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THE ORBIT OF COMET 1929 I (SCHWASSMANN-WACHMANN) IN THE YEARS 1920—1936

BY

HANS Q. RASMUSEN

WITH 1 FIGURE

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The following revision of the orbit of comet 1929 I is based on the elements computed by Dr. S. KANDA (T. A. B. 41—42). These elements are as follows:

$$\left.\begin{aligned} T &= 1929 \text{ March } 23.25926 \text{ U. T.} \\ \omega &= 357^{\circ}.76403 \\ \Omega &= 126.32592 \\ i &= 3.72893 \end{aligned}\right\} 1950.0 \qquad \text{(I)}$$
$$\begin{aligned} e &= 0.3950135 \\ a &= 3.455363 \\ \mu &= 0.1534488 \end{aligned}$$

$$\left.\begin{aligned} x &= -1.936\ 9388\ (\cos E - e) - 2.623\ 4602 \sin E \\ y &= +2.628\ 6605\ (\cos E - e) - 1.710\ 7396 \sin E \\ z &= +1.130\ 4612\ (\cos E - e) - 0.517\ 0711 \sin E \end{aligned}\right\} 1950.0$$

From these elements I have computed the perturbed co-ordinates of the comet from 1929 to 1935 (A. N. 6069 and Copenhagen Observatory Publ. 102).

The comet was rediscovered by Professor VAN BIESBROECK on 1934 Dec. 11. A comparison with the ephemeris gave the following residuals:

$$\Delta \alpha \cos \delta = +150^{s},\ \Delta \delta = +780''.$$

From the above mentioned computation I found for 1934 Dec. 11.11181 U. T. the following approximate per-

turbations as differences between the perturbed and unperturbed co-ordinates:

$$\left.\begin{aligned} \xi &= +0.04978 \\ \eta &= -0.01415 \\ \zeta &= -0.00832 \end{aligned}\right\} 1950.0$$

From these perturbations and the following observations:[1]

U. T.			
1929 Febr.	1.0	$5^h38^m15^s.04$	$+21°10'\ 4''.3$ Normal place Nr. 1 (20 obs.)
1929 March	31.0	6 35 54.50	+23 14 36.1 Normal place Nr. 2 (7 obs.)
1934 Dec.	11.11181	1 43 24.31	+ 5 21 31.7 Yerkes

and using the method of the variation of the geocentric distances for the times 1929 Febr. 1.0 and 1929 March 31.0 I have computed the following revised elements:

Epoch and osculation: 1929 Febr. 18.0 U. T.

$$\left.\begin{aligned} M &= 354.^\circ90992 \\ \omega &= 357.71314 \\ \Omega &= 126.32675 \\ i &= 3.72833 \end{aligned}\right\} 1950.0 \qquad \text{(II)}$$

$$\begin{aligned} e &= 0.3945110 \\ a &= 3.452618 \\ \mu &= 0.1536318 \end{aligned}$$

$$\left.\begin{aligned} x &= -1.932\ 906\ (\cos E - e) - 2.623\ 552\ \sin E \\ y &= +2.628\ 200\ (\cos E - e) - 1.707\ 662\ \sin E \\ z &= +1.130\ 052\ (\cos E - e) - 0.515\ 907\ \sin E \end{aligned}\right\} 1950.0$$

[1]) All the observations and normal places are referred to the equinox for the beginning of the year of observation.

Using these elements I have repeated the computation of perturbed equatorial co-ordinates from 1929 to 1936 (7 figure computation; the perturbations from Jupiter and Saturn are considered; attention has been paid to an essential part of the effect of the planets Merkur, Venus, Earth through the use of the value $k^2 = 0.0002959139$ which corresponds to the sum of the masses of these three planets and the Sun). The co-ordinates are:

Equinox 1950.0.

U. T.		x	y	z
1929 Jan.	19.0	− 0.378 379	+ 1.958 404	+ 0.782 292
—	29.0	0.509 634	1.915 575	0.773 037
Febr.	8.0	0.639 322	1.866 864	0.761 408
—	18.0	0.767 011	1.812 317	0.747 398
—	28.0	0.892 266	1.752 025	0.731 020
March	10.0	1.014 662	1.686 120	0.712 299
—	20.0	1.133 782	1.614 774	0.691 279
—	30.0	1.249 234	1.538 202	0.668 023
April	9.0	1.360 644	1.456 654	0.642 605
—	19.0	1.467 675	1.370 416	0.615 119
—	29.0	1.570 019	1.279 802	0.585 668
May	9.0	1.667 411	1.185 149	0.554 370
—	19.0	1.759 623	1.086 814	0.521 348
—	29.0	1.846 473	0.985 164	0.486 737
June	8.0	1.927 818	0.880 575	0.450 674
—	18.0	2.003 559	0.773 424	0.413 300
July	8.0	2.138 026	0.552 921	0.335 185
—	28.0	2.249 826	0.326 524	0.253 504
Aug.	17.0	2.339 409	+ 0.096 870	0.169 307
Sept.	6.0	2.407 610	− 0.133 698	+ 0.083 550
—	26.0	2.455 536	0.363 170	− 0.002 921
Oct.	16.0	2.484 466	0.589 859	0.089 380
Nov.	5.0	2.495 769	0.812 388	0.175 215
—	25.0	2.490 840	1.029 655	0.259 919
Dec.	15.0	− 2.471 056	− 1.240 804	− 0.343 081

Equinox 1950.0.

	U. T.		x	y	z
1930	Jan.	4.0	−2.437 745	−1.445 179	−0.424 373
	—	24.0	2.392 165	1.642 298	0.503 536
	Febr.	13.0	2.335 491	1.831 818	0.580 371
	March	5.0	2.268 818	2.013 511	0.654 727
	—	25.0	2.193 152	2.187 237	0.726 493
	April	14.0	2.109 418	2.352 931	0.795 592
	May	4.0	2.018 461	2.510 582	0.861 973
	—	24.0	1.921 056	2.660 225	0.925 605
	July	3.0	1.709 660	2.935 782	1.044 583
	Aug.	12.0	1.480 167	3.180 412	1.152 561
	Sept.	21.0	1.236 696	3.395 151	1.249 711
	Oct.	31.0	0.982 700	3.581 143	1.336 284
	Dec.	10.0	0.721 095	3.739 562	1.412 571
1931	Jan.	19.0	0.454 363	3.871 572	1.478 884
	Febr.	28.0	−0.184 633	3.978 295	1.535 541
	April	9.0	+0.086 246	4.060 803	1.582 852
	May	19.0	0.356 654	4.120 108	1.621 122
	June	28.0	0.625 155	4.157 161	1.650 636
	Aug.	7.0	0.890 461	4.172 854	1.671 672
	Sept.	16.0	1.151 403	4.168 024	1.684 486
	Oct.	26.0	1.406 905	4.143 453	1.689 324
	Dec.	5.0	1.655 967	4.099 880	1.686 415
1932	Jan.	14.0	1.897 644	4.037 999	1.675 976
	Febr.	23.0	2.131 036	3.958 464	1.658 211
	April	3.0	2.355 269	3.861 902	1.633 314
	May	13.0	2.569 489	3.748 909	1.601 467
	June	22.0	2.772 848	3.620 060	1.562 848
	Aug.	1.0	2.964 497	3.475 916	1.517 626
	Sept.	10.0	3.143 574	3.317 026	1.465 966
	Oct.	20.0	3.309 196	3.143 936	1.408 030
	Nov.	29.0	3.460 452	2.957 196	1.343 981
1933	Jan.	8.0	3.596 392	2.757 367	1.273 983
	Febr.	17.0	3.716 016	2.545 031	1.198 206
	March	29.0	3.818 266	2.320 800	1.116 828
	May	8.0	+3.902 018	−2.085 329	−1.030 041

Equinox 1950.0.

	U. T.		x	y	z
1933	June	17.0	+ 3.966 066	— 1.839 335	— 0.938 055
	July	27.0	4.009 110	1.583 610	0.841 105
	Sept.	5.0	4.029 748	1.319 045	0.739 457
	Oct.	15.0	4.026 457	1.046 662	0.633 424
	Nov.	24.0	3.997 585	0.767 647	0.523 373
1934	Jan.	3.0	3.941 330	0.483 397	0.409 746
	Febr.	12.0	3,855 738	— 0.195 576	0.293 078
	March	24.0	3.738 689	+ 0.093 806	0.174 033
	May	3.0	3.587 908	0.382 297	— 0.053 435
	June	12.0	3.400 977	0.666 878	+ 0.067 680
	July	2.0	3.293 176	0.806 566	0.128 033
	—	22.0	3.175 397	0.943 805	0.187 997
	Aug.	11.0	3.047 332	1.077 981	0.247 349
	—	31.0	2.908 684	1.208 406	0.305 840
	Sept.	20.0	2.759 176	1.334 310	0.363 185
	Oct.	10.0	2.598 564	1.454 836	0.419 065
	—	30.0	2.426 653	1.569 022	0.473 118
	Nov.	19.0	2.243 310	1.675 802	0.524 937
	Dec.	9.0	2.048 496	1.773 996	0.574 065
	—	29.0	1.842 288	1.862 301	0.619 992
1935	Jan.	18.0	1.624 919	1.939 298	0.662 153
	Febr.	7.0	1.396 820	2.003 455	0.699 928
	—	27.0	1.158 666	2.053 147	0.732 648
	March	19.0	0.911 427	2.086 688	0.759 604
	April	8.0	0.656 422	2.102 377	0.780 058
	—	28.0	0.395 363	2.098 570	0.793 278
	May	18.0	+ 0.130 383	2.073 775	0.798 562
	June	7.0	— 0.135 962	2.026 760	0.795 289
	—	27.0	0.400 729	1.956 679	0.782 962
	July	17.0	0.660 677	1.863 191	0.761 268
	Aug.	6.0	0.912 399	1.746 560	0.730 117
	—	26.0	1.152 498	1.607 708	0.689 676
	Sept.	15.0	1.377 792	1.448 207	0.640 378
	Oct.	5.0	1.585 496	1.270 207	0.582 899
	—	25.0	— 1.773 376	+ 1.076 307	+ 0.518 126

From these co-ordinates α and δ have been found through interpolation and reduction to the equinox for the beginning of the year of observation, and the following residuals were found:

U. T.			$\Delta\alpha \cos\delta$	$\Delta\delta$	
1934	Dec.	11.11181	— 12^s.73	— 65″.2	Yerkes
—	—	11.17500	— 12.87	— 67.2	»
—	—	12.10558	— 12.75	— 65.9	»
1935	Febr.	6.80389	— 11.01	— 60.9	Bergedorf
—	—	6.84194	— 12.03	— 67.1	»
—	March	5.80424	— 11.64	— 62.5	»

which led to the normal places:

U. T.			
1934 Dec. 12.0	$1^h43^m14^s.64$	+5° 22′ 9″.6	Normal place Nr. 3
1935 Febr. 7.0	2 11 57.78	+9 37 36.1	— — - 4

Comparison with all the normal places gave the result:

		U. T.	$\Delta\alpha \cos\delta$	$\Delta\delta$
Normal place	Nr. 1	1929 Febr. 1.0	— 0^s.20	— 0″.5
—	- 2	1929 March 31.0	+ 0.17	— 0.2
—	- 3	1934 Dec. 12.0	— 12.79	— 66.1
—	- 4	1935 Febr. 7.0	— 11.43	— 62.5

As the large residuals in 1934 and 1935 presumably arise from the inaccuracy of the perturbations used for the revision I have computed new perturbations for 1934 Dec. 11 from the difference between the new perturbed co-ordinates and the unperturbed co-ordinates deduced from the elements (II). The new perturbations are for 1934 Dec. 11.11181 U. T.:

$$\left.\begin{aligned} \xi &= +0.048\ 392 \\ \eta &= -0.013\ 344 \\ \zeta &= -0.007\ 886 \end{aligned}\right\} 1950.0$$

From these values of the perturbations I have made a new revision, which gave the new set of elements:

Epoch and osculation 1929 Febr. 18.0 U. T.

$$\left.\begin{aligned} M &= 354^{\circ}.91062 \\ \omega &= 357.71203 \\ \Omega &= 126.32728 \\ i &= 3.72839 \end{aligned}\right\} 1950.0 \qquad \text{(III)}$$
$$\begin{aligned} e &= 0.3945470 \\ a &= 3.452821 \\ \mu &= 0.1536183 \end{aligned}$$

$$\left.\begin{aligned} x &= -1.932\ 993\ (\cos E - e) - 2.623\ 676 \sin E \\ y &= +2.628\ 374\ (\cos E - e) - 1.707\ 710 \sin E \\ z &= +1.130\ 122\ (\cos E - e) - 0.515\ 915 \sin E \end{aligned}\right\} 1950.0$$

Using these elements the computation of the perturbed equatorial co-ordinates for 1929—1936 has once more been repeated with the following result:

			Equinox 1950.0.		
	U.T.		x	y	z
1929	Jan.	19.0	−0.378 371	+1.958 408	+0.782 290
	—	29.0	0.509 628	1.915 578	0.773 035
	Febr.	8.0	0.639 318	1.866 866	0.761 406
	—	18.0	0.767 008	1.812 318	0.747 397
	—	28.0	0.892 265	1.752 026	0.731 018
	March	10.0	1.014 662	1.686 119	0.712 297
	—	20.0	1.133 784	1.614 772	0.691 277
	—	30.0	−1.249 237	+1.538 199	+0.668 020

Equinox 1950.0.

	U. T.		x	y	z
1929	April	9.0	−1.360 649	+1.456 650	+0.642 603
	—	19.0	1.467 681	1.370 412	0.615 117
	—	29.0	1.570 027	1.279 797	0.585 666
	May	9.0	1.667 420	1.185 143	0.554 367
	—	19.0	1.759 635	1.086 806	0.521 346
	—	29.0	1.846 486	0.985 155	0.486 734
	June	8.0	1.927 833	0.880 566	0.450 672
	—	18.0	2.003 576	0.773 414	0.413 298
	July	8.0	2.138 045	0.552 909	0.335 183
	—	28.0	2.249 848	0.326 511	0.253 502
	Aug.	17.0	2.339 435	+0.096 857	0.169 305
	Sept.	6.0	2.407 641	−0.133 713	+0.083 549
	—	26.0	2.455 572	0.363 186	−0.002 922
	Oct.	16.0	2.484 507	0.589 876	0.089 381
	Nov.	5.0	2.495 816	0.812 405	0.175 215
	—	25.0	2.490 894	1.029 674	0.259 919
	Dec.	15.0	2.471 118	1.240 824	0.343 081
1930	Jan.	4.0	2.437 815	1.445 201	0.424 372
	—	24.0	2.392 242	1.642 322	0.503 535
	Febr.	13.0	2.335 578	1.831 845	0.580 370
	March	5.0	2.268 914	2.013 541	0.654 726
	—	25.0	2.193 258	2.187 271	0.726 493
	April	14.0	2.109 533	2.352 969	0.795 594
	May	4.0	2.018 588	2.510 625	0.861 976
	—	24.0	1.921 193	2.660 274	0.925 609
	July	3.0	1.709 819	2.935 845	1.044 590
	Aug.	12.0	1.480 348	3.180 491	1.152 574
	Sept.	21.0	1.236 899	3.395 249	1.249 730
	Oct.	31.0	0.982 925	3.581 263	1.336 310
	Dec.	10.0	0.721 341	3.739 706	1.412 605
1931	Jan.	19.0	0.454 628	3.871 749	1.478 927
	Febr.	28.0	−0.184 917	3.978 497	1.535 594
	April	9.0	+0.085 945	4.061 037	1.582 918
	May	19.0	0.356 337	4.120 377	1.621 200
	June	28.0	+0.624 825	−4.157 467	−1.650 728

Equinox 1950.0.

	U. T.		x	y	z
1931	Aug.	7.0	+ 0.890 120	— 4.173 199	— 1.671 779
	Sept.	16.0	1.151 053	4.168 410	1.684 609
	Oct.	26.0	1.406 549	4.143 884	1.689 464
	Dec.	5.0	1.655 608	4.100 356	1.686 573
1932	Jan.	14.0	1.897 286	4.038 522	1.676 153
	Febr.	23.0	2.130 682	3.959 037	1.658 408
	April	3.0	2.354 923	3.862 525	1.633 531
	May	13.0	2.569 154	3.749 584	1.601 706
	June	22.0	2.772 530	3.620 789	1.563 109
	Aug.	1.0	2.964 199	3.476 700	1.517 910
	Sept.	10.0	3.143 301	3.317 865	1.466 274
	Oct.	20.0	3.308 955	3.144 832	1.408 363
	Nov.	29.0	3.460 247	2.958 150	1.344 339
1933	Jan.	8.0	3.596 230	2.758 378	1.274 366
	Febr.	17.0	3.715 903	2.546 099	1.198 615
	March	29.0	3.818 210	2.321 925	1.117 264
	May	8.0	3.902 027	2.086 511	1.030 503
	June	17.0	3.966 147	1.840 572	0.938 543
	July	27.0	4.009 273	1.584 899	0.841 619
	Sept.	5.0	4.030 003	1.320 384	0.739 997
	Oct.	15.0	4.026 816	1.048 048	0.633 988
	Nov.	24.0	3.998 059	0.769 074	0.523 961
1934	Jan.	3.0	3.941 932	0.484 857	0.410 354
	Febr.	12.0	3.856 482	— 0.197 062	0.293 705
	March	24.0	3.739 590	+ 0.092 306	0.174 675
	May	3.0	3.588 981	0.380 796	— 0.054 087
	June	12.0	3.402 240	0.665 395	+ 0.067 024
	July	2.0	3.294 540	0.805 100	0.127 378
	—	22.0	3.176 867	0.942 363	0.187 345
	Aug.	11.0	3.048 912	1.076 570	0.246 703
	—	31.0	2.910 377	1.207 033	0.305 202
	Sept.	20.0	2.760 986	1.332 986	0.362 560
	Oct.	10.0	2.600 496	1.453 570	0.418 456
	—	30.0	2.428 707	1.567 827	0.472 530
	Nov.	19.0	+ 2.245 490	+ 1.674 692	+ 0.524 375

Equinox 1950.0.

	U. T.		x	y	z
1934	Dec.	9.0	+ 2.050 800	+ 1.772 983	+ 0.573 534
	—	29.0	1.844 716	1.861 401	0.619 498
1935	Jan.	18.0	1.627 468	1.938 529	0.661 703
	Febr.	7.0	1.399 484	2.002 835	0.699 531
	—	27.0	1.161 436	2.052 696	0.732 311
	March	19.0	0.914 290	2.086 424	0.759 335
	April	8.0	0.659 362	2.102 320	0.779 866
	—	28.0	0.398 358	2.098 739	0.793 171
	May	18.0	+ 0.133 406	2.074 185	0.798 548
	June	7.0	— 0.132 942	2.027 424	0.795 374
	—	27.0	0.397 748	1.957 603	0.783 152
	July	17.0	0.657 774	1.864 377	0.761 565
	Aug.	6.0	0.909 609	1.748 001	0.730 520
	—	26.0	1.149 862	1.609 389	0.690 182
	Sept.	15.0	1.375 343	1.450 106	0.640 980
	Oct.	5.0	1.583 262	1.272 298	0.583 589
	—	25.0	1.771 378	1.078 558	0.518 892
	Nov.	14.0	1.938 090	0.871 761	0.447 915
	Dec.	4.0	2.082 459	0.654 885	0.371 764
	—	24.0	2.204 172	0.430 856	0.291 556
1936	Jan.	13.0	— 2.303 859	+ 0.202 413	+ 0.208 371

Comparison with the 4 normal places then gave the residuals:

		U. T.		$\Delta\, \alpha \cos \delta$	$\Delta\, \delta$
Normal place	Nr. 1	1929 Febr.	1.0	— $0^s.15$	+ 0".2
—	— - 2	1929 March	31.0	+ 0.14	+ 0.1
—	— - 3	1934 Dec.	12.0	+ 0.02	+ 2.3
—	— - 4	1935 Febr.	7.0	— 0.89	— 5.5

The discrepancies between observation and computation are now so small that the orbit may be considered as fairly satisfactory. A revision based on the last computation of

perturbed co-ordinates should be postponed till the appearance of new observations.

From the co-ordinates and velocities for 1935 Oct. 5.0 I deduced the following osculating elements:

Epoch and osculation 1935 Oct. 5.0 U. T.

$$\left.\begin{aligned} M &= 5^\circ.74536 \\ \omega &= 357.97151 \\ \Omega &= 126.29158 \\ i &= 3.72853 \end{aligned}\right\} 1950.0 \qquad \text{(III a)}$$
$$\begin{aligned} e &= 0.3938329 \\ a &= 3.455860 \\ \mu &= 0.1534157 \end{aligned}$$

$$\left.\begin{aligned} x &= -1.945\,836\,(\cos E - e) - 2.619\,892 \sin E \\ y &= +2.623\,348\,(\cos E - e) - 1.719\,222 \sin E \\ z &= +1.129\,044\,(\cos E - e) - 0.520\,587 \sin E \end{aligned}\right\} 1950.0$$

As it may be possible to observe the comet during the winter 1935—36 I have computed the following ephemeris from the elements (III a).

0^h U. T.

1935	α 1935.0	δ 1935.0	Δ	r
Oct. 25	$11^h\ 6^m49^s$	$+6^\circ 46'.1$	2.714	2.138
— 29	14 33	6 3.0	2.687	2.144
Nov. 2	22 10	5 20.3	2.659	2.150
— 6	29 39	4 38.1	2.631	2.157
— 10	37 1	3 56.5	2.602	2.164
— 14	44 16	3 15.6	2.572	2.172
— 18	51 23	2 35.5	2.541	2.180
— 22	11 58 21	1 56.4	2.509	2.188
— 26	12 5 10	1 18.4	2.477	2.196
— 30	12 11 49	+0 41.6	2.444	2.205

0^h U. T.

1935		α 1935.0	δ 1935.0	Δ	r
Dec.	4	$12^h18^m19^s$	$+0°\ 6'.0$	2.410	2.214
—	8	24 39	$-0\ 28.1$	2.375	2.224
—	12	30 48	1 0.7	2.340	2.234
—	16	36 45	1 31.8	2.305	2.244
—	20	42 30	2 1.2	2.269	2.254
—	24	48 1	2 28.7	2.232	2.265
—	28	53 18	2 54.3	2.195	2.276
—	32	12 58 21	-3 17.9	2.158	2.287

0^h U. T.

1936		α 1936.0	δ 1936.0	Δ	r
Jan.	1	$12^h58^m24^s$	$-3°18'.2$	2.158	2.287
—	5	13 3 11	3 39.8	2.120	2.298
—	9	7 40	3 59.1	2.083	2.310
—	13	11 52	4 16.2	2.045	2.322
—	17	15 44	4 30.9	2.008	2.334
—	21	19 16	4 43.2	1.971	2.346
—	25	22 27	4 53.0	1.934	2.359
—	29	25 15	5 0.2	1.898	2.371
Febr.	2	27 39	5 4.9	1.863	2.384
—	6	29 38	5 6.9	1.830	2.397
—	10	31 12	5 6.3	1.797	2.411
—	14	32 20	5 3.0	1.766	2.424
—	18	33 1	4 57.1	1.736	2.438
—	22	33 15	4 48.6	1.709	2.452
—	26	33 1	4 37.7	1.683	2.466
March	1	32 21	4 24.5	1.660	2.480
—	5	13 31 15	-4 9.0	1.641	2.494

The small inclination of the orbit and the distance of the aphelion 4.81 made a former proximity to Jupiter probable. In fact such a proximity took place in the first part of 1926.

To find the elements before this I have computed the co-ordinates backwards till 1920. From 1929 to 1924 Jupiter and Saturn were taken into consideration in a 7-figure computation, from 1924 to 1920 only Jupiter was considered and a 6-figure computation was used. The resulting equatorial co-ordinates were as follows:

			Equinox 1950.0.		
	U. T.		x	y	z
1929	Jan.	9.0	−0.245 974	+1.995 348	+0.789 193
1928	Dec.	30.0	−0.112 853	2.026 431	0.793 779
	—	20.0	+0.020 594	2.051 722	0.796 096
	—	10.0	0.153 986	2.071 320	0.796 205
	Nov.	30.0	0.286 968	2.085 352	0.794 173
	—	20.0	0.419 207	2.093 966	0.790 078
	—	10.0	0.550 399	2.097 332	0.784 002
	Oct.	21.0	0.808 557	2.089 076	0.766 266
	—	1.0	1.059 544	2.062 193	0.741 695
	Sept.	11.0	1.301 874	2.018 388	0.711 037
	Aug.	22.0	1.534 436	1.959 377	0.675 020
	—	2.0	1.756 437	1.886 832	0.634 340
	July	13.0	1.967 356	1.802 341	0.589 642
	June	23.0	2.166 890	1.707 383	0.541 520
	—	3.0	2.354 908	1.603 320	0.490 508
	May	14.0	2.531 414	1.491 391	0.437 091
	April	24.0	2.696 514	1.372 718	0.381 696
	—	4.0	2.850 391	1.248 308	0.324 707
	March	15.0	2.993 281	1.119 066	0.266 461
	Febr.	24.0	3.125 459	0.985 800	0.207 258
	—	4.0	3.247 225	0.849 234	0.147 362
	Jan.	15.0	3.358 894	0.710 012	0.087 008
1927	Dec.	26.0	3.460 791	0.568 712	+0.026 400
	—	6.0	3.553 241	0.425 849	−0.034 276
	Nov.	16.0	3.636 570	0.281 885	0.094 860
	Oct.	27.0	3.711 097	+0.137 234	0.155 209
	—	7.0	+3.777 136	−0.007 734	−0.215 194

Equinox 1950.0.

	U. T.		x	y	z
1927	Sept.	17.0	+3.834 994	−0.152 682	−0.274 701
	Aug.	28.0	3.884 966	0.297 311	0.333 629
	—	8.0	3.927 341	0.441 348	0.391 887
	July	19.0	3.962 396	0.584 546	0.449 394
	June	29.0	3.990 401	0.726 680	0.506 076
	—	9.0	4.011 615	0.867 547	0.561 866
	May	20.0	4.026 290	1.006 962	0.616 706
	April	30.0	4.034 668	1.144 752	0.670 540
	—	10.0	4.036 986	1.280 763	0.723 319
	March	21.0	4.033 473	1.414 852	0.774 999
	—	1.0	4.024 353	1.546 885	0.825 538
	Febr.	9.0	4.009 845	1.676 742	0.874 899
	Jan.	20.0	3.990 164	1.804 308	0.923 048
1926	Dec.	31.0	3.965 524	1.929 483	0.969 954
	—	11.0	3.936 138	2.052 170	1.015 591
	Nov.	21.0	3.902 221	2.172 283	1.059 933
	—	1.0	3.863 992	2.289 745	1.102 963
	Oct.	12.0	3.821 679	2.404 491	1.144 665
	Sept.	22.0	3.775 517	2.516 467	1.185 032
	—	2.0	3.725 760	2.625 634	1.224 067
	Aug.	13.0	3.672 683	2.731 979	1.261 787
	July	24.0	3.616 584	2.835 523	1.298 233
	—	4.0	3.557 790	2.936 335	1.333 481
	June	14.0	3.496 654	3.034 561	1.367 658
	May	25.0	3.433 521	3.130 453	1.400 974
	—	5.0	3.368 666	3.224 398	1.433 737
	April	15.0	3.302 173	3.316 904	1.466 350
	March	26.0	3.233 796	3.408 483	1.499 229
	—	6.0	3.162 945	3.499 449	1.532 652
	Febr.	14.0	3.088 901	3.589 738	1.566 614
	Jan.	25.0	3.011 102	3.678 972	1.600 869
	—	5.0	2.929 293	3.766 630	1.635 054
1925	Dec.	16.0	2.843 474	3.852 210	1.668 808
	Nov.	26.0	2.753 801	3.935 314	1.701 847
	—	6.0	+2.660 495	−4.015 635	−1.733 945

Equinox 1950.0.

U. T. (resp. G. M. T.)			x	y	z
1925	Oct.	17.0	+ 2.563 797	— 4.092 950	— 1.764 944
	Sept.	27.0	2.463 944	4.167 095	1.794 725
	—	7.0	2.361 157	4.237 948	1.823 204
	Aug.	18.0	2.255 642	4.305 413	1.850 313
	July	29.0	2.147 592	4.369 419	1.876 007
	—	9.0	2.037 184	4.429 907	1.900 244
	June	19.0	1.924 583	4.486 828	1.922 997
	May	10.0	1.693 423	4.589 815	1.963 950
	March	31.0	1.455 270	4.678 125	1.998 718
	Febr.	19.0	1.211 194	4.751 553	2.027 193
	Jan.	10.0	0.962 186	4.809 941	2.049 293
1924	Nov.	30.5	0.709 202	4.853 159	2.064 958
	Oct.	21.5	0.453 158	4.881 090	2.074 138
	Sept.	11.5	+ 0.194 951	4.893 642	2.076 794
	Aug.	2.5	— 0.064 537	4.890 738	2.072 895
	June	23.5	0.324 425	4.872 310	2.062 418
	May	14.5	0.583 839	4.838 312	2.045 350
	April	4.5	0.841 895	4.788 711	2.021 681
	Febr.	24.5	1.097 700	4.723 492	1.991 412
	Jan.	15.5	1.350 351	4.642 655	1.954 551
1923	Dec.	6.5	1.598 922	4.546 228	1.911 117
	Oct.	27.5	1.842 469	4.434 256	1.861 139
	Sept.	17.5	2.080 022	4.306 816	1.804 657
	Aug.	8.5	2.310 586	4.164 013	1.741 723
	June	29.5	2.533 131	4.005 993	1.672 410
	May	20.5	2.746 594	3.832 938	1.596 803
	April	10.5	2.949 880	3.645 084	1.515 015
	March	1.5	3.141 853	3.442 716	1.427 176
	Jan.	20.5	3.321 341	3.226 190	1.333 448
1922	Dec.	11.5	3.487 132	2.995 929	1.234 023
	Nov.	1.5	3.637 975	2.752 445	1.129 128
	Sept.	22.5	3.772 587	2.496 342	1.019 034
	Aug.	13.5	3.889 646	2.228 334	0.904 055
	July	4.5	— 3.987 810	— 1.949 257	— 0.784 560

Equinox 1950.0.

G. M. T.			x	y	z
1922	May	25.5	−4.065 714	−1.660 081	−0.660 977
	April	15.5	4.121 987	1.361 927	0.533 793
	March	6.5	4.155 273	1.056 079	0.403 571
	Jan.	25.5	4.164 239	0.743 996	0.270 945
1921	Dec.	16.5	4.147 611	0.427 329	0.136 633
	Nov.	6.5	4.104 207	−0.107 925	−0.001 433
	Sept.	27.5	4.032 966	+0.212 161	+0.133 769
	Aug.	18.5	3.933 002	0.530 666	0.268 000
	July	9.5	3.803 644	0.845 121	0.400 201
	May	30.5	3.644 491	1.152 864	0.529 235
	April	20.5	3.455 468	1.451 060	0.653 897
	March	11.5	3.236 873	1.736 738	0.772 925
	Jan.	30.5	2.989 433	2.006 841	0.885 026
1920	Dec.	21.5	−2.714 342	+2.258 280	+0.988 902

The figure on page 19 illustrates the abnormally large perturbations in the orbit of the comet near the proximity to Jupiter in 1926. The orbit is shown projected on the ecliptic (the inclination is always very small).

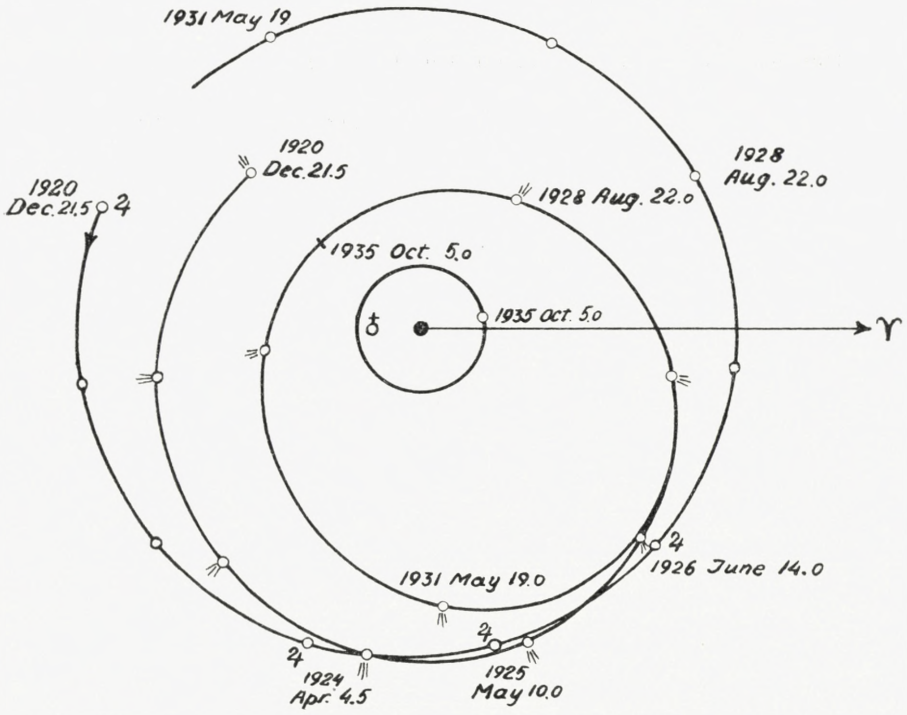
From the co-ordinates and velocities for 1921 March 11.5 I have deduced the following set of elements:

Epoch and osculation 1921 March 11.5 G. M. T.

$$\left.\begin{aligned} M &= 32^{\circ}.384 \\ \omega &= 335.462 \\ \Omega &= 126.681 \\ i &= 0.710 \end{aligned}\right\} 1950.0$$
$$\begin{aligned} e &= 0.19707 \\ a &= 4.4261 \\ \mu &= 0.10585 \end{aligned} \qquad \text{(III b)}$$

$$\left.\begin{aligned} x &= -0.93118\ (\cos E - e) - 4.24194 \sin E \\ y &= +3.97877\ (\cos E - e) - 0.85674 \sin E \\ z &= +1.70072\ (\cos E - e) - 0.31824 \sin E \end{aligned}\right\} 1950.0$$

I have not been successful in establishing any identity between these elements and any other set of elements in the tables of comets and asteroids.



The following table shows the distance of the comet from Jupiter for a number of dates from 1921 to 1928:

U. T. (resp. G. M. T.)			Δ
1928	Nov.	10.0	3.508
1927	Oct.	7.0	1.188
1926	Sept.	2.0	0.357
1925	July	29.0	0.438
1924	June	23.5	0.895
1923	May	20.5	1.078
1922	April	15.5	1.141
1921	March	11.5	2.055

On 1926 March 26 the distance had a minimum value: 0.179.

I am indepted to the Carlsbergfond for a grant, which enabled me to carry out the present investigation.

University Observatory, Copenhagen 1935 Aug. 9.

HANS Q. RASMUSEN.

Færdig fra Trykkeriet den 19. December 1935.