to John of Lignères.

QB61. Cu,87v (secondary, 14-15th c.), Pn,55v: "T. revolutionis ascensionum annorum (a.a.: Pn; ascendentium Cu)". – Ranges: AD 1 (1) 20 (20) 100 (100) 1500, 2000, 4000 Pn; same but ending in year 800, Cu. – The table gives multiples of 87;19,6°, without any hidden sexagesimals, in both Pn and Cu. Value for 800 years: 14;40,0° (6 Cu) Cu Pn. The table is not the same as in the Ratdolt printing of the Alfonsine tables, for which see Poulle 1984 p. 130.

QB62. Cu,87v (secondary, 14-15th c.): "T. revolutionis annorum mundi in suis fractionibus". – Range as in QB61, ms. Cu. However, the value does not quite agree with QB61; see note under Q*. – The table gives multiples of 5h;49,16,44. Value for 800 years: 1h;3,6,40.

QB63. Pn,55v: "T. revolutionis ascensionum annorum in fractionibus temporis". Range as in QB61, ms. Pn. – Like QB62, but with 5h;49,16 for 1 year and 0h;53,20 for 800 years. The value appears to be abridged from a standard Alfonsine one; cf. note to QB64.

QB64. Pn,55v, "Tabula revolutionis mensium", on a page together with two tables for excess revolution, perhaps by John of Lignères. It is in the Ratdolt printing of the Alfonsine tables (Poulle 1984 p. 130). Our table was no doubt made by dividing a standard year into 13 equal parts, cf. Poulle's commentary (1984 p. 193). An analogous table is QB53. – The present value for 13 months coheres with the rest of the table. The same value is quoted by John of Murs (Poulle 1980 p. 253); John reads "34" in the 4ths' place, like the Ratdolt copy and our table. However, in two other places (Poulle 1980 p. 251, 252) John presents the value sexagesimally, as an Alfonsine "quantitas anni vera" of 365;14,33,9,59,20,7,30 days.[1] This entails the reading "44" in the 4ths' place. John appears to imply that our value is derived from the sexagesimal one; if so, "44" would be correct.

Text. From Pn. The slide in the column of thirds has been corrected from a recomputation. The Ratdolt copy shows the correct readings.

Numerus mensium	Di	Ho	Mi	Se	3a	4a	5a
1	28	2	17	38	*9*	11	51
2	56	4	35	16	*18*	23	42
3	84	6	52	54	*27*	35	33
4	112	9	10	32	*36*	47	24
5	140	11	28	10	*45*	59	15
6	168	13	45	48	*55*	11	6
7	196	16	3	27	*4*	22	57
8	224	18	21	5	*13*	34	48
9	252	20	38	43	*22*	46	39
10	280	22	56	21	*31*	58	30
11	309	1	13	59	<*41*>	10	21
12	337	3	31	37	*50*	22	12
13	365	5	49	15	59	<u>34</u>	3

(3a,1-12) 3, 9 18 27 36 45 55 4 13 22 31 51 Pn. **(4a,13)** 44 *recte (Poulle).*

---

1 This length of the year is slightly different from the two values actually used in the Alfonsine tables; see, e.g., Poulle 1980 p. 251 n.(a).

R. Astrology.

The present tables and lists are for judiciary astrology. They are transcribed for purposes of reference, without interpretation and largely without corrections. Tables for astrological computation are listed elsewhere. They include: BH, houses; N, projections of rays; Q, revolution of years.

RA. Dignities of planets, etc., as in Khw/M Tab. 116.

Most of the tables treated here are similar to those found in Suter's ms. "O" of Adelard's translation of Alkhwarizmi / Maslama, printed by Suter Tab.116 p.231. Some, however, show readings that are closer, e.g., to "Albattani's rose", Nallino II p. 299.

All these tables have 12 rows, one for each sign. They occur in varying combinations, listed below; those joined with "+" share an entrance column. Despite the combinations, I list each table separately.

Witnesses:

```
Ct,48v:          RA22; RA31; RA41                   (plus 1 or 2 others)

Cq2,117:                     RA41 +RA31
Fc, 58r:                     RA41; RA31
R,55v:                       RA41; RA31             (plus others)

Ey,Ir:           RA11 +RA21 +RA41 +RA31
Ch,58r:          RA11 +RA21 +RA41 +RA31             (:Savasorda 2)
Fj,93v:          RA11 +RA21 +RA41 +RA31             (plus others)

Lu,89r:          RA11 +RA21 +RA41 +RA31; RA42
P,112r:          RA11 +RA21 +RA41 +RA31; RA42
Lw,128r-v:       RA11 +RA21 +RA41; RA31 +RA42

Fc,74r:          RA11:var.  +RA41; RA31:var.
```

In most cases Fj has its own layout, with rows represented as columns and vice versa; this has not been recorded in detail.

RA11. Houses and exaltations.

Columns (a-d) are the same as in the "rose of Albattani", Nallino II p. 299, two innermost zones; for the inauthenticity of the "rose" cf. Nallino II p. 308.

Columns (a-c) are also in Khw/M, Suter p. 231 tab. 116, upper half, cols. 1-3; this table is an addition, in Suter's ms. "O" only. For other parallels see Nallino II p. 313.

Witnesses: **{a0}** Ey,Ir. — **{a1}** Fc,74r. — **{aT}** Lu,89r; P,112r. — **{k}** Lw,128r. — **{d}** Fj,93v. — **{?}** Ch,58r (:Savasorda 2).

Headings.

In common with some of RA21, RA41, RA31, as listed under RA for each witness:

(1) (in common with RA41+31:) **Tabulae cognitionis domorum et exaltationis et triplicitatum et terminorum et facierum** :: Fc(74r).

(2) (in common with RA21+41(+31):) **Tabula ad inveniendum dignitates planetarum** (**+in signis** Lw) :: P Lw.

(3: none) :: elsewhere.

This table: **(4) Exaltationes planetarum** Fc; **(5) Domini domorum; Domini exaltationum** Lu P Lw Fj Ch. — **(6: none)** Ey.

Text. Collated for values: **{a0}** Ey; **{a1}** Fc; **{aT}** Lu P; **{k}** Lw; **{?}** Ch. — Reproduced without headings, as in Ey. — Layout, etc.: Fc merges columns (b) and (c) into one column, with values of the form (Ari:)

"Domus Martis; Exaltatio solis; ...". For entries showing value "0" Fc has (Leo:) "Domus solis; Exaltatio solis; ...". Then follows col. (a), with the values of col. (d) added, perhaps in a secondary hand. – Ey lacks col. (d) except for the first "19".

The text reproduced here shows no variants from Nallino's reproduction of the pseudo-Albatenian "rose" (II p. 299; this has been emended, ibid. p. 309). I have not checked Nallino's facsimile (III p. 244).

	(Dom.)	(Exalt.)	
Ari	Mar	Sol	19
Tau	Ven	Lun	3
Gem	Mer	Cpt	3
Cnc	Lun	Iup	15
Leo	Sol	0	
Vir	Mer	Mer	15
Lib	Ven	Sat	21
Sco	Mar	0	
Sgr	Iup	Cau	3
Cap	Sat	Mar	28
Aqr	Sat	0	
Psc	Iup	Ven	27
(a)	(b)	(c)	(d)

(c,Ari) 19: *om.* Lw. **(c,Leo)** 0: cap() 0 Lw. **(c,Sco)** 0: cap() 0 Lw. **(c,Aqr)** 0: cap() 0 Lw. **(d Ari)** *om.* Lw. **(d Vir)** 18 Lu P. **(d Lib)** <-> P. **(d Sgr)** <-> P. **(d Cap)** 27 Fc.

RA11a. Variant of RA11.

R,55v shows a table "De exaltationibus planetarum" (heading secondary) with basically the same values as in RA11, (c-d), but ordered according to the planets, thus:

Sat	Lib	21
Jup	Cnc	15
Mar	Cap	28
Sol	Ari	19
Ven	Psc	27
Mer	Vir	15
Lun	Tau	3
Cpt	Gem	3
Cau	Sgr	3

RA21. Triangles by day.

Cf. the "rose of Albattani", Nallino II p. 299, next to outermost zone, or Khw/M, Suter p. 231 Tab. 116, upper half, col. 6 "Trigonalia in die" (Suter's ms. "O" only). See Nallino II p. 310 with explanation and further parallels: the values are common since Ptolemy's Tetrabiblos.

Witnesses: **{a0}** Ey,Ir; **{aT}** Lu,89r; P,112r; **{k}** Lw,128r; **{d}** Fj,93v; **{?}** Ch,58r (:Savasorda 2). – In {d} Fj, the columns appear as rows. – *Headings:* **Domini triplicitatum** (-tis Fj) Lu P Lw Fj Ch; **(none)** Ey. For the general headings in P Lw, cf. notes to RA11.

Text. From Ey Lu. For the headings, see above. – The corresponding table in Khw/M (Suter Tab. 116) reads Saturn for Mars at Tau, Vir and Cap; this is non-standard, cf. Nallino II p. 309. Nallino's reproduction of the "rose" (II p. 299) has the same values as here.

(Ari)	Sol	Iup	Sat
(Tau)	Ven	Lun	Mar
(Gem)	Sat	Mer	Iup
(Cnc)	Ven	Mar	Lun
(Leo)	Sol	Iup	Sat
(Vir)	Ven	Lun	Mar
(Lib)	Sat	Mer	Iup
(Sco)	Ven	Mar	Lun
(Sgr)	Sol	Iup	Sat
(Cap)	Ven	Lun	Mar
(Aqr)	Sat	Mer	Iup
(Psc)	Ven	Mar	Lun

RA22. Triangles, variant.

Same function as RA21. The upper half of the table serves as entrance for the lower half. – *Witness:* **{a0}** Ct,48v. – *Text,* from Ct:

Triplicitates et earum domini.

Ari	Tau	Gem	Cnc
Leo	Vir	Lib	Sco
Sgr	Cap	Aqr	Psc
Sol	Ven	Sat	Ven
Iup	Lun	Mer	Mar
Sat	Mar	Iup	Lun

RA31. Decans.

Iteration of the series of seven planets, in the order of the spheres but beginning with Mars.

Witnesses: **{a0}** Ct,48v; Cq2,117; Ey,Ir (stops with Sco). – **{aX}** R,55v. – **{aT}** Lu,89r; P,112r. – **{k}** Lw,128v. – **{d}** Fj,93v. – **{?}** Ch,58r (:Savasorda 2). — For the variant tables in Fc(58r) and Fc(74r), see RA31a-b.

Headings: **Facies signorum** Ct; **Tabula facierum** Cq2 R; **Domini facierum** Lu P Lw Fj Ch; **(none)** Ey; a text-hand gloss in Fc(58r). – For Fc(74r) and for the general heading in P, see note to RA11.

Versions. The values shown are as in Ct Ey (except that Ct uses Roman numerals); they may also have the form "10 gr. Martis" (Cq2), or they may lack numbers (Lu P Lw Fj Ch).

Parallel tables. This table, including the numbers "10", is like the tables of Zael, Introductorius (Carmody 3.6), ms. Pz, 27va, and of Alcabitius, Introductorius (Carmody 27.1a), ms. Lf, 200vb.

The series of planets is from Greek sources, though not Ptolemaic (Nallino II p. 310-11). The values are the same as in, e.g., the "rose of Albattani", Nallino II p. 299, third zone from centre, or in Khw/M, Suter p. 231 Tab. 116 "Facies" (Suter's ms. "O" only); both, however, lack the numbers "10".

Text. From Ct. – The readings are the same as in the tables of Zael or of Alcabitus, above.

Facies signorum.

Ari	Mar	10	Sol	10	Ven	10
Tau	Mer	10	Lun	10	Sat	10
Gem	Iup	10	Mar	10	Sol	10
Cnc	Ven	10	Mer	10	Lun	10
Leo	Sat	10	Iup	10	Mar	10
Vir	Sol	10	Ven	10	Mer	10
Lib	Lun	10	Sat	10	Iup	10
Sco	Mar	10	Sol	10	Ven	10
Sgr	Mer	10	Lun	10	Sat	10
Cap	Iup	10	Mar	10	Sol	10
Aqr	Ven	10	Mer	10	Lun	10
Psc	Sat	10	Iup	10	Mar	10
(a)	(b)	(c)	(d)	(e)	(f)	(g)

RA31*. Decans: variants of RA31.

RA31a. Fc,58r. – Each row is written in reverse, with the entrance on the outer right; there are no numbers "10", but a bottom entrance row has "gr 30, gr 20, gr 10".

RA31b. Fc,74r. – The entrance is folded such as to show Ari+Sco; Tau+Sgr; Gem+Cap; Cnc+Aqr; Leo+Psc; Vir+Lib. The values are the same within these pairs of signs, except the last one, so all entries except the last one show single values. There are no numbers "10".

RA41. Terms according to Egyptians.

An "Egyptian" system is attested in the Tetrabiblos, and the present values were common among the Arabs; see Nallino II p. 309-10.

Witnesses: **{a0}** Ct,48v; Cq2,117; Ey,Ir (stops with Sco). – **{a1}** Fc,58r; Fc,74r (last column secondary). – **{aX}** R,55v. – **{aT}** Lu,89r; P,112r. – **{k}** Lw,128r. – **{d}** Fj,93v. – **{?}** Ch,58r (:Savasorda 2). — Also in Lf,200v, not used. – In {d} Fj, the columns appear as rows.

Headings.

(1) Termini Aegyptiorum et dicuntur esse Hermetis Ct.
(2) Tabula terminorum Cq2.
(3) Tabula terminorum secundum Aegyptios, quos plus imitamur R.
(4) Domini terminorum, et isti termini planetarum sunt termini Aegyptiorum, et dicuntur esse Hermetis Lu P.
(5) Termini planetarum in signis secundum Aegyptios, et dicuntur esse Hermetis Lw.
(6) Domini terminorum Fj.
(7: other) :: (none) Ey Ch; a text-hand gloss in Fc(58r); for Fc(74r) and for the general headings in P Lw, see note to RA11.

Columns: **(8) Terminus 1'us; ...; Terminus 4'us; <*>** Fc; **(9: none)** elsewhere.

Parallel tables: Alcabitius, Introductorius (Carmody 1956, 27.1a), ms. Oo, 56v, with the same heading as in ms. Ct. Ascribed to Alcabitius in ms. Nc,84v (fgt., just before the Toledan tables).

Also, e.g., in: Khw/M, Suter p. 231 Tab. 116, "Fines secundum Medos" (="Mellius" (=Vellius = Wâlîs) = (Vettius) Valens, according to Nallino II p. 310 n.2). – Albumasar, Introductorius (Carmody 13.1a), ms. Xu, 171va, "Differentia nona in terminis Egiptiorum". – Zael, Introductorius (Carmody 3.6), ms. Pz, 27r, "Termini Egipt() qui dicuntur Hermetis". — Ibn al-Kammad, Madrid 10023, 65rb. — I have not looked into the provenance of any of these tables.

Text. Values from Ct Cq2 Lu. Heading from Ct. — There are no variants from the text of Alcabitius, ms. Oo, above. The other parallels have not been compared.

Termini Aegyptiorum, et dicuntur esse Hermetis.

(1)	Ari	Iup 6	Ven 6	Mer 8	Mar 5	Sat 5
(2)	Tau	Ven 8	Mer 6	Iup 8	Sat 5	Mar 3
(3)	Gem	Mer 6	Iup 6	Ven 5	Mar 7	Sat 6
(4)	Cnc	Mar 7	Ven 6	Mer 6	Iup 7	Sat 4
(5)	Leo	Iup 6	Ven 5	Sat 7	Mer 6	Mar 6
(6)	Vir	Mer 7	Ven 10	Iup 4	Mar 7	Sat 2
(7)	Lib	Sat 6	Mer 8	Iup 7	Ven 7	Mar 2
(8)	Sco	Mar 7	Ven 4	Mer 8	Iup 5	Sat 6
(9)	Sgr	Iup 12	Ven 5	Mer 4	Sat 5	Mar 4
(10)	Cap	Mer 7	Iup 7	Ven 8	Sat 4	Mar 4
(11)	Aqr	Mer 7	Ven 6	Iup 7	Mar 5	Sat 5
(12)	Psc	Ven 12	Iup 4	Mer 3	Mar 9	Sat 2
	(a)	(b)(c)	(d)(e)	(f)(g)	(h)(j)	(k)(L)

(c11) 6 Cq2. **(e12)** 7 Cq2.

RA42. Terms according to Ptolemy.

The system is from the Tetrabiblos; cf. Nallino II p. 309.

Witnesses: **{aT}** Lu,89r; P,112r; **{k}** Lw,128v. — *Heading:* **Termini Caldaeorum et Ptolomaei** (precalomei Lw) :: Lu P Lw.

Parallel tables. The values may be essentially the same as in the pseudo-Albatenian "rose", Nallino II p. 299, cf. ibid. p. 308-10; see the collation below. A table similar to the present one is in Albumasar, Introductorius (Carmody 13.1a), ms. Xu, 171va, "Differentia decima in terminis Tolomei"

Text. Values from Lu P. — Parallels quoted for values: **$bs** = Albatenian rose, from the facsimile Nallino III p. 244 (f. 197r of his ms.). **$bt** = same, as printed by Nallino (II p. 299), where the values are taken from the Tetrabiblos (Frankfurt edition, cf. Nallino II p. 309). **$ms** = Albumasar, *ms. cit.*

Our copy differs much from all three parallels, least perhaps from Albumasar. I use underscoring in the places where it differs from more than one of them. The five items in each row may be differently ordered in our table and in the parallels; such differences are not considered as variants.

For Leo-Scorpio and for Capricorn, I quote the differences row by row, putting ".." where the parallel text reads like our table. Thus the apparatus only shows the variants for Ari-Cnc, Sgr, Aqr-Psc.

Termini Caldaeorum et Ptolomaei.

(1)	Ari	Iup 6	Ven 8	Mer 7	Mar 5	Sat 4
(2)	Tau	Ven 8	Mer 7	Iup 7	Sat 2	Mar 6
(3)	Gem	Mer 7	Iup 6	Ven 7	Mar 6	Sat 4
(4)	Cnc	Mar 6	Iup 7	Mer 7	Ven 7	Sat 3
(5)	Leo	Sat 6	Mer 7	Mar 5	Ven 6	Iup 6
(6)	Vir	Mer 7	Ven 6	Iup 5	Sat 6	Mar 6
(7)	Lib	Sat 6	Ven 5	Mer 5	Iup 8	Mar 6
(8)	Sco	Mar 6	Ven 7	Iup 8	Mer 6	Sat 3
(9)	Sgr	Iup 8	Ven 6	Mer 5	Sat 6	Mar 5
(10)	Cap	Ven 6	Mer 6	Mar 5	Iup 8	Sat 5
(11)	Aqr	Sat 6	Mer 6	Ven 8	Iup 5	Mar 5
(12)	Psc	Ven 8	Iup 6	Mer 6	Mar 5	Sat 5
	(a)	(b)(c)	(d)(e)	(f)(g)	(h)(j)	(k)(L)

(c1) 5 $bs $ms; =6 $bt. **(c3)** 8 $bs. **(c4)** 7 $bs. **(e3)** 7 $bt. **(e4)** 6 $bs. **(f4)** Ven $bs $bt. **(g1)** 6 $bs. **(g2)** 6 $bs. **(g12)** 7 $bs. **(h4)** Mer $bs $bt. **(j2)** 3 $bs; 7 $ms; 4 $bt. **(j3)** 3 $bs; 5 $bt. **(j12)** 6 $ms $bt. **(k7)** Mar: P; Mer Lu. **(L1)** 5 $bs $ms; =4 $bt. **(L2)** 4 $bs $bt $ms. **(L12)** 4 $bs $bt $ms.

(5)	Mer 6	Ven 7	Iup 6	Sat 7	Mar 4	$bs;
	Mer 7	Ven 6	Iup 6	Sat 6	Mar 5	$bt;
	..	..	Ven 6	Iup 6	Mar 5	$ms.
(6)	..	Ven 5	Iup 6	Mar 6	Sat 5	$bs;
	..	..	..	Mar 6	Sat 6	$bt.
(7)	..	..	Iup 8	Mer 6	Mar 5	$bs;
	..	..	Iup 8	Mer 5	..	$bt;
	..	..	Iup 8	Mer 6	..	$ms.
(8)	..	Iup 8	Ven 7	Mer 7	Sat 6	$bs;
	..	Iup 8	Ven 7	..	..	$bt;
	..	Iup 8	Ven 4	..	Sat 6	$ms.
(10)	..	Mer 8	Iup 7	Mar 3	Sat 6	$bs;
	..	..	Iup 7	Mar 6	..	$bt;
	..	Mer 8	Iup 4	Mar 5	..	$ms.

RB. Lunar mansions.

RB11. Lunar mansions, rota.

Fj,95v, no heading: Rota with 28 numbered sectors, each divided into an outer and an inner part. Some glosses are added in the main hand, one of which mentions a Liber Imbrium.[1] – Sample:

(Sector)		(Outer part)		(Inner part)	
Auster	1.	Albocayn	felix	Allazel	azunet
	2.	Althorage	infelix	Agasie	<<humida>>
	3.	Aldebaran	infelix	Azubene	<<humida>>
	4.	Albachaa	felix	Alchil	<<humida>>
	5.	Almatha	infelix	Alchalb	.i. cor scor.
....	......	....	....	....	....
(Oriens)	27.	Allobut	felix	Alzari	<<humida>>
	28.	Anather	infelix	Allaasem	<<temperata>>

RB12. Lunar mansions, list.

Mh,17r. Headings and captions from Mh. Variants to the canon from Xn,102r, are noted below. The full list of names from Mh has been printed by Millás (1942 p. 184-85).

	Nomina mansionum lunae	Si	Gr	Mi	Si	Gr	Mi	Qualitas mansionum
1.	Anatha vel Alnayth vel Alnahath vel Anathe	Ari	8	30	Ari	0	0	Temperata
2.	Alocaym vel Acchaycaym	Ari	21	21	Ari	13	20	Siccitatis
3.	Alcorayce vel Adoraya vel Alcoracen vel Pliades	Tau	4	12	Ari	26	40	Temperata
4.	Allebaran Alaharic Alcalaniz que sunt omi'a	Tau	17	3	Tau	10	0	Humoris
5.	Alicuscem Alahachab vel Alacha	Tau	29	55	Tau	23	20	Temperata p() humoris
6.	Alahana vel Atraya vel Accaya	Gem	12	46	Gem	6	40	Temperata p() humoris
...	....	...	...	...	...	...	...	....
28.	Venter piscis Abuaceg	Psc	25	38	*Ari*	0	0	Connexa

Canon: Mh, 17r, with variants from Xn,102r: "Haec tabula (+suprascripta Mh) tractat in quo gradu in quo minuto intrat luna in quamlibet (*om.* Mh) mansionem. Et intratur cum loco lunae (c.l.l.: *om.* Mh) verificato cum motu 8 sphaerae cum proximiori et minori. Et quia locus lunae in *tacuino* invenitur cum motu 8 sphaerae, et mansiones secundum Thebit (Theluch Mh) considerandae sunt sine motu, eo quod virtus mansionum procedat ex (a Mh) stellis fixis, dicamus ergo (*om.* Mh) ubi praedictae mansiones incipiant, ut per locum lunae (+in tacuino Xn) mansionem, in qua est, inveniamus. Cum fuerit igitur (i.f. Mh) luna in *tacuino* in Ar() 8 et 30, intrat in mansionem primam; cum autem fuerit in Ar() 21 et (*om.* Xn) 21, intrat in mansionem secundam, (+ cum autem fuerit in (Tau) 4 12, intrat in mansionem tertiam Xn) et sic in (de Xn) ceteris (+ subsequentibus Xn)."

The table and canon are also in Xn,102r, at the very end of a miscellany including Novara tables. In the table, the "Qualitas" column stands before the column of names, but after the number column, which is labelled "numerus". There is an extra column on the right, labelled "figurae mansionum", with dotted figures. The names of the houses are much as in Mh apart from spelling; variants are not given. There

---

1 The "liber imbrium" in question might be the "Superioris discipline" ascribed to Iafar (Carmody 1956, 12A,1), which mentions some properties of the mansions, e.g. in Vat. Pal.lat. 1398, 37v. I have not, however, checked the details.

are no variants for the numbers reproduced here; variants for the text of the canon are shown above. A secondary note says, as far as I can tell, "lun(e) secundum iiiib()um (=imbrium?? Cf. RB11)".

Both sets of longitude values are evenly spaced. The first one (starting in 8;30°, presumably the precession value spoken of) corresponds to a division into 28 mansions. The second one constitutes a division into 27 parts (though Mh and Xn erroneously read Psc 0;0° for the last value; the correct value is shown above). I do not know the purpose of this division.

RC. Properties of planets.

RC11. "Anni planetarum".

Witnesses: **{a0}** Ct,48v; **{?}** Ch,4v (:prologue). – *Heading:* **Tabula de annis planetarum** Ch; **(none)** Ct. – Sub-headings: in Ct, as shown below. Ch has the arrangement **Anni planetarum [Maiores; Medii; Minores].**

Parallel tables: Messahalla, De receptione, e.g. Vat. Barb.lat. 303, 78rb; Mc,136vb (appended to De Receptione, perhaps in a secondary hand).

A non-tabular list of the values is in Albumasar, Introductorius "Laus deo qui creavit", e.g., Par. lat. 14704, 187ra; and the values occur scattered in the planetary chapters of Alcabitius, Introductorius "Postulata" (e.g., ms. Oo, 59v and following).

A table of the values is in Ibn al-Kammad, Madrid 10023, 64v; its rows and columns are interchanged relative to the present table.

Text. Values from Ct Ch. Headings according to Ct. – Also quoted for values: **$mr** = Messahalla, ms. Barb.lat. 303, cited above (this copy is ordered like the present text; some corrections are tacitly accepted); **$am** = Albumasar, *ms. cit.* (order: Sol Ven Mer Lun Sat Iup Mar).

The order of rows is according to Ct, supported by $mr. In Ch, the order is Sat Jup Mar Sol Ven Mer Lun. – There is no consensus against any of the adopted readings.

Nomina planetarum	Anni maiores	Anni medii	Anni minores
Sol	120	39 & d.	19
Luna	108	39 & d.	25
Saturnus	57	43 & d.	30
Iupiter	79	45 & d.	12
Mars	66	40 & d.	15
Venus	82	45	8
Mercurius	76	48	20
(a)	(b)	(c)	(d)

(b Lun) 180 $mr. **(b Mer)** 96 $am. **(b Iup)** 89 $am. **(c Sol ... Mar)** & d.: et dimidium Ct; & s() Ch; *alia alii.* **(c Sol)** "39 1/2 et secundum quosdam 69 1/2" $am. **(c Lun)** "66 1/2 et secundum quosdam 39 1/2" $am. **(c Iup)** 45 Ch.

RC2*. Lucky days, etc., for planets.

RC21. Fj,94r, no heading. – Rows for Sat, Iup, Mar, Sol, Ven, Mer, Cpt, Cau; 4 columns entitled "Qui fortunati et infortunati, et qui diurni et qui nocturni; Complexiones; Qui masculini et qui feminini; Quid significent planetae".

RC22. Ps,9v, no heading. – Rows for Sat, Iup, Mar, Sol, Ven, Mer, Cpt; columns for the aspects sextile, trine, quarter, opposition, and conjunction. Text in cell for Saturn, sextile: "Dies fortunatus, bonum est in ea iungi consulibus et agere res eorum". – Similar tables are in Mf,123r and Fd,73v, both appended to Zael, Introductorius "Omnibus planetis".

RD. Properties of planets in houses.

RD11. R,55v: "De gaudiis", a secondary heading for the following list, repeated for the gloss below, which is in the text-hand. – Text:

```
Mercurius   in ascendente
Luna        in tertio
Venus       in quinto
Mar         in sexto
Sol         in nono
Jupiter     in undecimo
Saturnus    in duodecimo

Diurni      in oriente
Nocturni    in occidente.
```

Gloss: "Superiores gaudent in quarta masculina; inferiores in quarta feminina; Mercurius in utraque gaudet".

RE. Properties of planets in signs.

RE11. Dignities.

Witnesses: **{aT}** Lu,89r; P,112r; **{k}** Lw,127v; Cn,104v(m2). – Variant in R(55v): see RE11a. – *Context:* astrological, close to RA11+ in Lu P Lw. – *Headings:* **Quot in signo planeta dignitates habeat** Lu P. – (Tabula ad inveniendum+ Cn) **Quot dignitates habent planetae in signis** Lw Cn.

Text. Collated for values: Lu Lw; (from RE11a:) R. – Heading from Lu.

Quot in signo planeta dignitates habeat.

Signa	Sat	Iup	Mar	Sol	Ven	Mer	Lun
Ari	5	5	8	8	3	2	0
Tau	3	2	5	0	10	4	8
Gem	5	6	3	1	2	10	0
Cnc	2	6	5	0	6	3	9
Leo	6	6	3	8	2	2	0
Vir	2	2	5	1	6	12	3
Lib	10	6	2	0	7	5	1
Sco	2	2	11	1	6	2	3
Sgr	6	10	5	3	2	3	1
Cap	7	3	10	1	5	2	3
Aqr	10	5	2	0	3	6	1
Psc	3	8	6	0	9	2	3

(Tau,Mer) 4: Lu Lw; 3 R. **(Leo,Sat)** 6: R Lu Lw.pc; 8 Lw.ac. **(Vir,Sol)** 1: R Lu; 0 Lw. **(Sgr,Mar)** 5: Lu Lw; 2 R. **(Psc,Mer)** 2: R Lu; 6 Lw.

RE11a. R,55v: "Quot in signo dignitates habeat quilibet planeta". – The numbers are standard, but the columns stand in the order Sol Ven Mer Luna Sat Iup Mar.

RE21. Dignities.

Vm,32r, no heading; placed after all other tables, close to AD31 and AD12. Each number apparently denotes a certain kind of "dignity". The system has some relation to that of RE11: for the sun, at least, RE11 gives the sum of the numbers listed here, though this is not the case everywhere. – Text:

Signa	Sat	Iup	Mar	Sol	Ven	Mer	Lun
Ari	2	32	5321	431	21	2	0
Tau	321	221	2	0	52	321	41
<Gem>	2	21	21	1	32	52	0
<Cnc>	2	42	12	0	21	21	531
<Leo>	21	321	321	53	2	2	0
<Vir>	32	2	2	1	21	5421	0
<Lib>	421	21	2	0	532	2	1
<Sco>	2	2	521	1	21	2	3
<Sgr>	21	532	32	3	2	21	1
<Cap>	532	21	421	1	2	32	0
<Aqr>	52	2	2	0	321	21	1
<Psc>	21	521	21	0	42	2	3

(Iup,Tau) 221: *ita* Vm. **(Mar,Cnc)** 12: *ita* Vm.

RE31. Moon in signs.

Fc,92v-93r: "Tabula lunae quid significet in unoquoque signo". In two parts, totalling 34 rows, for various actions; 12 columns, one for each sign. The following sample contains the first and last row in each part of the table. The scribe indicates that "de tela ordinando" should be moved to the end of the second part.

	Ari	Tau	Gem	Cnc	Leo	Vir	Lib	Sco	Sgr	Cap	Aqr	Psc
De emptione domus	M	B	M	M	B	B	M	M	M	M	C	B
....	...	...	...	...	...	...	...	...	...	...	...	...
De tela ordinando	C	M	B	C	M	C	B	M	C	C	C	B
De emptione bestiarum	M	B	M	M	B	M	M	M	M	M	M	M
....	...	...	...	...	...	...	...	...	...	...	...	...
De cursu equorum	B	M	B	M	B	C	B	M	M	C	M	C

RF. Properties of signs.

RF11. "Tabula praenostica Salomonis".

Pz,135r: "Tabula praenostica Salomonis". 24 rows, for various incidents; 12 columns, one for each sign. — Sample, showing the contents of the first and the last row:

	(Row 1) De sonitu domus.	(Row 24) Si vestimentum inquinatur sangui.
Ari	Bonum	Angustiam de potestate
Tau	De potestate malum	Vestimentum novum afferet
Gem	Pestem designat carnis	Pater aut mater morietur
Cnc	Inventio pecunie	Pecunie et divitie
Leo	Hospes veniet	Egritudo in persona
Vir	Bona intimatio	Dolor dentium inveniet (!)
Lib	Bonus accessus et recessus	Angustia
Sco	Egritudinem habebit	Gaudium
Sgr	Fatigatio	Letitia
Cap	Angustia super suos	Letitia in muliere
Aqr	Pecunia animalis	Adicies bonum
Psc	Bonum tibi eveniet	Invenies bonum

RF21. Triplicities.

Witness: **{a1}** Fc,74r. — *Heading:* cf. notes to RA11. — *Text:* "Aries Leo Sagittarius; Taurus Virgo Capricornus; Gemini Libra Aquarius; Cancer Scorpius Piscis".

RF3*. Various properties.

RF31. Fj,93v: "Tabula ostendens quae signa sunt masculina, quae feminina, quae stabilia, quae instabilia, quae mediocria, quae duorum negotiorum, quae unius, et cuius complexionis sit unumquodque, et in qua parte mundi vigeant". — Addition to a larger table but no doubt in the main hand. Columns are here presented as rows.

Masculina	Ari Gem Leo Lib Sgr Aqr
Feminina	Tau Cnc Vir Sco Cap Psc

Stabilia et haec annorum		Leo Tau Sco Aqr
Instabilia dierum		Ari Cnc Lib Cap
Mediocria et haec mensium		Gem Vir Sgr Psc
Duorum negotiorum		Gem Vir Sgr Psc
Unius negotii		Ari Tau Cnc Leo Lib Sco Cap Aqr
Calida et sicca	orientalia	Ari Leo Sgr
Frigida et sicca	meridionalia	Tau Vir Cap
Calida et humida	occidentalia	Gem Lib Aqr
Frigida et humida	septentrionalia	Cnc Sco Psc

RF32. R,56v shows a list containing some of these properties, and some further ones concerning signs and planets, with glosses in the main hand.

RG. Properties of certain degrees of signs.

All the values of RG11-51 occur in Alcabitius, Introductorius "Postulata a domino", though only RG41-51 are shown in tabular form.

RG11. "Gradus azimene".

R,56r, "Gradus azimene", first of three separate tables in a row, the remaining ones being "Gr. augentes fortunam; Gr. fortunati" (see RG21). — Alcabitius, Introductorius (ms. Oo, 58r) has a non-tabular list of "gradus azemena", with values like those of R. It is here shown in parallel with R.

Text of R:					*Alcabitius, ms. Oo:*	
Ari	.	.	.	.		
Tau	7	8	9	10	in tauro	6 7 8 9 10
Gem	.	.	.	.		
Cnc	9 usque ad 15				in cancro autem	9 usque ad 15
Leo	19	27	28	.	in leone	18 27 28
Vir	.	.	.	.		
Lib	.	.	.	.		
Sco	19	29	.	.	in scorpione	19 et 29
Sgr	1	7	18	19	in sagittario	1 7 18 19
Cap	26	27	ad	29	in capricorno	26 usque ad 29
Aqr	18	19	.	.	in aquario	18 19
Psc	.	.	.	.		
(a)	(b)	(c)	(d)	(e)		

(Tau b) al() 6 *add.* R *s.l.* **(Leo e)** 28 R.ac.

Gloss in R: "Gradus azimene sunt, in quibus cum luna vel dominus ascendentis vel alcocoden inventus fuerit in nativitatibus, nato debilitatem cronicam, ut surditatem vel cecitatem, decernunt; similiter etiam querentem ostendunt in aliquo membro debilem".

RG21. "Gradus augmentantes fortunam".

Witnesses: **{a0}** Ct,48v; **{aX}** R,56r. Headings as shown. – *Context and versions:* Ct contains one table, followed by table of "putei" (RG31). – R has two separate tables following on "gradus azimene" (RG11). These two tables may be the same table in two different traditions. – *Parallel:* Alcabitius; see below.

Text of Ct:

Gradus augmentantes fortunam.

(a)	(b)	(c)	(d)	(e)	(f)
Ari	19				
Tau	3	15	27	30	
Gem	11				
Cnc	1	2	3	14	15
Leo	2	5	7	17	
Vir	2	5	17	20	
Lib	3	5	21		
Sco	7	12	20		
Sgr	13	20			
Cap	13	14	20		
Aqr	7	16	17	20	
Psc	12	20			

Text of R:

Gradus augentes fortunam.

(g)	(h)	(j)	(k)	(L)	(m)
Ari	19				
Tau	3	5	10	17	
Gem	11				
Cnc	1	2	4	15	
Leo	2	5	6	7	19
Vir	3	13	26		
Lib	3	5	21		
Sco	7	18	20		
Sgr	13	20			
Cap	12	13	24		
Aqr	7	16	17	20	
Psc	13	20			

Gradus fortunati.

(n)	(o)	(p)	(q)	(r)	(s)
Ari	19				
Tau	8				
Gem	11				
Cnc	1	2	3	14	15
Leo	5	7	17	20	
Vir	2	13	20		
Lib	3	5	21		
Sco	12	20			
Sgr	13	20			
Cap	12	13	14	20	
Aqr	7	17	27		
Psc	12	20			

(Tau g) in al() taurus 3 15 27 *add.* R *mg.* **(Cnc j)** al() 3 *add.* R *s.l.* **(Vir k)** al() 20 *add.* R *s.l.* **(Cap k)** al() 14 20 *add.* R *s.l.*

Parallel in Alcabitius. Alcabitius, Introductorius (ms. Oo, 58r) has a non-tabular list of "gradus ... augmentantes fortunam". Probably the values are analogous to all those reproduced above, but it is hard to see how the sets are related to each other. – Excerpt containing the values:

Ari	19			
Tau	3	15	27	
Gem	11			
Cnc	1	2	4	15
Leo	2	5	7	19
Vir	3	13	20	
Lib	3	5	21	
Sco	7	18	20	
Sgr	13	20		
Cap	12	13	24	
Aqr	7	16	17	20
Psc	14	20		

RG31. "Putei".

Witnesses: **{a0}** Ct,48r; **{aX}** R,56r. Headings as shown. — *Versions:* The two versions differ considerably, though perhaps by accident. In Ct, this table follows table RG21 and shares its entrance column. In R, it is a separate table. — *Parallel:* Alcabitius; see below.

Text of Ct:

Gradus qui dicuntur putei.

(a)	(b)	(c)	(d)	(e)	(f)	(g)
(Ari)	6	11	17	24	29	
(Tau)	5	13	18	24	25	26
(Gem)	2	12	17	26	30	
(Cnc)	12	17	23	26	30	
(Leo)	6	13	15	22	23	28
(Vir)	8	13	16	21	25	
(Lib)	1	7	20	30		
(Sco)	9	10	17	22	23	27
(Sgr)	7	12	15	24	27	30
(Cap)	2	17	22	24	28	
(Aqr)	1	12	17	22	29	
(Psc)	4	9	24	27	28	

Text of R:

Putei stellarum.

(a)	(b)	(c)	(d)	(e)	(f)	(g)
Ari	6	11	16	23	29	
Tau	4	12	24	25	.	
Gem	2	12	17	30	.	
Cnc	11	17	23	26	30	
Leo	6	15	22	23	28	30
Vir	8	13	10	21	15	
Lib	11	7	20	30	.	
Sco	19	22	27	.	.	
Sgr	7	12	15	24	27	30
Cap	2	7	17	22	24	28
Aqr	12	17	33	29		
Psc	4	9	24	27	.	.

(Gem) in al() 11 12 17 26 30 R *mg.* **(Cnc b)** al() 12 *add.* R *s.l.* **(Leo e)** al() 13 *add.* R *s.l.* **(Leo g)** al() 0 *add.* R *s.l.* **(Vir d)** 10: *sic* R; al() 16 25 0 *add.* R *mg.* **(Vir f)** 15: *sic* R. **(Sco)** in al() 9 10 22 23 27 *add.* R *mg.* **(Aqr)** in al() 1 11 17 24 29 R *mg.* **(Aqr d)** 33: *sic* R. **(Psc f)** al() 28 R *s.l.*

Parallel in Alcabitius. Alcabitius, Introductorius (ms. Oo, 58r, top) has a non-tabular list of "gradus qui dicuntur putei". It shares features with one or the other of the versions above, in no apparent pattern. The values are:

Ari	6	11	16	23	29		
Tau	5	12	24	25			
Gem	2	12	17	26	30		
Cnc	12	17	24	26	30		
Leo	6	13	15	22	26	28	(22: 12 Oo)
Vir	8	14	16	21	25		
Lib	1	7	20	30			
Sco	9	10	22	<**>			
Sgr				<**>	30		
Cap	2	7	17	22	24	28	
Aqr	12	17	24	29			
Psc	4	9	24	27			

RG41. Male and female degrees.

Witnesses: **{aX}** R,55v; **{d}** Fj,93v. Headings as shown below. – The table is attached to RA31, both in R and Fj. – *Versions and parallel tables:* Alcabitius, Introductorius (ms. Oo, 57v): table with values resembling ms. R, and collated together with R below. – Albumasar, Introductorius "Laus deo" (ms. Par. lat. 14704 (=Xu), 173ra: table with values resembling ms. Fj, and collated together with Fj below.

Values. For each sign, the table lists how many degrees in succession are male and female; thus the sum of the numbers should be 30, and "male" and "female" should alternate.

Text of R. – Also quoted for values: **$q** = Alcabitius; cf. above. Italics are used where the reading of R has been altered, underscoring where it has been kept against $q. I transcribe "ma(sculinus)" and "fe(mininus)", regardless of the notation in the manuscripts.

R has some corrections that agree more or less with $q, and have been accepted where they cause the sum of the degrees to become 30. In Sgr, R and $q are both in error, and only the correction in R makes sense: this has been accepted though it may be a construct.

De gradibus masculinis et femininis.

Ari	ma 8	fe 1	ma 6	fe 7	ma 8		
Tau	fe 5	ma 6	fe 6	ma 4	fe 3	ma 6	
Gem	fe 5	ma 11	fe 6	ma 4	fe 4		
Cnc	ma 2	fe 6	ma 2	fe 2	ma 11	<*fe 4*	*ma 3*>
Leo	ma 5	fe 3	ma 7	fe *8*	ma 7		
Vir	fe 8	ma 4	fe 8	ma 10			
Lib	ma 5	fe 10	ma 5	fe 7	ma 3		
Sco	ma 4	fe 10	ma 3	fe 8	ma 5		
Sgr	ma 2	fe 3	ma <u>7</u>	fe *12*	ma 6		
Cap	ma 11	fe 8	ma 11				
Aqr	ma 5	fe 10	ma 6	fe 4	ma 2	fe 3	
Psc	ma 10	fe 10	ma 3	fe 5	ma 2		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

(b,Gem) fe: in al() ma R*s.l.* **(c,Sco)** 10: 12 $q.ac. **(d,Sgr)** 7: 8 $q. **(e,Leo)** 8: $q; in al() 8 R*s.l.*; 7 R.txt. **(e,Sgr)** 12: in al() 12 R*s.l.*; 8 R; 9 $q. **(f,Cnc)** 11: in al() 2 R*s.l.* **(g-h,Cnc)** *om.* R.txt; item in al() fe 4 ma 3 R.mg; f 4, m 4 $q.

Text of Fj. Columns in the transcription correspond to rows in Fj. – Also quoted: **$am** = Albumasar; cf. above. – Italics and underscoring, and the transcription of "ma(sculinus)", are as above.

Qui gradus sint in signis masculini vel feminini.

(Ari)	ma 7	fe 2	ma 6	fe 7	ma 8		
(Tau)	ma 7	fe 8	ma 15				
(Gem)	fe 6	ma 11	fe 6	ma 4	fe *3*		
(Cnc)	ma 2	fe 5	ma <u>3</u>	fe *2*	ma *11*	<*fe 4*	*ma 3*>
(Leo)	ma 5	fe 2	ma 6	fe 10	ma 7		
(Vir)	fe 7	ma 5	fe 8	<u>ma 10</u>			
(Lib)	ma 5	fe 5	ma 11	fe 7	ma 2		
(Sco)	ma 4	fe 6	ma 4	fe 5	ma 8	fe 3	
(Sgr)	ma 2	fe <u>4</u>	ma 7	fe <u>11</u>	ma 6		
(Cap)	ma 11	fe 8	ma 11				
(Aqr)	ma 5	fe 7	ma 6	fe 7	ma 5		
(Psc)	ma 10	fe 10	ma 3	fe 5	ma 2		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

(c,Sgr) 4: Fj; 3 $am. **(d,Cnc)** 3: Fj; 4 $am. **(e,Cnc)** 2: $am; 11 Fj. **(e,Vir)** ma 10: Fj; ma 3 fe 7 $am. **(e,Sgr)** 11: Fj; 12 $am. **(f,Gem)** 3: $am; 4 Fj. **(f,Cnc)** 11: $am; 2 Fj *(cf. (f,Gem))*. **(g-h,Cnc)** fe 4, ma 3: $am: *om.* Fj.

RG51. "De gradibus lucidis, obscuris ...".

Witnesses: **{aX}** R,56r; **{d}** Fj,93v. – *Headings:* as shown below, R. "Qui gradus sint in signis lucidi tenebrosi vacui fumosi" Fj.

Parallel tables: Alcabitius, Introductorius (ms. Oo, 58r): table collated together with R Fj below. – Albumasar, Introductorius "Laus deo" (ms. Par. lat. 14704 (=Xu), 173rb: table with similar values, but with many variants, most of them dissimilar to both of the manuscripts examined. Not collated.

Values. The sum of the numbers for each sign should be 30°, as in RG41.

Text. Values from R Fj. Heading and layout from R. – Fj presents the rows as columns, and vice versa. – Also collated: **$q** = Alcabitius, above. – I transcribe "lu(cidus)", "te(nebrosus)", "va(cuus)" and "fu(mosus)", regardless of the notation in the manuscripts.

The majority of R Fj $q is normally adopted; this yields the required sum of 30° for each sign. R has many errors. The entry for Vir seems difficult to emend: the corresponding row in the Albumasar copy is,

Vir	te 5	lu *4*	va 2	lu 6	*te 4*	*lu 6*	*va 3*,

which does give the required sum but is otherwise too different from our text to be helpful. The same is the case for Gem, which is also problematic, and for some of the other signs.

De gradibus lucidis, obscuris vel tenebrosis, vacuis et fumosis.

Ari	te 3	lu 5	te 8	lu 4	va 4	lu 5	va 1
Tau	te 3	lu 4	va 5	lu 3	va 5	lu 8	te 2
Gem	lu 4	te 3	lu 5	va 4	lu 6	te 5	va 3
Cnc	lu 12	te 2	va 4	fu 2	lu 8	va 2	. .
Leo	te 10	fu 10	. .	va 5	lu 5	. .	. .
Vir	te 5	lu 3	va 2	lu 6	fu 6	va 5	te 4
Lib	lu 5	te 5	lu 8	te 3	lu 6	va 3	. .
Sco	te 3	lu 5	va 6	lu 6	fu 2	va 5	te 3
Sgr	lu 9	te 3	lu 7	fu 4	lu 7	. .	. .
Cap	te 7	lu 3	fu 5	lu 4	te 3	va 3	te 5
Aqr	fu 4	lu 5	te 4	lu 8	va 4	lu 5	. .
Psc	te 6	lu 6	te 6	lu 4	va 3	lu 3	te 2
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

(b,Tau) 3: Fj $q; al() 3 R*s.l.*; 4 R. **(b,Gem)** 4: R; 7 Fj; 3 $q. **(b,Vir)** 5: R $q; 6 Fj. **(b,Sgr)** 9: Fj $q; 8 R. **(b,Cap)** 7: Fj $q; al() 7 R*s.l.*; 8 R. **(b,Aqr)** fu: Fj $q; al() fu R*s.l.*; te R. **(c,Cnc)** 2: R $q; al() 3 R*s.l.* **(d,Vir)** va: R $q; luc() Fj. **(e,Gem)** 4: R $q; 2 Fj. **(e,Vir)** 6: R $q; 7 Fj. **(e,Lib)** 3: Fj $q; 6 R. **(e,Sco)** 6: Fj $q; 2 R. **(e,Sgr)** 4: Fj $q; 7 R. **(e,Cap)** 4: Fj $q; 3 R. **(e,Aqr)** 8: Fj $q; 4 R. **(e,Psc)** 4: Fj $q; 3 R. **(f,Ari)** va: Fj $q; te R. **(f,Vir)** 6: R $q; 4 Fj. **(f,Lib)** lu: Fj $q; fu R. **(f,Cap)** 3: R $q; 2 Fj. **(g,Gem)** 5: Fj; al() 5 R*s.l.*; 3 R; 6 $q. **(g,Lib)** va: R $q; lu Fj. **(g,Cap)** 3: R $q; 4 Fj. **(h,Gem)** 3: R $q; 2 Fj. **(h Leo-Psc)** te 3, -, te 3, -, te 5, -, te 2, - R. **(+h,Vir)** 4: Fj $q; al() 4 R*s.l.*; 3 R.

S. Almanacs and ephemerides.

SA. Solar almanacs.

SA11. Solar almanac from the Old Quadrant.

This is the solar almanac that normally accompanies the treatise of the Old Quadrant "Geometriae duae sunt partes" (ed. Tannery, Mémoires scientifiques 5, 1922, p. 118-197, without these tables).

Witnesses: **{a2}** Md,117r-118v; **{k}** Eh,107r-109v; **{p}** Pd,94r-95v. – *Headings:* as shown. Variants: "...in orbe declivi fixo (*om.* Md)"; "Numerus dierum (n.d.: dies Eh)".

Parallel tables. The values are the same as in the Almanac of Humenuz, e.g. ms. Da,121r or Lg,207v-209r (observed by W. Knorr, private communication; for the Almanac of Humenuz, cf. Millás 1950 p. 152 and 378-92). The version of the Almanac in mss. Da Lg has 4 tables, analogous to the present ones, but it begins in September. In the first table below, the September sub-table reproduces this beginning, whereas the months of March until August are as in the fourth table of the Almanac. – The values are not the same as in Azarchel's Almanac as printed by Millás 1950 p. 158-65, tables 7-14.

Sample. From Md Eh; headings from Md. Not emended.

Tabula solis in anno bissextili ad inveniendum locum eius in orbe declivi.

Numerus dierum	Mar Psc Gr Mi	Apr Ari Gr Mi	Mai Tau Gr Mi	Iun Gem Gr Mi	Iul Cnc Gr Mi	Aug Leo Gr Mi	Sep Vir Gr Mi	Oct Lib Gr Mi	Nov Sco Gr Mi	Dec Sgr Gr Mi	Ian Cap Gr Mi	Feb Aqr Gr Mi
1	17 58	18 24	17 22	17 0	15 34	15 14	15 24	15 2	16 10	16 42	18 19	19 43
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
13	29 47	0 2	28 52	28 26	27 5	26 51	27 11	27 1	28 22	28 57	0 30	1 46
14	0 46	1 0	29 49	29 23	28 2	27 49	28 10	28 1	29 23	29 58	1 31	2 46
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
28	14 29	15 31	13 12	12 43	11 26	11 28	12 3	12 7	13 38	14 15	15 42	16 43
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
30	16 27	17 25	15 6	14 37	13 20	13 26	14 2	14 9	15 41	16 17	17 43	0 0
31	17 26	0 0	16 3	0 0	14 17	14 25	0 0	15 10	0 0	17 18	18 43	0 0

(Apr 28) 15°: 14 Eh. **(Apr 30)** 17°: 16 Eh. **(Aug 13)** 51′: 49 Eh. **(Aug 14)** 49′: 47 Eh. **(Aug 28)** 28′: 27 Eh. **(Nov 30)** 41′: 40 Eh. **(Dec 1)** 42′: 41 Eh. **(Ian 1)** 18°: 10 Eh. **(Ian 30)** 43′: 42 Eh.

Tabula solis in anno post bissextum ad inveniendum locum eius in orbe declivi.

Numerus dierum	Mar Psc Gr Mi	Apr Ari Gr Mi	Mai Tau Gr Mi	Iun Gem Gr Mi	Iul Cnc Gr Mi	Aug Leo Gr Mi	Sep Vir Gr Mi	Oct Lib Gr Mi	Nov Sco Gr Mi	Dec Sgr Gr Mi	Ian Cap Gr Mi	Feb Aqr Gr Mi
1	17 43	18 9	17 7	16 45	15 19	14 59	15 9	14 47	15 55	16 27	18 4	19 28
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
13	29 32	29 47	28 37	28 11	26 49	26 34	26 56	26 46	28 7	28 42	0 14	1 31
14	0 31	0 45	29 34	29 8	27 47	27 32	27 55	27 46	29 8	29 44	1 15	2 31
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
28	14 15	14 16	12 57	12 28	11 11	11 13	11 48	11 52	13 25	14 0	15 27	16 28
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
30	16 12	16 10	14 51	14 22	13 5	13 11	13 47	13 54	15 26	16 2	17 28	0 0
31	17 11	0 0	15 48	0 0	14 2	14 10	0 0	14 55	0 0	17 3	18 28	0 0

(Aug 28) 13′: 12 Eh. **(Nov 28)** 25′: 24 Eh. **(Dec 14)** 44′: 43 Eh. **(Ian 13)** 14′: 15 Eh. **(Ian 14)** 15′: 16 Eh. **(Ian 31)** 28′: 29 Eh.

Tabula solis in anno secundo post bissextum ad inveniendum locum eius in orbe declivi.

Nume	Mar	Apr	Mai	Iun	Iul	Aug	Sep	Oct	Nov	Dec	Ian	Feb
rus	Psc	Ari	Tau	Gem	Cnc	Leo	Vir	Lib	Sco	Sgr	Cap	Aqr
dierum	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi
1	17 28	17 54	16 52	16 30	15 4	14 44	14 54	14 32	15 40	16 12	17 49	19 13
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
13	29 17	29 32	28 22	27 56	26 35	26 19	26 41	26 31	27 52	28 27	0 0	1 16
14	0 16	0 30	29 19	28 53	27 32	27 17	27 40	27 31	28 53	29 28	1 1	2 16
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
28	13 59	14 0	12 42	12 13	10 56	10 57	11 33	11 37	13 10	13 45	15 12	16 13
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
30	15 57	15 55	14 36	14 7	12 50	12 56	13 32	13 39	15 11	15 47	17 13	0 0
31	16 56	0 0	15 33	0 0	13 47	13 55	0 0	14 40	0 0	16 48	18 13	0 0

(Apr 28) 0′: 1 Eh. **(Sep 30)** 32′: 31 Eh. **(Nov 28)** 10′: 9 Eh. **(Ian 30)** 13′: 12 Eh.

Tabula solis in anno tertio post bissextum ad inveniendum locum eius in orbe declivi.

Nume	Mar	Apr	Mai	Iun	Iul	Aug	Sep	Oct	Nov	Dec	Ian	Feb
rus	Psc	Ari	Tau	Gem	Cnc	Leo	Vir	Lib	Sco	Sgr	Cap	Aqr
dierum	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi	Gr Mi
1	17 12	17 39	16 37	16 15	14 49	14 29	14 39	14 17	15 25	15 57	17 34	18 58
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
13	29 2	29 17	28 7	27 41	26 19	26 2	26 27	26 16	27 37	28 12	29 45	1 1
14	0 1	0 15	29 4	28 38	27 18	27 1	27 25	27 16	28 38	29 13	0 46	2 1
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
28	13 45	13 46	12 30	11 58	10 42	10 42	11 19	11 22	12 54	13 30	14 57	15 58
....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
30	15 43	15 40	14 24	13 52	12 35	12 41	13 17	13 24	14 56	15 32	16 58	0 0
31	16 41	0 0	15 18	0 0	13 32	13 40	0 0	14 25	0 0	16 33	17 58	0 0

(Mai 28) 30′: 27 Eh. **(Mai 30)** 24′: 21 Eh.pc. **(Iul 14)** 18′: 17 Eh. **(Iul 28)** 42′: 41 Eh. **(Aug 13)** 2′: 4 Eh. **(Aug 14)** 1′: 2 Eh. **(Sep 13)** 27′: 26 Eh. **(Sep 28)** 19′: 18 Eh.

Feb 29, not listed above, has the value "0 0" (= blank) in the first three tables of Md Eh. The fourth table of Eh has the expected value "16 58" whereas Md shows "0 0".

SA21. Solar almanac dated AD 1292, extract from William of St. Cloud.

Da3,133r: "Tabula solis prima in anno bissextili ad inveniendum locum eius, verificata anno domini 1292'o". — Presumably meant to be the first of a series of tables, but the rest are absent from Da3, and f.133v is filled with other material. The collection Da3 is a late fragment, and the relevance of this table is slight.

The values for the first of each month are the same as those for AD 1292 in William of St. Cloud's Almanac (ms. Vat. lat. 4572, 1r-6v), except that this shows "Psc 19;0" for March 1. The later values for each month are William's too; however, many of them are corrupt, mainly because some of the degree-number series have been allowed to run on evenly.

Sample. Not emended. The values that differ from William of St. Cloud's Almanac (see above) are underscored, but the William readings are not quoted.

Numerus dierum	Mar Psc Gr	Mi	Apr Ari Gr	Mi	Mai Tau Gr	Mi	Iun Gem Gr	Mi	Iul Cnc Gr	Mi	Aug Leo Gr	Mi	Sep Vir Gr	Mi	Oct Lib Gr	Mi	Nov Sco Gr	Mi	Dec Sgr Gr	Mi	Ian Cap Gr	Mi	Feb Aqr Gr	Mi
1	19	59	19	28	18	26	18	4	16	40	16	22	16	27	16	5	17	14	17	44	19	22	20	47
....	.....		.....		.....		.....		.....		.....		.....		.....		.....		.....		.....		.....	
13	0	51	1	6	30	57	0	30	28	7	28	58	28	16	28	5	29	24	29	59	1	34	2	50
14	1	50	2	4	0	54	1	27	29	5	29	56	29	15	29	5	0	25	0	1	2	35	3	50
....	.....		.....		.....		.....		.....		.....		.....		.....		.....		.....		.....		.....	
28	15	36	16	33	14	16	15	48	13	29	12	33	13	6	13	11	14	41	14	17	16	45	17	47
....	.....		.....		.....		.....		.....		.....		.....		.....		.....		.....		.....		.....	
30	17	34	18	29	16	10	17	42	15	25	14	30	15	6	15	12	16	43	16	19	18	46	0	0
31	18	32	19	0	17	7	18	0	16	23	15	28	16	0	16	13	0	0	17	20	19	46	0	0

SA31. Solar almanac for months of AD 1252.

Witnesses: **{k}** Ou,76r; **{d}** Fj,83v(m2). — *Headings.* Main heading: as shown, Ou Fj. Sub-headings: "Menses (*om.* Fj); Si Gr Mi Se". — *Text,* from Ou Fj. There are no variant readings.

Anno domini 1252, qui est annus bissextilis,
loca solis in orbe declivi fixo
ad initia cuiuslibet mensis illius anni.

Menses	Signa	Gr	Mi	Se
Mar	Psc	17	3	26
Apr	Ari	17	29	46
Mai	Tau	16	30	32
Iun	Gem	16	8	46
Iul	Cnc	14	44	10
Aug	Leo	14	26	1
Sep	Vir	14	30	45
Oct	Lib	14	7	31
Nov	Sco	15	15	26
Dec	Sgr	15	45	37
Ian	Cap	17	23	18
Feb	Aqr	18	48	47

SA41. Solar almanac, days during one year.

Fj,93r: "Tabula ostendens in quo signo et gradu sit sol omni die". — The first degree of a sign is labelled with the sign-name; these names are left out in the sample below.

Gloss: "Nota quod, ubi incipiunt litterae rubeae (not shown here as they are not apparent in the microfilm), ibi est principium primi gradus signi ibi scripti secundum nonum caelum. Item, ubi sunt scuta rubea (marked as * in the table), ibi est principium primi gradus signi in eadem linea suprascripti secundum octavum caelum".

Dies mensis	Ian	Feb	Mar	Apr	Mai	Iun	Iul	Aug	Sep	Oct	Nov	Dec
	Cap	Aqr	Psc	Ari	Tau	Gem	Cnc	Leo	Vir	Lib	Sco	Sgr
	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr
1	18	19	18	18	17	16	15	16	15	15	16	16
..	...	...	...	...	...	...	...	...	...	...	...	...
13	30	1	29	30	28	28	27	27	27	27	28	29
14	1	2	30	1	29	29	28	28	28	28	29	30
15	2	3	1	2	30	30	29	29	29	29	30	1
16	3	4	2	3	1	1	30	30	30	30	1	2
17	4	5	3	4	2	2	1	1	1	1	2	3
..	...	...	...	...	...	...	...	...	...	...	...	...
21	8	9*	7	8	6	6	5	5	5	5	6	7
22	9	10	8	9	7	7	6	6	6	6	7	8
23	10*	11	9	10*	8	8	7	7	7	7	8	9
24	11	12	10*	11	9	9	8	8	8	8	9*	10*
25	12	13	11	12	10*	10*	9	9	9*	9	10	11
26	13	14	12	13	11	11	10*	10*	10	10*	11	12
..	...	...	...	...	...	...	...	...	...	...	...	...
30	17		16	17	15	15	14	14	14	14	15	16
31	18		17		16		15	15		15		17

SA51. Solar almanac, as in the Astrolabe of Hermannus.

Same as a table in the astrolabe tract by Hermannus Contractus; a printing of this table is in Patrologia Latina 143, cols. 395-396. – All columns have the same set of degree-values, though their zodiacal signs differ. In each column the value steps by one degree per day.

Witnesses: **{d}** Nc,134r; Mh,14r. A further copy is in Pz,86*bis*,r. – *Heading:* as shown below, Nc Mh. – Subheadings: as below, Mh; "Menses, Dies" in Nc.

Gloss, text-hand below table, both mss.: "Dum vis per hanc tabulam scire signum et gradum solis in quolibet die, considera in utroque latere praesentem mensem eiusque diem praesentem, et ita binis altrinsecus lineis ingredere usque ad proselidem angularem, et quorum ibi reperies numerum, desuper in eadem linea considerato signo, ipse est gradus solis quem quaeris". This is the same text as Hermannus, Patr. Lat. 143 col. 394 C-D. – Sample, from Mh:

Tabula ad inveniendum gradum solis in omni die.

Dies mensis	Ian	Feb	Mar	Apr	Mai	Iun	Iul	Aug	Sep	Oct	Nov	Dec
	Cap	Aqr	Psc	Ari	Tau	Gem	Cnc	Leo	Vir	Lib	Sco	Sgr
1	16	16	16	16	16	16	16	16	16	16	16	16
..	...	...	...	...	...	...	...	...	...	...	...	...
14	29	29	29	29	29	29	29	29	29	29	29	29
15	30	30	30	30	30	30	30	30	30	30	30	30
	Aqr	Psc	Ari	Tau	Gem	Cnc	Leo	Vir	Lib	Sco	Sgr	Cap
16	1	1	1	1	1	1	1	1	1	1	1	1
17	2	2	2	2	2	2	2	2	2	2	2	2
..	...	...	...	...	...	...	...	...	...	...	...	...
30	15	15	15	15	15	15	15	15	15	15	15	15

SB. Lunar almanacs.

SB11. Fragment of lunar almanac.

Fc2,109r-v (within tables of John of Lignères): "Medius cursus lunae in annis collectis". Scheme like Profatius' Almanac, Boffito & Melzi D'Eril 1908 p.46-7; the values are, however, different. Preserved from year 27 until year 80 (Profatius stops at 76 years), and from March to June. With a short canon. — Sample:

27y:	6 17 29 51
76y:	7 4 44 51
80y:	0 25 14 24
Mar 1:	0 20 50 35
Mar 31:	1 26 8 3
Jun 30:	5 25 10 56.

The month-table values are like those of Profatius, but augmented by 7°40'; thus the second-values are the same as in Profatius. I do not know how the year-table was made.

SB21. Old lunar almanac.

To get the sign of the moon from the age of the moon (rows) and the solar month (columns). This form is the commonest medieval one; for a description with references to some witnesses cf., e.g., F.S. Pedersen 1983 p. 14, 285ff., 393.

Witnesses: Pz,135r (at end of Toledan tables); Fc,100r (appended to a calendar at the end of the Toledan tables, in another hand than the tables); Fj,95r (in appendix to Toledan tables). — No headings.

Text. From Pz.

		Ian	Feb	Mar	Apr	Mai	Iun	Iul	Aug	Sep	Oct	Nov	Dec
1	2	Aqr	Psc	Ari	Tau	Gem	Cnc	Leo	Vir	Lib	Sco	Sgr	Cap
4	5	Psc	Ari	Tau	Gem	Cnc	Leo	Vir	Lib	Sco	Sgr	Cap	Aqr
6	7	Ari	Tau	Gem	Cnc	Leo	Vir	Lib	Sco	Sgr	Cap	Aqr	Psc
9	10	Tau	Gem	Cnc	Leo	Vir	Lib	Sco	Sgr	Cap	Aqr	Psc	Ari
11	12	Gem	Cnc	Leo	Vir	Lib	Sco	Sgr	Cap	Aqr	Psc	Ari	Tau
14	15	Cnc	Leo	Vir	Lib	Sco	Sgr	Cap	Aqr	Psc	Ari	Tau	Gem
16	17	Leo	Vir	Lib	Sco	Sgr	Cap	Aqr	Psc	Ari	Tau	Gem	Cnc
19	20	Vir	Lib	Sco	Sgr	Cap	Aqr	Psc	Ari	Tau	Gem	Cnc	Leo
21	22	Lib	Sco	Sgr	Cap	Aqr	Psc	Ari	Tau	Gem	Cnc	Leo	Vir
24	25	Sco	Sgr	Cap	Aqr	Psc	Ari	Tau	Gem	Cnc	Leo	Vir	Lib
26	27	Sgr	Cap	Aqr	Psc	Ari	Tau	Gem	Cnc	Leo	Vir	Lib	Sco
29	30	Cap	Aqr	Psc	Ari	Tau	Gem	Cnc	Leo	Vir	Lib	Sco	Sgr

The number column may be inscribed "Aetas lunae" (Fc); "Dies" (Fj). The numbers missing above may be written at row boundaries (Fc). Fc shows an additional series of numbers; these end in 30 too.

SB31 Lunar almanac "secundum Aegyptios".

Ps,10v, secondary hand (13th-14th c.?): "Cyclus lunae per signa secundum Aegyptios", 12 rows; begins differently from the traditional form, above. — Sample:

Mar	Apr	Mai	Iun	Iul	Aug	Sep	Oct	Nov	Dec	Ian	Feb	<->		
Ari	Tau	Gem	Cnc	Leo	Vir	Lib	Sco	Sgr	Cap	Aqr	Psc	1	2	
Tau	Gem	Cnc	Leo	Vir	Lib	Sco	Sgr	Cap	Aqr	Psc	Ari	3	4	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Psc	Ari	Tau	Gem	Cnc	Leo	Vir	Lib	Sco	Sgr	Cap	Aqr	28	29	(?)

SC-SD. Miscellaneous.

SC11. List of syzygies, AD 1233-1243.

Pa,12v-16v, no heading. One table for each of the years AD 1233 up to 1243. The table for 1243 is in the bottom margin, and ends in June, at the end of the Arab year 640. The exemplar may have had more tables; cf. the Arab-Christian concordance tables on ff.5r-12r (AE11), which also begin in 1233 but stop in 1348, and were perhaps meant to go on until 1352. — Sample of the first table:

Anni Xpi. 1233	C-ones et o-ones	Di es	Fe ri ae	Ho	Mi		Si	Gr	Mi	Men ses Arab.	630
Jan	Coniu.	12	4	8	37		Cap	29	13	3	
	Oppo.	27	5	10	7		Aqr	14	58	4	
Feb	Con	11	6	0	39		Aqr	29	9		
	Oppo.	26	7	9	0		Psc	14	28	5	
	...	...	...	...	...		...	...	...	...	
Sep	Con	6	3	2	14		Vir	19	29	(11)	
	Oppo.	20	3	6	27	Ecl.lun.	Lib	3	28	12	
Oct	Con	5	4	11	58		Lib	18	35		
	Oppo.	20	5	0	8		Sco	3	8	1	631
	Con	3	5	10	3		Sco	18	11		
	...	...	...	...	...		...	...	...	...	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(L)	(m)

I do not know why the Arab years and months are listed as if they start in oppositions.

SD11. Almanac of Venus, AD 1245-1284.

Fc,84v: "Istae duae tabulae, scilicet prima et secunda, sunt Veneris, et additur 1 gradus".

Glosses: (Top:) "Scripsi istam tabulam anni (sic!) d. 1278, et currit secunda linea. Inventa est haec tabula (+mark at 12(45?)). — (Bottom, canon:) Tabula Veneris est perpetua ... Verbi gratia, anno domini 1245 currit prima linea quae incipit a 12 gra scorpionis ... Unde facta ratione 1278 currit secunda linea quae incipit in 17 gra aquarii ...". — Sample comprising sub-table for January; there are similar sub-tables for the other months, forming two sections as stated in the heading.

	Linea	p'a	2'a	3'a	4'a	5'a	6'a	7'a	8'a
	12-	77	78	79	80	81	82	83	84
	12-	45	46	47	48	49	50	51	52
Menses	Dies	Sco	Aqr	Sgr	Sgr	Aqr	Sgr	Aqr	Cap
		Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr
Ianuarius	1	12	17	23	9	0	4	23	11
	6	26	23	29	9	6	10	27	17
		Sgr		Cap				Psc	
	11	2	29	5	10	12	16	1	23
			Psc						
	16	8	5	11	12	18	22	4	29
									Aqr
	21	13	9	17	15	25	28	7	6
						Psc	Cap		
	26	19	16	24	16	1	5	10	12

This is different from Azarchel's Almanac (Millás 1950 p. 205-06, tables 54-55) and from the almanac of Humenuz (e.g., ms. Lg,210r, which is essentially the same as Azarchel's).

T. Calendars and computus.

Excluding Christian ecclesiastical computus.

TA11. Calendars.

Calendars annexed to collections of Toledan tables occur in Fc,94r-99v; Ps,7r-8v; Wd,41v-43v; R,83r-85v; Vd,45r-54r; Pv,47r-52v; Ch2,181r-183v; Mv,100r-102v (m2). None of them is astronomical (except Ch2, calendar of Grosseteste; and Fc has a table of day-lengths, 9h;9-14h;51). They are not further treated here; some features which may indicate their origin are listed in the general descriptions of manuscripts, Pr:06.

TA21. Lunar age for each solar month.

Witnesses: **{a1}** Ps,9r. — **{d}** Fj,95r.

Context: This table occurs together with other computistical matter, and probably in the main hand in both witnesses. In Ps, it is placed after a calendar and before the Toledan tables; in Fj, between the Toledan collections Fj and Fj2.

Headings: "Tabula -- revolutio lunae" Ps, see below; "Tabula ostendens quota sit luna in kalendis mensium" Fj. — Sub-headings: "Numerus annorum 19 lunarium; Jan ... Dec" Ps; "Aureus numerus; Jan ... Dec" Fj.

Text. Values from Ps Fj. Headings from Ps.

Numerus annorum 19 lunarium	Ian	Feb	Mar	Apr	Mai	Iun	Iul	Aug	Sep	Oct	Nov	Dec
	Tabula monstrans lunarem diem per singulas kalendas 12 mensium solarium in 19 annis, qui sunt una revolutio lunae.											
1	9	10	9	10	11	12	13	14	16	16	18	18
2	20	21	20	21	22	23	24	25	27	27	29	29
3	1	2	1	2	3	4	5	6	8	8	10	10
4	12	13	12	13	14	15	16	17	19	19	21	21
5	23	24	23	24	25	26	27	28	30	30	2	2
6	4	5	4	5	6	7	8	9	11	11	13	13
7	15	16	15	16	17	18	19	20	22	22	24	24
8	26	27	26	27	28	29	30	1	3	3	5	5
9	7	8	7	8	9	10	11	12	14	14	16	16
10	18	19	18	19	20	21	22	23	25	25	27	27
11	29	30	29	30	1	2	3	4	6	6	8	8
12	10	11	10	11	12	13	14	15	17	17	19	19
13	21	22	21	22	23	24	25	26	28	28	30	30
14	2	3	2	3	4	5	6	7	9	9	11	11
15	13	14	13	14	15	16	17	18	20	20	22	22
16	24	25	24	25	26	27	28	29	1	1	3	3
17	5	6	5	6	7	8	9	10	12	12	14	14
18	16	17	16	17	18	19	20	21	23	23	25	25
19	27	28	27	28	29	30	1	3	5	5	7	7

(Mar,18) 16: 26 Ps. **(Iul,1)** 13: Fj; 14 Ps. **(Iul,7)** 19: 29 Ps. **(Aug,19)** 3: 2 Fj. **(Sep,19)** 5: 4 Fj. **(Oct,19)** 5: 4 Fj. **(Nov,2)** 29: 28 Ps. **(Nov,19)** 7: 6 Fj. **(Dec,2)** 29: 28 Ps. **(Dec,19)** 7: 6 Fj.

U. Various auxiliary tables.

UA. Tables of proportion, 60 x 60.

A rule for such tables "de minutis proportionalibus", in mss. Ch1 S La2 H, is reproduced in the appendix to canons Ca, as CaA02. Islamic multiplication tables are treated by King (1975 p. 40-41; 1986n-o).

UA11. Triangular table of proportions.

Double-argument table, showing the product of two numbers between 1 and 60. Laid out on 8 pages, which are numbered (1)-(8) in the sample below. When pieced together, the table is triangular except that the products 29*28, 30*28 and 30*29 occur twice each.

Witnesses: **{aT}** P,66r-69v. – **{d}** Fj,78r-81v.

Heading: **Tabula de minutis proportionalibus,** for each partial table in both witnesses.

Sample showing layout. From P Fj. The layout is the same in both witnesses; the values have not been checked apart from those listed. It is shown what tabular values are placed on each of the 8 pages taken up by the table. On pages (5)-(8), the alignment of tabular values between the two components is not rendered faithfully; for instance, each page contains copies of all the pertinent values of the arguments, and these form part of the column structure along with the tabular values.

Tabula de minutis proportionalibus.

(Page:)	(1)	(2)	(3)	(4)
	60 ... 52	**51 ... 44**	**43 ... 36**	**35 ... 28**
1	1,0 --- 0,52	0,51 --- 0,44	0,43 --- 0,36	0,35 --- 0,28
..	| |	| |	| |	| |
30	30,0 --- 26,0	25,30 --- 22,0	21,30 --- 18,0	17,30 --- 14,0

(Page:)	(5)	(6)	(7)	(8)	
	27 ... 20	**19 ... 12**	**11 ... 4**	**3 ... 1**	
1	0,27 --- 0,20	0,19 --- 0,12	0,11 --- 0,4	0,3 --- 0,1	
..					
3				0,9	
4			0,16		
..				60,0	**60**
11			2,1		**..**
12		2,24		46,49	**53**
..			45,4		**52**
19		6,1			**..**
20	6,40		33,45		**45**
..		32,16			**44**
27	12,9				**..**
		22,49			**37**
	21,36				**36**
					..
	16,1 --- 18,36	19,7 --- 22,44	23,15 --- 26,52	27,23 --- 31,0	**31**
	31 ... 36	**37 ... 44**	**45 ... 52**	**53 ... 60**	

UA2*. Various square tables of proportions.

Double-argument tables giving the product of two numbers between 1 and 60. The tables are square or almost square; the heading and page layout varies. All tabular values are in sexagesimals unless otherwise noted. Rules for such tables are listed as CaA02 and in CbA.U91.

UA21. Lu,89v-91v: no heading. Order of partial tables (rows, cols.): (1-60,1-14); (1-60,15-28); (1-60,29-42); (1-60,43-56); (1-60,57-59); and (1-60,1-8) repeated.

UA22. Eg,25r-28v: "Tabula de proportione minutorum". Order of partial tables (rows,cols.): (1-60,1-8); (1-60,9-16); ...; (1-60, 57-60).

UA23. C,263-277: "Tabula minutorum proportionalium". Order of partial tables (rows, cols.): (1-30,1-9); (31-60,1-9); (1-30,10-18); (31-60,10-18); ...; (1-30,55-60); (31-60,55-60).

UA24. A2,288v-295v: "Tabula multiplicationis fractionum cum fractis necessariis ad astronomiam". Order of partial tables (rows, cols.): (1-30,1-8); (31-60,1-8); (1-30,9-16); (31-60,9-16); ...; (1-30,57-60); (31-60,57-60).

A2,288r "Tabula multiplicationis graduum cum gradibus", (1-30,1-12), with values in decimals, may or may not be a first attempt at the square table just mentioned.

UB. Other tables for calculation.

Some late tables for use with eclipses have been listed in section JB*.

UB10. Fc,101v: 10 x 10 table of multiplication.

UB15. Eg,28v: "Tabula ad accipiendum XII'as". Three sub-tables: (a) multiples 1-30 of 0°5'; (b) multiples 1-60 of 0'5"; (c) multiples 1-60 of 0"5$^{(3)}$. The last two tables differ about their column-headings only.

UB20. Cu,83r: "Tabula portionum ad 60", list of the first 60 multiples of 60, in decimal numbers.

UB25. Op,77v: "Tabula minutorum proportionalium", list of the first 60 submultiples of 3600, in decimal integers.

UB30. Fd,4v (with Novara tables): "Tabula veri motus planetarum in una hora per buth planetae ad gradus et ad minuta graduum". Two sub-tables: one gives the first 30 multiples of 0;2,30; the other shows the multiples 1, 2(2)58 of 0;0,2,30°. — Cf. the Alfonsine tables for converting between hours and sixtieths of a day, Poulle 1984 p. 123.

A few multiples of 2;30 are attached to AF12 in Cu,87r. AF12 is Alfonsine, and both items are additions.

UB35. Tables for denominations of sexagesimal products and quotients, e.g.: Ow, 177r (m2) "Tabula multiplicationis", "Tabula divisionis", both with two-way entrances from degrees down to 9ths. Trivial; there are similar tables, e.g., in Khw/M (Suter tab. 57b) and in Albattani (c. 2, Nallino I p.7).

List of works cited

&

Indices

List of works cited.

Library catalogues that can be found in Kristeller 1960, Section C under individual libraries, are normally omitted here.

B&T = Benjamin & Toomer 1971.

Beaujouan, Guy: 1974 (pub. 1975), "Observations et calculs astronomiques de Jean de Murs (1321-1344)". Proceedings, XIVth international Congress of the History of Science, Tokyo - Kyoto, 1974, vol.2, 27-30. Tokyo - Kyoto: Science Council of Japan.

BEC = Bibliothèque de l'École des Chartes. Paris.

Benjamin, Francis S., Jr. / Toomer, G.J.: 1971, Campanus of Novara and medieval planetary theory. Theorica planetarum. Madison, Milwaukee / London: U. of Wisconsin P.

Bennett, J.A.: 1978, Catalogue of the archives and manuscripts of the Royal Astronomical Society. Memoirs of the Royal Astronomical Society 85, 1-90.

Birkenmajer, A.: 1970 (1922), "La Bibliothèque de Richard de Fournival, poète et érudit français du debut du XIII'e siècle, et son sort ultérieur". Studia Copernicana 1 (1970) 117-210. Originally in Acad. Pol., Fac. philol., Rozp. 60,4, 1922, in Polish.

Birkenmajer, A.: 1970 (1949), "Pierre de Limoges, commentateur de Richard de Fournival". Isis 40 (1949) 18-31. — Repr. in Studia Copernicana I (1970) 222-249.

Bjørnbo, A.A.: 1902, "Über zwei mathematische Handschriften aus dem vierzehnten Jahrhundert". Bibliotheca Mathematica 3.F., 3 (1902) 63-75.

Bjørnbo, A.A.: 1903, 1905, 1912, "Die mathematischen S. Marcohandschriften in Florenz". Bibliotheca Mathematica 3.Folge: 4 (1903) 238-245; 6 (1905) 230-238; 12 (1912) 97-132; 12 (1912) 193-224. Leipzig: Teubner.

Bjørnbo, A.A. / S. Vogl: 1912, Alkindi, Tideus und Euklid: drei optische Werke. Abhandlungen zur Geschichte der mathematischen Wissenschaften mit Einschluß ihrer Anwendungen XXVI,3. Berlin: Teubner.

Boffito, J. / C. Melzi D'Eril: 1908, Almanach Dantis Aligherii sive Profhacii Judaei Montispessulani Almanach perpetuum ad annum 1300 inchoatum. Firenze: Olschki.

Boncompagni, B.: 1851, Della vita e delle opere di Gherardo Cremonese, traduttore del secolo duodecimo, e di Gherardo da Sabbionetta, astronomo del secolo decimoterzo. — Atti dell' Accademia pontificia de' Nuovi Lincei 4 (1850-51) 387-493. Also separately, Rome 1851.

Bossong, G.: 1978, Los Canones de Albateni. Tübingen: Niemeyer.

Boutelle, Marion: 1968, "The Almanac of Azarquiel". Centaurus 12, 12-20.

Brandis, Tilo & all. (ed.): 1975, Zimelien. Abendländische Handschriften des Mittelalters aus den Sammlungen der Stiftung Preußischer Kulturbesitz. (Ausstellung, 13. Dez. 1975 - 1. Feb. 1976.) Wiesbaden 1975. (Cf. description of ms. Berlin SBB-PK Hdschr. 218.)

Bubnov, N.: 1899, Gerberti, postea Silvestri II papae, opera mathematica. Berlin: Friedländer.

Burckhardt, Johann Jakob: 1956, "Die astronomischen Tafeln von Al-Khwârizmî". Verhandlungen der Schweizerischen Naturforschenden Gesellschaft (Basel 1956), 73-75.

Burnett, Ch.: 1984, "The content and affiliation of the scientific manuscripts written at, or brought to, Chartres in the time of John of Salisbury". — The world of John of Salisbury (= Studies in Church History, Subsidia 3), 127-160.

Burnett, Ch.: "Catalogue" 1987, "Catalogue. The writings of Adelard of Bath and closely associated works, together with the manuscripts in which they occur". Burnett, Ch. (ed.): Adelard of Bath, an English scientist and Arabist of the early twelfth century. Warburg Institute Surveys and Texts XIV. London: Warburg Institute, p. 163-196.

Burnett, Ch.: 1990, "A new source for Dominicus Gundissalinus's account of the science of the stars?". Annals of Science 47, 361-374.

Burnett, Ch.: 1994, "Magister. Iohannes Hispanus: Towards the identity of a Toledan translator." Comprendre et maîtriser la nature au moyen âge. Mélanges ... Guy Beaujouan, p. 425-436. Genève: Droz.

Bursill-Hall, G.L.: 1981, A census of medieval Latin grammatical manuscripts. Stuttgart: Frommann & Holzboog.

Carmody, Francis J.: 1942, Theorica Planetarum Gerardi. Edited from 14 copies... Berkeley, California: printed by the editor.

Carmody, Francis J.: 1956, Arabic astronomical and astrological sciences in Latin translation. Berkeley and Los Angeles: U. of Calif.

Casulleras and Samsó: see FBTB.

Catalogi librorum manuscriptorum Angliae et Hiberniae. Vol.I-II in one, Oxford 1697. – I,I: Oxford, Bodleian L. I,II: Oxford colleges. I,III: Cambridge. II,I: various. II,II: Ireland.

Catalogus codicum manuscriptorum medii aevi Latinorum qui in bibliotheca Jagellonica Cracoviae asservantur. – Vol.I, 1980; II, 1982; III, 1984; IV, 1988. Wroclaw &c.: Ossolineum.

Chabás, José, & B. R. Goldstein: 1994, "Andalusian astronomy: al-Zîj al-Muqtabis of Ibn al-Kammâd", Archive for History of Exact Sciences 48,1 (1994) 1-41.

CIMAGL = Cahiers de l'Institut du moyen-âge grec et latin. Copenhagen: Inst. of Greek and Latin medieval philology.

CMA = Catalogi librorum mss. Angliae et Hiberniae.

CMA 1,2 = CMA vol.I pars II.

CMF: Catalogo di manoscritti filosofici nelle bibliotheche Italiane. Vol.2, 1981. Firenze: Olschki.

Constantinides, Costas N. / Robert Browning: 1993, Dated Greek manuscripts from Cyprus to the year 1570. Washington D.C. and Nicosia.

Curtze, M.: 1898, "Über eine Algorismus-Schrift des XII. Jahrhunderts". Abhandlungen zur Geschichte der Mathematik 8 (1898) I (=pp.1-27). = Zeitschrift für Mathematik und Physik 42 (1897) Suppl.13 (1898).

Curtze, M.: 1900, "Urkunden zur Geschichte der Trigonometrie im christlichen Mittelalter". Bibliotheca Mathematica 3.Folge 1, 321-416. Leipzig: Teubner.

Dalen, Benno van: 1993, Ancient and mediaeval astronomical tables: mathematical structure and parameter values. Diss., University of Utrecht.

Dalen, Benno van: 1996, "Al-Khwarizmi's astronomical tables revisited: Analysis of the equation of time". FBTB, 195-252.

D'Alverny, M.-Th. / Poulle, E.: 1958, "Un nouveau manuscrit des "Tabulae Mechlinenses" d'Henri Bate de Malines". Actes du 8'e congrès international d'histoire des sciences (1956, printed 1958) 355-358. Firenze / Paris: / Hermann.

D'Alverny, M.-Th.: 1962, "Avicenna latinus". Archives d'histoire doctrinale et littéraire du Moyen Âge 28 (1961, printed 1962) 281-316.

D'Alverny, M.-Th.: 1977, "Les 'Solutiones ad Chosroem' de Priscianus Lydus et Jean Scot". Colloques Internationaux du C.N.R.S. 561: Jean Scot Érigène et l'histoire de la philosophie, p.149ff. Paris: CNRS.

Daly, J.F.: 1964, 1965, "Mathematics in the Codices Ottoboniani Latini". Manuscripta 8 (1964) 3-17; 9 (1965) 12-29.

De La Mare, A.: 1971, Catalogue of the collection of medieval manuscripts bequeathed to the Bodleian Library Oxford by James R.P. Lyell. Oxford: Clarendon.

De Ricci, S. / W.J. Wilson: 1935-40, Census of medieval and Renaissance manuscripts in the United States and Canada. Vol. 1-3. New York.

Delambre, J.B.J.: 1819, Histoire de l' astronomie du moyen-âge. Paris. (Repr. 1965:) Sources of science, No.24. New York & London: Johnson Reprint.

Delisle, L.: 1868-81, Le cabinet des manuscrits de la Bibliothèque Nationale ("B. Impériale", T.I.). Tome I-IV. Paris. (Repr.: 1978, Hildesheim: Olms.)

Duhem, Pierre: 1914, 1915, 1916, 1917, Le système du monde 2; 3; 4; 5. Paris: Hermann.
Faye, C.U. / Bond, W.H.: 1962, Census of medieval and Renaissance Manuscripts..., Supplement. New York.
FBTB = From Baghdad to Barcelona. Studies in the Islamic Exact Sciences in Honour of Prof. Juan Vernet, ed. Josep Casulleras & Julio Samsó. Barcelona 1996.
FDTE = From Deferent to Equant: A volume of studies ... in honor of E.S. Kennedy, ed. D.A. King & George Saliba. Annals of the New York Academy of Sciences, Volume 500 (1987). New York.
Folkerts, Menso: 1981, "Mittelalterliche mathematische Handschriften in westlichen Sprachen in der Berliner Staatsbibliothek. Ein vorläufiges Verzeichnis." Dauben, Joseph W. (ed.): Mathematical perspectives. Essays on mathematics and its historical development. New York. (Cf. description of ms. Berlin SBB-PK Hdschr. 218.)
Forshall, J.: 1834, Catalogue of the manuscripts in the British Museum. New Series, Volume I, Part I: The Arundel manuscripts. London.
Fowler, G.B.: 1947, Intellectual interests of Engelbert of Admont. New York: Columbia U.P.
Fowler, G.B.: 1954, "Manuscripts of Engelbert of Admont (chiefly in Austrian and German libraries)". Osiris 11, 455-85.
Funaioli, Hyginus: 1910, "Index codicum Latinorum qui Volaterris in Bybliotheca Guarnacciana adservantur". Studi Italiani di filologia classica 18, 77-169.
Gerbert, M.: 1784, Scriptores ecclesiastici de musica. Vol.1-3. Reprint, Milano 1931. — Here cited after T&K p.xv.
Gingerich, O. / Welther, B.: 1977, "The accuracy of the Toledan Tables". Prismata, Festschrift für Willy Hartner, ed. Maeyama / Saltzer, p.151-63. Wiesbaden: Steiner.
Glorieux, P.: 1933, Répertoire des maîtres en théologie de Paris au XIII'e siècle, I-II. Paris: Vrin.
Glorieux, P.: 1971, La faculté des arts et ses maîtres au XIII'e siècle. Paris: Vrin.
Goldstein, B.R.: 1964-65, "On the theory of trepidation". Centaurus 10, 232-247.
Goldstein, B.R.: 1967, Ibn al-Muthannâ's commentary on the astronomical tables of al-Khwârizmî. New Haven: Yale U.P.
Goldstein, B.R. / J. Chabás / J.L. Mancha: 1994, "Planetary and lunar velocities in the Castilian Alfonsine Tables". Proc. of the American Philosophical Society, vol. 138, no. 1, 61-95.
Goldstein, B.R.: 1996, "Lunar velocity in the Middle Ages: a comparative study". FBTB, 181-194.
Goldstein, B.R.: 1998, "Abraham Zacut and the medieval Hebrew astronomical tradition". Journal for the history of astronomy 29, 177-186.
Goldstein, B.R.: 1999, "Astronomy in the medieval Spanish Jewish community". Between Demonstration and Imagination: Essays ... presented to John D. North, ed. Lodi Nauta and Arjo Vanderjagt. Leiden: Brill.
Grumel, V.: 1958, La chronologie. =Traité des études byzantines, I. Paris: P.U.F.
Gushee, L.: 1969, "New sources for the biography of Johannes de Muris". Journal of the American Musicological Society 22, 3-26.
Haddad, Fuad I. / E.S. Kennedy / D. Pingree: 1981, Alî ibn Sulaymân al-Hâshimî. The book of the reasons behind astronomical tables. Studies in Islamic philosophy and Science, Delmar, N.Y.
Harper, Richard I.: 1971, "Prophatius Judaeus and the medieval astronomical tables". Isis 62, 61-68.
Harris, R.: 1846, An account of some astronomical tables in the library of the Rev. C.Turnor, A.M. F.R.S. &c. — Memoirs of the Royal Astronomical Society 15, 179-91.
Hartmann, P.: 1961, Bernardus de Virduno O.F.M., Tractatus super totam astrologiam. Werl/Westfalen.
Haskins, Ch.H.: 1924 (rev. 1927; rep. 1960), Studies in the history of mediaeval science. New York: Ungar (1960); Harvard U.P. (1924).
Heilbronner, J.Ch.: 1742, Historia matheseos universæ. Leipzig: Gleditsch.
Heinemann, O.v.: 1898, Die Handschriften der Herzoglichen Bibliothek von Wolfenbüttel. Zweite Abth.: Die Augusteischen Handschriften. III, Wolfenbüttel.
Herz, N.: 1894, Geschichte der Bahnbestimmung von Planeten und Kometen. II. Leipzig.

Hogendijk, Jan P.: 1988, "Three Islamic lunar crescent visibility tables". Journal of the History of Astronomy 19, 19-44.

Hogendijk, Jan P.: 1989, "The mathematical structure of two Islamic astrological tables for 'casting the rays'", Centaurus 32, 171-202.

L'Huillier, G.: 1981, "Aspects nouveaux de la biographie de Jean de Murs". Archives d'histoire doctrinale et littéraire du Moyen Age 47 (1981; année 1980) 272-6. Paris: Vrin.

Ives, S.A.: 1942, "Corrigenda and addenda to the descriptions of the Plimpton manuscripts as recorded in the De Ricci 'Census'". Speculum 17, 33-49.

James, M.R.: 1895, A descriptive catalogue of the manuscripts in the Fitzwilliam Museum. Cambridge.

K&K = Kennedy & Kennedy 1987.

Kennedy, E.S.: 1956, "A survey of Islamic astronomical tables". Transactions of the American Philosophical Society, N.S. vol.46 pt.2, 123-177.

Kennedy, E.S.: 1956a, "Parallax theory in Islamic astronomy". Isis 47, 33-53.

Kennedy, E.S. / Walid Ukashah: 1969, "Al-Khwârizmî's planetary latitude tables". Centaurus 14, 86-96.

Kennedy, E.S. / H. Krikorian-Preisler: 1972, "The astrological doctrine of projecting the rays". Kennedy & all. 1983, 372-84 (originally in al-Abhath 25, 3-15).

Kennedy, E.S. & all.: 1983, Studies in the Islamic exact sciences. Beirut.

Kennedy, E.S. / Kennedy, M.H.: 1987, Geographical coordinates of localities from Islamic sources. Frankfurt a.M.: Institut für Geschichte der arabisch-islamischen Wissenschaften.

Ker, N.R.: 1969+, Medieval manuscripts in British libraries. I, 1969; II, 1977; III, 1984. Oxford: Clarendon.

King & Saliba: see FDTE.

King, David A.: 1975, "On the astronomical tables of the Islamic Middle Ages". Studia Copernicana 13, 37-56.

King, David A.: 1986n (1974), "On medieval Islamic multiplication tables". Islamic Mathematical Astronomy (article XIV). London: Variorum. (Originally in: Historia Mathematica 1 (1974) 317-323.)

King, David A.: 1986o (1979), "Supplementary notes on medieval Islamic multiplication tables". Islamic Mathematical Astronomy (article XV). London: Variorum. (Originally in: Historia Mathematica 6 (1979) 405-417.)

King, David A.: 1987, "Some early Islamic tables for determining lunar crescent visibility". FDTE p. 185-225.

King, David A.: 2000, "Too many cooks... A new account of the earliest Muslim geodetic measurements". Suhayl 1, 207-241. Barcelona: Universitat de Barcelona.

Klette, A.: 1865, Catalogi chirographorum in Bibliotheca Academica Bonnensi servatorum. Fasciculi VI pars I (p.143-59).

Knorr, Wilbur R.: 1993, "Two medieval monks and their astronomy books: mss. Bodley 464 and Rawlinson C.117". Bodleian Library Record 15, no. 2, 269-284.

Kristeller, P.O.: 1960, Latin manuscript books before 1600. New York: Fordham U.P. (Fourth edition: by Sigrid Krämer, München: MGH, 1999.)

Kristeller, P.O.: (It.It.), Iter Italicum. I, 1965; II, 1967; III, 1983; IV, 1989; V, 1990; VI, 1992; Index, 1997. London: Warburg / Leiden: Brill.

Kunitzsch, Paul: 1961, Untersuchungen zur Sternnomenklatur der Araber. Wiesbaden.

Kunitzsch, Paul: 1966, Typen von Sternverzeichnissen in astronomischen Handschriften des zehnten bis vierzehnten Jahrhunderts. Wiesbaden: Harassowitz.

Kunitzsch, Paul: 1980, "Two star tables from Muslim Spain". Journal for the history of astronomy 11, 192-201.

Kunitzsch, Paul: 1986+, Der Sternkatalog des Almagest. Die arabisch-mittelalterliche Tradition. I-III: 1986, 1990, 1991. Wiesbaden: Harassowitz.

Lacombe, G., et all.: Aristoteles Latinus, Codices. I, Roma 1939; II, Cambridge 1955.

Lesley, M.: 1957, "Bîrûnî on rising times and daylight lengths". Centaurus 5, 121-141.

Liechtenstein, Petrus: 1515, Almagestum Cl. Ptolemei Pheludiensis... Venezia. (Same as the translation by Gerard of Cremona, or the "Arabo-Latin Almagest".)

Lorch, Richard: 1995(1992), "Some remarks on the Almagestum Parvum". Arabic Mathematical Sciences; Instruments, texts, transmission (article V). Aldershot: Variorum 1995. (Originally in: Festschrift für Hans Wussing on the occasion of his 65th birthday, ed. S.S.Demidov *et all.*, Basel 1992.)

Manuscrits Datés = Samaran / Marichal.

MBB = Montfaucon, Bibliotheca Bibliothecarum.

MBB 1 = MBB vol.I.

Menzzer, C.L.: 1879, Nicolaus Coppernicus, Über die Kreisbewegungen der Weltkörper. Thorn. — From Steinschneider 1884, (87) n.1.

Mercier, R.P.: 1976, 1977, "Studies in the medieval conception of precession". Archives internationales d' histoire des sciences 26 (1976) 197-220; 27 (1977) 33-71.

Mercier, R.P.: 1987, "Astronomical tables in the twelfth century". Adelard of Bath, ed. Charles Burnett, p.87-118. London: Warburg Institute.

Mercier, R.P.: 1991, "The lost zij of al-Sufi in the twelfth-century tables for London and Pisa". Lectures from the conference on al-Sufi and Ibn al-Nafis, 5-8 October 1987, University of Jordan. Beirut / Damascus.

Mercier, R.P.: 1996, "Accession and recession: reconstruction of the parameters". In FBTB, 299-347.

Merlette, Bernard: 1975, "Écoles et bibliothèques, à Laon, du déclin de l'Antiquité au développement de l'Université". Actes du 95'e congrès national des sociétés savantes (Reims, 1970), Section de philologie et d'histoire jusqu'à 1610, I, p.52. Paris: Bibl.Nat.

Millás Vallicrosa, J.M.: 1936, "Una obra desconocida de Johannes Avendaut Hispanus". Osiris 1, 451-475.

Millás Vallicrosa, J.M.: 1942, Las traducciones orientales en los manuscritos de la Biblioteca Catedral de Toledo. Madrid: Inst. Arias Montano.

Millás Vallicrosa, J.M.: 1947, El libro de los fundamentos de las Tablas astronómicas de R. Abraham ibn ᶜEzra. Madrid - Barcelona.

Millás Vallicrosa, J.M.: ("1943"-)1950, Estudios sobre Azarquiel. Madrid - Granada.

Millás Vallicrosa, J.M.: 1959, La obra 'Sefer Hesbon mahlekot ha-kokabim' de R. Abraham bar Hiyya ha-Bargeloni. Barcelona.

Millás Vallicrosa, J.M.: 1962, Las tablas astronomicas del Rey Don Pedro el Ceremonioso. Madrid - Barcelona.

Millás Vendrell, E.: 1963, El comentario de Ibn al-Muṯannâ' a las Tablas Astronómicas de al-Jwârizmî. Madrid-Barcelona.

Montfaucon, Bernard: 1739, Bibliotheca bibliothecarum manuscriptorum nova. Vol.I-II. Paris.

Munk Olsen, B.: 1982, L'étude des auteurs classiques latins aux XI'e et XII'e siècles. Tome I. Paris: CNRS.

Nallino, Carlo Alfonso: 1903, 1907, 1899 (="Nallino I-III" or "vol. I-III"), Al-Battani sive Albatenii opus astronomicum. Pubblicazioni del Reale Osservatorio di Brera in Milano, no.40, parte 1-3. Milano: Hoepli.

Narducci, E.: 1883, Sur un manuscrit du Vatican du XIV'e siècle contenant un traité de calcul emprunté à la méthode "Gobâri". Extrait du Bulletin des Sciences mathématiques, 2'e série, t.VII, 1883. Paris: Gauthier-Villars.

Narducci, E.: 1892, Catalogo di manoscritti ora posseduti da D. Baldassare Boncompagni. 2nd ed. Roma.

Neugebauer, O. / O. Schmidt: 1952, "Hindu astronomy at Newminster in 1428". Annals of Science 8, 221-228.

Neugebauer, O.: 1962, The astronomical tables of al-Khwârizmî. Hist. Filos. Skr. Dan. Vid. Selsk. 4, no.2. Copenhagen.

Neugebauer, O.: 1975 (=HAMA), A history of ancient mathematical astronomy. Berlin etc.: Springer.

North, John D.: 1976, Richard of Wallingford I-III. Oxford: O.U.P.

North, John D.: 1986, Horoscopes and history. London: Warburg Institute.

North, John D.: 1995, "'Aragonensis' and the Toledan material in Trinity ms. O.8.34". CIMAGL 65, 59-61.

Omont, H.: 1900, Bibliothèque Nationale. Nouvelles Acquisitions du Département des manuscrits pendant les années 1898-1899. Paris.

Ouy, G., & all.: 1983, Le catalogue de la bibliothèque de l'abbaye de Saint-Victor de Paris de Claude de Grandrue 1514. Paris: CNRS.

Pedersen, F.S.: 1983, 1984, Petri Philomenae de Dacia et Petri de S. Audomaro opera quadrivialia. – Corpus Philosophorum Danicorum medii Aevi 10:1-2. København: DSL / Gad.

Pedersen, F.S.: 1986a-b, "Scriptum Johannis de Sicilia super canones Azarchelis de tabulis Toletanis". CIMAGL 51 (=1986a), CIMAGL 52 (=1986b).

Pedersen, F.S.: 1987, "Canones Azarchelis: some versions, and a text". CIMAGL 54, 129-218.

Pedersen, F.S.: 1990, "A twelfth-century planetary theorica in the manner of the London Tables". CIMAGL 60, 199-318.

Pedersen, F.S.: 1992, "Alkhwarizmi's astronomical rules: yet another Latin version?". CIMAGL 62, 31-75.

Pedersen, F.S.: 1993, "Addendum on Alkhwarizmi: a table found?". CIMAGL 63, 312.

Pedersen, F.S.: 1994, "A Latin star-list for Toledo". CIMAGL 64, 59-62.

Pedersen, F.S.: 1998, "The Toulouse Tables: a list of manuscripts". CIMAGL 68, 3-12.

Pedersen, O.: 1974, A survey of the Almagest. Odense: Odense U.P.

Pedersen, O.: 1975, "The Corpus Astronomicum and the traditions of mediaeval Latin astronomy". Colloquia Copernicana 3, 57-96.

Pedersen, O.: 1976, "Petrus Philomena de Dacia: A problem of identity. With a survey of the manuscripts". CIMAGL 19, 1-54.

Pingree, D.: 1965, "The Persian 'observation' of the solar apogee in *ca.* A.D. 450". Journal of Near Eastern Studies 24 No.4, 334-336.

Pingree, D.: 1976, "The Byzantine version of the Toledan Tables: The work of George Lapithes?" – Dumbarton Oaks Papers 30, 85-132.

Poulle, E.: 1956, "Peut-on dater les astrolabes médiévaux?" Revue d'histoire des sciences et de leurs applications 9, 301-322.

Poulle, E.: 1963, La bibliothèque scientifique d'un imprimeur humaniste au XV'e siècle. Travaux d'humanisme et renaissance LVII, Genève: Droz.

Poulle,E.: 1964, "Le traité d'astrolabe de Raymond de Marseille". Studi medievali 3'a serie (anno V) 866-900 + I-IV.

Poulle, E.: 1964b, "Le quadrant nouveau médiéval", Journal des Savants 1964, 148-167 and 182-214.

Poulle, E.: 1967b, "Astrologie et tables astronomiques au XIII'e siècle: Robert le Febvre et les tables de Malines". Bulletin philologique et historique (jusqu'à 1610) du Comité des travaux historiques et scientifiques, année 1964. Actes du 89'e Congrès national des Sociétés savantes tenu à Lyon. Paris: Bibl.Nat., 1967.

Poulle, E.: 1980, "Jean de Murs et les tables Alphonsines". Archives d'histoire doctrinale et littéraire du Moyen Âge 47 (année 1980, pr. 1981), 241-271.

Poulle, E.: 1984, Les Tables Alphonsines avec les canons de Jean de Saxe. – Sources d'histoire médiévale, publiées par l'Institut de Recherche et d'Histoire des Textes. Paris: CNRS.

Poulle, E.: 1987a, "La date de naissance de Louis VIII". Bibliothèque de l'École des Chartes 145 (1987) 427-30. (On ms. Par. lat. 16208 (Pz) and its datable notes)

Poulle, E.: 1994, "Un témoin de l'astronomie latine du XIIIe siècle, les tables de Toulouse". Comprendre et maîtriser la nature au Moyen Âge: Mélanges ... Guy Beaujouan, p. 55-81. Genève/Paris.

Powicke, F.M.: 1931, The medieval books of Merton College. Oxford: Clarendon.

Prete, S.: 1960, I codici della Biblioteca Comunale di Fermo. Firenze: Olschki.

Richter-Bernburg, L.: Sâᶜid, the Toledan Tables, and Andalusî science. In FDTE, 373-401.

Rico y Sinobas, M.: 1863-1867, Libros del Saber de Astronomia del Rey D. Alfonso X de Castilla. Vol.1-5. Madrid.

Rouse, R.H.: 1973, Manuscripts belonging to Richard de Fournival. Revue d'histoire des textes 3, 253-269.

Rosinska, G.: 1984, Scientific writings and astronomical tables in Cracow: A census of manuscript sources (XIVth-XVIth centuries). – Studia Copernicana XXII, Wroclaw &c.: Ossolineum.
Samaran, Ch. / Marichal, R.: 1959+, Catalogue des manuscrits en écriture latine portant des indications de date, de lieu ou de copiste. Tome 1+. Paris: CNRS.
Samsó, J.: 1985, "On the solar model and the precession of the equinoxes in the Alphonsine zîj and its Arabic sources". History of oriental astronomy: Proceedings of an International Astronomical Union Colloquiun No. 91, New Delhi, India, 13-16 November 1985, ed. G. Swarup & all., p. 175-183. Cambridge: Cambridge University Press.
Samsó, J.: 1987, "Al-Zarqâl, Alfonso X and Peter of Aragon on the solar equation". FDTE, p.467-476.
Samsó, J.: 1992, Las Ciencias de los Antiquos en al-Andalus. Madrid: Mapfre.
Samsó, J.: 1994, Islamic astronomy and medieval Spain. Aldershot: Variorum (=Collected Studies Series, CS428).
Samsó, J.: 1994a, "Andalusian astronomy: its main characteristics and influence in the Latin West". Samsó 1994, article I.
Samsó, J.: 1994h, "Trepidation in al-Andalus in the 11th century". Samsó 1994, article VIII.
Samsó, J. / Millás, E.: Ibn al-Bannâ', Ibn Ishaq and Ibn al-Zarqâlluh's solar theory. Samsó 1994, article X.
Samsó, J.: 1997, Andalusian astronomy in 14th century Fez: al-zîj al-Muwâfiq of Ibn ᶜAzzûz al-Qusantînî. Zeitschrift für Geschichte der arabisch-islamischen Wissenschaften 11, 73-110.
Samsó, J. / Millás, E.: 1998, "The computation of planetary longitudes in the zij of Ibn al-Bannâ'". Arabic Sciences and Philosophy 8, p. 259-286. Cambridge: C.U.P.
Saxl, F.: 1915, 1927, 1953, Verzeichnis astrologischer und mythologischer illustrierter Handschriften des lateinischen Mittelalters 1-3.
Schmitz, Hans-Georg: Kloster Prüfening im 12. Jahrhundert. =Miscellanea Bavarica Monacensia 49. München: Stadtarchiv.
Sezgin, Fuat: 1978, Geschichte des arabischen Schrifttums. Band VI: Astronomie bis ca. 430 H. Leiden: Brill.
Silverstein, Theodore: 1957, Medieval Latin scientific writings in the Barberini Collection. Chicago, Illinois: U. of Chicago P.
Southern, R.W.: 1986, Robert Grosseteste. Oxford: Clarendon.
Stahlman, William D.: 1960, The astronomical tables of codex Vaticanus Graecus 1291. Dissertation, Brown U.
Steinschneider, M.: 1881+, Études sur Zarkali, astronome arabe du XI'e siècle, et ses ouvrages. Roma. – Extracts of: Bullettino di bibliografia e di storia delle scienze matematiche e fisiche (ed. Boncompagni) no. 14, 16, 17, 18, 20 (1881-87).
Steinschneider, M.: 1904, 1905, Die Europäischen Übersetzungen aus dem Arabischen bis Mitte des 17. Jahrhunderts. – (A: 1904): Schriften bekannter Übersetzer. Szb. der Kaiserlichen Akademie der Wissenschaften in Wien CXLIX/IV, 1904. – (B: 1905): Übersetzungen von Werken bekannter Autoren, deren Übersetzer unbekannt oder unsicher sind. Szb. (as above) CLI/I, 1905. – Re-printed together, Graz 1956.
Sudhoff, Karl: 1914, "Die Kurze "Vita" und das Verzeichnis der Arbeiten Gerhards von Cremona". Archiv für Geschichte der Medizin 8, 73-82. Leipzig: Barth.
Suter, H. Die Mathematiker und Astronome der Araber und ihre Werke (Abhandlungen zur Gesch. der mathematischem Wissenschaften 10 + 14). Leipzig 1900-02.
Suter, H. / Bjørnbo, A. / Besthorn, R.: 1914, Die astronomischen Tafeln des Muhammed ibn Musa al-Khwarizmi... Dan. Vid. Selsk. Skr., 7.Rk., Hist. Filos. Afd. III.1. København: Høst.
T&K = Thorndike / Kibre 1963.
Thorndike, L.: (Magic): A history of magic and experimental science. Vol.I-II, 1923 (New York: Macmillan); III-IV, 1934; V-VI, 1941; VI-VII, 1958 (all New York: ColUP).
Thorndike, L.: 1949, The Sphere of Sacrobosco and its commentators. Chicago: U. of Chicago Press.

Thorndike, L.: 1956, 1958, "Notes upon some medieval Latin astronomical, astrological and mathematical manuscripts at the Vatican". Isis 47 (1956) 391-404; 49 (1958) 34-49.

Thorndike, L.: 1957 (Paris), "Notes on some astronomical, astrological and mathematical manuscripts of the Bibliothèque Nationale, Paris". Journal of the Warburg and Courtauld Institutes 20, 112-172.

Thorndike, L.: 1957 Study, "The study of mathematics and astronomy in the thirteenth and fourteenth centuries as illustrated by three manuscripts". Scripta Mathematica 23, 67-76.

Thorndike, L.: 1959 British, "Notes on some less familiar British astronomical and astrological manuscripts". Journal of the Warburg and Courtauld Institutes 22, 157-171.

Thorndike, L.: 1959 (Florence), "Notes upon some medieval astronomical, astrological and mathematical manuscripts at Florence, Milan, Bologna and Venice". Isis 50, 33-50.

Thorndike, L. / P. Kibre: 1963, A catalogue of incipits of mediaeval scientific writings in Latin. Cambridge, Mass.: Mediaeval Acad. of America.

Toomer, Gerald J.: 1964, review of Neugebauer 1962. Centaurus 10, 203-212.

Toomer, Gerald J.: 1968, "A survey of the Toledan tables". Osiris 15, 5-174. Bruges: De Tempel.

Toomer, Gerald J.: 1969, "The solar theory of az-Zarqâl. A history of errors." Centaurus 14, 306-336. Copenhagen: Munksgaard.

Toomer, Gerald J.: 1973, "Prophatius Judaeus and the Toledan Tables". Isis 64, 351-55.

Toomer, Gerald J.: 1984, Ptolemy's Almagest. London: Duckworth.

Toomer, Gerald J.: 1987, "The solar theory of Az-Zarqâl: An epilogue". FDTE, 513-519.

Ullman, B.L. / Ph.A. Stadter: 1972, The public library of Renaissance Florence: Niccolò Niccoli, Cosimo de' Medici and the library of San Marco. — Medioevo e Umanesimo 10. Padova: Antenore.

Unterkircher, F.: 1969, Die datierten Handschriften der Österreichischen Nationalbibliothek bis zum Jahre 1400. 1.Teil: Text. — Katalog der datierten Handschriften in lateinischer Schrift in Österreich, Bd.I. Wien: Böhlau.

Van Dijk, J.P.: Handlist of the Latin liturgical manuscripts in the Bodleian Library Oxford. — Typescript in the Bodleian Library, as quoted by Toomer 1968.

Vitelli, C.: 1900, "Index codicum latinorum qui Pisis in bybliothecis Conventus S. Catherinae et Universitatis adservantur". Studi Italiani di Filologia Classica 8, 321-427.

Walther, H.: 1959, Initia carminum ac versuum medii aevi posterioris latinorum. Göttingen: Vandenhoeck & Ruprecht.

Watson, A.G.: 1966, The library of Sir Simonds D'Ewes. London.

Wichner, P.J.: 1889, Zwei Bücherverzeichnisse des 14. Jahrh. in der Admonter Stiftsbibliothek. — Beihefte zum Centralblatt für Bibliothekswesen, Erster Bd. (Leipzig 1888-89), Heft 4 (1889).

Wright, J.K.: 1923, "Notes on the knowledge of latitudes and longitudes in the middle ages". Isis 5, 75-98.

Wüstenfeld, F.: 1877, "Die Übersetzungen Arabischer Werke in das Lateinische seit dem XI. Jahrhundert". Abhandlungen der kgl. Gesellschaft der Wissenschaften zu Göttingen 22. Göttingen: Dieterich.

Zinner, Ernst: 1925, Verzeichnis der astronomischen Handschriften des deutschen Kulturgebietes. München: Beck.

Zinner, Ernst: 1936, "Die Tafeln von Toledo (Tabulae Toletanae)". Osiris 1, 747-774.

Index of manuscripts.

Covers the manuscript inventories in Pr:03 and Pr:06, the lists in Ca:02, Cb:02, Cc:02 and T:03, a selection of descriptive passages about single manuscripts elsewhere, and manuscripts that are cited though they do not contain Toledan tables. References are to pages. The reference "193n3" means "page 193, note 3", and the reference "90b" means "page 90, right-hand column". If a manuscript has been assigned a symbol, this is added in {braces}.

List of incipits and table headings.

Comprises incipits of texts that have been edited here, a selection of incipits of texts that are only excerpted or summarized, and a selection of typical main headings of tables, normally in abridgment. The manuscript descriptions Pr:06 are not covered. Rubrics are mostly ignored. Headings such as "Aequatio dierum..." may alternate freely with "T(abula) aequationis dierum..."; of such alternatives, either or both may have been listed. No distinction is made between "T(abula)..." and "T(abulae)...".

Index locorum.

This is a supplement to the General Index, comprising the references to specific places in sources and parallels. The General Index should be consulted for further references to the authors or texts in question.

General index.

Not including the manuscript descriptions (Pr:06), the geographical lists in section M* of the edition, or the star lists in section L* of the edition. Only the common technical terms are covered, using a selection of illustrative passages. In Arabic names, initial "ibn" or "al-" are generally left out. Interpretations of Arabic words follow Suter 1914, 241 ff.