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COMMUNICATION FROM THE OBSERVATORY AT LEIDEN.

Photographic observations of RR Lyrae from plates taken at Potsdam 1910—1913,

by *Ejnar Hertzsprung*.

The variable star *RR* Lyrae is the brightest known of the so called cluster type and therefore specially fit for detailed investigation. In fact, it is the only star of this kind for which spectroscopic elements have been determined (C. C. KIESS, *Lick Bull.* 232, **7**, 140; 1913).

In addition to the variables of the δ Cephei type mentioned in *B. A. N.* 13, *RR* Lyrae was observed with the *UV* Zeiss triplet ($a = 15$ cm., $f = 150$ cm.) at Potsdam. The plates (20 cm. by 20 cm. or 16 cm. by 16 cm.) were taken 3 mm. intrafocal. The diameter of the star images is therefore ·3 mm. The coordinates of the variable *v* and the comparison stars are given in Table 1.

TABLE 1.

Star	*B.D.*	α (1855)	δ (1855)	*UV* mag.
		h m s	° ′	m
a	+42°3325	19 18 23·5	+42 41·2	6·686
v	42°3338	20 50·5	42 30·8	(7·07—8·19)
f	42°3340	21 23·4	42 2·1	7·978
m	41°3350	22 14·8	41 10·9	—
c	41°3352	22 42·3	41 56·0	7·186
g	41°3354	22 55·6	41 21·1	8·224
l	42°3357	24 24·1	42 52·7	—
h	42°3359	24 38·0	42 20·9	8·251
e	42°3364	25 51·5	42 51·6	8·022
x	42°3372	26 38·5	42 39·9	8·244

The *UV* photographic magnitudes given in Table 1 *) are only apparent, i. e. not corrected for position on the plate or differential extinction and referred to an arbitrary zero. The fainter comparison stars of similar apparent magnitude were finally combined into pairs or groups as follows: *ef*, *ghx* and *lm* with mean apparent magnitudes of 8·000, 8·240 and 8·668 respectively.

*) For the variable the mean range of variation is given.

The comparison star *a* and the pair *lm* were used in a few exceptional cases only.

All the plates here considered were taken between 18^h59^m and 0^h31^m sidereal time and no correction for change in differential extinction was needed. The telescope was used in the position to the east of the pier.

From 1910 Sept. 2 to 1913 Oct. 21 I obtained 155 plates on 39 nights with 1010 exposures alltogether. The usual exposure time was 3 minutes. An account of these plates is given in Table 2.

Moreover 6 plates were taken with a grating placed in front of the objective (*A.N.* 4916) in order to determine the apparent differences in magnitude between the comparison stars.

The plates have been measured in the Hartmann microphotometer by Frl. H. MATTENKLODT. A few revisions especially in the ascending part of the light curve have been made here in Leiden with the aid of a thermoelectric arrangement constructed with the kind help of Prof. F. ZERNIKE (*cf.* J. SCHILT, *B. A. N.* 10).

The details of each separate exposure are given in Table 3 (pp. 144—147). The *J. D.* is given in heliocentric Greenwich M. T. The last exposure of each plate is marked by a point after the fraction of the *J. D.* The phase *P* has been calculated according to the formula

$$P = 1{\cdot}7641511\ (J.\ D.\ \text{hel. M. T. Grw.} - 2418791).$$

corresponding to a period of $^d{\cdot}56684488$. This period was derived from my own observations. As pointed out by R. PRAGER (*Sitzungsber. d. Kön. preuss. Akad. d. Wiss.* **8**, 216; 1916) the period is subjected to slow secular change. It has not yet been decided, whether this change is of periodic character or not.

TABLE 2.

Date	Nr. of first plate	Sid. time Potsdam middle		Number of		J. D.	Phase observed		Correction to phase for 40d.6 period
		first exp.	last exp.	plates	exp.		first exp.	last exp.	
		h m	h m				P	P	P
1910 Sept. 2	330	22 19	0 15	4	33	2418917	223·073	·215	+ ·023
4	336	21 49	0 24	5	41	8919	226·556	·744	+ ·024
5	344	21 59	0 15	5	40	8920	228·327	·493	+ ·023
10	335	21 58	0 1	5	34	8925	237·122	·273	+ ·013
11	362	22 25	23 45	3	24	8926	238·914	·012	+ ·011
12	368	23 22	23 27	1	3	8927	240·743	·749	+ ·008
26	408	22 32	22 54	1	8	8941	265·312	·339	— ·023
29	421	21 59	23 46	4	32	8944	270·550	·680	— ·018
Oct. 1	432	21 52	22 37	2	17	8946	274·059	·115	— ·011
7	462	22 3	22 26	1	9	8952	284·629	·657	+ ·009
8	474	21 45	22 34	2	17	8953	286·366	·425	+ ·013
13	483	22 29	23 22	3	9	8958	295·216	·281	+ ·023
25	531	21 49	22 3	1	6	8970	316·278	·295	— ·001
27	535	21 44	22 25	2	16	8972	319·791	·840	— ·007
Nov. 5	545	22 16	22 32	1	7	8981	335·663	·682	— ·024
17	594	21 52	22 43	6	12	8993	356·744	·807	+ ·010
1911 Aug. 24	1261	22 6	0 31	5	39	9273	851·140	·317	— ·004
26	1273	22 24	23 57	3	25	9275	854·681	·794	+ ·003
27	1282	21 44	0 24	6	50	9276	856·392	·586	+ ·007
31	1305	22 12	23 17	3	22	9280	863·462	·542	+ ·019
Sept. 3	1342	22 41	0 12	3	27	9283	868·776	·887	+ ·023
20	1420	21 48	23 50	4	33	9300	898·620	·769	— ·018
Oct. 16	1459	23 6	0 31	3	22	9326	944·457	·560	+ ·023
1913 Aug. 22	2604	21 33	22 9	2	12	2420002	2137·172	·217	— ·010
25	2643	19 24	22 26	8	48	0005	2142·294	·515	— ·000
26	2667	20 23	22 9	4	24	0006	2144·125	·254	+ ·004
27	2690	20 14	22 22	6	36	0007	2145·873	·030	+ ·006
28	2712	19 25	22 26	8	48	0008	2147·572	·794	+ ·010
Sept. 1	2756	18 59	20 47	4	20	0012	2154·577	·688	+ ·020
6	2760	19 13	21 21	5	28	0017	2163·393	·548	+ ·023
7	2771	20 38	21 58	3	18	0018	2165·255	·352	+ ·022
10	2837	19 32	22 54	8	49	0021	2170·452	·698	+ ·015
12	2865	20 38	22 1	4	24	0023	2174·051	·153	+ ·008
23	2969	21 14	22 11	3	14	0034	2193·448	·517	— ·023
26	3008	20 55	21 57	3	18	0037	2198·701	·778	— ·023
27	3056	21 0	0 26	8	49	0038	2200·467	·719	— ·022
29	3144	21 9	23 7	4	24	0040	2203·996	·141	— ·018
Oct. 1	3221	20 13	23 26	7	42	0042	2207·447	·683	— ·013
21	3439	21 37	23 54	5	30	0062	2242·735	·901	+ ·015

So far the differences from a uniform period are not greater than might reasonably be explained from orbital motion of *RR* Lyrae round another star.

In *Contrib. Mount Wilson Obs.* 112, *Ap. J.* **43**, 217; 1916 HARLOW SHAPLEY has discussed the observations of *RR* Lyrae using as time of reference the moment, when the star passes the median magnitude on the ascending branch of the light curve. Besides the slow perturbation also announced by PRAGER, SHAPLEY found another term in the residuals *O—C* having a period of 40 days and an amplitude of d·026, at least as far as the first condensed series of observations of WENDELL is concerned. SHAPLEY writes: „There can be no doubt that a real irregularity is present. An attempt was made to find a uniform period for the variation that would satisfy all the observations. This failed in part, perhaps because of insufficient data, but it seems that for the whole series the oscillation is roughly periodic with a varying amplitude." The present observations give further evidence of the existence of this secondary oscillation.

In the upper part of the accompanying figure (p. 143) 9 diagrams are given showing my separate observations on 14 *) different nights, when the variable was between the phases ·4 and ·8, which interval covers the ascending branch of the light curve and the adjacent minimum and maximum. For comparison the mean light curve, using the uniform period mentioned above,

*) The circles on the first of these 9 diagrams represent additional observations discussed in the Appendix.

has been drawn on each diagram. It is evident from these diagrams that a real irregularity is present *). In *Ap. J.* **43**, 228, Table V, the observations used by SHAPLEY are given. After correction for the slow secular perturbation the residuals $O—C_2$ were formed. These residuals should therefore show the term of about 40 days period. Adding my own observations and tabulating separately the epochs E of the residuals $O—C$ exceeding $\pm$ ^{d}·0075, I find the list of 26 epochs given in Table 4. From this list only the epoch 8473 ($O—C_2 = +{}^{d}$·010) of TOWNLEY has been excluded for discordance.

TABLE 4.

Difference $O—C$ disregarding secondary oscillation		observed epoch of great $O—C$	adopted epoch of secondary oscillation	calculated epoch of max. $O—C$	Diff.
SHAPLEY $O—C_2$	HZG. $O—C$	Eo	E'	Ec	$Eo—Ec$
d	d				
+·012	—	100	0	112	—12
+ 10	—	114	0	112	+ 2
+ 18	—	121	0	112	+ 9
— 9	—	144	·5	148	— 4
+ 10	—	195	1	184	+11
— 11	—	218	1·5	219	— 1
— 12	—	225	1·5	219	+ 6
— 10	—	285	2·5	291	— 6
— 8	—	578	6·5	578	0
— 10	—	936	11·5	936	0
+ 12	—	2755	37	2762	— 7
— 8	—	2799	37·5	2798	+ 1
+ 18	—	5761	79	5771	—10
—	—·021	7167	98·5	7168	— 1
—	+ 10	7211	99	7204	+ 7
—	+ 11	7839	108	7848	— 9
+ 29	—	8431	116	8421	+10
— 10	—	8540	117·5	8529	+11
—	— 12	9095	125·5	9102	— 7
—	+ 14	9104	125·5	9102	+ 2
—	— 9	9111	125·5	9102	+ 9
—	+ 14	9141	126	9138	+ 3
—	+ 9	9148	126	9138	+10
+ 24	—	9210	127	9209	+ 1
— 22	—	9238	127·5	9245	— 7
— 9	—	9873	136·5	9890	—17

A least square solution then gave the following elements of SHAPLEY's term:

*) The 6 observations of plate no. 3056 shown on the 8th diagram between the phases ·46 and ·50 give an unusual faint brightness for the variable. Probably this plate has been unsuccessful. It has however not been rejected. The point marked by a circle on the same diagram represents an additional plate taken with the grating before the objective.

Max. $(O—C)$ at $E—4983 = 71·634$ $(E'—68)$
$\pm$ 1·6 $\pm$ ·028 (m. e.)

or at *J. D.* 2417681^{d}·2 + 40^{d}·605 $(E'—68)$
$\pm$ ·9 $\pm$ ·016 (m. e.)

The difference $E_O—E_C$ exceeds one quarter of the period (71·634), only in the case of the excluded observation at $E = 8473$, the mean square of the tabulated residuals $E_O—E_C$ being $63·5 = (\pm\ 8·0)^2$.

From my own observations alone I derived for the 12 epochs given in Table 5 the phase $P_{7·6}$ at which

TABLE 5

$E—6941$	$\frac{E}{71·637}$	θ	$P_{7.6}$ Phase of mag 7.6 ascending branch O	C	$O—C$
	P'	°	P	P	P
226	100·04	14	·535	·550	—·015
270	100·66	238	·589	·591	—.002
856	108·84	302	·566	·566	—·000
863	108·94	338	·567	·554	+·013
898	109·42	151	·592	·591	+·001
944	110·07	25	·564	·550	+·014
2147	126·86	310	·559	·564	—·005
2154	126·96	346	·550	·553	—·003
2163	127·08	29	·548	·550	—·002
2170	127·18	65	·556	.558	—·002
2200	127·60	216	·596	·596	+·000
2207	127·70	252	·588	·586	+·002

the magnitude $7^{m}·6$ was reached on the ascending branch of the light curve. The phases P' of the $40^{d}.6$ oscillation were counted from SHAPLEY's $E = O$ (corresponding to $—6941$ in my counting) as zero point. A least square solution then gave the following formula

$$P_{7·6} = {}^{P}·5735 - {}^{P}·0062 \sin\theta - {}^{P}·0229 \cos\theta$$

where θ is the phase P' expressed in angle.

The corresponding range of the $40^{d}·6$ oscillation is $\pm$ ^{P}·0237 $\pm$ ^{P}·0036 (m. e.) or $\pm$ ^{d}·0134 $\pm$ ^{d}·0020 (m. e.). This is the same as found by SHAPLEY from WENDELL's observations (*Ap. J.* **43**, 231). Having regard to the period of $40^{d}·6$ this range appears much too great to be reasonably explained by orbital motion of *RR* Lyrae round another star, which would give changes in radial velocity of the order of 10^3 *km/sec.* It is the first variable star for which such a secondary oscillation has been indicated. This most interesting result of SHAPLEY is confirmed as far as the present observations go, but more material is required to settle the question definitively.

As to the varying height of the maximum, the observations are not sufficient to decide whether this variation has the same period of 40·6 days. If so, the evidence there is tends to show that the maximum is brightest when the period is shortest. This would imply that the „mean" light curve is never presented by the variable because when the time of passing the median magnitude is normal the maximum will either be higher or lower than in the mean.

Nevertheless I have computed a mean light curve. For this purpose the effect of the $40^d{\cdot}6$ oscillation must first be eliminated. Therefore corrections to the phases P (as given in Table 3) were calculated according to the formula for $P_{7\cdot6}$ given above. The corrections thus used for each separate night are contained in the last column of Table 2. Dividing the 1010 observations into groups of 40 or 30, I find the values of Table 6 which are shown graphically on the diagram at the bottom of the accompanying figure *). This light curve shows the usual particulars of stars of this kind. The quickest rise in brightness on the ascending branch is very nearly at the rate of 1 magnitude per hour. The mean UV photographic range is $8^m{\cdot}19-7^m{\cdot}07=1^m{\cdot}12$, while from WENDELL's visual observations $7^m{\cdot}67-6^m{\cdot}82={}^m{\cdot}85$ is found. The difference $1{\cdot}12-{\cdot}85={\cdot}27$ gives the corresponding range in colour-index. Between the phases ·15 and ·42, or during about one quarter of the period, the brightness of the variable does not change sensibly. Between the phases ·42 and ·47 the brightness decreases by $8^m{\cdot}19-8^m{\cdot}12={}^m{\cdot}07$ and then rises to maximum. This detail is only little changed (min. $8^m{\cdot}17$) when the plate No. 3056 already mentioned is left out for discordance. The tenth and eleventh normal places of Table 5 would then be altered as shown at the end of that table below the line. It is remarkable that the same peculiarity has already been announced for variables in the cluster Messier 3 by J. LARINK (*Astron. Abh. d. Hamburger Sternw. in Bergedorf*, **2**, Nr. 6, 6; 1922). In a particularly striking way this feature is shown in the photographic light curve of SS Cancri by W. BAADE (*Mitt. d. Hamburger Sternw. in Bergedorf*, **5**, Nr. 14, 23; 1922). This peculiarity therefore seems to be characteristic for variables of this type.

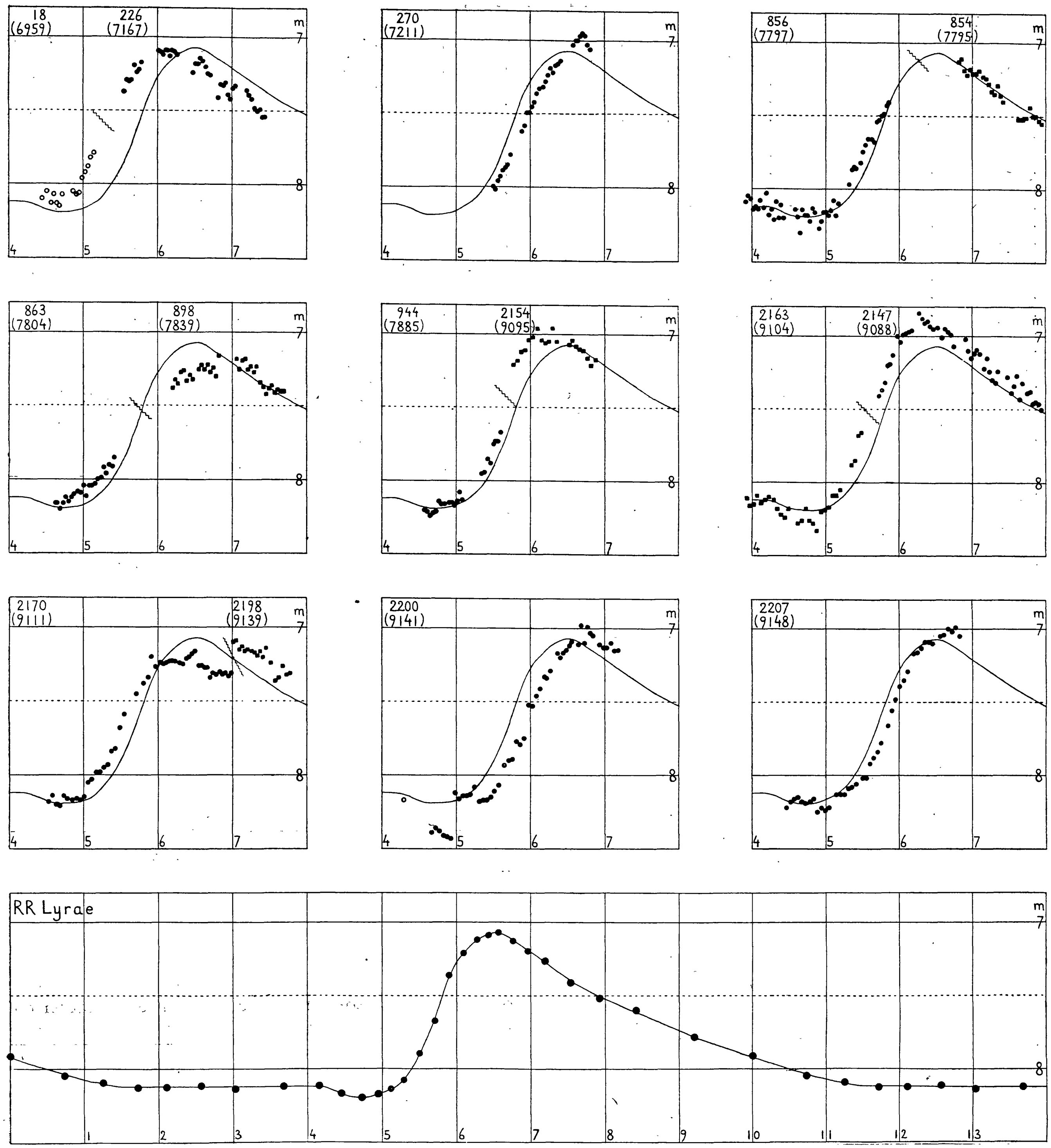
TABLE 6.

number of exposures	mean corrected phase	mean magnitude	number of exposures	mean corrected phase	mean magnitude
	P	m		P	m
40	·0006	7·911	30	·5900	7·361
40	·0737	8·048	30	·6092	7·208
40	·1256	8·091	30	·6279	7·118
40	·1720	8·125	30	·6433	7·087
40	·2106	8·123	30	·6567	7·066
40	·2571	8·113	30	·6768	7·127
40	·3030	8·135	30	·6959	7·198
40	·3678	8·118	40	·7192	7·264
40	·4160	8·111	40	·7537	7·410
40	·4451	8·165	40	·7924	7·514
40	·4728	8·194	40	·8416	7·598
40	·4942	8·170	40	·9205	7·784
30	·5116	8·136			
30	·5293	8·074	37	·4447	8·148
30	·5501	7·891	37	·4734	8·175
30	·5710	7·670			

*) This diagram is directly comparable with those given in *B. A. N.* 13 of X, V, Z and RR Lacartae and in *A. N.* 4916 of S Sagittae.

The accuracy of the present observations has been evaluated in the following way. The mean square of the difference in magnitude between the last exposure of one plate and the first on the next following plate is, taking account of the variability of the star, found to be $2\times{\cdot}00311\,m^2$, while the mean square of the difference between two consecutive exposures on the same plate is $2\times{\cdot}00138m^2$. Hence the square of the systematic mean error of one plate is ${\cdot}00311-{\cdot}00138={\cdot}00173m^2$. Accordingly the weight of a plate carrying n exposures is $1/({\cdot}00173+{\cdot}00138/n)m^{-2}$. For $n=6$ the weight is $510m^{-2}$. The total weight of all the 155 plates calculated in this way is $78750m^{-2}$. If a new plate had been used for each exposure the total weight would have been $1010/{\cdot}00311=325000m^{-2}$ or about 4 times as large. But besides the increased expense and work the number of exposures per hour would have been considerably less in that case.

It is seen from the foregoing that many observations are still needed to unveil the true character of the perturbations in the light curve of RR Lyrae. The star may therefore be recommended to further attention. Owing to the short period, collaboration between observatories at different longitude, may be useful. Photographic observations are preferable because of the danger of bias in visual work in the case of a quickly changing star and because the range is greater photographically than visually.



Upper diagrams: Individual observations of *RR* Lyrae ou 15 different nights, compared with mean light curve.
Lower diagram: Mean light curve of *RR* Lyrae.

TABLE 3.

J. D. 2418917

Hel. M. T. Grw. d	P	m
·4478	223·073	8·08
·4498	·077	8·09
·4518	·080	8·09
·4539	·084	8·08
·4560	·088	8·11
·4579	·091	8·11
·4598	·094	8·13
·4617.	·098	8·12
·4647	·103	8·08
·4666	·106	8·06
·4685	·110	8·08
·4704	·113	8·11
·4723	·116	8·11
·4742	·120	8·16
·4761	·123	8·16
·4780.	·126	8·17
·4925	·152	8·17
·4944	·155	8·21
·4964	·159	8·28
·4983	·162	8·15
·5002	·166	8·20
·5022	·169	8·27
·5033	·171	8·20
·5052	·174	8·26
·5071.	·178	8.15
·5142	·190	8·12
·5162	·194	8·17
·5182	·197	8·14
·5201	·200	8·21
·5220	·204	8·20
·5242	·208	8·17
·5261	·211	8·14
·5281.	·215	8·15

J. D. 2418919

d	P	m
·4218	226·556	7·37
·4237	·559	7·29
·4255	·562	7·30
·4274	·565	7·29
·4293	·569	7·19
·4312	·572	7·24
·4331	·575	7·22
·4349.	·579	7·17
·4476	·601	7·09
·4495	·604	7·10
·4513	·608	7·12
·4533	·611	7·09
·4548	·614	7·09
·4563	·616	7·13
·4582	·620	7·09
·4601	·623	7·10
·4619.	·626	7·12
·4741	·648	7·24
·4760	·651	7·18
·4779	·654	7·18
·4798	·658	7·14
·4817	·661	7·16
·4835	·664	7.20
·4854	·668	7·25
·4873.	·671	7·26
·4934	.682	7·41
·4954	·685	7·32
·4971	·688	7·33
·4989	·692	7·31
·5008	·695	7·39
·5026	·698	7·42
·5045	·701	7·35
·5063.	·705	7·33
·5152	·720	7·36
·5171	·724	7·39
·5190	·727	7·42
·5210	·730	7·48
·5229	·734	7·50
·5250	·738	7·49
·5269	·741	7·54
·5287.	·744	7·54

J. D. 2418920

d	P	m
·4260	228·327	8·08
·4280	·330	8·12
·4298	·334	8·09
·4317	·337	8·13
·4337	·341	8·11
·4356	·344	8·13
·4374	·347	8·12
·4394.	·351	8·11
·4425	·356	8·10
·4444	·359	8·11
·4463	·363	8·10
·4481	·366	8·08
·4500	·369	8·14
·4519	·373	8·08
·4538	·376	8·11
·4556.	·379	8·11
·4668	·399	8·04
·4686	·402	8·11
·4705	·406	8·13
·4724	·409	8·14
·4742	·412	8·13
·4761	·415	8·16
·4779	·419	8·16
·4798.	·422	8·15
·4828	·427	8·11
·4846	·430	8·09
·4865	·434	8·10
·4884	·437	8·06
·4902	·440	8·14
·4918	·443	8·12
·4941	·447	8·13
·4960.	·450	8·13
·5070	·470	8·11
·5089	·473	8·09
·5108	·477	8·07
·5126	·480	8·07
·5145	·483	8·09
·5164	·486	8·06
·5184	·490	8·05
·5203.	·493	8·00

J. D. 2418925

d	P	m
·4115	237·122	8·05
·4134	·126	8·01
·4152	·129	8·03
·4172	·132	8·04
·4192	·136	8·03
·4210	·139	8·04
·4228	·142	8·04
·4247.	·146	8·02
·4363	·166	8·06
·4381	·169	8·07
·4400	·172	8·02
·4418	·176	8·02
·4436	·179	8·04
·4454	·182	8·01
·4472	·185	8·05
·4491.	·188	8·05
·4517	·193	8·03
·4535	·196	8·05
·4554	·200	8·07
·4572	·203	8·09
·4591	·206	8·06
·4609	·209	8·08
·4627	·213	8·10
·4646.	·216	8·00
·4760	·236	8·07
·4779	·239	8·06
·4798	·243	7·99
·4816	·246	7·98
·4835	·249	7·96
·4854	·252	8·10
·4872	·256	7·94
·4890.	·259	8·02
·4917	·264	8·12
·4969.	·273	8·10

J. D. 2418926

d	P	m
·4271	238·914	7·88
·4294	·918	7·88
·4313	·921	7·91
·4332	·925	7·93
·4350	·928	7·94
·4369	·931	7·92
·4387	·934	7·93
·4406.	·938	7·94
·4516	·957	7·88
.4537	·961	7·95
·4557	·964	7·88
·4577	·968	7·88
·4596	·971	7·92
·4616	·975	7·93
·4635	·978	7.96
·4654.	·982	8·00
·4690	·988	7·95
·4711	·992	7·96
·4730	·995	7·92
·4749	·998	7·92
·4770	239·002	7.92
·4789	·005	7·91
·4809	·009	7·92
·4829.	·012	8·00

J. D. 2418927

d	P	m
·4637	240.743	7.58
·4655	·746	7·63
·4673.	·749	7·63

J. D. 2418941

d	P	m
·3906	265·312	8·13
·3927	·316	8·11
·3958	·321	8·09
·3978	·324	8·14
·3996	·328	8·17
·4015	·331	8·18
·4034	·334	8·18
·4061.	·339	8·16

J. D. 2418944

d	P	m
·3598	270·550	8·00
·3616	·553	8·02
·3636	·556	7·96
·3654	·560	7·93
·3672	·563	7·89
·3691	·566	7·87
·3710	·570	7·85
·3734.	·574	7·78
·3821	·589	7·62
·3840	·593	7·58
·3859	·596	7·49
·3877	·599	7·49
·3896	·602	7·45
·3914	·606	7·42
·3933	·609	7·36
·3952.	·612	7·33
·3982	·618	7·32
·4000	·621	7·28
·4019	·624	7·24
·4038	·627	7·19
·4056	·631	7·22
·4074	·634	7·17
·4097	·638	7·16
·4115.	·641	7·14
·4210	·658	7·03
·4228	·661	7·00
·4247	·664	7·00
·4265	·668	6·97
·4284	·671	6·95
·4302	·674	6·97
·4320	·677	7·03
.4339.	·680	7·06

J. D. 2418946

d	P	m
·3491	274·059	8·03
·3509	·062	8·02
·3527	·066	8·04
·3546	·069	8·02
·3571	·073	7·99
·3582	·075	7·96
·3600	·079	8·05
·3619·	·082	8·07
·3656	·088	8·05
·3674	·092	8·07
·3692	·095	8·05
·3710	·098	8·10
·3728	·101	8·08
·3751	·105	8·13
·3770	·108	8·17
·3788	·112	8·15
·3806.	·115	8·11

J. D. 2418952

d	P	m
·3403	284·629	7·09
·3421	·632	7·08
·3440	·635	7·06
·3458	·638	7·06
·3476	·642	7·05
·3495	·645	7·03
·3520	·649	7·08
·3538	·652	7·06
·3563.	·657	7·02

J. D. 2418953

d	P	m
·3249	286·366	8·22
·3268	·369	8·20
·3286	·372	8·13
·3304	·375	8·13
·3326	·379	8·10
·3344	·382	8·12
·3364	·386	8·12
·3383.	·389	8·09
·3419	·396	8·10
·3438	·399	8·11
·3456	·402	8·09
·3477	·406	8·03
·3496	·409	8·08

d	P	m
·3512	·412	8·05
·3549	·418	8·04
·3568	·422	8·06
·3586.	·425	8·07

J. D. 2418958

d	P	m
·3418	295·216	8·19
·3440	·220	8·16
·3462.	·224	8·12
·3576	·244	8·08
·3596	·248	8·10
·3616.	·251	8·11
·3734	·272	8·10
·3755	·276	8·09
·3784.	·281	8·13

J. D. 2418970

d	P	m
·2808	316·278	8·08
·2827	·282	8·06
·2845	·285	8·08
·2863	·288	8·06
·2882	·291	8·20
·2900.	·295	8·23

J. D. 2418972

d	P	m
·2717	319·791	7·59
·2736	·794	7·58
·2754	·797	7·60
·2772	·800	7·59
·2790	·804	7·59
·2808	·807	7·66
·2826	·810	7·60
·2844.	·813	7·67
·2865	·817	7·72
·2888	·821	7·69
·2906	·824	7·73
·2924	·827	7·71
·2942	·830	7·68
·2960	·834	7·68
·2978	·837	7·64
·2996.	·840	7·68

J. D. 2418981

d	P	m
·2687	335·663	7·11
·2706	·666	7·08
·2724	·669	7·13
·2743	·673	7·14
·2762	·676	7·09
·2780	·679	7·16
·2798.	·682	7·13

J. D. 2418993

d	P	m
·2185	356·744	7·47
·2203.	·747	7·51
·2230	·752	7·42
·2248.	·755	7·39
·2339	·771	7·42
·2357.	·774	7·33
·2381	·778	7·48
·2399.	·782	7·48
·2481	·796	7·47
·2499.	·799	7·54
·2523	·804	7·57
·2541.	·807	7·59

J.D. 2419273

d	P	m
·4642	851·140	8·13
·4658	·142	8·17
·4680	·146	8·17
·4702	·150	8·11
·4723	·154	8·15
·4745	·158	8·16
·4767	·162	8·09
·4789.	·166	8·10
·4885	·183	8·12
·4907	·187	8·11
·4930	·191	8·10
·4954	·195	8·10
·4976	·199	8·16
·4998	·202	8·20
·5020	·206	8·11
·5042.	·210	8·16
·5074	·216	8·10
·5096	·220	8·10
·5118	·224	8·14
·5140	·228	8·15
·5162	·232	8·12
·5184	·235	8·13
·5206	·239	8·11
·5229.	·243	8.10
·5303	·256	8·13
·5325	·260	8·16
·5347	·264	8·18
·5370	·268	8·18
·5392	·272	8·16
·5414	·276	8·18
·5436	·280	8·21
·5459.	·284	8·16
·5490	·289	8·09
·5513	·293	8·14
·5535	·297	8·11
·5557	·301	8·23
·5601	·309	8·25
·5623	·313	8·23
·5646.	·317	8·14

J. D. 2419275

d	P	m
·4716	854·681	7·13
·4738	·685	7·11
·4760	·689	7·19
·4783	·693	7·22
·4808	·697	7·18
·4830	·701	7·21
·4852	·705	7·21
·4876.	·709	7·19
·4907	·715	7·23
·4929	·719	7·24
·4951	·722	7·28
·4973	·726	7·33
·4996	·730	7·35
·5018	·734	7·29
·5040	·738	7·36
·5062.	·742	7·40
·5178	·762	7·52
·5200	·766	7·52
·5221	·770	7·52
·5240	·774	7·51
·5269	·779	7·44
·5291	·782	7·50
·5313	·786	7·50
·5337	·791	7·53
·5359.	·794	7·55

J. D. 2419276

d	P	m
·4412	856·392	8·09
·4430	·395	8·05
·4449	·398	8·07
·4470	·402	8·14
·4488	·405	8·12
·4507	·408	8·14
·4526	·412	8·08
·4551.	·416	8·13
·4572	·420	8·03
·4590	·423	8·18
·4609	·426	8·14
·4627	·430	8·21
·4646	·433	8·09
·4664	·436	8·20
·4682	·439	8·11
·4701.	·443	8·20
·4792	·459	8·14
·4811	·462	8·19
·4829	·465	8·30
·4848	·468	8·14
·4866	·472	8·18
·4886	·475	8·18
·4905	·479	8·22
·4924	·482	8·13
·4942.	·485	8·16
·4974	·491	8·27
·4993	·494	8·22
·5011	·497	8·16
·5030	·501	8·16
·5049	·504	8·18
·5068	·507	8·15
·5086	·510	8·08
·5104	·514	8·18
·5123.	·517	8·10
·5206	·532	7·97
·5225	·535	7·87
·5243	·538	7·85
·5262	·542	7·86
·5296	·548	7·82
·5315	·551	7·75
·5333	·554	7·70
·5352.	·557	7·66
·5382	·563	7·66
·5401	·566	7·68
·5420	·569	7·54
·5438	·573	7·53
·5457	·576	7·50
·5477	·580	7·49
·5496	·583	7·43
·5514.	·586	7·41

J. D. 2419280

d	P	m
·4490	863·462	8·16
·4505	·465	8·16
·4527	·468	8·20
·4549	·472	8·16
·4571	·476	8·12
·4593	·480	8·15
·4614	·484	8·12
·4636.	·488	8·10
·4665	·493	8·08
·4687	·497	8·09
·4708	·500	8·04
·4730	·504	8·11
·4752	·508	8·04
·4774	·512	8·04
·4795	·516	8·03
·4817.	·520	8·00
·4843	·524	7·99
·4862	·528	7·92
·4880	·531	7·96
·4904	·535	7·90
·4929	·539	7·91
·4942.	·542	7·85

J. D. 2419283

d	P	m
·4611	868·776	7·45
·4629	·779	7·61
·4648	·782	7·62
·4666	·786	7·54
·4686	·789	7·50
·4708	·793	7·57
·4730	·797	7·62
·4751	·801	7·52
·4773.	·804	7·69
·4805	·810	7·48
·4826	·814	7·55
·4848	·818	7·52
·4870	·822	7·55
·4892	·825	7·55
·4914	·829	7·60
·4936	·833	7·56
·4957	·837	7·50
·4979.	·841	7·61
·5058	·855	7·70
·5080	·859	7·65
·5102	·862	7·68
·5124	·866	7·65
·5155	·872	7·72
·5177	·876	7·60
·5199	·880	7·69
·5221	·884	7·75
·5243.	·887	7·65

J. D. 2419300

d	P	m
·3781	898·620	7·38
·3803	·624	7·32
·3825	·628	7·35
·3847	·632	7·27
·3868	·635	7·26
·3890	·639	7·33
·3914	·643	7·29
·3936.	·647	7·32
·3981	·655	7·25
·4003	·659	7·22
·4027	·663	7·25
·4048	·667	7·22
·4071	·671	7·27
·4091	·675	7·24
·4114	·679	7·30
·4135.	·682	7·16
·4270	·706	7·18
·4292	·710	7·25
·4314	·714	7·19
·4335	·718	7·18
·4357	·722	7·25
·4378	·725	7·23
·4400	·729	7·27
·4422.	·733	7·23
·4451	·738	7·34
·4473	·742	7·37
·4494	·746	7·42
·4516	·750	7·38
·4538	·754	7·36
·4560	·757	7·41
·4582	·761	7·39
·4604	·765	7·40
·4625.	·769	7·40

J. D. 2419326

d	P	m
·3606	944·457	8·20
·3628	·461	8·21
·3650	·465	8·24
·3672	·469	8·22
·3694	·472	8·21
·3715	·476	8·14
·3737	·480	8·16
·3759.	·484	8·16
·3794	·490	8·15
·3816	·494	8·15

d	P	m
·3838	·498	8·17
·3859	·502	8·14
·3874	·504	8·08
·3896.	·508	8·13
·4044	·534	7·95
·4066	·538	7·94
·4090	·542	7·85
·4112	·546	7·88
·4134	·550	7·75
·4149	·553	7·73
·4170	·556	7·73
·4192.	·560	7·67

J. D. 2420002

d	P	m
·4453	2137·172	8·11
·4475	·176	8·18
·4499	·181	8·14
·4521	·185	8·02
·4543	·188	8·21
·4565.	·192	8·18
·4596	·198	8·22
·4618	·202	8·15
·4640	·206	8·11
·4662	·210	8·06
·4684	·213	8·19
.4706.	·217	8·13

J. D. 2420005

d	P	m
·3482	2142·294	8·18
·3503	·297	8·12
·3525	·301	8·21
·3549	·306	8·17
·3570	·309	8·16
·3593.	·313	8·16
·3645	·322	8·27
·3667	·326	8·24
·3689	·330	8·16
·3711	·334	8·25
·3734	·338	8·23
·3756.	·342	8·19
·3815	.352	8·09
·3837	·356	8·15
·3860	·360	8·06
·3882	·364	8·09
·3904	·368	8·15
·3926.	·372	8·13
·3968	·380	8·20
·3990	·383	8·22
·4013	·387	8·22
·4035	·391	8·16
·4057	·395	8·15
·4072.	·398	8·18
·4151	·412	8·19
·4173	·416	8·05
·4195	·420	8·10
·4217	·423	8·11
·4239	·427	8·14
·4262.	·431	8·22
·4289	·436	8·14
·4318	·441	8·09
·4340	·445	8·16
·4362	·449	8·12
·4384	·453	8·11
·4406.	·457	8·12
·4475	·469	8·08
·4497	·473	8·10
·4519	·477	8·11
·4541	·481	8·08
·4563	·484	8·23
·4585.	·488	8·14
·4620	·494	8·24
·4643	·498	8·07

d	P	m
·4665	·502	8·18
·4687	·506	8·16
·4709	·510	8·12
·4737.	·515	8·12

J. D. 2420006

d	P	m
·3861	2144·125	8·13
·3883	·129	8·27
·3905	·132	8·14
·3927	·136	8·10
·3950	·140	8·16
·3972.	·144	8·11
·4140	·174	8·19
·4162	·178	8·21
·4184	·182	8·18
·4206	·186	8·12
·4228	·190	8·18
·4250.	·193	8·16
·4339	·209	8·06
·4362	·213	8·12
·4383	·217	8·10
·4405	·221	8·23
·4427	·225	8·25
·4449.	·228	8·20
·4479	·234	8·15
·4501	·238	8·16
·4523	·241	8·10
·4545	·245	8·23
·4567	·249	8·13
·4595.	·254	8·15

J. D. 2420007

d	P	m
·3772	2145·873	7·60
·3794	.877	7·70
·3816	·881	7·68
·3838	·885	7·67
·3860	·889	7·66
·3882.	·893	7·70
·3915	.898	7·71
·3936	·902	7·80
·3958	·906	7·72
·3980	·910	7·72
·4003	·914	7·78
·4025.	·918	7·82
·4084	·928	7·79
·4109	·933	7·89
·4136	·937	7·89
·4157	·941	7·88
·4179	·945	7·91
·4200.	·949	7·88
·4230	·954	7·81
·4251	·958	7·86
·4273	·962	7·92
·4303	·967	7·85
·4325	·971	7·90
·4347.	·975	7·88
·4408	·986	7·98
·4430	·989	7·92
·4452	·993	7·90
·4474	·997	7·80
·4495	2146·001	7·96
.4517.	·005	7·99
·4551	·011	7·82
·4573	·014	7·88
·4595	·018	7·92
·4617	·022	7·92
·4638	·026	7·91
·4660.	·030	7·96

J. D. 2420008

d	P	m
·3405	2147·572	7·41
·3427	·576	7·37
·3449	·580	7·32
·3471	·584	7·20
·3493	·588	7·19
·3515.	·592	7·13
·3549	·598	7·00
·3571	·602	7·04
·3593	·606	6·99
·3615	·610	6·98
·3637	·614	6·97
·3658.	·617	6·96
·3719	·628	6·83
·3741	·632	6·88
·3764	·636	6·91
·3786	·640	6·90
·3808	·644	6·93
·3831.	·648	6·95
·3864	·654	6·94
·3896	·659	7·01
·3918	·663	6·95
·3940	·667	6·97
·3963	·671	6·99
·3985.	·675	7·07
·4076	·691	7·02
·4098	·695	7·10
·4120	·699	7·15
·4142	·703	7·12
·4163	·706	7·09
·4185.	·710	7·12
·4220	·716	7·22
·4241	·720	7·15
·4263	·724	7·24
·4285	·728	7·30
·4307	·732	7·32
·4328.	·736	7·24
·4402	·748	7·28
·4429	·753	7·39
·4451	·757	7·34
·4472	·761	7·27
·4494	·765	7·43
·4516.	·768	7·32
·4552	·775	7·39
·4574	·779	7·38
·4596	·783	7·46
·4618	·786	7.45
·4639	·790	7.46
·4661.	·794	7·50

J. D. 2420012

d	P	m
·3112	2154·577	7·21
·3142	·583	7·18
·3171	·588	7·12
·3200	·593	7·11
·3229	·598	7·04
·3258.	·603	7·02
·3295	·610	6·96
·3325	·615	7·04
·3354	·620	7·06
·3383	·625	7·05
·3412	·630	6·96
·3441.	·636	7·05
·3537	·652	7·07
·3559	·656	7·04
·3587	·661	7·08
·3616	.666	7·10
·3645	·672	7·11
·3674	.677	7·16
·3704.	·682	7·21
·3739.	·688	7·17

J. D. 2420017

d	P	m
·3081	2163·393	8·11
·3103	·397	8·16
·3132	·402	8·15
·3161	·407	8·09
·3190	·412	8·14
·3219.	·417	8·12
·3249	·422	8·10
·3285	·429	8·12
·3313	·434	8·18
·3342	·439	8·22
·3371	·444	8·24
·3400.	·449	8·18
·3474	·462	8·28
·3503	·467	8·26
·3532	·472	8·18
·3561	·477	8·26
·3590	·482	8·28
·3619.	·488	8·33
·3654	·494	8·20
·3683	·499	8·19
·3712	·504	8·17
·3741	·509	8·09
·3770	·514	8·09
·3798.	·519	8·05
·3884	·534	7·88
·3913	·540	7·85
·3942	·545	7·68
·3962.	·548	7·66

J. D. 2420018

d	P	m
·3634	2165·255	8·02
·3672	·261	8·07
·3698	·266	8·09
·3728	·271	8·10
·3756	·276	8·06
·3785.	·281	8·07
·3846	·292	8·03
·3874	·297	8·02
·3907	·303	8·00
·3939	·308	8·03
·3967	·313	8·00
·3996.	·318	7·98
·4045	·327	8·01
·4074	·332	8·08
·4102	·337	8·08
·4131	·342	8·04
·4160	·347	7·99
·4189.	·352	8·04

J. D. 2420021

d	P	m
·3098	2170·452	8·18
·3128	·458	8·14
·3156	·463	8·20
·3186	·468	8·21
·3214	·473	8·14
·3244.	·478	8·16
·3281	·485	8·17
·3314	·490	8·16
·3343	·496	8·17
·3372	·501	8·15
·3401	·506	8·05
·3430.	·511	8·03
·3466	·517	7·98
·3495	·522	7·98
·3524	·528	7·95
·3553	·533	7·93
·3582	·538	7·84
·3610.	·543	7·82
·3646	·549	7·68
·3678	·555	7·59
·3771	·571	7·45
·3824	·580	7·38
·3859	·587	7·34

d	P	m
·3888	·592	7·20
·3916.	·597	7·27
·3952	·603	7·24
·3977	·607	7·25
·3998	·611	7·24
·4020	·615	7·23
·4042	·619	7·23
·4067.	·623	7·23
·4101	·629	7·24
·4126	·634	7·25
·4152	·638	7·21
·4173	·642	7·20
·4195	·646	7·18
·4217.	·650	7·16
·4246	·655	7·26
·4267	·659	7·26
·4289	·662	7·27
·4311	·666	7·27
·4333	·670	7·34
·4354.	·674	7·31
·4378	·678	7·32
·4406	·683	7·30
·4427	·687	7·32
·4449	·691	7·31
·4471	·695	7·33
·4493.	·698	7·31

J. D. 2420023

d	P	m
·3499	2174·051	7·96
·3524	·056	7·96
·3550	·060	7·96
·3571	·064	8·03
·3593	·068	8·01
·3615.	·072	7·97
·3644	·077	8·14
·3667	·081	8·06
·3688	·085	8·01
·3710	·089	8·01
·3732	·092	8·03
·3754.	·096	8·07
·3808	·106	7·98
·3830	·110	8·09
·3844	·112	8·06
·3873	·117	7·99
·3894	·121	8·06
·3916.	·125	8·12
·3945	·130	8·03
·3967	·134	7·97
·3989	·138	8·05
·4030	·145	8·06
·4052	·149	8·07
·4074.	·153	8·07

J. D. 2420034

d	P	m
·3445	2193·448	8·18
·3476	·453	8·18
·3505	·458	8·18
·3535	·463	8·20
·3564	·468	8·20
·3593.	·474	8·23

d	P	m
·3628	·480	8·19
·3658	·485	8·33
·3686	·490	8·17
·3716	·495	8·22
·3745	·500	8·20
.3774.	·506	8·28
·3809	·512	8·15
·3839.	·517	8·20

J. D. 2420037

d	P	m
·3226	2198·701	7·10
·3248	·705	7·09
·3273	·710	7·15
·3292	·713	7·13
·3314	·717	7·16
·3336.	·721	7·15
·3365	·726	7·16
·3387	·730	7·17
·3408	·734	7·19
·3430	·737	7·16
·3452	·741	7·20
·3474.	·745	7·14
·3514	·752	7·24
·3542	·757	7·36
·3571	·762	7·34
·3600	·767	7·26
·3629	·772	7·32
·3657.	·778	7·31

J. D. 2420038

d	P	m
·3235	2200·467	8·39
·3264	·472	8·36
·3292	·477	8·38
·3321	·482	8·41
·3350	·487	8·42
·3379.	·492	8·43
·3415	·499	8·12
·3444	·504	8·16
·3472	·509	8·14
·3501	·514	8·14
·3530	·519	8·13
·3559.	·524	8·08
·3599	·531	8·18
·3628	·536	8·17
·3657	·542	8·17
·3686	·547	8·15
·3715	·552	8·11
·3744.	·557	8·07
·3794	·566	7·93
·3823	·571	7·90
·3852	·576	7·89
·3881	·581	7·77
·3911	·586	7·79
·3940.	·591	7·75
·3976	·598	7·52
·4005	·603	7·53
·4034	·608	7·46
·4063	·613	7·41
·4092	·618	7·33
·4113	·622	7·34

d	P	m
·4141.	·627	7·29
·4197	·637	7·17
·4219	·641	7·20
·4240	·644	7·17
·4262	·648	7·15
·4284	·652	7·12
·4306.	·656	7·09
·4357	·665	7·11
·4379	·669	6·98
·4401	·673	7·10
·4423	·677	6·99
·4444	·680	7·03
·4466.	·684	7·05
·4516	·693	7·11
·4546	·698	7·13
·4574	·703	7·13
·4603	·708	7·10
·4632	·714	7·15
·4661.	·719	7·15

J. D. 2420040

d	P	m
·3239	2203·996	7·86
·3267	2204·001	7·86
·3303	·007	7·91
·3325	·011	7·85
·3354	·016	7·87
·3383.	·022	7·93
·3421	·028	7·82
·3450	·033	7·90
·3479	·038	7·96
·3508	·044	7·93
·3537	·049	7·94
·3566.	·054	7·98
·3634	·066	7·96
·3670	·072	8·04
·3706	·078	8·30
·3748	·086	8·18
·3784	·092	8·11
·3820.	·099	8·02
·3881	·109	8·03
·3917	·116	8·06
·3953	·122	8·06
·3989	·128	8·08
·4025	·135	8.08
·4061.	·141	8·10

J. D. 2420042

d	P	m
·2798	2207·447	8·22
·2828	·452	8·18
·2857	·457	8·16
·2885	·462	8·15
·2915	·467	8·18
·2944.	·472	8·19
·2979	·479	8·18
·3008	·484	8·16
·3038	·489	8·25
·3067	·494	8·22
·3096	·499	8·24
·3125.	·504	8·22
·3185	·515	8·13

d	P	m
·3216	·520	8·13
·3245	·526	8·13
·3274	·531	8·09
·3303	·536	8·08
·3332.	·541	8·06
·3384	·550	8·02
·3413	·555	8·02
·3443	·560	7·92
·3472	·566	7·88
·3500	·571	7·84
·3529·	·576	7·78
·3582	·585	7·66
·3611	·590	7·56
·3640	·595	7·48
·3669	·600	7·39
·3703	·606	7·35
·3732.	·611	7·29
·3781	·620	7·17
·3810	·625	7·16
·3839	·630	7·13
·3868	·635	7·09
·3896	·640	7·09
·3925.	·646	7·10
·3985	·656	7·05
·4014	·661	7·04
·4048	·667	7·00
·4078	·672	7·02
·4107	·678	6·99
·4136.	·683	7·05

J. D. 2420062

d	P	m
·2826	2242·735	7·35
·2855	·740	7·43
·2884	·745	7·37
·2913	·750	7·37
·2942	·755	7·49
·2971.	·760	7·43
·3016	·768	7·50
·3046	·773	7·56
·3074	·778	7·55
·3103	·784	7·60
·3132	·789	7·61
·3161.	·794	7·57
·3235	·807	7·48
·3252	·810	7·44
·3281	·815	7·50
·3310	·820	7·55
·3339	·825	7·54
·3367.	·830	7·54
·3425	·840	7·58
·3456	·846	7·69
·3485	·851	7·57
·3517	·856	7·63
·3546	·862	7·62
·3574.	·867	7·61
·3627	·876	7·72
·3656	·881	7·67
·3685	·886	7·71
·3714	·891	7·71
·3742	·896	7·70
·3771.	.901	7·69

APPENDIX. (Additional Observations).

Previously to the observations discussed above I obtained 11 plates on 5 nights with 78 exposures altogether, which were taken in the other position of the instrument viz. with the telescope to the west of the pier. The dates of these plates are given in Table 7 and the individual observations in Table 8. The apparent

TABLE 7

Date	Nr. of first plate	Sid. time Potsdam middle		Number of		*J. D.*	Phase observed	
		first exp.	last exp.	plates	exp.		first exp.	last exp.
		h m	h m				P	P
1910 May 1	238	16 35	16 58	1	8	2418793	4·493	·521
3	241	14 41	17 10	5	36	8795	7·872	·053
5	246	14 37	15 37	2	16	8797	11·386	·459
7	254	14 36	14 43	1	3	8799	14·903	·912
9	250	14 54	15 52	2	15	8801	18·444	·514

magnitudes of the comparison stars were again derived from 6 other plates taken with the grating in front of the objective. When *ef* (the mean of stars *e* and *f*) is as above taken to be $8^m{\cdot}000$, I find for *c* $7^m{\cdot}283$ and for *ghx* $8^m{\cdot}310$. According to the corrections for position on the plate as determined by Prof. MÜNCH, and also taking into account the differences in differential extinction of the stars in the two series, the apparent magnitude to be adopted for *ef* comes out to be practically the same for these additional observations as for those already discussed. The magnitudes given in Table 8 ought accordingly to be directly comparable with those in Table 3. Nevertheless I have thought it safer to treat them separately in order not to increase the risk of inhomogenuity of the material. On the other hand I would not entirely suppress these 78 observations. Those from *J. D.* 2418801 or 18^P are shown by open circles on the first of the 9 diagrams. They show an early rise to maximum light, the same as the observations from 226^P or about $3 \times 71^P{\cdot}64$ later.

Their total weight, calculated as described above, is 5670 m^{-2}.

TABLE 8.

J. D. 2418793

d	P	m
·5467	4·493	8·11
·5491	·497	8·13
·5513	·501	8·08
·5536	·505	8·08
·5558	·509	8·06
·5581	·513	8·04
·5603	·517	8·04
·5625.	·521	8·05

J. D. 2418795

d	P	m
·4620	7·872	7·77
·4645	·876	7·80
·4667	·880	7·75
·4689	·884	7·76
·4711	·888	7·76
·4734	·892	7·80
·4756	·896	7·78
·4780.	·900	7·77
·4867	·915	7·76
·4890	·919	7·76
·4912	·923	7·76
·4935	·927	7·82
·4957	·931	7·81
·4979	·935	7·83
·5001	·939	7·84
·5022.	·943	7·86
·5098	·956	7·92
·5122	·960	7·97
·5145	·964	7·94
·5167	·968	7·94
·5191	·972	8·00
·5213	·976	7·99
·5235	·980	7·94
·5264.	·985	7·92
·5343	·999	7·87
·5365	8·003	7·92
·5387	·007	7·94
·5409	·011	8·01
·5431	·015	8·00
·5454	·019	8·02
·5476	·023	8·06
·5498.	·026	8·05
·5582	·041	8·08
·5605	·045	8·12
·5628	·050	8·11
·5650.	·053	8·15

J. D. 2418797

d	P	m
·4542	11·386	8·11
·4566	·390	8·11
·4591	·395	8·08
·4614	·399	8·11
·4636	·403	8·10
·4658	·407	8·09
·4680	·410	8·15
·4702.	·414	8·13
·4798	·431	8·13
·4820	·435	8·08
·4843	·439	8·21
·4865	·443	8·11
·4887	·447	8·04
·4909	·451	8·14
·4931	·455	8·10
·4953.	·459	8·13

J. D. 2418799

d	P	m
·4475	14·903	7·80
·4497	·907	7·85
·4526.	·912	7·87

J. D. 2418801

d	P	m
·4550	18·444	8·10
·4585	·450	8·05
·4620	·456	8·13
·4642	·460	8·07
·4663	·464	8·13
·4684	·468	8·15
·4708.	·472	8·07
·4792	·487	8·05
·4816	·491	8·07
·4838	·495	8·06
·4860	·499	7·96
·4882	·503	7·92
·4904	·507	7·88
·4926	·510	7·82
·4948.	·514	7·79