$$\lim_{n=\infty} \left| \frac{f_{n+1}}{f_n} z^2 \right| < 1$$

or when

$$| z | < \lim_{n=\infty} \sqrt{\frac{f_n}{f_{n+1}}}.$$

Now

$$\lim \sqrt{\frac{f_n}{f_{n+1}}} = \lim 2 \sqrt{\frac{b_1 \dots b_{n+1} D_{n-1}}{D_n}} = \alpha$$

therefore

$$\lim \frac{b_1 \dots b_{n+1} D_{n-1}}{D_n} = \left(\frac{\alpha}{2}\right)^2$$

$$\lim \frac{b_1 \dots b_{n+1} \cdot b_1 \dots b_n D_{n-2}}{D_n} = \left(\frac{\alpha}{2}\right)^4 \text{ etc.}$$

and finally

$$1 = \frac{\left(\frac{\alpha}{2}\right)^2}{b_1} - \frac{\left(\frac{\alpha}{2}\right)^4}{2!\, b_1 b_2} + \frac{\left(\frac{\alpha}{2}\right)^6}{3!\, b_1 b_2 b_3} - \text{etc.}$$

Hence it is evident that α is a root of the equation $I'(z) = 0$ as might be expected.

Astronomy. — *"Researches on the orbit of the periodic comet Holmes and on the perturbations of its elliptic motion."* By Dr. H. J. Zwiers. (Communicated by Prof. H. G. van de Sande Bakhuijzen.)

In 1902, after the reappearance of the comet Holmes in 1899—1900 I published in full the results which I had derived from the investigation of the observations after its return. [1]) With the most accurate elements which I had been able to deduce from its appearance in 1892—93 I had calculated in advance the perturbations arising from the action of Jupiter and of Saturnus and at first also of the earth and thence I have derived a system of elements for 1899 September 9.0 mean time Greenwich, which served as a basis for an ephemeris published in No. 3553 of the *Astron. Nachrichten.* By means of this ephemeris the comet has been rediscovered at the Lick Observatory and the relatively small difference between the observed and the computed place proved that the elements of the

[1]) Recherches sur l'orbite de la comète périodique de Holmes et sur les perturbations de son mouvement elliptique, par Dr. H. J. Zwiers. Deuxième mémoire. Leyde, E. J. Brill, 1902.

orbit found for 1892 and the computation of the perturbations which had been based on them were very nearly correct.

The observations in 1899 and 1900 furnished me with sufficient material to apply to the elements such small corrections as brought the remaining differences between the predicted and the observed positions within the limits of ordinary errors of observation. The system of elements obtained thus, which satisfied both the appearance of 1892—93 and that of 1899—1900 and which in my "Deuxième Mémoire" p. 78 has been recorded as "Système VII", must naturally furnish the basis for further investigations. Therefore I shall give it here in its general features.

System VII.

Epoch 1899 June 11.0 mean time of Greenw.
Osculation 1899 September 9.0 „ „ „ „

$$M_0 = 22661'' 3264$$
$$\mu = 516'' 188791$$
$$log\ a = 0.558\ 1320.0$$
$$\varphi = 24°\ 17'\ 23''54$$
$$e = 0.4113532$$
$$\left.\begin{aligned} i &= 20°\ 48'\ \ 9''84 \\ \pi &= 345\ \ 48\ \ 38.06 \\ \Omega &= 331\ \ 43\ \ 18.24 \end{aligned}\right\}\ 1899.0$$
$$\left.\begin{aligned} i &= 20\ \ 48\ \ 10.29 \\ \pi &= 345\ \ 49\ \ 28.27 \\ \Omega &= 331\ \ 44\ \ \ 8.95 \end{aligned}\right\}\ 1900.0$$

Although the corrections which had to be applied to the elements in consequence of the new observations were small, I immediately after the publication of those researches resolved to repeat the computation of the perturbations between 1892 and 1900 with the new elements and to extend it to all the planets of which the disturbing effect could not a priori be neglected as being insensible. This elaborate investigation, which necessarily required a new discussion of the two appearances of the comet, was however only partly finished when in 1905 the preparation for the third appearance had to be taken in hand.

I have then started from system VII, which though not perfect, yet satisfied all practical demands. I did not venture, however, to use those elements without more for the computation of the places at the return of the comet in 1906. It is true that the disturbing planets, especially Jupiter, whose influence is by far the greatest, remained at a considerable distance during the entire revolution of the comet, yet the feeble light of the comet in 1899—1900 and the difficulty experienced by most observers to properly identify the comet in the midst of numerous faint nebulae near the apparent orbit, made me fear that such a rough ephemeris of the apparent places for 1906 might prove insufficient for rediscovering it and observing it.

In the autumn of 1905, I therefore resolved to derive the perturbations which the comet would suffer on its path between the perihelion passages of 1899 and 1906. The original plan of also computing the perturbations arising from the action of Saturnus had to be given up through lack of time. And so Jupiter remained the only disturbing planet. The method I chose was that of the variation of the elliptic constants; I also chose an interval of 80 days, because former investigations had shown that the accuracy, attainable by it was more than sufficient for my purpose. In former researches we have always adopted the rule that for each new epoch the small variations which the elements had undergone during the course of the last interval were to be applied to them. The computations required for this implied, however, an amount of labour not to be underrated, and as in this case the computations could have only a preliminary character I could leave aside these small corrections by which in this case only small quantities of the second order were neglected. Thus the above mentioned system VII was used as a basis for the computation of perturbations for the entire revolution. The places of the disturbing planet are taken from the Nautical Almanac; the longitudes only were reduced to the equinox of 1900.0 by applying the precession. The neglection of the small corrections for nutation and for the variation in the obliquity of the ecliptic cannot have any perceptible influence on the perturbations caused by the planet.

Instead of the elaborate tables of perturbations I shall for shortness communicate only the summed series, namely the quantities ${}^{II}f$ for the mean daily motion and the quantities ${}^{I}f$ for the other elements. By working out each table the reader will be able to form a judgment on the accuracy reached. The initial constants printed in big figures, which in the construction of the tables were derived from the first values of $\frac{dE}{dt}$, (E representing one of the 6 elements) and from their differences up to f^{IV} are chosen so that the integrals disappear for 1899 September 9 as lower limit. Up to 1900 February 16 the derivatives could be borrowed from the tables which I have communicated in my Deuxième Mémoire ps. 26—32; with regard, however to the interval chosen now I had to multiply $\frac{d\mu}{dt}$ by 4, and the other derivatives of the elements by 2.

TABLES OF THE JUPITER PERTURBATIONS.

Dates		i	☊	μ	M	π	φ
		″	″	″	″	″	″
1899	Jan. 12			— 21.5730			
		+ 4.536	+ 7.382		+ 0.176	+ 13.677	— 29.200
	April 2			— 8.4814			
		+ 2.690	+ 6.991		+ 4.983	+ 6.957	— 16.151
	June 21			— 1.5328			
		+ 0.760	**+ 3.297**		**+ 2.505**	**+ 2.601**	**— 4.611**
	Sept. 9			**+ 0.2737**			
		— 0.625	— 3.826		— 2.530	— 3.150	+ 4.197
	Nov. 28			— 1.2125			
		— 1.018	— 13.652		— 5.973	— 13.460	+ 11.287
1900	Febr. 16			— 4.2367			
		— 0.203	— 25.174		— 6.752	— 28.616	+ 18.278
	May 7			— 7.5053			
		+ 1.867	— 37.406		— 5.822	— 47.169	+ 26.379
	July 26			— 10.1533			
		+ 5.118	— 49.494		— 4.954	— 67.123	+ 36.268
	Oct. 14			— 11.6218			
		+ 9.397	— 60.732		— 6.051	— 86.516	+ 48.205
1901	Jan. 2			— 11.5478			
		+ 14.489	— 70.570		— 10.874	— 103.621	+ 62.168
	Mrch 23			— 9.6867			
		+ 20.135	— 78.624		— 20.923	— 117.008	+ 77.946
	June 11			— 5.8601			
		+ 26.049	— 84.681		— 37.388	— 125.552	+ 95.199
	Aug. 30			+ 0.0784			
		+ 31.931	— 88.702		— 61.130	— 128.426	+ 113.505
	Nov. 18			+ 8.2654			
		+ 37.487	— 90.817		— 92.674	— 125.094	+ 132.387
1902	Febr. 6			+ 18.8422			
		+ 42.443	— 91.315		— 132.210	— 115.298	+ 151.341
	April 27			+ 31.9635			
		+ 46.560	— 90.624		— 179.598	— 99.047	+ 169.854
	July 16			+ 47.8025			
		+ 49.651	— 89.287		— 234.380	— 76.601	+ 187.427
	Oct. 4			+ 66.5527			
		+ 51.593	— 87.924		— 295.802	— 48.453	+ 203.590
	Dec. 23			+ 88.4279			
		+ 52.337	— 87.192		— 362.841	— 15.304	+ 217.927
1903	Mrch 13			+ 113.6611			
		+ 51.916	— 87.735		— 434.253	+ 21.975	+ 230.081
	June 1			+ 142.5014			
		+ 50.444	— 90.131		— 508.617	+ 62.385	+ 239.783
	Aug. 20			+ 175.2122			
		+ 48.115	— 94.838		— 584.410	+ 104.856	+ 246.855
	Nov. 8			+ 212.0688			
		+ 45.193	— 102.143		— 660.082	+ 148.314	+ 251.221
1904	Jan. 27			+ 253.3579			
		+ 41.996	— 112.115		— 734.136	+ 191.752	+ 252.903
	April 16			+ 299.3790			
		+ 38.875	— 124.566		— 805.216	+ 234.308	+ 252.011
	July 5			+ 350.4492			
		+ 36.183	— 139.032		— 872.176	+ 275.334	+ 248.718
	Sept. 23			+ 406.9127			
		+ 34.243	— 154.764		— 934.123	+ 314.438	+ 243.224
	Dec. 12			+ 469.1545			
		+ 33.309	— 170.745		— 990.396	+ 351.479	+ 235.703
1905	Mrch 2			+ 537.6167			
		+ 33.518	— 185.739		— 1040.430	+ 386.444	+ 226.250
	May 21			+ 612.8073			
		+ 34.834	— 198.384		— 1083.432	+ 419.129	+ 214.885
	Aug. 9			+ 695.2691			
		+ 36.981	— 207.384		— 1117.855	+ 448.580	+ 201.767
	Oct. 28			+ 785.4184			
		+ 39.372	— 211.929		— 1141.214	+ 472.756	+ 187.961
1906	Jan. 16			+ 883.0549			
		+ 41.116	— 212.537		— 1152.415	+ 490.526	+ 176.821
	April 6			+ 986.3401			
		+ 41.312	— 212.305		— 1158.665	+ 508.036	+ 173.909
	June 25			+ 1090.7414			

By means of these tables it is not difficult to integrate the perturbations for an arbitrary epoch according to the known expressions of the mechanical quadrature. As a new osculation epoch I have chosen

1906 January 16.0 mean time Greenwich

and I have found:

$$\Delta i = + \quad 40''34 \qquad \Delta \Omega = - \; 3' \, 32''48$$

$$\Delta \mu = + \quad 1''258874 \qquad \iint \frac{d\mu}{dt} = + \quad 883''5368$$

$$\Delta_1 M = - \, 1147''7070 \qquad \Delta \pi = + \, 8' \quad 2''08$$

$$\Delta \varphi = + \, 3' \quad 2''01$$

hence the new elements become:

epoch and osculation 1906 January 16.0 mean time Greenwich

$$M_0 = 1266412''143$$
$$\mu = 517''447665$$
$$\log a = 0.557\;4267.74$$
$$\varphi = 24^\circ \, 20' \, 25''55$$
$$e = 0.412\;1574$$

$$\left.\begin{aligned} i &= \;\; 20^\circ 48' 50''63 \\ \pi &= 345 \;\; 57 \; 30.35 \\ \Omega &= 331 \;\; 40 \; 36.47 \end{aligned}\right\} 1900.0$$

From these disturbed elements we derive for the time of perihelion passage

1906 March 14.1804 mean time Greenwich

while the original system VII, without regard to the perturbations during the period since 1899 June would give

1906 March 13.8083.

If we take into account that the small retardation of not yet 9 hours is compensated by an increased longitude of the perihelion of 8′, we find a posteriori confirmed, what could have been foreseen, that the perturbations during the second revolution have only slightly affected the places of the comet in space.

By reducing the elements i, π and Ω to the mean equinox of 1906.0 I find

$$\left.\begin{aligned} i &= \;\; 20^\circ 48' 53''30 \\ \pi &= 346 \quad 2 \; 31.63 \\ \Omega &= 331 \;\; 45 \; 40.75 \end{aligned}\right\} 1906.0.$$

In order to compute from these elements an ephemeris I have derived the following expressions for the heliocentric coordinates of the comet referred to the equator:

$$x = [9.993\ 7731.9]\ \sin\ (v + 77°\ 37'\ 24''85)$$
$$y = [9.876\ 2012.2]\ \sin\ (v - 20\ \ 58\ 31.25)$$
$$z = [9.832\ 7001.5]\ \sin\ (v - \ \ 1\ 47\ 16.19)$$

The coefficients in square brackets are logarithms; the quantity v denotes the true anomaly of the comet.

By means of the expressions above given the heliocentric coordinates have been derived from 4 to 4 days for mean noon at Greenwich; the coordinates of the sun were taken from the Nautical Almanac after having been reduced to the mean equinox of the beginning of the year. In the reduction of the mean places to apparent ones the aberration terms are omitted, because, as it is known, the influence of the aberration for the bodies of our solar system can be more simply accounted for by subtracting from the times of observation the equation of light. In the two following tables which contain the apparent places of the comet in α and δ I have therefore added in column ϑ for each date the equation of light expressed in mean solar days. The 4th column gives the logarithms of the geocentric distance. As first date I have chosen May 1st because I had derived from a preliminary computation that before that time there would be no chance to discover the comet owing to its small apparent distance from the sun and its large distance from the earth. The possibility did not seem excluded, however, that by means of powerful telescopes or sensitive photographic plates the comet might be discovered in January **1906**. Therefore I have derived positions for that month and sent a short ephemeris to Prof. KREUTZ, who in a circular has communicated it to astronomers. To give a clear idea of the apparent orbit of the comet and also because the published places were not perfectly correct owing to a small reduction error, I here shall give the correct results from 4 to 4 days. Up to now (February 14) no tidings about the discovery have arrived, at which we need not wonder if we consider the cloudiness and especially the southern and generally unfavourable position.

The next table gives the apparent positions of the comet for the last 8 months of the year. The direct computations have been made from 4 to 4 days; between them one date has been interpolated taking into account the fourth differences.

As a measure for the probable brightness we generally calculate the quantity $H = \frac{1}{r^2\,\rho^2}$. Although on account of the irregular variation of the comet's light it is not certain that the brightness will be

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PLACES OF THE COMET BEFORE THE CONJUNCTION.

1906	apparent α	apparent δ	log ρ	ϑ	H
	h m s	° ′ ″			
Jan. 1	20 45 1.65	− 21 23 1 7	0.47858	0.017373	0.0230
5	53 18.18	− 20 26 48.1	.48066	456	0229
9	21 1 33.24	− 19 29 15.1	.48257	533	.0229
13	9 46.66	− 18 30 24.6	.48431	603	.0228
17	17 58.35	− 17 30 17.8	.48590	668	.0228
21	26 8.26	− 16 28 58 8	.48733	726	.0228
25	34 16.26	− 15 26 28.4	.48860	778	.0227
29	42 22.19	− 14 22 50 3	.48971	824	.0227
Febr. 2	50 25.91	− 13 18 7.8	.49067	863	.0227
6	58 27.36	− 12 12 24.5	.49147	896	.0227
10	22 6 26.56	− 11 5 43 5	.49213	923	.0227

proportional to H, I for completeness have added this quantity to the table from 4 to 4 days. In 1892—93 this so-called "theoretical brightness" varied between 0.075 and 0.012.

Because the elements adopted for 1900 might still require small corrections, and as up to 1906 only the principal perturbation by Jupiter has been taken into account, it is not improbable that when the comet happens to be discovered there will be some difference between the observed and these computed places. In order to facilitate the search for astronomers who possess the needed instruments for finding it, I have repeated the calculation of the places first on the supposition that the comet will pass through its perihelion 4 days *earlier*, and secondly that it will pass 4 days *later* than would follow from the most probable elements. Although the adopted latitude of ± 4 days will probably be much larger than the real error in the accepted time of passage through the perihelion I give the results as obtained from direct calculation. The following table contains the variations in right ascension and declination for the two suppositions; column $\Delta \log \varrho$ gives the corrections which would have to be applied to the 5^{th} decimal of $\log \varrho$ from the ephemeris communicated before.

APPARENT PLACES OF THE COMET FROM MAY 1 TO DECEMBER 31, 1906,

FOR 0h MEAN TIME AT GREENWICH.

1906		α	δ	$\log \rho$	ϑ	H
		h m s	° ′ ″			
May	1	0 40 15.28	+ 12 49 44.3	0.47733	0.017 322	0.0240
	3	44 0.82	+ 13 25 36.3	.47632	282	
	5	47 46.23	+ 14 1 21.2	47528	241	.0241
	7	51 31.54	36 58.4	.47421	199	
	9	55 16.77	+ 15 12 27.8	.47312	156	.0242
	11	59 1.94	47 48.8	.47200	111	
	13	1 2 47.03	+ 16 23 1.3	.47084	066	.0243
	15	6 32.06	58 4.7	.46966	019	
	17	10 17.02	+ 17 32 58.6	.46844	0.016 972	.0244
	19	14 1 90	+ 18 7 42.8	.46719	923	
	21	17 46.67	42 16.7	.46591	873	.0246
	23	21 31.32	+ 19 16 39.8	.46460	822	
	25	25 15.84	50 51.9	.46326	770	.0247
	27	29 0.20	+ 20 24 52.4	.46189	717	
	29	32 44.40	58 40.9	.46048	663	.0248
	31	36 28.40	+ 21 32 17.0	.45904	608	
June	2	40 12.22	+ 22 5 40.5	.45757	552	.0250
	4	43 55.83	38 51 0	.45607	495	
	6	47 39.23	+ 23 11 48.3	.45453	437	.0252
	8	51 22.42	44 32 1	.45296	378	
	10	55 5.37	+ 24 17 2.4	.45137	317	.0253
	12	58 48.06	49 18.9	.44974	256	
	14	2 2 30 46	+ 25 21 21.5	.44807	194	.0255
	16	6 12.51	53 9 8	.44637	131	
	18	9 54.18	+ 26 24 43.6	.44464	067	.0257
	20	13 35.40	56 2 8	.44287	001	
	22	17 16.13	+ 27 27 7 1	.44107	0 015 935	.0259
	24	20 56 31	57 56.2	.43923	868	
	26	24 35.89	+ 28 28 30 0	.43736	799	.0261

1906	α	δ	log ρ	ϑ	H
	h m s	° ′ ″			
June 28	2 28 14.81	+ 28 58 48.2	0.43545	0.015 730	
	31 53 03	+ 29 28 50.8	.43350	660	0.0264
July 2	35 30.49	58 37.7	43152	589	
4	39 7.15	+ 30 28 8 8	42951	517	0266
6	42 42.95	57 24.2	42746	444	
8	46 17.85	+ 31 26 24 1	.42538	370	.0269
10	49 51.75	55 8 4	42326	295	
12	53 24.59	+ 32 23 37.4	42111	219	.0271
14	56 56.26	51 50 9	41892	143	
16	3 0 26 67	+ 33 19 49.1	41669	065	0274
18	3 55 70	47 32.1	.41442	0 014 987	
20	7 23.24	+ 34 14 59.8	.41212	907	.0277
22	10 49.18	42 12.4	.40978	827	
24	14 13.40	+ 35 9 9 8	.40740	746	.0281
26	17 35.80	35 52.2	40499	665	
28	20 56.25	+ 36 2 19.8	.40254	582	.0284
30	24 14 64	28 32.6	.40006	499	
Aug. 1	27 30 86	54 31.0	.39755	416	.0288
3	30 44.79	+ 37 20 15.2	.39500	331	
5	33 56 32	45 45.6	.39241	246	.0291
7	37 5.28	+ 38 11 2.7	.38979	160	
9	40 11.54	36 6.8	38714	074	.0295
11	43 14 91	+ 39 0 58.0	.38446	0.013 988	
13	46 15 20	25 36.8	38174	900	.0300
15	49 12.25	50 3 3	.37899	813	
17	52 5 84	+ 40 14 17 8	.37621	724	.0304
19	54 55 77	38 20.5	.37340	636	
21	57 41 84	+ 41 2 11 5	.37057	547	.0308
23	4 0 23.84	25 50 9	.36771	458	
25	3 1.59	49 19.0	.36482	369	.0313
27	5 34 86	+ 42 12 35 9	36191	280	

1906		α	δ	log ρ	ϑ	H
		h m s	° ′ ″			
Aug.	29	4 8 3.48	+ 42 35 41.8	0.35899	0.013 191	0.0318
	31	10 27.24	58 36.9	.35605	102	
Sept.	2	12 45 92	+ 43 21 21 3	.35308	013	.0323
	4	14 59 28	43 55 4	35010	0 012 924	
	6	17 7 07	+ 44 6 19 0	.34712	835	.0329
	8	19 9 03	28 32 3	.34412	747	
	10	21 4 88	50 35.1	.34112	659	.0334
	12	22 54 34	+ 45 12 27.0	.33812	572	
	14	24 37 12	34 7.7	33512	485	.0339
	16	26 12 92	55 36 6	.33212	399	
	18	27 41.47	+ 46 16 53 0	.32913	314	.0345
	20	29 2 48	37 56 1	.32615	230	
	22	30 15 71	58 44.9	32320	147	.0350
	24	31 20.90	+ 47 19 18.3	.32027	066	
	26	32 17.81	39 35.2	.31737	0.011 985	0356
	28	33 6.20	59 34.3	31450	907	
	30	33 45 85	+ 48 19 14.3	.31168	830	.0361
Oct.	2	34 16.56	38 33.8	.30891	754	
	4	34 38 08	57 31.0	.30618	681	.0366
	6	34 50 16	+ 49 16 3.6	.30351	609	
	8	34 52.61	34 9.6	.30092	540	.0370
	10	34 45.25	51 46.5	.29840	473	
	12	34 27 94	+ 50 8 51.4	.29595	409	.0375
	14	34 0.56	25 21.4	29359	347	
	16	33 23.06	41 13.3	.29134	288	.0378
	18	32 35.43	56 23.7	.28919	232	
	20	31 37.75	+ 51 10 49.1	28715	180	.0381
	22	30 30.16	24 26.0	.28523	130	
	24	29 12.87	37 11.0	.28345	085	.0383
	26	27 46.15	49 0.8	28181	043	
	28	26 10.32	59 51 9	.28031	005	.0384

1906		α	δ	log ρ	ϑ	H
		h m s	° ′ ″			
Oct.	30	4 24 25.75	+ 52 9 41.1	0.2789	0.010 971	
Nov.	1	22 32.88	18 25.1	.27779	941	0.0384
	3	20 32.19	26 0.8	.27678	916	
	5	18 24.26	32 25.2	.27595	895	.0383
	7	16 9.72	37 35.5	.27530	879	
	9	13 49.28	41 29.2	.27484	867	.0380
	11	11 23.70	44 4 0	.27457	861	
	13	8 53.82	45 18.4	.27451	859	.0376
	15	6 20.53	45 11.0	.27466	863	
	17	3 44.79	43 41.2	.27502	872	.0371
	19	1 7.59	40 48.9	.27560	886	
	21	3 58 29.91	36 35.1	.27640	906	.0365
	23	55 52.74	31 1.1	.27742	932	
	25	53 17 00	24 8.9	.27865	963	.0357
	27	50 43.59	16 0.8	.28010	0.011 000	
	29	48 13.36	6 39.9	.28178	042	.0848
Dec.	1	45 47.10	+ 51 56 9.2	.28368	090	
	3	43 25.56	44 32.6	.28578	144	.0337
	5	41 9.42	31 53.9	.28810	204	
	7	38 59 30	18 17.3	.29062	269	.0326
	9	36 55.80	3 47.5	.29334	340	
	11	34 59.40	+ 50 48 29.0	.29627	417	.0314
	13	33 10 58	32 26.7	.29939	499	
	15	31 29.73	15 45.9	.30270	587	.0302
	17	29 57.19	+ 49 58 31.6	.30619	681	
	19	28 33.19	40 49.1	.30984	779	.0289
	21	27 17.93	22 43.8	31365	883	
	23	26 11.50	4 20.5	.31763	993	.0275
	25	25 13.95	+ 48 45 43 9	.32175	0.012 107	
	27	24 25.22	26 58.7	.32601	226	.0262
	29	23 45.29	8 8 8	33039	350	
	31	23 14.07	+ 47 49 18.0	.33489	479	.0249

VARIATIONS OF α, δ AND $\log \rho$ FOR THE ALTERED TIME OF PASSAGE THROUGH THE PERIHELION.

1906	$T = -4$ days			$T = +4$ days		
	$\Delta\alpha$	$\Delta\delta$	$\Delta \log \rho$	$\Delta\alpha$	$\Delta\delta$	$\Delta \log \rho$
	m s	′ ″		m s	′ ″	
May 5	+ 3 13.48	+ 38 55.2	+ 231	— 3 13.42	— 39 27.7	— 233
» 21	+ 3 22.15	+ 36 23.2	+ 294	— 3 22.12	— 37 3 8	— 297
June 6	+ 3 33.07	+ 33 10.6	+ 355	— 3 33.23	— 33 58.3	— 359
» 22	+ 3 46.12	+ 29 19.9	+ 413	— 3 46.62	— 30 13.4	— 418
July 8	+ 4 1.25	+ 24 55.8	+ 469	— 4 2.30	— 25 53.4	— 476
» 24	+ 4 18.58	+ 20 4.1	+ 521	— 4 20.42	— 21 4.4	— 529
Aug. 9	+ 4 38.61	+ 14 54.2	+ 567	— 4 41.55	— 15 55.9	— 576
» 25	+ 5 2 49	+ 9 39.3	+ 606	— 5 6.87	— 10 41.7	— 616
Sept. 10	+ 5 31.97	+ 4 41.9	+ 632	— 5 38.29	— 5 45.9	— 642
» 26	+ 6 9.74	+ 39 2	+ 640	— 6 18.02	— 1 49.1	— 649
Oct. 12	+ 6 55.91	— 1 27.1	+ 621	— 7 5.99	+ 4 1	— 627
» 28	+ 7 44.03	— 23.3	+ 566	— 7 54.54	— 1 20.9	— 569
Nov. 13	+ 8 15.71	+ 4 15.2	+ 475	— 8 23.95	— 6 19.7	— 474
» 29	+ 8 10.71	+ 10.42.4	+ 361	— 8 14.80	— 12 50.9	— 356
Dec. 15	+ 7 29.94	+ 15 44.7	+ 247	— 7 30.69	— 17 37.3	— 241

Leyden, January 1906.

Physics. — *"On the motion of a metal wire through a lump of ice"*. By L. S. ORNSTEIN. (Communicated by Prof. H. A. LORENTZ).

In a well known experiment on the regelation of ice a metal wire charged with weights is placed on a lump of ice. It moves slowly through the ice, while on the upper side new ice is formed; after a short time the motion takes place with uniform velocity. This phenomenon is explained by the fact, that if we increase the pressure the meltingpoint is lowered.

In order to calculate the velocity of the wire I shall consider an infinite circular cylinder which is moved through an infinite lump