DET KGL. DANSKE VIDENSKABERNES SELSKAB
MATEMATISK-FYSISKE MEDDELELSER, BIND XXV, NR. 2

THE MOTION OF COMET SCHWASSMANN-WACHMANN 2 IN THE YEARS 1942-1949

BY

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When comet Schwassmann-Wachmann 2 was rediscovered in 1941 the deviation from the calculated position appeared to be $\Delta\alpha \cos\delta = -2\overset{s}{.}2$ and $\Delta\delta = +6''$. A continuation of the calculated orbit for the years 1929—1942[1] therefore is likely to lead to an ephemeris sufficiently accurate to make it possible to find the comet in the coming apparition in 1947—48. As before account has been taken of the perturbations from Jupiter and Saturn. The computed equatorial co-ordinates for the equinox 1950.0 are given in the following table.

Table I.

0^h U. T.	x	y	z
1942 Feb. 10	— 1.157 275	+ 1.659 070	+ 0.710 564
Mar. 2	1.381 204	1.504 224	0.662 982
22	1.588 657	1.331 425	0.607 488
Apr. 11	1.777 488	1.143 014	0.544 872
May 1	1.946 127	0.941 597	0.476 058
21	2.093 577	0.729 904	0.402 052
Jun. 10	2.219 408	0.510 650	0.323 884
30	2.323 690	0.286 411	0.242 561
Jul. 20	2.406 905	+ 0.059 550	0.159 029
Aug. 9	2.469 858	— 0.167 838	+ 0.074 148
29	2.513 575	0.393 942	— 0.011 319
Sep. 18	2.539 233	0.617 239	0.096 714
Oct. 8	2.548 083	0.836 472	0.181 477
28	— 2.541 401	— 1.050 625	— 0.265 142

[1] Det Kgl. Danske Videnskabernes Selskab, Math.-fys. Medd. XIII, 16 and XIX, 3, and Publikationer og mindre Meddelelser fra Københavns Observatorium Nr. 106 and 128.

Table I (continued).

0h U. T.	x	y	z
1942 Nov. 17	— 2.520 449	— 1.258 897	— 0.347 324
Dec. 7	2.486 448	1.460 670	0.427 716
27	2.440 560	1.655 476	0.506 069
1943 Jan. 16	2.383 882	1.842 978	0.582 191
Feb. 5	2.317 434	2.022 941	0.655 933
25	2.242 163	2.195 216	0.727 182
Mar. 17	2.158 942	2.359 722	0.795 859
Apr. 6	2.068 577	2.516 431	0.861 908
26	1.971 805	2.665 360	0.925 291
May 16	1.869 304	2.806 556	0.985 992
Jun. 5	1.761 694	2.940 097	1.044 002
25	1.649 546	3.066 072	1.099 327
Jul. 15	1.533 381	3.184 594	1.151 980
Aug. 24	1.290 875	3.399 760	1.249 352
Oct. 3	1.037 570	3.586 624	1.336 327
Nov. 12	0.776 344	3.746 263	1.413 161
Dec. 22	0.509 664	3.879 762	1.480 136
1944 Jan. 31	— 0.239 657	3.988 178	1.537 544
Mar. 11	+ 0.031 825	4.072 527	1.585 675
Apr. 20	0.303 150	4.133 778	1.624 814
May 30	0.572 872	4.172 849	1.655 236
Jul. 9	0.839 687	4.190 602	1.677 203
Aug. 18	1.102 412	4.187 854	1.690 965
Sep. 27	1.359 959	4.165 372	1.696 760
Nov. 6	1.611 314	4.123 877	1.694 812
Dec. 16	1.855 524	4.064 056	1.685 332
1945 Jan. 25	2.091 678	3.986 560	1.668 523
Mar. 6	2.318 895	3.892 008	1.644 576
Apr. 15	2.536 319	3.780 996	1.613 674
May 25	2.743 098	3.654 099	1.575 992
Jul. 4	2.938 384	3.511 877	1.531 702
Aug. 13	3.121 321	3.354 882	1.480 969
Sep. 22	3.291 033	3.183 663	1.423 957
Nov. 1	+ 3.446 621	— 2.998 772	— 1.360 829

Table I (continued).

0^h U. T.	x	y	z
1945 Dec. 11	+ 3.587 150	— 2.800 772	— 1.291 753
1946 Jan. 20	3.711 644	2.590 247	1.216 901
Mar. 1	3.819 073	2.367 809	1.136 451
Apr. 10	3.908 347	2.134 114	1.050 598
May 20	3.978 301	1.889 869	0.959 551
Jun. 29	4.027 691	1.635 858	0.863 544
Aug. 8	4.055 178	1.372 955	0.762 843
Sep. 17	4.059 316	1.102 155	0.657 751
Oct. 27	4.038 545	0.824 602	0.548 628
Dec. 6	3.991 175	0.541 634	0.435 896
1947 Jan. 15	3.915 380	— 0.254 827	0.320 066
Feb. 24	3.809 194	+ 0.033 932	0.201 762
Apr. 5	3.670 514	0.322 368	— 0.081 749
May 15	3.497 118	0.607 710	+ 0.039 020
Jun. 24	3.286 708	0.886 562	0.159 355
Aug. 3	3.036 994	1.154 733	0.277 752
Sep. 12	2.745 853	1.407 044	0.392 320
Oct. 2	2.584 186	1.525 306	0.447 442
22	2.411 572	1.637 099	0.500 666
Nov. 11	2.227 930	1.741 393	0.551 595
Dec. 1	2.033 272	1.837 061	0.599 792
21	1.827 723	1.922 871	0.644 768
1948 Jan. 10	1.611 559	1.997 491	0.685 992
30	1.385 240	2.059 496	0.722 882
Feb. 19	1.149 454	2.107 390	0.754 818
Mar. 10	0.905 155	2.139 630	0.781 146
30	0.653 609	2.154 677	0.801 195
Apr. 19	0.396 427	2.151 055	0.814 301
May 9	+ 0.135 585	2.127 427	0.819 832
29	— 0.126 576	2.082 693	0.817 229
Jun. 18	0.387 383	2.016 090	0.806 043
Jul. 8	0.643 902	1.927 290	0.785 981
28	0.893 052	1.816 479	0.756 943
Aug. 17	— 1.131 740	+ 1.684 415	+ 0.719 047

Table I (continued).

0^h U. T.	x	y	z
1948 Sep. 6	— 1.357 031	+ 1.532 417	+ 0.672 641
26	1.566 300	1.362 321	0.618 292
Oct. 16	1.757 369	1.176 382	0.556 754
Nov. 5	1.928 595	0.977 142	0.488 922
25	2.078 909	0.767 284	0.415 780
Dec. 15	2.207 801	0.549 494	0.338 343
1949 Jan. 4	2.315 242	0.326 345	0.257 612
24	— 2.401 660	+ 0.100 208	+ 0.174 532

From these co-ordinates the following ephemeris was deduced and cabled to the Yerkes Observatory on Oct. 17:

0^h U. T.	α 1947.0	δ 1947.0
1947 Oct. 18	$2^h\ 36^m.0$	$+ 9° 27'$
22	2 33.2	+ 9 11
26	2 30.2	+ 8 54
30	2 27.0	+ 8 36

The comet was rediscovered by Van Biesbroeck on Oct. 20, and by Jeffers on Oct. 24. The last observation gave the following residuals:

	$\Delta\alpha \cos\delta$	$\Delta\delta$
1947 Oct. 24.41048	$+ 1^s.49$	$+ 8''.2$
24.47645	+ 1.40	+ 8.4

In the first part of 1949 the comet will be well placed for observation, and the following ephemeris is deduced from the rectangular co-ordinates:

Table II.

0h U. T.	α 1950.0	δ 1950.0	Δ	r
1948 Nov. 25	$12^h\ 3^m.4$	+ 1° 31′	2.533	2.254
29	9.8	· 0 55	2.499	2.263
Dec. 3	16.1	+ 0 21	2.464	2.272
7	22.2	— 0 12	2.428	2.281
11	28.1	0 44	2.392	2.290
15	33.9	1 13	2.356	2.300
19	39.4	1 42	2.317	2.310
23	44.7	2 8	2.279	2.320
27	49.8	2 32	2.241	2.331
31	54.6	2 55	2.202	2.341
1949 Jan. 4	12 59.2	3 16	2.164	2.352
8	13 3.4	3 34	2.125	2.363
12	7.4	3 50	2.086	2.375
16	11.1	4 4	2.048	2.386
20	14.4	4 15	2.010	2.398
24	17.4	4 24	1.972	2.410
28	19.9	4 30	1.935	2.422
Feb. 1	22.1	4 34	1.900	2.435
5	23.9	4 35	1.865	2.447
9	25.3	4 34	1.832	2.461
13	26.2	4 30	1.800	2.473
17	26.7	4 23	1.770	2.486
21	26.8	4 14	1.743	2.499
25	26.4	4 2	1.718	2.512
Mar. 1	25.6	3 48	1.695	2.526
5	24.4	3 32	1.676	2.539
9	22.8	3 14	1.660	2.553
13	20.8	2 55	1.647	2.567
17	18.5	2 34	1.638	2.581
21	16.0	2 13	1.633	2.595
25	13.2	1 51	1.632	2.609
29	10.3	1 29	1.635	2.623
Apr. 2	7.2	1 8	1.642	2.638
6	13 4.2	— 0 47	1.654	2.652

Table II (continued).

0^h U. T.	α 1950.0	δ 1950.0	Δ	r
1949 Apr. 10	$13^h\ 1^m.2$	$-0°\ 28'$	1.671	2.667
14	12 58.3	−0 10	1.691	2.681
18	55.6	+0 6	1.716	2.696
22	53.0	0 20	1.745	2.711
26	50.7	0 32	1.778	2.725
30	48.7	0 41	1.815	2.740
May 4	12 47.0	+0 48	1.855	2.755

The co-ordinates and velocities for 1949 January 4.0 U.T. lead to the following elements:

Epoch and osculation 1949 Jan. 4.0 U.T.

$$
\begin{aligned}
T &= 1948 \text{ Aug. } 23.5770 \text{ U.T.} \\
M &= 20°.1512 \\
\left.\begin{aligned} \omega &= 358.1003 \\ \Omega &= 126.0201 \\ i &= 3.7239 \end{aligned}\right\} & \ 1950.0 \\
e &= 0.383651 \\
a &= 3.49212 \\
\mu &= 0.1510324
\end{aligned}
$$

$$
\begin{aligned}
P_x &= -0.560986 & Q_x &= -0.826157 \\
P_y &= +0.760332 & Q_y &= -0.539306 \\
P_z &= +0.327400 & Q_z &= -0.163137
\end{aligned}
\Bigg\}\ 1950.0
$$

The ephemeris of course can also be computed by means of these elements, but it is far easier to deduce the ephemeris from the rectangular co-ordinates for every 20th day and then interpolate to every 4th day, as has been done in this case.

The perturbed co-ordinates of comet Schwassmann-Wachmann 2 based on elements from 1929 Feb. 18 have now been computed for 20 years, during which time the comet has made three revolutions.

The differences between computation and observations are less than one minute of arc, and undoubtedly the orbit will not deviate particularly much from the observations even if the same elements are used for a few more revolutions. After 270 intervals, however, the perturbations are somewhat uncertain, so that the good accordance may partly be due to chance. At any rate an improvement of the orbit by means of the observed positions cannot be obtained without computing perturbations of higher accuracy.

I am indebted to the Carlsberg Foundation for having placed at my disposal the calculating-machine used in this investigation.

Værslevgaarden, May 1948.

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