Photographic photometry of VW Cephei
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COMMUNICATIONS FROM THE OBSERVATORY AT LEIDEN.

Photographic Photometry of VW Cephei, by *H. van Gent.*

The star VW Cep = B. D. + 75° 752 = H. D. 197433 was found by ADAMS to have a spectrum similar to that of W U Ma and for this reason it was examined for variability by SCHILT, who in fact found a lightcurve of the expected character with a range of $^{m}\cdot35$ (*Ap. J.* **64**, 221; 1926).

VW Cep has a remarkable proper motion, viz. $''\cdot632$ yearly in the direction $32°\cdot8$. The parallax has been found to be $+ ''\cdot044 \pm ''\cdot013$ (m. e.) and is thus hardly measurable. From the spectrum: G5 (dwarf), visual magnitude: $7^{m}\cdot62$, and duplicity ($\Delta m = + {}^{m}\cdot75$) a parallax of about $''\cdot031$ may be expected. This corresponds to a lateral velocity of $4\cdot75 \times \cdot632/\cdot031 = 97$ km/s, so that the star very probably belongs to those of high velocity above OORT's limit of 63 km/s.

By the courtesy of Dr. SCHILT observations of this interesting object could be started in Leiden soon after establishment of its variability. The considerable brightness and high declination of the variable make it an easy object to observe during a great part of the year at this latitude.

The instrument used was the 33 cm photographic Leiden refractor, the scale being 1 mm = $39''\cdot37$. A coarse grating consisting of wires 3·9 mm thick, separated by free spaces of 3·7 mm width, was placed in front of the objective. The difference in magnitude between the central image and the spectra of the first order, which has been found to be $^{m}\cdot92$, was provisionally taken as unit, the reduction factor ·92 having only been applied to the final results.

The diameter of the grating was 294 mm. Eastman 40 plates were used throughout.

The variable and the comparison star B. D. + 74°877 were alternately placed next to each other in a row on the plate, the distance between two consecutive exposures being ·8 mm or 30″. The time of exposure was 80 sec. with 40 sec. in between.

After my departure to Johannesburg the plates have been measured at Leiden in the Schilt microphotometer by C. J. KOOREMAN. The galvanometer readings for the central image and the diffraction images of the first order were registered for both VW Cep and the comparison star. For each of the two stars the sum and the difference between these two galvanometer readings were formed. Usually the difference in magnitude between the two stars was then simply calculated as the difference between the two sums divided by the sum of the two differences. In this procedure it is assumed that the galvanometer reading is a quadratic function of the magnitude, which in most cases is true with sufficient accuracy for the present purpose.

Only in the case of the 4 plates 1183, 1194, 1197 and 1198 the galvanometer readings were first converted into provisional magnitudes.

Of each exposure the images of both stars were measured, not only, as was originally intended, those placed next to each other in a row. The measures of the outside images were reduced to the principal row by a graphical procedure, thus eliminating systematic differences arising from unequal sensitiveness of the plate and similar causes.

The distance between the variable and the comparison star was 31 mm on the plate or 20′.

The results for each exposure are given in the first and third column of Table 2. Here and elsewhere in this paper

J. D. means J. D. hel. M. astr. T. Grw.

The period was determined from the 9 epochs of minimum given in Table 3.

TABLE 3.

J. D.	epoch	$O-C$	observer
d 2424658·7586	0	d + ·0005	SCHILT
4695·4934	264	— 28	VAN GENT
4696·4719	271	+ 16	»
4711·4982	379	— 14	»
4757·4245	709	+ 22	»
4758·3963	716	— 1	»
4907·7154	1789	+ 6	»
4955·5854	2133	— 4	»
5632·3195	6996	— 1	OOSTERHOFF

The first of these epochs was derived from the 105 observations given by SCHILT (*l. c.*) The phases of these observations were, after reduction of the J. D. to the sun, calculated from the formula:

$$\text{phase} = 7^{d^{-1}} \cdot 18596 \ (\text{J. D.} - 2420000)$$

The observations were then arranged according to phase and divided into 21 groups of 5 observations each. The mean values thus obtained are given in Table 4. Through these 21 points a curve was drawn and, using the method described in *B. A. N.* 147 and 166, the phase of minimum was found to be $^{P}\cdot653$, corresponding to the epoch J. D. $2424658^{d}\cdot7586$.

TABLE 4.

Mean values of every 5 observations made by SCHILT

P	m	P	m	P	m
·019	8·12	·290	8·21	·612	8·46
·062	8·18	·327	8·21	·677	8·45
·102	8·19	·368	8·28	·723	8·44
·144	8·14	·407	8·26	·787	8·39
·187	8·18	·447	8·27	·852	8·31
·223	8·15	·498	8·37	·912	8·27
·257	8·17	·552	8·41	·975	8·19

From the differences between observations following each other in phase the mean error of a single of SCHILT's observations was found to be $\pm {}^{m}\cdot071$ and their total weight $105/(\pm \cdot071)^2 = 20700\ m^{-2}$.

(The only individual minimum thoroughly observed by SCHILT is that of 1926 June 13. The epoch derived from this minimum alone is J. D. $2424680^{d}\cdot7461$).

From my own material 7 epochs of individual minima were determined by the aid of series of consecutive observations covering both the descending and ascending branch of the lightcurve.

Furthermore the epoch of a recent minimum, more than doubling the interval of time covered by the observations, was kindly determined by P. TH. OOSTERHOFF.

From the 9 minima of Table 3 the period was found by a least squares solution to be $^{d}\cdot13915974 \pm {}^{d}\cdot00000026$ (m. e.) and the reciprocal period $7^{d^{-1}}\cdot185986 \pm {}^{d^{-1}}\cdot000014$ (m. e.). In reality the phase was calculated for each individual observation of Table 2 from the formula

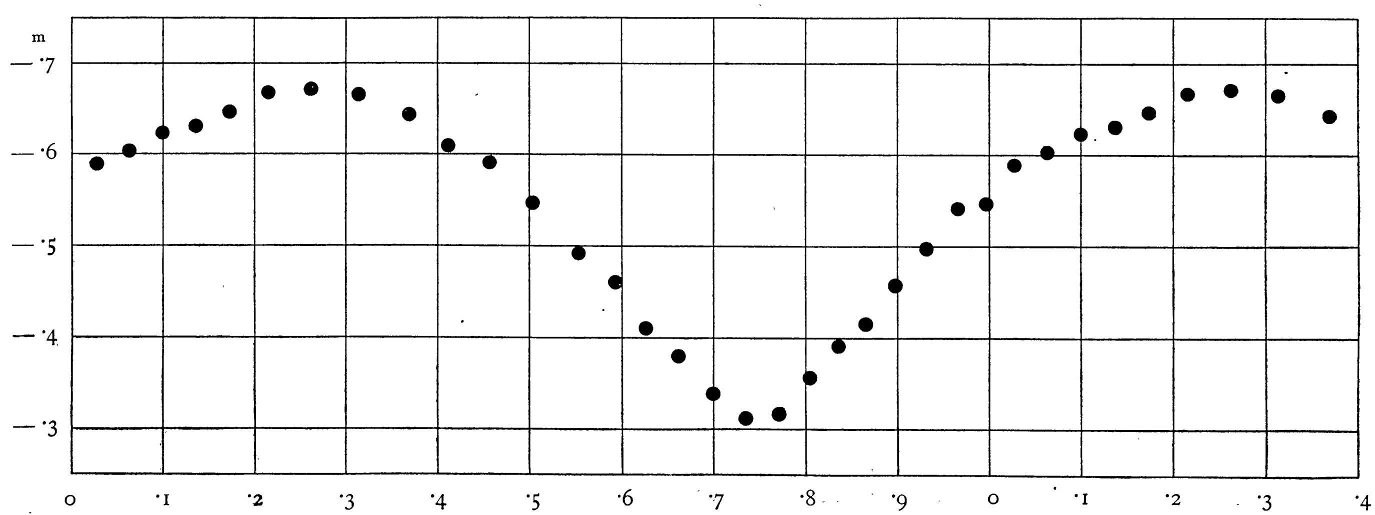
$$\text{phase} = 7^{d^{-1}} \cdot 18598 \ (\text{J. D.} - 2420000)$$

For each plate the last figure of the number of epochs calculated by this formula has been indicated in order to distinguish the even from the odd minima. The odd minima were found to be deeper than the even ones by $^{m}\cdot04 \pm {}^{m}\cdot02$ (m. e). The difference therefore is not warranted and has been neglected.

All the 1340 observations were then arranged according to phase and divided into 134 groups of 10 observations each. The mean results thus obtained are given in Table 5, were also 26 groups of 50 or 60 observations each are formed. These are represented in figure 1.

A curve was drawn through these 26 points and read off on 100 places equidistant in phase. Then for each provisionally assumed value of the phase of the minimum the sum of the squares of the differences between the magnitude on the descending and ascending branch of the lichtcurve was computed. From the 5 values of this sum indicated in Table 6 the phase of minimum found according to the formula given on page 39 of *B. A. N.* 166 is $^{P}\cdot7446$. This value was finally adopted.

FIGURE 1.



VW Cephei, 1340 Observations by VAN GENT.

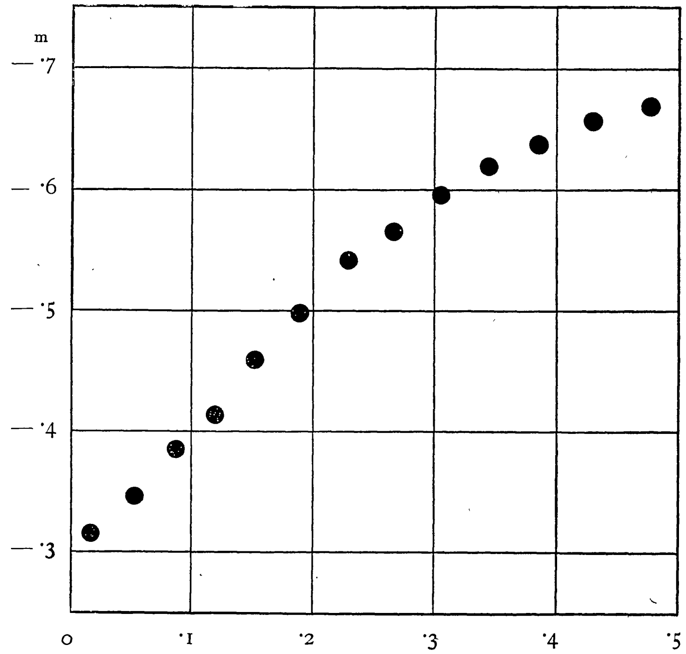
TABLE 6.

assumed phase of minimum	$\Sigma\,(\Delta m_{pr})^2$	calculated
P		
·735	·017921	·017931
·740	8656	8627
·745	5841	5866
·750	9651	9647
·755	19975	19973

The 134 mean values of 10 observations each as given in Table 5 were then arranged according to the phase counted from minimum. Strictly the individual observations ought to be arranged in this way, but practically the rearrangement of only the mean values of 10 observations is sufficient.

This new arrangement of the 134 mean values is presented in Table 7, where also mean values of 13 greater groups of 100 or 120 observations each are given. These 13 mean values are represented in Figure 2. After multiplication of the provisional magnitudes by ·92, and assuming that the even and odd minima are equally deep and symmetrical, they form the final results presented in Table 8.

FIGURE 2.



Means of 100 or 120 observations. Phase counted from minimum.

TABLE 8.

number of exposures	phase counted from minimum	$·92\,m_{pr}$	magnitude counted from maximum	$\cos 4\pi P$	square of the intensity of the light received in units of its maximum value $1 - ·3625 \cos^2 2\pi P$ *O*	*C*	*O—C*	"rectified" magnitude
	P	m	m					m
100	·0177	—·2894	·3270	+·994	·5475	·6386	+·0911	+·0835
100	·0530	—·3182	·2982	+·945	·5774	·6475	+ 701	+·0622
100	·0876	—·3554	·2610	+·852	·6183	·6643	+ 460	+·0390
100	·1195	—·3797	·2367	+·731	·6466	·6863	+ 397	+·0323
100	·1520	—·4219	·1945	+·578	·6989	·7140	+ 151	+·0116
100	·1888	—·4573	·1591	+·375	·7460	·7508	+ 48	+·0035
100	·2291	—·4977	·1187	+·131	·8036	·7950	— 86	—·0058
100	·2665	—·5198	·0966	—·103	·8370	·8374	+ 4	+·0003
100	·3052	—·5480	·0684	—·340	·8816	·8804	— 12	—·0008
100	·3446	—·5699	·0465	—·560	·9179	·9203	+ 24	+·0014
100	·3854	—·5868	·0296	—·752	·9469	·9551	+ 82	+·0047
120	·4298	—·6041	·0123	—·904	·9776	·9826	+ 50	+·0028
120	·4765	—·6157	·0007	—·989	·9987	·9980	— 7	—·0004

The total range is only $^{m}·33$ and the question arises if this is not merely due to ellipticity of the stars, the eclipse itself being only small.

According to H. N. RUSSELL (*Ap. J.* **36**, 63; 1912) the change in brightness caused by ellipticity of the stars can be written in the form

$$l^2 = 1 - \varepsilon^2 \sin^2 i \cos^2 \vartheta,$$

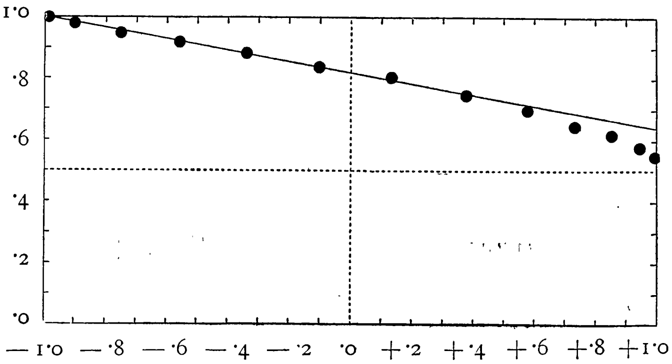
where l is the intensity of the light received in units of its maximum value, ε the excentricity of the equatorial section of the stars, i the inclination of the orbit and ϑ the phase angle counted from minimum light.

From the last 8 mean values of Table 8 the coefficient $\varepsilon^2 \sin^2 i$ was found by least squares to be ·3625. The minimum value of ε is accordingly $\sqrt{·3625} = ·60$.

Putting $\varepsilon^2 \sin^2 i = ·3625$ the lightcurve was then "rectified". The variation thus left to be explained by eclipse is indicated in the last column of Table 8. Its range is only $^{m}·09$. Figure 3 represents the sixth column of Table 8. The form of the system remains rather uncertain. It only seems safe to state that there is no evidence of the difference between the present lightcurve and that of WUMa having any other important cause than difference in the inclinations of the orbits.

In the last column of Table 2 the deviation of each observed magnitude from a mean lightcurve is

FIGURE 3.



"Rectifying" the curve. Abscinae: $\cos 4\pi P$;
Ordinates: square of intensity.

indicated. It will be seen, that some series of obervations show systematic differences from the mean curve. (see Table 1, sixth column). As to the possible cause of these differences I want to call attention to the fact, that on the plate 1194 there are two series of exposures from two different nights. The systematic difference between these two series is $·13 \times ·92 = {}^{m}·12$, thus suggesting that the differences in question are merely due to changes in the atmospheric conditions. On the night (1926 Aug. 4), when VW Cep was found comparatively bright, mist was noted. As the spectrum of the comparison star is A2 against G5 for VW Cep, the sign of the difference mentioned seems reasonable.

The mean square of the difference between two consecutive mean values of m_{pr} in Table 7 is $·000461\ m_{pr}^2$. Accordingly the mean error of a single observation is found to be $\pm ·92\sqrt{10 \times ·000461/2} = \pm {}^{m}·0442$ and the total weight of all the observations $1340/(\pm ·0442)^2 = 686400\ m^{-2}$.

The root of the mean square of the differences given in Table 2 of the individual observations from a mean lightcurve indicate a greater m. e. than the above, viz. $·92 \times \sqrt{38·1} = \pm {}^{m}·0568$, corresponding to a total weight of $415000\ m^{-2}$. In this connection it should be considered that a systematic deviation of a series covering practically the whole lightcurve only increases the mean error as calculated in the second way. When these systematic deviations are taken into account to their full amount (which is somewhat exaggerating) the m. e. of one observation is found to be $\pm {}^{m}·0440$ and the total weight $694000\ m^{-2}$.

In either way the lightcurve here presented appears to be the most accurate one that has so far been published of a variable of the WUMa type.

The mean epoch of minimum derived from the 1340 observations is

$$\text{J. D. } 2424798^{d}·4749.$$

I want to thank Mr. KOOREMAN and Mr. OOSTERHOFF for their kind co-operation, and especially Prof. HERTZSPRUNG for his very valuable advice and help during the preparation of this paper.

TABLE 1.

plate no.	astronomical date	beginning of first and last exposure sidereal time Leiden				number of exposures used	mean deviation of plate from general mean	mean square of deviation from general mean	mean square of deviation corrected for plate error	reduction to heliocentric time
		h	m	h	m		m prov.	m^2 pr.	m^2 pr.	d
1181 1)	1926 June 28	17	20	19	28	65	+ ·015	·0019	·0017	— ·00110
1182	29	17	0	19	44	83	— 23	36	32	— 108
1183 2)	30	16	48	20	8	92	— 64	92	52	— 106
1185 3)	July 6	19	16	20	38	41	+ 9	17	17	— 95
1187	12	17	0	21	20	120	— 8	22	22	— 82
1188	12	21	40	21	48	5	+ 18	9	7	— 82
1189	13	17	10	21	18	40	— 13	22	21	— 80
1190	13	21	38	21	50	7	+ 73	68	18	— 80
1191	14	17	10	21	42	134	— 64	69	28	— 78
1193	17	17	20	21	52	129	— 21	26	21	— 71
1194 4)	Aug. 4	18	18	18	32	7	— 126	172	16	— 28
1194 5)	16	18	36	20	36	57	+ 4	17	17	+ 3
1195	29	19	40	23	52	102	+ 35	30	17	+ 36
1197	29	0	8	1	28	40	+ 68	57	12	+ 36
1198	30	19	4	22	8	89	+ 16	30	27	+ 38
1211 6)	1927 Jan. 13	3	20	3	34	8	+ 20	11	8	+ 73
1211	26	13	8	14	44	49	+ 37	21	8	+ 42
1225	March 15	13	18	16	6	84	+ 8	14	13	— 80
1265 7)	June 16	16	30	17	30	31	+ 74	71	17	— 129
1266 8)	16	17	50	18	0	6	+ 48	29	7	— 129
1267 9)	22	17	0	17	56	28	+ 31	22	12	— 120
1283	Aug. 2	19	56	22	54	45	+ 52	45	19	— 34
1285	Oct. 9	21	14	22	14	31	+ 19	30	27	+ 121
1286	9	23	8	23	48	21	+ 60	52	16	+ 121
1290	Dec. 6	23	50	0	40	26	+ 32	48	39	+ 138

1) stopped by dawn, 2) smoke from electricity works, 3) stopped by clouds, 4) stopped by derangement of shutter, 5) mist, 6) stopped by clouds, 7) somewhat mysty, full moon, bad seeing, 3) stopped by mist, 9) bad seeing, stopped by mist.

TABLE 2.

J. D. 2424695, plate no. 1181

d	P	m_{pr}	Δm_{pr}
·4418	1·351	—·63	+·01
·4432	·361	·61	+ 3
·4446	·371	·61	+ 2
·4460	·381	·61	+ 2
·4473	·391	·60	+ 2
·4487	·401	·62	0
·4501	·411	·60	+ 1
·4515	·421	·65	— 4
·4529	·431	·55	+ 5
·4543	·440	·60	— 1
·4557	·450	·58	+ 1
·4570	·460	·60	— 2
·4584	·470	·52	+ 5
·4598	·480	·53	+ 4
·4612	·490	·50	+ 6
·4626	·500	·52	+ 3
·4640	·510	·53	+ 1
·4654	·520	·41	+ 12
·4667	·530	·49	+ 3
·4681	·540	·42	+ 9
·4695	·550	·51	— 1
·4709	·560	·42	+ 7
·4723	·570	·44	+ 4
·4737	·580	·42	+ 5
·4750	·590	·41	+ 5
·4764	·600	·43	+ 2
·4778	·610	·45	— 2
·4792	·620	·38	+ 4
·4806	·630	·36	+ 5
·4820	·640	·36	+ 4
·4834	·650	·35	+ 4
·4847	·659	·33	+ 5
·4861	·669	·33	+ 4
·4875	·679	·32	+ 4
·4889	·689	·34	+ 1
·4903	·699	·30	+ 4
·4917	·709	·28	+ 5
·4931	·719	·31	+ 1
·4944	·729	·27	+ 4
·4958	·739	·30	+ 1
·4972	·749	·25	+ 6
·4986	·759	·33	— 2
·5000	·769	·29	+ 3
·5014	·779	·33	0
·5027	·789	·28	+ 6
·5041	·799	·39	— 4
·5055	·809	·36	0
·5069	·819	·30	+ 7
·5083	·829	·39	— 1
·5097	·839	·42	— 3
·5111	·849	·41	— 1
·5124	·859	·39	+ 2
·5138	·868	·52	— 10
·5152	·878	·42	+ 1
·5166	·888	·45	0
·5180	·898	·55	— 9
·5194	·908	·48	— 1
·5208	·918	·60	— 12
·5221	·928	·53	— 4
·5235	·938	·50	0
·5249	·948	·51	0
·5263	·958	·50	+ 2
·5277	·968	·53	0
·5291	·978	·53	+ 1
·5305	·988	·57	— 2

J. D. 2424696, plate no. 1182

d	P	m_{pr}	Δm_{pr}
·4252	8·418	—·56	+·05
·4266	8·428	—·60	0
·4280	·438	·60	0
·4294	·448	·50	+ 9
·4308	·458	·59	— 1
·4322	·468	·60	— 2
·4335	·478	·61	— 4
·4349	·487	·54	+ 2
·4363	·497	·60	— 5
·4377	·507	·63	— 8
·4391	·517	·57	— 3
·4405	·527	·53	0
·4419	·537	·51	+ 1
·4432	·547	·54	— 3
·4446	·557	·42	+ 8
·4460	·567	·55	— 6
·4474	·577	·41	+ 6
·4488	·587	·58	— 12
·4502	·597	·57	— 12
·4516	·607	·51	— 8
·4529	·617	·41	+ 2
·4543	·627	·47	— 5
·4557	·637	·40	0
·4571	·647	·37	+ 2
·4585	·657	·47	— 9
·4599	·667	·36	+ 1
·4612	·677	·36	0
·4626	·687	·38	— 3
·4640	·697	·36	— 2
·4654	·706	·33	0
·4668	·716	·33	— 1
·4682	·726	·27	+ 5
·4696	·736	·33	— 2
·4709	·746	·37	— 6
·4723	·756	·34	— 3
·4737	·766	·30	+ 2
·4751	·776	·36	— 3
·4765	·786	·35	— 2
·4779	·796	·26	+ 8
·4793	·806	·41	— 5
·4806	·816	·32	+ 5
·4820	·826	·44	— 6
·4834	·836	·38	+ 1
·4848	·846	·47	— 7
·4862	·856	·35	+ 6
·4876	·866	·42	0
·4890	·876	·43	0
·4903	·886	·51	— 7
·4917	·896	·43	+ 3
·4931	·906	·53	— 6
·4945	·915	·50	— 2
·4959	·925	·58	— 9
·4973	·935	·51	— 1
·4986	·945	·58	— 7
·5000	·955	·67	— 15
·5014	·965	·62	— 9
·5028	·975	·59	— 5
·5242	·985	·59	— 4
·5056	·995	·70	— 14
·5070	9·005	·53	+ 3
·5083	·015	·74	— 17
·5097	·025	·65	— 7
·5111	·035	·76	— 17
·5125	·045	·60	— 1
·5139	·055	·69	— 9
·5153	·065	·56	+ 4
·5167	·075	·74	— 13
·5180	·085	·63	— 1
·5194	·095	·69	— 7
·5208	·105	·64	— 1
·5222	·115	·66	— 3
·5236	·125	·63	+ 1
·5250	9·134	—·68	— 4
·5263	·144	·63	+ 1
·5277	·154	·65	0
·5291	·164	·66	— 1
·5305	·174	·63	+ 3
·5319	·184	·61	+ 5
·5333	·194	·66	0
·5347	·204	·67	— 1
·5360	·214	·67	0
·5374	·224	·70	— 3
·5388	·234	·60	+ 7

J. D. 2424697, plate no. 1183

d	P	m_{pr}	Δm_{pr}
·4240	5·595	—·70	—·25
·4254	·605	·69	— 25
·4268	·615	·48	— 5
·4282	·625	·54	— 12
·4296	·635	·55	— 14
·4310	·645	·52	— 12
·4323	·655	·58	— 20
·4337	·665	·50	— 13
·4351	·675	·50	— 14
·4365	·685	·41	— 6
·4379	·695	·42	— 8
·4393	·705	·29	+ 4
·4407	·715	·27	+ 5
·4420	·725	·31	+ 1
·4434	·735	·44	— 13
·4448	·744	·30	+ 1
·4462	·754	·31	0
·4476	·764	·44	— 13
·4490	·774	·48	— 16
·4504	·784	·42	— 9
·4517	·794	·33	+ 1
·4531	·804	·37	— 2
·4545	·814	·49	— 13
·4559	·824	·25	+ 12
·4573	·834	·48	— 10
·4587	·844	·39	+ 1
·4601	·854	·46	— 5
·4614	·864	·49	— 7
·4628	·874	·48	— 5
·4642	·884	·41	+ 3
·4656	·894	·52	— 7
·4670	·904	·63	— 17
·4684	·914	·58	— 10
·4697	·924	·64	— 15
·4711	·934	·52	— 2
·4725	·944	·54	— 3
·4739	·954	·56	— 4
·4753	·963	·62	— 9
·4767	·973	·52	+ 2
·4781	·983	·57	— 2
·4794	·993	·60	— 5
·4808	6·003	·54	+ 2
·4822	·013	·60	— 3
·4836	·023	·67	— 9
·4850	·033	·71	— 13
·4864	·043	·66	— 7
·4878	·053	·62	— 2
·4891	·063	·67	— 7
·4905	·073	·54	+ 7
·4919	·083	·68	— 7
·4933	·093	·55	+ 7
·4961	·113	·70	— 7
·4974	·123	·67	— 4
·5002	·143	·68	— 4
·5016	·153	·80	— 15
·5030	·163	·73	— 8
·5044	·172	·57	+ 9
·5058	6·182	—·65	+ 1
·5071	·192	·71	— 5
·5085	·202	·67	— 1
·5099	·212	·78	— 11
·5113	·222	·70	— 3
·5127	·232	·71	— 4
·5141	·242	·71	— 4
·5155	·252	·66	+ 1
·5168	·262	·67	0
·5182	·272	·73	— 6
·5196	·282	·77	— 10
·5210	·292	·73	— 7
·5224	·302	·77	— 11
·5238	·312	·71	— 5
·5251	·322	·73	— 8
·5265	·332	·66	— 1
·5279	·342	·75	— 10
·5293	·352	·76	— 12
·5307	·362	·75	— 11
·5321	·372	·79	— 16
·5335	·381	·69	— 6
·5348	·391	·69	— 7
·5362	·401	·83	— 23
·5376	·411	·65	— 4
·5390	·421	·60	+ 1
·5404	·431	·60	0
·5418	·441	·60	— 1
·5432	·451	·78	— 19
·5445	·461	·73	— 15
·5459	·471	·63	— 6
·5473	·481	·62	— 5
·5487	·491	·55	+ 1
·5501	·501	·72	— 17
·5515	·511	·58	— 4
·5529	·521	·62	— 9

J. D. 2424703, plate no. 1185

d	P	m_{pr}	Δm_{pr}
·5006	9·261	—·71	—·04
·5019	·271	·67	0
·5033	·281	·55	+ 12
·5047	·291	·66	0
·5061	·301	·63	+ 3
·5075	·311	·65	+ 1
·5089	·321	·68	— 3
·5103	·331	·70	— 5
·5116	·341	·71	— 6
·5130	·351	·70	— 6
·5144	·360	·68	— 4
·5158	·370	·67	— 4
·5172	·380	·61	+ 2
·5186	·390	·65	— 3
·5199	·400	·60	+ 2
·5213	·410	·61	0
·5227	·420	·56	+ 5
·5241	·430	·61	— 1
·5255	·440	·51	+ 8
·5269	·450	·64	— 5
·5283	·460	·54	+ 4
·5296	·470	·59	— 2
·5310	·480	·52	+ 5
·5324	·490	·58	— 2
·5338	·500	·54	+ 1
·5352	·510	·51	+ 3
·5366	·520	·54	— 1
·5380	·530	·51	+ 1
·5393	·540	·51	0
·5407	·550	·48	+ 2
·5421	·560	·49	0
·5435	·569	·45	+ 3
·5449	·579	·41	+ 6

d	P	m_{pr}	Δm_{pr}
·5463	9·589	—·40	+ 6
·5476	·599	·45	0
·5490	·609	·38	+ 5
·5504	·619	·43	0
·5518	·629	·36	+ 5
·5532	·639	·42	— 2
·5546	·649	·32	+ 7
·5560	·659	·34	+ 4

J. D. 2424709, plate no. 1187

d	P	m_{pr}	Δm_{pr}
·3901	1·583	—·50	—·03
·3915	·593	·38	+ 8
·3929	·603	·48	— 4
·3943	·613	·34	+ 9
·3957	·623	·43	— 1
·4095	·723	·24	+ 8
·4109	·732	·30	+ 1
·4123	·742	·28	+ 3
·4137	·752	·23	+ 8
·4150	·762	·25	+ 7
·4164	·772	·31	+ 1
·4178	·782	·29	+ 3
·4192	·792	·33	+ 1
·4206	·802	·33	+ 2
·4220	·812	·31	+ 5
·4234	·822	·33	+ 4
·4247	·832	·42	— 4
·4261	·842	·34	+ 5
·4275	·852	·38	+ 2
·4289	·862	·44	— 2
·4303	·872	·38	+ 5
·4317	·882	·42	+ 1
·4331	·892	·39	+ 6
·4344	·902	·50	— 4
·4358	·912	·51	— 4
·4372	·922	·49	0
·4386	·932	·48	+ 2
·4400	·941	·46	+ 5
·4414	·951	·49	+ 3
·4427	·961	·52	+ 1
·4441	·971	·53	+ 1
·4455	·981	·53	+ 1
·4469	·991	·52	+ 3
·4483	2·001	·57	— 1
·4497	·011	·58	— 1
·4511	·021	·52	+ 6
·4524	·031	·58	0
·4538	·041	·60	— 1
·4552	·051	·66	— 6
·4566	·061	·51	+ 9
·4580	·071	·63	— 2
·4594	·081	·59	+ 2
·4608	·091	·66	— 4
·4621	·101	·67	— 5
·4635	·111	·64	— 1
·4649	·121	·64	— 1
·4663	·131	·56	+ 8
·4677	·141	·59	+ 5
·4691	·151	·71	— 6
·4704	·160	·68	— 3
·4718	·170	·67	— 2
·4732	·180	·70	— 4
·4746	·190	·68	— 2
·4760	·200	·71	— 5
·4774	·210	·72	— 5
·4788	·220	·66	+ 1
·4801	·230	·64	+ 3
·4815	·240	·65	+ 2
·4829	·250	·80	— 13
·4843	·260	·68	— 1
·4871	·280	·67	0
·4885	·290	·68	— 2
·4898	2·300	—·64	+ 2
·4912	·310	·66	0
·4926	·320	·63	+ 2
·4940	·330	·66	— 1
·4954	·340	·69	— 4
·4968	·350	·62	+ 2
·4982	·360	·65	— 1
·4995	·369	·71	— 8
·5009	·379	·60	+ 3
·5023	·389	·67	— 5
·5037	·399	·73	— 11
·5051	·409	·63	— 2
·5065	·419	·56	+ 5
·5078	·429	·60	0
·5092	·439	·63	— 3
·5106	·449	·64	— 5
·5120	·459	·60	— 2
·5148	·479	·63	— 6
·5162	·489	·59	— 3
·5175	·499	·56	— 1
·5189	·509	·60	— 6
·5203	·519	·57	— 3
·5217	·529	·58	— 5
·5231	·539	·53	— 1
·5245	·549	·62	— 11
·5259	·559	·55	— 6
·5272	·569	·55	— 7
·5286	·578	·47	0
·5300	·588	·53	— 7
·5314	·598	·50	— 5
·5328	·608	·49	— 6
·5342	·618	·43	0
·5355	·628	·45	— 4
·5369	·638	·43	— 3
·5383	·648	·44	— 5
·5397	·658	·37	+ 1
·5411	·668	·42	— 5
·5425	·678	·42	— 6
·5439	·688	·35	0
·5452	·698	·34	0
·5466	·708	·35	— 2
·5480	·718	·39	— 7
·5494	·728	·30	+ 2
·5508	·738	·37	— 6
·5522	·748	·45	— 14
·5536	·758	·36	— 5
·5549	·768	·35	— 3
·5563	·778	·27	+ 6
·5577	·788	·40	— 6
·5591	·797	·39	— 4
·5605	·807	·33	+ 3
·5619	·817	·39	— 2
·5633	·827	·43	— 5
·5646	·837	·35	+ 4
·5660	·847	·44	— 4
·5674	·857	·33	+ 8
·5688	·867	·36	+ 6
·5702	·877	·39	+ 4

J. D. 2424709, plate no. 1188

d	P	m_{pr}	Δm_{pr}
·5840	2·977	—·56	—·02
·5854	·987	·51	+ 4
·5868	·997	·52	+ 4
·5882	3·006	·56	0
·5896	·016	·54	+ 3

J. D. 2424710, plate no. 1189

d	P	m_{pr}	Δm_{pr}
·3943	8·799	—·33	+·02
·3957	·809	·46	— 10
·3971	·819	·33	+ 4
·3985	·829	·42	— 4
·3999	8·839	—·43	— 4
·4013	·849	·34	+ 6
·4026	·859	·51	— 10
·4040	·869	·45	— 3
·4054	·879	·46	— 3
·4068	·889	·44	+ 1
·4082	·899	·46	0
·4096	·909	·49	— 2
·4110	·919	·57	— 9
·4123	·929	·46	+ 3
·4137	·939	·53	— 3
·4151	·949	·63	— 12
·4165	·959	·53	— 1
·4179	·969	·57	— 4
·4193	·979	·58	— 4
·4220	·999	·64	— 8
·5398	9·845	·40	0
·5412	·855	·43	— 2
·5425	·864	·40	+ 2
·5439	·874	·48	— 5
·5453	·884	·42	+ 2
·5467	·894	·42	+ 3
·5481	·904	·43	+ 3
·5495	·914	·50	— 2
·5509	·924	·45	+ 4
·5522	·934	·47	+ 3
·5536	·944	·53	— 2
·5550	·954	·56	— 4
·5564	·964	·55	— 2
·5578	·974	·59	— 5
·5592	·984	·53	+ 2
·5605	·994	·50	+ 6
·5619	0·004	·63	— 7
·5633	·014	·58	— 1
·5647	·024	·57	+ 1
·5661	·034	·63	— 5

J. D. 2424710, plate no. 1190

d	P	m_{pr}	Δm_{pr}
·5799	0·133	—·52	+·12
·5813	·143	·64	0
·5827	·153	·60	+ 5
·5841	·163	·56	+ 9
·5855	·173	·60	+ 6
·5869	·183	·54	+ 12
·5882	·193	·59	+ 7

J. D. 2424711, plate no. 1191

d	P	m_{pr}	Δm_{pr}
·3916	5·966	—·57	—·04
·3930	·976	·47	+ 7
·3944	·986	·56	— 1
·3958	·996	·49	+ 7
·3972	6·006	·56	0
·3985	·016	·63	— 6
·3999	·026	·61	— 3
·4013	·036	·54	+ 5
·4027	·046	·62	— 3
·4041	·055	·57	+ 3
·4055	·065	·60	0
·4069	·075	·58	+ 3
·4082	·085	·71	— 9
·4096	·095	·67	+ 5
·4110	·105	·62	+ 1
·4124	·115	·65	— 2
·4138	·125	·68	— 4
·4152	·135	·65	— 1
·4165	·145	·75	— 11
·4179	·155	·71	— 6
·4193	·165	·62	+ 3
·4207	·175	·70	— 4
·4221	·185	·71	— 5
·4235	·195	·70	— 4
·4249	6·205	—·65	+ 2
·4262	·215	·78	— 11
·4276	·225	·78	— 11
·4290	·235	·74	— 7
·4304	·245	·75	— 8
·4318	·255	·69	— 2
·4332	·265	·75	— 8
·4346	·274	·83	— 16
·4359	·284	·73	— 6
·4373	·294	·69	— 3
·4387	·304	·77	— 11
·4401	·314	·70	— 4
·4415	·324	·66	— 1
·4429	·334	·66	— 1
·4442	·344	·69	— 4
·4456	·354	·74	— 10
·4470	·364	·75	— 11
·4484	·374	·70	— 7
·4498	·384	·67	— 4
·4512	·394	·79	— 17
·4526	·404	·75	— 13
·4539	·414	·72	— 11
·4553	·424	·58	+ 2
·4567	·434	·62	— 2
·4581	·444	·59	0
·4595	·454	·64	+ 5
·4609	·464	·71	— 13
·4623	·474	·68	— 11
·4636	·483	·58	— 1
·4650	·493	·66	— 10
·4664	·503	·60	— 5
·4678	·513	·60	— 6
·4692	·523	·55	— 2
·4706	·533	·55	— 3
·4720	·543	·50	+ 1
·4733	·553	·47	+ 3
·4747	·563	·56	— 7
·4761	·573	·55	— 7
·4775	·583	·55	— 8
·4789	·593	·57	— 11
·4803	·603	·41	— 3
·4816	·613	·43	0
·4830	·623	·39	+ 3
·4844	·633	·34	+ 7
·4858	·643	·47	— 7
·4872	·653	·47	— 8
·4886	·663	·40	— 2
·4913	·683	·33	+ 3
·4927	·693	·50	— 16
·4941	·702	·45	— 12
·4955	·712	·50	— 17
·4983	·732	·45	— 14
·4997	·742	·31	0
·5010	·752	·42	— 11
·5024	·762	·40	— 8
·5038	·772	·39	— 7
·5052	·782	·34	— 1
·5066	·792	·43	— 9
·5080	·802	·43	— 8
·5093	·812	·40	— 4
·5107	·822	·37	0
·5121	·832	·50	— 12
·5135	·842	·41	— 2
·5149	·852	·50	— 10
·5163	·862	·45	— 3
·5177	·872	·50	— 7
·5190	·882	·47	— 4
·5204	·892	·47	— 3
·5218	·902	·52	— 6
·5232	·911	·49	— 2
·5246	·921	·53	— 5
·5260	·931	·66	— 16
·5274	·941	·62	— 11

d	P	m_{pr}	Δm_{pr}
·5287	6·951	—·60	— 8
·5301	·961	·66	— 13
·5315	·971	·58	— 4
·5329	·981	·58	— 4
·5343	·991	·56	— 1
·5357	7·001	·64	— 8
·5371	·011	·62	— 5
·5384	·021	·70	— 12
·5398	·031	·70	— 12
·5412	·041	·71	— 12
·5440	·061	·79	— 19
·5454	·071	·68	— 7
·5467	·081	·76	— 15
·5481	·091	·73	— 11
·5495	·101	·71	— 9
·5509	·111	·77	— 14
·5523	·120	·72	— 9
·5537	·130	·73	— 9
·5551	·140	·71	— 7
·5564	·150	·81	— 16
·5578	·160	·80	— 15
·5592	·170	·66	— 1
·5606	·180	·69	— 3
·5620	·190	·77	— 11
·5633	·200	·75	— 9
·5648	·210	·72	— 5
·5661	·220	·77	— 10
·5675	·230	·79	— 12
·5689	·240	·75	— 8
·5703	·250	·84	— 17
·5717	·260	·81	— 14
·5731	·270	·73	— 6
·5744	·280	·68	— 1
·5758	·290	·78	— 12
·5772	·300	·67	— 1
·5786	·310	·75	— 9
·5800	·320	·77	— 12

J. D. 2424714, plate no. 1193

d	P	m_{pr}	Δm_{pr}
·3918	7·525	—·58	—·05
·3946	·545	·59	— 8
·3973	·565	·45	+ 4
·4001	·585	·45	+ 1
·4029	·605	·50	— 6
·4056	·625	·47	— 5
·4070	·635	·36	+ 5
·4084	·645	·37	+ 3
·4098	·655	·39	— 1
·4112	·664	·39	— 1
·4126	·674	·34	+ 2
·4140	·684	·39	— 4
·4153	·694	·30	+ 4
·4167	·704	·37	— 4
·4181	·714	·34	— 1
·4195	·724	·27	+ 5
·4209	·734	·28	+ 3
·4223	·744	·38	— 7
·4237	·754	·34	— 3
·4250	·764	·21	+ 11
·4264	·774	·31	+ 1
·4278	·784	·35	— 2
·4292	·794	·38	— 4
·4306	·804	·36	— 1
·4320	·814	·41	— 5
·4333	·824	·43	— 6
·4347	·834	·42	— 4
·4361	·844	·40	0
·4375	·854	·39	+ 2
·4389	·864	·44	— 2
·4403	·874	·49	— 6
·4417	·883	·42	+ 1
·4430	·893	·50	— 5

d	P	m_{pr}	Δm_{pr}
·4444	7·903	—·46	0
·4458	·913	·53	— 5
·4472	·923	·54	— 5
·4486	·933	·60	— 10
·4500	·943	·60	— 9
·4514	·953	·58	— 6
·4527	·963	·62	— 9
·4541	·973	·60	— 6
·4555	·983	·56	— 1
·4569	·993	·56	— 1
·4583	8·003	·61	— 5
·4597	·013	·58	— 1
·4610	·023	·72	— 14
·4624	·033	·63	— 5
·4638	·043	·70	— 11
·4652	·053	·68	— 8
·4666	·063	·73	— 13
·4680	·073	·61	0
·4694	·083	·69	— 8
·4707	·092	·61	+ 1
·4721	·102	·67	— 5
·4735	·112	·74	— 11
·4763	·132	·70	— 6
·4777	·142	·59	+ 5
·4791	·152	·69	— 4
·4804	·162	·62	+ 3
·4818	·172	·65	+ 1
·4832	·182	·63	+ 3
·4860	·202	·67	— 1
·4874	·212	·63	+ 4
·4888	·222	·70	— 3
·4901	·232	·71	— 4
·4915	·242	·70	— 3
·4929	·252	·63	+ 4
·4943	·262	·78	— 11
·4957	·272	·78	— 11
·4971	·282	·78	— 11
·4984	·292	·63	+ 3
·4998	·301	·74	— 8
·5012	·311	·72	— 6
·5026	·321	·64	+ 1
·5040	·331	·65	0
·5054	·341	·70	— 5
·5068	·351	·69	— 5
·5081	·361	·61	+ 3
·5095	·371	·64	— 1
·5109	·381	·58	+ 5
·5123	·391	·61	+ 1
·5137	·401	·60	+ 2
·5151	·411	·55	+ 6
·5165	·421	·60	+ 1
·5178	·431	·58	+ 2
·5192	·441	·60	— 1
·5206	·451	·66	— 7
·5220	·461	·59	— 1
·5234	·471	·56	+ 1
·5248	·481	·56	+ 1
·5261	·491	·61	— 5
·5275	·501	·57	— 2
·5289	·511	·53	+ 1
·5303	·520	·51	+ 2
·5317	·530	·46	+ 6
·5331	·540	·54	— 3
·5345	·550	·51	— 1
·5358	·560	·57	— 8
·5372	·570	·51	— 3
·5386	·580	·52	— 5
·5400	·590	·52	— 6
·5414	·600	·46	— 1
·5428	·610	·49	— 6
·5442	·620	·44	— 2
·5455	·630	·42	— 1
·5469	·640	·50	— 10

d	P	m_{pr}	Δm_{pr}
·5483	8·650	—·37	+ 2
·5497	·660	·35	+ 3
·5511	·670	·43	— 6
·5525	·680	·35	+ 1
·5539	·690	·45	— 10
·5552	·700	·34	0
·5566	·710	·36	— 3
·5580	·720	·35	— 3
·5594	·729	·27	+ 4
·5608	·739	·29	+ 2
·5622	·749	·33	— 2
·5635	·759	·33	— 2
·5649	·769	·37	— 5
·5663	·779	·27	+ 6
·5677	·789	·34	0
·5691	·799	·38	— 3
·5705	·809	·37	— 1
·5719	·819	·40	— 3
·5732	·829	·39	— 1
·5746	·839	·41	— 2
·5760	·849	·38	+ 2
·5774	·859	·44	— 3
·5788	·869	·42	0

J. D. 2424732, plate no. 1194

d	P	m_{pr}	Δm_{pr}
·3818	6·801	—·47	— 12
·3832	·811	·46	— 10
·3846	·821	·54	— 17
·3860	·831	·56	— 18
·3874	·841	·46	— 7
·3887	·851	·50	— 10
·3917	·872	·57	— 14

J. D. 2424744, plate no. 1194

d	P	m_{pr}	Δm_{pr}
·3618	2·889	—·42	+·03
·3632	·899	·49	— 3
·3646	·909	·43	+ 4
·3701	·949	·48	+ 3
·3715	·959	·55	— 3
·3729	·969	·45	+ 8
·3743	·979	·55	— 1
·3757	·989	·46	+ 9
·3771	·999	·48	+ 8
·3785	3·009	·55	+ 2
·3798	·019	·61	— 4
·3812	·029	·59	— 1
·3826	·039	·61	— 2
·3840	·048	·66	— 7
·3854	·058	·61	— 1
·3868	·068	·61	0
·3881	·078	·66	— 5
·3895	·088	·59	+ 3
·3909	·098	·73	— 11
·3923	·108	·59	+ 4
·3937	·118	·61	+ 2
·3951	·128	·67	— 3
·3965	·138	·62	+ 2
·3978	·148	·62	+ 3
·3992	·158	·63	+ 2
·4006	·168	·66	— 1
·4020	·178	·65	+ 1
·4034	·188	·67	— 1
·4048	·198	·71	— 5
·4062	·208	·69	— 2
·4075	·218	·68	— 1
·4089	·228	·61	+ 6
·4103	·238	·67	0
·4117	·248	·67	0
·4131	·258	·65	+ 2
·4145	·267	·75	— 8
·4159	·277	·69	— 2

d	P	m_{pr}	Δm_{pr}
·4186	3·297	—·65	+ 1
·4200	·307	·65	+ 1
·4214	·317	·68	— 2
·4228	·327	·65	0
·4242	·337	·73	— 8
·4255	·347	·60	+ 4
·4269	·357	·64	0
·4283	·367	·64	— 1
·4297	·377	·61	+ 2
·4311	·387	·65	— 3
·4325	·397	·64	— 2
·4339	·407	·62	— 1
·4352	·417	·59	+ 2
·4366	·427	·57	+ 3
·4380	·437	·54	+ 6
·4394	·447	·51	+ 8
·4408	·457	·60	— 2
·4422	·467	·59	— 1
·4436	·476	·51	+ 6
·4449	·486	·49	+ 7

J. D. 2424757, plate no. 1195

d	P	m_{pr}	Δm_{pr}
·3987	6·572	—·47	+·01
·4001	·582	·42	+ 5
·4015	·592	·48	— 2
·4028	·602	·40	+ 5
·4042	·612	·46	— 3
·4056	·622	·44	— 2
·4070	·632	·40	+ 1
·4084	·641	·41	— 1
·4098	·651	·40	— 1
·4111	·661	·34	+ 4
·4125	·671	·31	+ 6
·4139	·681	·37	— 1
·4153	·691	·36	— 1
·4167	·701	·33	+ 1
·4181	·711	·37	— 4
·4195	·721	·35	— 3
·4208	·731	·32	— 1
·4222	·741	·35	— 4
·4236	·751	·32	— 1
·4250	·761	·36	— 5
·4264	·771	·28	+ 4
·4278	·781	·32	+ 1
·4292	·791	·35	— 1
·4305	·801	·37	— 2
·4319	·811	·34	+ 2
·4333	·821	·36	+ 1
·4347	·831	·38	0
·4361	·841	·39	0
·4375	·850	·40	0
·4389	·860	·32	+ 9
·4402	·870	·40	+ 3
·4416	·880	·38	+ 5
·4430	·890	·44	+ 1
·4444	·900	·45	+ 1
·4458	·910	·46	+ 1
·4472	·920	·41	+ 7
·4485	·930	·49	0
·4499	·940	·45	+ 5
·4513	·950	·46	+ 6
·4527	·960	·50	+ 3
·4541	·970	·47	+ 7
·4624	7·030	·52	+ 6
·4638	·040	·53	+ 6
·4652	·050	·55	+ 5
·4666	·059	·59	+ 1
·4679	·069	·58	+ 3
·4693	·079	·55	+ 6
·4707	·089	·64	— 2
·4721	·099	·58	+ 4
·4735	·109	·59	+ 4

d	P	m_{pr}	Δm_{pr}
·4749	7·119	—·61	+ 2
·4762	·129	·60	+ 4
·4776	·139	·63	+ 1
·4790	·149	·64	+ 1
·4804	·159	·64	+ 1
·4818	·169	·62	+ 3
·4832	·179	·59	+ 7
·4846	·189	·61	+ 5
·4859	·199	·55	+ 11
·4873	·209	·59	+ 8
·4887	·219	·68	— 1
·4901	·229	·59	+ 8
·4915	·239	·57	+ 10
·4929	·249	·58	+ 9
·4943	·259	·59	+ 8
·4956	·269	·69	— 2
·4970	·278	·59	+ 8
·4984	·288	·58	+ 8
·4998	·298	·60	+ 6
·5012	·308	·60	+ 6
·5026	·318	·60	+ 6
·5040	·328	·65	0
·5053	·338	·55	+ 10
·5067	·348	·66	— 2
·5081	·358	·58	+ 6
·5095	·368	·61	+ 2
·5109	·378	·54	+ 9
·5123	·388	·63	— 1
·5136	·398	·61	+ 1
·5150	·408	·54	+ 7
·5164	·418	·54	+ 7
·5178	·428	·59	+ 1
·5192	·438	·54	+ 6
·5206	·448	·55	+ 4
·5220	·458	·58	0
·5233	·468	·55	+ 3
·5247	·478	·52	+ 5
·5261	·487	·40	+ 16
·5275	·497	·49	+ 6
·5289	·507	·53	+ 2
·5303	·517	·49	+ 5
·5317	·527	·41	+ 12
·5330	·537	·51	+ 1
·5344	·547	·41	+ 10
·5358	·557	·41	+ 9
·5372	·567	·44	+ 5
·5386	·577	·41	+ 6
·5400	·587	·41	+ 5
·5413	·597	·41	+ 4
·5427	·607	·32	+ 11
·5441	·617	·35	+ 8
·5455	·627	·30	+ 12

J. D. 2424757, plate no. 1197

d	P	m_{pr}	Δm_{pr}
·5566	7·706	—·25	+ ·08
·5580	·716	·22	+ 10
·5594	·726	·26	+ 6
·5607	·736	·22	+ 9
·5621	·746	·26	+ 5
·5635	·756	·24	+ 7
·5649	·766	·26	+ 6
·5663	·776	·29	+ 4
·5677	·786	·32	+ 1
·5690	·796	·32	+ 2
·5704	·806	·23	+ 13
·5718	·816	·33	+ 4
·5732	·826	·30	+ 8
·5746	·836	·37	+ 2
·5760	·846	·38	+ 2
·5774	·856	·34	+ 7
·5787	·866	·38	+ 4
·5801	·876	·30	+ 13
·5815	7·886	—·40	+ 4
·5829	·896	·42	+ 4
·5843	·906	·39	+ 8
·5857	·915	·38	+ 10
·5871	·925	·34	+ 15
·5884	·935	·47	+ 3
·5898	·545	·45	+ 6
·5912	·955	·46	+ 6
·5926	·965	·44	+ 9
·5940	·975	·47	+ 7
·5954	·985	·54	+ 1
·5968	·995	·48	+ 8
·5981	8·005	·45	+ 11
·5995	·015	·45	+ 12
·6009	·025	·56	+ 2
·6023	·035	·52	+ 7
·6037	·045	·52	+ 7
·6051	·055	·52	+ 8
·6064	·065	·52	+ 8
·6092	·085	·53	+ 9
·6106	·095	·56	+ 6
·6120	·105	·55	+ 8

J. D. 2424758. plate no. 1198

d	P	m_{pr}	Δm_{pr}
·3433	3·360	—·61	+ ·03
·3447	·370	·63	0
·3461	·380	·60	+ 3
·3475	·390	·61	+ 1
·3489	·400	·60	+ 2
·3503	·410	·61	0
·3517	·420	·61	0
·3530	·430	·61	— 1
·3544	·440	·55	+ 4
·3558	·450	·60	— 1
·3572	·460	·56	+ 2
·3586	·470	·58	— 1
·3600	·480	·55	+ 2
·3614	·489	·51	+ 5
·3627	·499	·56	— 1
·3641	·509	·55	— 1
·3655	·519	·52	+ 2
·3669	·529	·45	+ 8
·3683	·539	·55	— 3
·3697	·549	·44	+ 7
·3710	·559	·42	+ 7
·3724	·569	·38	+ 10
·3738	·579	·49	— 2
·3752	·589	·42	+ 4
·3766	·599	·40	+ 5
·3780	·609	·41	+ 2
·3794	·619	·47	— 4
·3821	·639	·34	+ 6
·3835	·649	·47	— 8
·3849	·659	·35	+ 3
·3863	·669	·31	+ 6
·3877	·679	·35	+ 1
·3891	·689	·24	+ 11
·3904	·699	·28	+ 6
·3918	·708	·26	+ 7
·3932	·718	·29	+ 3
·3946	·728	·29	+ 2
·3960	·738	·27	+ 4
·3974	·748	·28	+ 3
·3987	·758	·24	+ 7
·4001	·768	·21	+ 11
·4015	·778	·25	+ 8
·4029	·788	·28	+ 6
·4043	·798	·29	+ 6
·4057	·808	·40	— 4
·4071	·818	·31	+ 6
·4084	·828	·29	+ 9
·4098	·838	·40	— 1
·4112	3·848	—·30	+ 10
·4126	·858	·37	+ 4
·4140	·868	·41	+ 1
·4154	·878	·34	+ 9
·4168	·888	·50	— 5
·4181	·898	·50	— 4
·4195	·908	·38	+ 9
·4209	·917	·48	0
·4223	·927	·46	+ 3
·4237	·937	·44	+ 6
·4251	·947	·46	+ 5
·4292	·677	·56	— 2
·4306	·987	·61	— 6
·4320	·997	·62	— 6
·4334	4·007	·54	+ 3
·4348	·017	·72	— 15
·4361	·027	·53	+ 5
·4375	·037	·53	+ 6
·4389	·047	·64	— 5
·4403	·057	·68	— 8
·4417	·067	·53	+ 8
·4431	·077	·55	+ 6
·4445	·087	·67	— 5
·4458	·097	·63	— 1
·4472	·107	·64	— 1
·4486	·117	·64	— 1
·4500	·127	·61	+ 3
·4514	·136	·63	+ 1
·4528	·146	·67	— 2
·4542	·156	·67	— 2
·4555	·166	·62	+ 3
·4569	·176	·69	— 3
·4583	·186	·63	+ 3
·4597	·196	·68	— 2
·4625	·216	·72	— 5
·4638	·226	·63	+ 4
·4652	·236	·84	— 17
·4666	·246	·64	+ 3
·4680	·256	·68	— 1
·4694	·266	·66	+ 1
·4708	·276	·72	— 5

J. D. 2424894, plate no. 1211

d	P	m_{pr}	Δm_{pr}
·3158	0·455	—·61	— ·02
·3172	·465	·57	+ 1
·3186	·475	·57	0
·3199	·485	·52	+ 4
·3213	·495	·50	+ 6
·3227	·505	·56	— 1
·3241	·515	·50	+ 4
·3255	·525	·49	+ 4

J. D. 2424907, plate no. 1211

d	P	m_{pr}	Δm_{pr}
·6875	6·544	—·51	0
·6889	·554	·45	+ 5
·6903	·564	·44	+ 5
·6917	·574	·45	+ 3
·6931	·584	·43	+ 4
·6944	·594	·40	+ 5
·6958	·604	·39	+ 5
·6972	·614	·38	+ 5
·6986	·624	·30	+ 12
·7000	·634	·36	+ 5
·7014	·644	·38	+ 2
·7027	·654	·37	+ 2
·7041	·664	·35	+ 3
·7055	·674	·30	+ 6
·7069	·684	·33	+ 2
·7083	·694	·34	0
·7097	·704	·32	+ 1
·7111	·714	·31	+ 2
·7124	6·723	—·31	+ 1
·7138	·733	·34	— 3
·7152	·743	·26	+ 5
·7166	·753	·32	— 1
·7180	·763	·28	+ 4
·7194	·773	·31	+ 1
·7208	·783	·29	+ 4
·7221	·793	·34	0
·7235	·803	·33	+ 2
·7249	·813	·36	0
·7263	·823	·31	+ 6
·7277	·833	·33	+ 5
·7291	·843	·37	+ 2
·7304	·853	·36	+ 5
·7318	·863	·34	+ 8
·7332	·873	·39	+ 4
·7346	·883	·41	+ 2
·7360	·893	·40	+ 4
·7374	·903	·44	+ 2
·7388	·913	·39	+ 9
·7401	·923	·44	+ 5
·7415	·932	·42	+ 8
·7429	·942	·49	+ 2
·7443	·952	·49	+ 3
·7457	·962	·49	+ 4
·7471	·972	·47	+ 7
·7485	·982	·53	+ 2
·7498	·992	·48	+ 7
·7512	7·002	·53	+ 3
·7526	·012	·51	+ 6
·7540	·022	·53	+ 5

J. D. 2424955, plate no. 1225

d	P	m_{pr}	Δm_{pr}
·5622	0·571	—·42	+ ·06
·5636	·581	·44	+ 3
·5649	·591	·43	+ 3
·5663	·600	·42	+ 3
·5677	·610	·44	— 1
·5691	·620	·38	+ 4
·5705	·630	·37	+ 4
·5719	·640	·38	+ 2
·5732	·650	·36	+ 3
·5746	·660	·41	— 3
·5760	·670	·38	— 1
·5774	·680	·34	+ 2
·5788	·690	·32	+ 3
·5802	·700	·36	— 2
·5816	·710	·34	— 1
·5829	·720	·32	0
·5843	·730	·30	+ 1
·5857	·740	·31	0
·5871	·750	·36	— 5
·5885	·760	·30	+ 1
·5899	·770	·32	0
·5913	·780	·32	+ 1
·5926	·790	·25	+ 9
·5940	·800	·33	+ 2
·5954	·809	·34	+ 2
·5968	·819	·36	+ 1
·5982	·829	·34	+ 4
·5996	·839	·41	— 2
·6009	·849	·38	+ 2
·6023	·859	·47	— 6
·6037	·869	·43	— 1
·6051	·879	·46	— 3
·6065	·889	·47	— 2
·6079	·899	·50	— 4
·6093	·909	·47	0
·6106	·919	·51	— 3
·6120	·929	·48	+ 1
·6134	·939	·50	0
·6148	·949	·45	+ 6

d	P	m_{pr}	Δm_{pr}
·6162	0·959	—·55	— 3
·6176	·969	·48	+ 5
·6190	·979	·54	0
·6203	·989	·54	+ 1
·6217	·999	·62	— 6
·6231	1·009	·56	+ 1
·6245	·019	·63	— 6
·6259	·028	·51	+ 7
·6273	·038	·60	— 1
·6287	·048	·53	+ 6
·6300	·058	·59	+ 1
·6314	·068	·62	— 1
·6328	·078	·69	— 8
·6342	·088	·65	— 3
·6356	·098	·61	+ 1
·6370	·108	·62	+ 1
·6383	·118	·63	0
·6397	·128	·63	+ 1
·6411	·138	·60	+ 4
·6425	·148	·66	— 1
·6439	·158	·63	+ 2
·6453	·168	·62	+ 3
·6467	·178	·58	+ 8
·6480	·188	·65	+ 1
·6494	·198	·74	— 8
·6508	·208	·64	+ 3
·6522	·218	·67	0
·6536	·228	·67	0
·6550	·237	·62	+ 5
·6564	·247	·61	+ 6
·6577	·257	·65	+ 2
·6591	·267	·64	+ 3
·6605	·277	·68	— 1
·6619	·287	·68	— 2
·6633	·297	·56	+ 10
·6647	·307	·68	— 2
·6660	·317	·61	+ 5
·6674	·327	·62	+ 3
·6688	·337	·71	— 6
·6702	·347	·59	+ 5
·6716	·357	·67	— 3
·6744	·377	·60	+ 3
·6757	·387	·65	— 3
·6771	·397	·61	+ 1
·6785	·407	·59	+ 2

J. D. 2425048, plate no. 1265

d	P	m_{pr}	Δm_{pr}
·4407	7·994	—·50	+·06
·4421	8·004	·53	+ 3
·4435	·014	·49	+ 8
·4449	·024	·48	+ 10
·4463	·034	·56	+ 2
·4477	·044	·42	+ 17
·4491	·054	·50	+ 10
·4504	·064	·46	+ 14
·4518	·074	·52	+ 9
·4532	·084	·48	+ 14
·4546	·094	·55	+ 7
·4560	·104	·57	+ 6
·4574	·114	·58	+ 5
·4588	·124	·58	+ 6
·4601	·134	·50	+ 14
·4615	·144	·56	+ 8
·4629	8·153	—·57	+ 8
·4643	·163	·65	0
·4657	·173	·65	+ 1
·4671	·183	·66	0
·4684	·193	·59	+ 7
·4698	·203	·61	+ 5
·4712	·213	·57	+ 10
·4726	·223	·62	+ 5
·4740	·233	·60	+ 7
·4754	·243	·59	+ 8
·4768	·253	·59	+ 8
·4781	·263	·61	+ 6
·4795	·273	·58	+ 9
·4809	·283	·55	+ 12
·4823	·293	·61	+ 5

J. D. 2425048, plate no. 1266

d	P	m_{pr}	Δm_{pr}
·4962	8·392	—·58	+·04
·4975	·402	·58	+ 4
·4989	·412	·56	+ 5
·5003	·422	·55	+ 6
·5017	·432	·51	+ 9
·5031	·442	·58	+ 1

J. D. 2425054, plate no. 1267

d	P	m_{pr}	Δm_{pr}
·4452	1·142	—·64	0
·4466	·152	·66	— 1
·4494	·172	·63	+ 3
·4508	·182	·67	— 1
·4521	·192	·61	+ 5
·4535	·202	·66	0
·4549	·212	·63	+ 4
·4563	·222	·64	+ 3
·4577	·232	·70	— 3
·4591	·242	·59	+ 8
·4605	·252	·60	+ 7
·4618	·262	·62	+ 5
·4632	·272	·63	+ 4
·4646	·282	·65	+ 2
·4660	·292	·64	+ 2
·4674	·302	·64	+ 2
·4688	·311	·67	— 1
·4701	·321	·60	+ 5
·4715	·331	·59	+ 6
·4729	·341	·68	— 3
·4743	·351	·59	+ 5
·4757	·361	·61	+ 3
·4771	·371	·58	+ 5
·4785	·381	·59	+ 4
·4798	·391	·59	+ 3
·4812	·401	·55	+ 7
·4826	·411	·48	+ 13
·4840	·421	·60	+ 1

J. D. 2425095, plate no. 1283

d	P	m_{pr}	Δm_{pr}
·4559	5·844	—·29	+·11
·4573	·854	·32	+ 9
·4587	·864	·34	+ 8
·4601	·874	·35	+ 8
·4615	·884	·36	+ 8
·4629	·894	·41	+ 4
·4642	5·904	—·37	+ 9
·4656	·914	·39	+ 9
·4670	·924	·42	+ 7
·4684	·934	·42	+ 8
·4698	·944	·48	+ 3
·4712	·954	·52	0
·4726	·964	·48	+ 5
·4739	·974	·47	+ 7
·4753	·984	·51	+ 4
·4767	·994	·43	+ 13
·4781	6·004	·52	+ 4
·4795	·014	·52	+ 5
·4809	·024	·47	+ 11
·4823	·034	·52	+ 6
·4836	·044	·58	+ 1
·4850	·053	·56	+ 4
·4864	·063	·58	+ 2
·4878	·073	·54	+ 7
·4892	·083	·56	+ 5
·4906	·093	·51	+ 11
·4919	·103	·51	+ 11
·4933	·113	·49	+ 14
·4961	·133	·50	+ 14
·4975	·143	·68	— 4
·5598	·591	·41	+ 5
·5612	·601	·47	— 2
·5626	·611	·42	+ 1
·5640	·621	·43	— 1
·5654	·631	·37	+ 4
·5667	·641	·38	+ 2
·5681	·651	·37	+ 2
·5695	·661	·37	+ 1
·5709	·671	·37	0
·5723	·681	·34	+ 2
·5737	·690	·30	+ 5
·5751	·700	·27	+ 7
·5764	·710	·33	0
·5778	·720	·30	+ 2
·5792	·730	·29	+ 2

J. D. 2425163, plate no. 1285

d	P	m_{pr}	Δm_{pr}
·3250	3·550	—·60	—·10
·3264	·560	·50	— 1
·3278	·570	·52	— 4
·3291	·580	·42	+ 5
·3305	·590	·47	— 1
·3319	·600	·39	+ 6
·3333	·610	·49	— 6
·3347	·620	·40	+ 2
·3361	·630	·40	+ 1
·3374	·640	·32	+ 8
·3388	·650	·38	+ 1
·3402	·660	·31	+ 7
·3416	·669	·33	+ 4
·3430	·679	·29	+ 7
·3444	·689	·35	0
·3458	·699	·26	+ 8
·3471	·709	·30	+ 3
·3485	·719	·32	0
·3499	·729	·33	— 2
·3513	·739	·22	+ 9
·3527	·749	·34	— 3
·3541	·759	·33	— 2
·3555	3·769	—·27	+ 5
·3568	·779	·25	+ 8
·3582	·789	·34	0
·3596	·799	·21	+ 14
·3610	·809	·34	+ 2
·3624	·819	·42	— 5
·3638	·829	·32	+ 6
·3651	·839	·42	— 3
·3665	·849	·41	— 1

J. D. 2425163, plate no. 1286

d	P	m_{pr}	Δm_{pr}
·4039	4·117	—·57	+·06
·4053	·127	·58	+ 6
·4067	·137	·54	+ 10
·4081	·147	·54	+ 11
·4095	·157	·66	— 1
·4109	·167	·62	+ 3
·4122	·177	·60	+ 6
·4136	·187	·58	+ 8
·4150	·197	·56	+ 10
·4164	·207	·61	+ 6
·4178	·217	·62	+ 5
·4192	·227	·53	+ 14
·4206	·237	·64	+ 3
·4219	·247	·61	+ 6
·4233	·257	·54	+ 13
·4247	·267	·60	+ 7
·4261	·277	·64	+ 3
·4275	·287	·61	+ 5
·4289	·297	·64	+ 2
·4303	·307	·67	— 1
·4316	·317	·61	+ 5

J. D. 2425221, plate no. 1290

d	P	m_{pr}	Δm_{pr}
·2754	9·980	—·62	—·08
·2768	·990	·53	+ 2
·2781	0·000	·49	+ 7
·2795	·010	·48	+ 9
·2809	·020	·49	+ 9
·2823	·030	·49	+ 9
·2837	·040	·65	— 6
·2851	·050	·59	+ 1
·2865	·060	·58	+ 2
·2878	·070	·62	— 1
·2892	·080	·59	+ 2
·2906	·090	·61	+ 1
·2920	·100	·50	+ 12
·2934	·110	·66	— 3
·2948	·120	·65	— 2
·2962	·130	·49	+ 15
·2975	·140	·57	+ 7
·2989	·150	·67	— 2
·3003	·160	·63	+ 2
·3017	·170	·74	— 9
·3031	·179	·52	+ 14
·3045	·189	·62	+ 4
·3058	·199	·61	+ 5
·3072	·209	·62	+ 5
·3086	·219	·60	+ 7
·3100	·229	·65	+ 2

TABLE 5.

means of every 10 observations		means of every 50 or 60 observations		means of every 10 observations		means of every 50 or 60 observations		means of every 10 observations		means of every 50 or 60 observations		means of every 10 observations		means of every 50 or 60 observations	
P	m_{pr}	P	m_{pr}	P	m_{pr}	P	m_{pr}	P	m_{pr}	P	m_{pr}	P	m_{pr}	P	m_{pr}
·0147	— ·585			·2585	— ·678	·2620	— ·672	·5715	— ·477			·8109	— ·381		
·0216	·592			·2658	·672			·5799•	·450•			·8176	·365		
·0275	·551	·0279	— ·589	·2741	·695			·5872	·476			·8236•	·376•		
·0342	·610			·2819	·665			·5933	·476	·5935	— ·460	·8299	·401		
·0413	·606			·2909•	·661•			·6002	·433			·8365	·399	·8359	— ·391
·0483•	·605•			·2995	·654			·6067	·466			·8419	·388		
·0557	·593			·3086	·682	·3137	— ·666	·6125•	·424•			·8477	·391		
·0630	·600	·0630	— ·603	·3177	·659			·6196	·421			·8531•	·408•		
·0703	·596			·3272	·655			·6261	·407	·6262	— ·410	·8591	·407		
·0778	·623			·3383	·684			·6327	·397			·8654	·410	·8652	— ·415
·0851•	·619•			·3492	·653			·6401	·401			·8714	·438		
·0923	·611			·3589	·640			·6477•	·396•			·8771.	·414		
·0994	·628	·0997	— ·623	·3683	·659	·3682	— ·643	·6543	·412			·8842	·427•		
·1072	·612			·3779	·632			·6611	·361	·6619	— ·380	·8909	·445		
·1145	·643			·3868	·633			·6689	·374			·8973	·473	·8975	— ·457
·1222•	·637•			·3950•	·645•			·6775	·357			·9042	·475		
·1301	·601			·4032	·628			·6851•	·349•			·9108	·465		
·1372	·613	·1366	— 630	·4116	·600	·4118	— ·609	·6923	·369			·9172•	·495•		
·1433	·643			·4201	·583			·7002	·325	·6999	— ·338	·9245	·489		
·1500	·657			·4289	·589			·7075	·310			·9318	·500	·9316	— ·498
·1563•	·662•			·4379•	·570•			·7144	·338			·9387	·497		
·1633	·656			·4469	·579			·7214	·308			·9458	·508		
·1704	·647	·1743	— ·646	·4563	·622	·4563	— ·591	·7286	·290			·9523•	·535•		
·1769	·626			·4654	·598			·7353	·322	·7353	— ·312	·9597	·559		
·1834	·637			·4752	·585			·7420	·315			·9662	·531	·9659	— ·541
·1904	·650			·4839•	·527•			·7494	·324			·9728	·529		
·1976•	·667•			·4932	·564			·7566•	·314•			·9787	·552		
·2050	·649			·5032	·578	·5032	— ·547	·7636	·301			·9846•	·551•		
·2123	·681	·2159	— ·668	·5132	·543			·7707	·320	·7708	— ·316	·9910	·532		
·2197	·672			·5227	·521			·7780	·314			·9965	·548	·9967	— ·546
·2269	·657			·5333•	·514•			·7852	·332			1·0027	·559		
·2338	·680			·5444	·508			·7920•	·341•			1·0086	·541		
·2417•	·662•			·5539	·482	·5533	— ·492	·7989	·342						
·2500	·659			·5635	·480			·8051	·353	·8049	— ·356				

TABLE 7.

means of 10 observations		means of 100 or 120 observations		means of 10 observations		means of 100 or 120 observations		means of 10 observations		means of 100 or 120 observations		means of 10 observations		means of 100 or 120 observations	
phase counted from minimum		phase counted from minimum		phase counted from minimum		phase counted from minimum		phase counted from minimum		phase counted from minimum		phase counted from minimum		phase counted from minimum	
P	m_{pr}	P	m_{pr}	P	m_{pr}	P	m_{pr}	P	m_{pr}	P	m_{pr}	P	m_{pr}	P	m_{pr}
— ·0026	— ·315			— ·0595	— ·349			— ·1119	— ·397			— ·1647	— ·450		
+ ·0048	·324			+ ·0605	·353			+ ·1145	·407			+ ·1662	·465		
— ·0093	·322			+ ·0663	·381			— ·1185	·407			+ ·1726	·495		
+ ·0120	·314			— ·0671	·357			+ ·1208	·410	·1195	— ·413	— ·1731	·477		
— ·0160	·290			+ ·0730•	·365•			— ·1250	·421			+ ·1799	·489		
+ ·0190	·301	·0177	— ·315	— ·0757	·374			+ ·1268	·438			— ·1811	·480		
— ·0232	·308			+ ·0790	·376			— ·1321	·424			+ ·1872	·500	·1888	— ·497
+ ·0261	·320			— ·0835	·361			+ ·1325	·414			— ·1907	·482		
— ·0302	·338			+ ·0853	·401	·0876	— ·386	— ·1379•	·466•			+ ·1941	·497		
+ ·0334	·314			— ·0903	·412			+ ·1396	·427			— ·2002	·508		
— ·0371•	·310•			+ ·0919	·399			— ·1444	·433			+ ·2012	·508		
+ ·0406	·332			— ·0969	·396			+ ·1463	·445			+ ·2077.	·535		
— ·0444	·325			+ ·0973	·388			— ·1513	·476	·1520	— ·459	— ·2113	·514•		
+ ·0474	·341			+ ·1031	·391			+ ·1527	·473			+ ·2151	·559		
— ·0523	·369	·0530	— ·346	— ·1045•	·401•			— ·1574	·476			+ ·2216	·531		
+ ·0543	·342			+ ·1085	·408			+ ·1596	·475			— ·2219	·521		