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A STUDY OF THE VARIABLE STARS IN THE GLOBULAR CLUSTER MESSIER 14

II. PERIODS AND LIGHT CURVES OF THE SECOND GROUP OF TWENTY VARIABLES

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A STUDY OF THE VARIABLE STARS IN THE GLOBULAR CLUSTER MESSIER 14

II. Periods and Light Curves of the Second Group of Twenty Variables

By Helen Sawyer Hogg and Amelia Wehlau

The data forming the basis of this program, and its purpose, have already been described in the *Publications of the David Dunlap Observatory*, vol. II, no. 17, 1966. In the present paper we give the observations for the second group of twenty variables in Messier 14, NGC 6402, with their mean light curves. A summary of this material was presented to the American Astronomical Society (Sawyer Hogg and Wehlau, 1965). The cluster is now shown to contain four long-period Cepheids, which means that it is exceeded in the number of Cepheids, among globular clusters of our own Galaxy, only by Omega Centauri. Therefore we describe the period-luminosity relation it defines.

This second group consists of the following variables: numbers 3, 8, 12, 13, 14, 17, 18, 20, 27, 31, 34, 37, 51, 59, 61, 62, 68, 71, 75 and 76. Table I gives, for each of these variables, the maximum, minimum and mean magnitudes, the epoch of maximum (usually the nearest maximum just before J.D. 2438200 in the 1963 series of observations), and the period, followed by the value of Beta, and remarks, when pertinent. For several stars for which our observations do not completely rule out an alternate period, the date of maximum is that actually observed.

Of this group of 20 variables, only three are not RR Lyrae stars. One of these is a Cepheid, Variable 76, whose discovery was reported in our first paper. Its period now is calculated as 1.89003 days, and it raises to four the number of Cepheids in the cluster with periods determined.

The other two non-RR Lyrae stars, Variable 17 and Variable 27 are probably not members of the cluster. Variable 17 has a period of 12.097 days with an amplitude of only 0.65 magnitude, a sine-type light curve, and the largest period change so far found among our variables. Its value of Beta is $+35 \times 10^{-7}$ day/day. This variable is about two magnitudes brighter than the RR Lyrae stars. Its spectrum was investigated by Joy (1949) and found to vary between F8 and G2, and his measured radial velocities were +9 and −18 km sec.

TABLE I

ELEMENTS OF TWENTY VARIABLES

Var.	Magnitudes Max.	Min.	Mean	Epoch of Maximum	Period days	Remarks
3	16.65	17.55	17.1	38199.823	0.522455	$\beta = -23$
8	17.8	18.6	18.2	38199.496	0.686071	R
12	17.1	18.6	17.85	38199.918	0.503952	R
13	17.0	18.6	17.8	38199.690	0.535215	$\beta = +41$
14	17.2	18.1	17.65	38199.931	0.471857	R
17	15.5	16.15	15.8	38204.72	12.097	R
18	16.9	18.15	17.55	38199.885	0.479065	$\beta = -23$
20	17.9	18.55	18.2	38198.734	0.263721	R
27	16.45	17.6	17.0	34936	167.0	R
31	16.8	17.7	17.25	38199.383	0.619636	R
34	17.8	18.8	18.3	38199.854	0.606627	$\beta = +13$
37	17.65	18.9	18.25	38199.654	0.489060	R
51	17.6	18.15	17.9	38198.709	0.367606	R
59	17.4	18.75	18.05	38199.561	0.555634	
61	16.6	17.7	17.15	38199.610	0.569824	R
62	18.0	18.5	18.25	38235.444	0.638460	R
68	17.1	18.7	17.9	38199.958	0.507217	R
71	17.05	18.3	17.7	38199.602	0.525925	
75	16.9	18.1	17.5	38199.737	0.545281	
76	16.15	16.9	16.55	38199.466	1.89003	R

REMARKS TO TABLE I

Var. 8 Large scatter.
Var. 12 Maximum seems low in 1940.
Var. 14 Large scatter.
Var. 17 Peculiar type of variable. $\beta = +35{,}000$. P = $0^d.92131$, with $\beta = +210 \times 10^{-10}$ represents the observations nearly as well.
Var. 20 P = $0^d.358181$ also fits data.
Var. 27 P = $308^d.3$ almost as good for these observations.
Var. 31 Large scatter.
Var. 37 Difficult to measure, near cluster centre.
Var. 51 P = $0^d.268795$ and $0^d.268597$ also represent observations.
Var. 61 Large scatter.
Var. 62 P = $0^d.389254$ also fits observations.
Var. 68 Large scatter.
Var. 76 Short period Cepheid.

He compared these values with the cluster velocity of −131 km/sec earlier determined by Mayall (1946). Though Joy noted that his own velocity measures have some uncertainty because the spectral lines

are few and poor, he questioned the cluster membership of the variable both because of the poor velocity agreement, and the distance of the star from the cluster centre. Further data are needed to assign a definite type of variability for this star.

Variable 27 has the second greatest distance from the cluster centre of all the 76 variables. It is a long-period variable, at maximum about one magnitude brighter than the RR Lyrae stars at maximum. A period of 167.0 days seems to represent our observations, but since the distribution of the plates is not favourable for the determination of such long periods, we cannot yet rule out a period of 308.3 days.

Seventeen of the variables are RR Lyrae type, with periods between 0.263721 and 0.686071 days. Four of these stars, Variables 3, 13, 18 and 34, show period changes. Of these changes, two are positive and two negative, with the values of Beta falling between +41 and −23. None of the RR Lyrae stars reported in our first paper showed period changes. For several of the RR Lyrae stars it proved difficult to decide among several related periods, as indicated in the table. In the case of Variable 62, we are greatly indebted to Dr. R. Margoni who generously supplied us with his unpublished measures from his Asiago plates to help in the period selection. Although it is tempting to draw a frequency distribution for the 34 RR Lyrae periods so far determined, this would not be meaningful until a higher proportion of periods have been found for the variable stars in this cluster.

TABLE II

Cepheid Variable Stars

Var.	Magnitudes Max.	Min.	Mean	Period days	Log P
1	14.65	16.1	15.35	18.73*	1.27
2	15.8	17.0	16.4	2.79468	0.45
7	15.4	16.5	15.95	13.596	1.13
76	16.15	16.9	16.55	1.89003	0.28

*Period changing.

Data for the period-luminosity relation as provided by the four Cepheids are tabulated in Table II; these are plotted in figure 1, along with the mean magnitudes of the 34 RR Lyrae variables. All the stars from our two papers are shown, except Variables 17 and 27, just discussed. Curiously, Variable 17 would lie close to the curve, but since it is probably not a cluster member, and perhaps not a

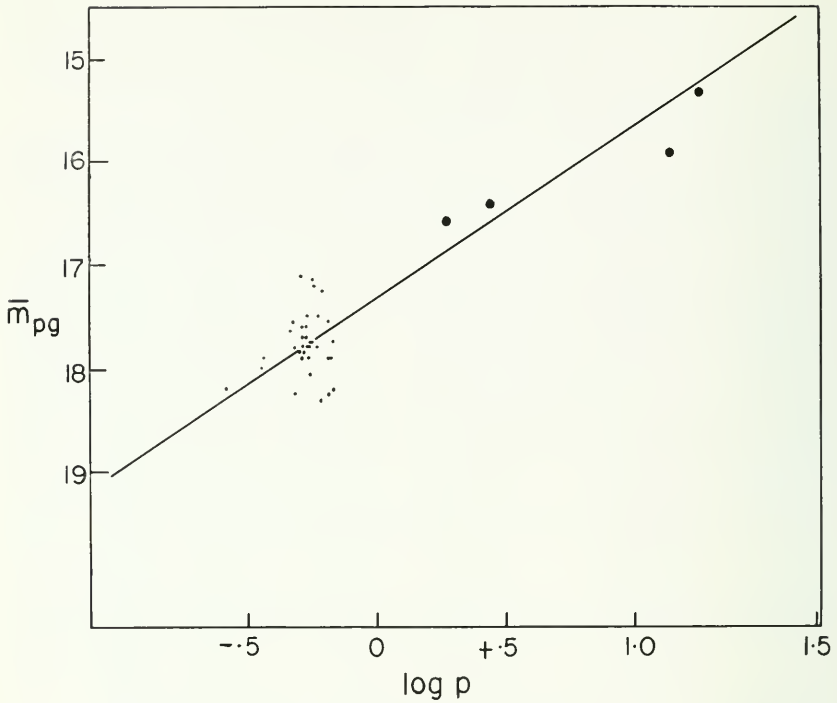

FIG. 1—The period-luminosity relationship as defined by variable stars in Messier 14. *Ordinate*, mean apparent photographic magnitude; *abscissa*, logarithm of the period. The large filled circles represent the four recognized long-period Cepheids; the small dots are the 31 RR Lyrae *ab* stars whose periods have thus far been determined.

Cepheid, it is not included. With a mean of the 31 RR Lyrae stars at 17.74 m_{pg} and log $P = -0.25$, the points indicate a slope of about -1.6, which compares with -1.74 obtained by Dickens and Carey (1967) in their paper discussing globular-cluster Cepheids. Some of the scatter in the magnitudes of the RR Lyrae stars is certainly real; part of it may be due to the effect of image crowding or to inclusion of field stars. Until the period determination of the variables in this cluster is more nearly complete, it cannot be known if more Cepheids are contained in it.

If we assume $M_{pg} = 0.6$ for the RR Lyrae stars in this cluster, from the average mean magnitude of the 31 RR Lyrae *ab* stars, the apparent photographic distance modulus is 17.1. Kron and Mayall (1960) give a visual absorption of 1.5 (Case I) or 1.8 (Case II). Correcting the

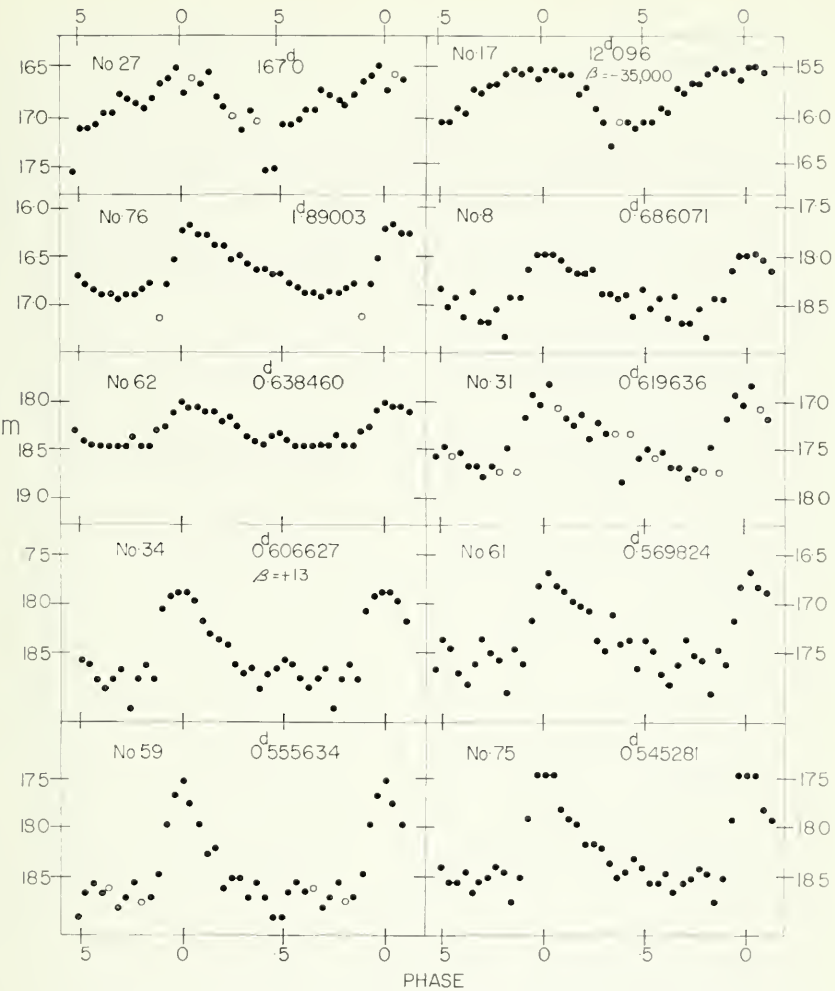

FIG. 2—The mean light curves for 10 variables, arranged in decreasing length of period.

photographic modulus by −0.6 to a visual modulus of 16.5 and accepting Case II, we obtain a corrected distance modulus of 14.7 corresponding to a distance of 8.5 kpc.

The light curves of these twenty variables, in order of decreasing length of period, are shown in figures 2 and 3. The points are the computed weighted means of all observations at intervals in phase of 0.04 of the period of the star. Observations with colons in Table III have

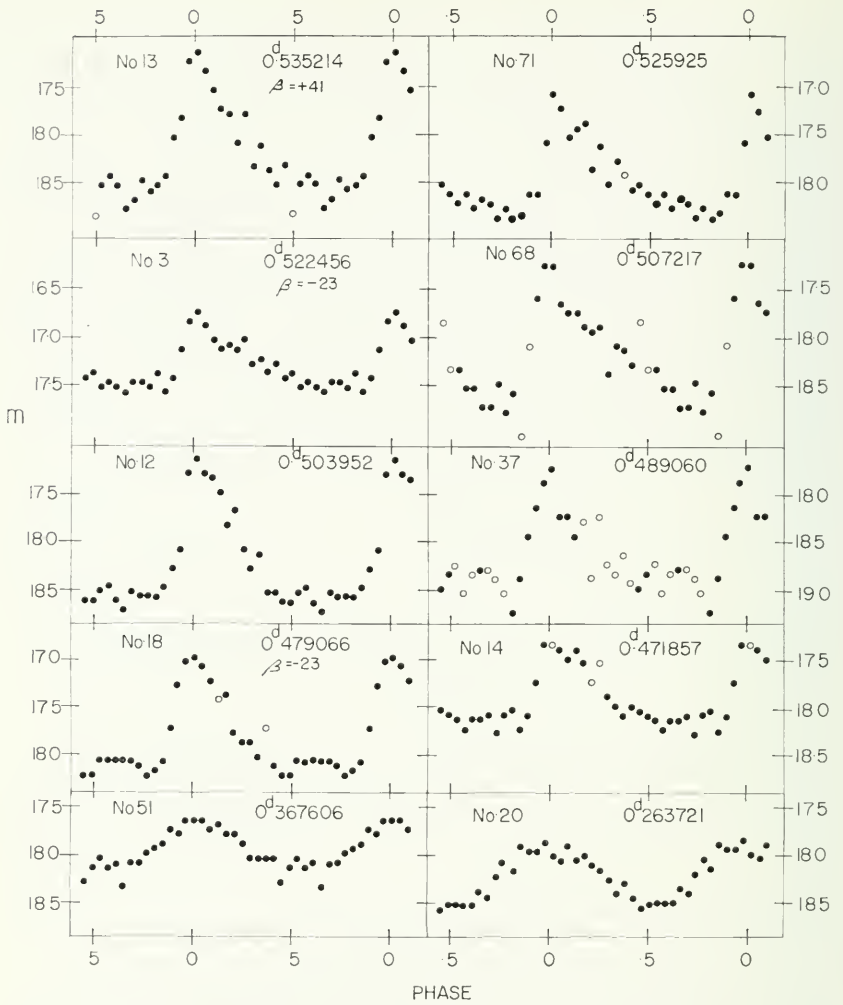

FIG. 3—The mean light curves of 10 variables, arranged in decreasing length of period.

been assigned half weight. A filled circle represents at least three good observations, but averages about ten such. Open circles represent mean points derived from observations which are few in number or of low weight.

The observations for these twenty variables are contained in Table III, which gives the number of the plate, the heliocentric Julian Day,

TABLE III

OBSERVATIONS OF VARIABLE STARS IN NGC 6402

Plate	Julian Day*	No. 3	No. 8	No. 12	No. 13	No. 14	No. 17	No. 18	No. 20	No. 27	No. 31
103	2419536.939						15.75			16.5	
2637	20726.750	17.1	18.0		18.2	18.4	16.2		18.3	16.9	17.9
2649	48.705	17.2	17.7	17.9	18.5	18.1	15.55	17.1	18.4	16.55	17.05
4397	1690.895	17.35:	17.7:		18.5:	18.1	15.65			16.65	17.9:
20544	26915.824	17.4	18.4	18.65:	18.2	17.8	15.6	18.0:	18.6	16.2	16.9
20559	21.824	16.85	18.5	19.0:	18.8:	17.9	15.45	18.3	18.1	16.4	
20571	23.785	17.3:					15.35:			16.3	
20584	24.758	17.4			17.1:		15.25		18.2	16.2	
20587	.824						15.45	16.5:	18.6:	16.5:	
20597	25.776	17.9:			18.35:		15.4			16.15	
20647	44.781	18.05:	18.35		18.8:		15.95	18.2	18.1:	16.25	
20675	46.742		17.7:				15.55		18.0	16.4:	
21377	27272.784	17.2	18.3	17.15	18.2:		15.6:	17.3:	18.1	16.65	
21380	.864	17.65	18.7	17.85:	18.35:	17.9:	15.55	17.5	18.4	16.6	
21386	73.788	17.45	17.95	17.3	17.7	18.8	15.4	18.5	18.0	16.5	17.5:
21399	74.776	17.3	18.6	17.0	17.4	18.3	15.4	18.1	18.8	16.5	17.1
21406	.891	17.1:	18.8	17.9:	18.7:	17.7	15.7	17.7	17.6	16.55	17.1:
21412	75.768	17.2	18.8	17.0		18.6	15.65	18.0	18.6	16.45	16.9
21416	.856	17.6	18.2	17.8	17.4	18.8	15.55		18.6	16.45	16.85
21515	306.776	17.7:	17.45	18.3:	18.5:	17.8	15.8			17.2	16.4:
21538	07.799	18.1:	18.2:	18.5:	18.5:	17.8:	15.6		18.3	16.6	
21556	08.800						15.65:			17.2:	
23178	639.790	17.1	18.2	18.4:	17.7	17.3	16.0	18.15	18.8	17.0	18.2
23237	58.749	17.2	17.95	17.1	18.7	17.6	15.45	16.95	18.8	17.25	16.6
23240	.811	17.35	17.9	17.4	18.25	17.9	15.55	17.75	18.0	17.2	17.1

*Heliocentric

Plate	Julian Day	No. 3	No. 8	No. 12	No. 13	No. 14	No. 17	No. 18	No. 20	No. 27	No. 31
23252	27659.760	17.1	18.75	17.0	18.3	18.5	15.5	17.7	18.6	17.9	17.3
23255	.823	17.45	18.4	17.5	18.3:	18.4	15.55		18.2	17.55	
23256	.840		17.9	17.6:	18.1:	17.9:	15.65	18.4:	18.0	17.35	
23306	64.765	17.4:	18.55	18.35	18.7	16.85	16.1	18.25	18.7	17.25	17.75
23308	.802	16.8	18.4	17.35	18.6	17.3	16.05	18.7	18.7	17.5	17.4
23522	713.649	16.8:			17.0:		16.2:	17.5:	17.8		
23529	14.663	17.4	18.7	18.65	17.8	18.1	16.2	18.9	18.0	17.05	17.4
23538	15.661	16.7:	17.8:				16.0	18.5:	18.2:	16.8:	
23600	28.630	16.9:					16.0:				
91	8015.608	17.55	17.8	17.45	18.0	18.3	16.2	18.2	18.4	17.05	17.1:
92	.677					18.0	16.2:	16.8:	18.0:		
100	16.610	17.1		17.25	17.35	17.35:	16.05	17.6	18.2	16.95	17.4:
101	.628	17.4		17.65	17.8	17.7:	16.05	17.3	18.2	17.05	
102	.674						16.1	16.15:	18.0	17.0	
103	.693	17.45:					16.0	16.5:	18.0	16.9	
104	.711	17.35:		19.0:	17.55		16.2	16.6:	18.2	17.1	
105	.732						16.3:			17.15:	
169	37.599	17.4:	17.9:			17.2:	15.95	17.7:		16.8	
170	.617						15.75:			16.9:	
185	38.569	17.2	19.0:	18.45	17.5	17.5	15.65	18.4	18.1	16.7	17.1:
186	38.582	17.65	18.7	18.3	17.7	17.6		18.0	18.0	17.15	17.0:
187	.608	17.15:	18.6:		17.9:	17.1:	15.9	17.7:	17.9	16.5	
189	.644	17.3:			17.5:	17.0:	16.1:	17.6:	18.2	16.8	
192	.701						16.1:		18.2:	16.35	
217	43.571	16.9	18.8:		19.0:		15.8	17.6	18.1	16.7	
219	.610	16.8	17.7	19.0:	19.0:	18.3	15.7	17.55	17.8	16.65	16.9:
223	.677	16.8	17.75			16.9:	15.85	17.5:	17.8	16.45	
820	308.751						15.95:				
821	.769						15.9:				
824	.843						15.8:				

Plate	Julian Day	No. 3	No. 8	No. 12	No. 13	No. 14	No. 17	No. 18	No. 20	No. 27	No. 31
836	28309.767	16.8	17.65				15.8		18.0	17.4	
837	.781						15.7:		18.1:		
840	.835	16.8:	17.8:	17.65:	16.75:		15.65		18.4:	17.2	
1109	65.637	16.85:	17.75:		17.55:		16.2		18.0	17.0	
1110	.656	16.8:	18.8:				16.15		17.8	16.6	
1112	.706	17.3	18.15	19.0:	18.7:	17.9:	16.05	17.5	18.2	16.85	
1113	.723	17.5:			18.5:	17.5:	16.25	17.5:	18.7	17.05	
1115	.770	17.4:	18.05:		19.0:		16.15			17.1	
1123	66.631	17.15	18.0		17.25:		16.15		18.3:	16.85	
1124	.658	17.05	18.05		17.55		16.05		18.2	16.95	
1127	.729	17.35:	17.4:		18.2:		16.05		18.0	16.85	
1226	91.592		17.45:				16.1		>18.2	17.2	
1227	.613	16.75:	17.7:				15.85		18.6:	16.7	
1229	.678	16.9:	18.7:		17.8:		15.9		18.2:	16.65	
1230	.699	16.9:	19.5:				15.95			16.65	
1240	92.603	16.75	18.3	17.75	19.1	17.5:	15.9		18.0	16.75	16.85:
1241	.623	16.75	18.2:		18.5:	17.8:	15.95	17.8	18.1	17.0	17.4:
1244	.695	17.0	18.4	17.8:	19.0	17.7	15.8	17.1	>18.2	16.6	
1257	93.623						15.8:				
1267	98.587	17.1	17.65	17.4:	18.3:	16.65:	15.75	16.95	17.8	16.4	
1268	.609	17.2:	19.0	17.05	17.8	17.3:	15.75	17.4:	18.0	16.55	
1271	.653	17.0:	17.5:		17.15:		15.75		18.1	16.55	
1272	.679	17.4:	19.0:		17.6	17.7:	15.9:	18.1	18.2	16.85	17.9:
1284	99.582	17.25	18.9	17.15	19.1	17.35	15.85	18.3	18.1	16.9	17.3:
1287	.630	17.5	18.3	17.25	18.1	17.9:	15.95	17.8	18.0	16.4	
1290	.695		17.5:				16.0:			16.45	
1980	688.713	17.4:	18.4:		17.7:		15.95	18.3	18.0	16.95	
1982	.759	16.85:	17.8:		17.7:		15.95	17.1:	18.2	17.0	
1984	.822	17.55	18.5	17.1	18.5		16.0	17.2:	18.4		
1994	89.720	17.5	18.35	18.6:	18.15	17.2	16.15	17.4	18.2	16.9	17.1:

Plate	Julian Day	No. 3	No. 8	No. 12	No. 13	No. 14	No. 17	No. 18	No. 20	No. 27	No. 31
1997	28689.804	17.4	19.0	18.1	17.25	18.3	16.1	17.55	18.2	16.95	17.4:
2013	93.746	17.5:	17.4:				16.15	17.7:	17.7:	16.7	
2021	95.759	17.2	18.5	19.5:	17.35:		15.7		18.0:	17.05	
2033	96.679	17.05:	17.9:		17.7:		15.65			16.65	
2035	.722	16.95	17.8	19.0	17.6	17.3	15.55	17.7:	18.6	16.85	
2037	.776	17.3	17.8	18.4:	17.35	17.1	15.5	17.8	18.6	17.0	17.15:
2111	715.675	17.25:	18.2:	17.9:	17.25:	17.1:	16.2	17.1:	18.4	16.65	
2114	.747	17.1	19.5:	19.0:	18.2	17.4:	16.1	17.9	18.6	16.55	
2115	.770	17.55	19.5:	18.45	18.8:	18.3:	16.2	17.8	18.6	16.65	
3249	9071.710	17.25	18.7	17.85	18.15	17.95:	15.25	17.8	18.2	16.2	17.3:
3252	.798	17.3	18.75	18.05	18.1	18.7:	15.5:	18.1	18.2	16.55	17.3:
3263	72.780	17.65	18.15	18.35	18.3	18.0	15.6	18.4	18.3	16.5	16.5
3275	73.709	17.65	18.65	18.25	17.85	18.5	15.7	17.7	18.1	16.5	17.7:
3278	.783	17.55	18.25	18.15	18.25	17.2	15.8	18.0	17.8	16.55	17.3:
3290	76.742	17.65	18.5	19.0:	17.3:	17.8:	16.35		18.4	16.75	
3303	77.702	17.05	18.7	18.8:	18.9	17.9:	16.1	17.5:	17.7	16.55	
3318	78.722	17.25	18.45	18.35	18.6	17.6:	15.9	17.8	18.0	16.4	
4209	405.920						16.0:				
4228	06.956	17.2:	18.05:	17.8:	17.5:						
4584	30.738	17.1	19.0:	17.95	18.05	18.1	15.55	17.9:	18.2	16.65	17.7
4684	62.653	16.65		18.3	17.55		16.6	17.2:	18.2	16.6	
4693	63.648	17.35		18.8	18.2	17.6:		18.1	18.4		17.6:
4703	64.653	17.15	18.5:	18.6:	19.0:	17.9:	16.05	18.8:	18.3	16.7	17.6:
4795	87.614	17.1:	18.6:	16.5:			16.0	17.5:	18.2:	17.4:	
4807	89.702	17.5	19.5:	17.9:	18.2:	18.0	15.85	18.1	18.6	16.65	
4819	90.657	17.35	17.85	17.45	18.2	18.1	15.6	18.0	17.9	17.1	17.7:
4973	519.568	17.25	18.1	18.7	18.6	18.1:	15.55	17.2	18.3	17.2	
5702	785.764	17.35	17.95	18.2	17.75:	17.6:	15.8	18.0	18.0	16.95	17.8:
5717	86.812		18.3		19.0:		15.9		17.9:	16.95	
5728	87.784	17.15	18.15	18.8	18.5	17.8	16.05	17.15	18.3	16.65	16.6

Plate	Julian Day	No. 3	No. 8	No. 12	No. 13	No. 14	No. 17	No. 18	No. 20	No. 27	No. 31
5729	29787.810	17.1	18.9	19.5:	18.5	17.7:	16.05	17.2	18.9	16.6	17.1:
5808	813.677	17.75	18.3	17.4	17.6	17.3	16.05	17.0	18.3	16.9	17.5
5812	.784	16.95	18.7	18.6	17.85	17.8	16.1	17.7:	18.2	16.85	17.4:
5820	14.672	17.5	19.0	17.2	18.5	17.9:	15.85	17.4	18.3	16.8	17.8:
5825	.770	17.3	18.4	17.9	16.8		15.9	18.4	17.8	16.9	17.4:
5835	15.657		18.4:				15.9:				
5836	.711	17.85	18.2	18.05	19.1	18.0:	15.8	18.0	18.5	16.8	
5840	16.631	17.35	18.4	18.7	18.7	17.8:	15.6	17.9	18.0	16.9	17.6:
5843	.690	17.55	18.5	17.4	18.5	18.0	15.6	18.3	18.0	16.75	17.5:
5846	.733	17.6	18.7	17.85	18.5	18.0	15.55	18.4	18.4	16.85	17.8:
5848	.780	17.95	18.45	18.2	18.45	18.3:	15.6	18.4	18.4	16.9	18.3:
5948	41.688	17.4	17.95		18.1	17.6:	15.5	18.3:	18.2	17.05	
5964	42.703	17.0:	18.5:		18.0:		15.5		17.9:	16.8	
5974	43.623	16.85	19.0	18.7	17.7	18.4:	15.5	18.3	18.2	17.0	17.1:
5980	.732	17.4	19.5:	18.6:	17.8:		15.45		17.6	17.0	17.15:
6836	30169.693	16.8:	17.6:		17.4:	17.6:	15.5		17.8	17.3:	16.85:
6837	.722	17.2	17.6	19.0:	17.9	17.1:	15.55		18.0	17.9	
6838	.751	17.25	18.2	18.4	17.8	18.1:	15.5	17.7	18.2	17.7	
6839	.789	17.05	17.9	19.2:	18.5	17.5:	15.55	18.0	17.7	17.6	
6847	70.715	17.2	18.25	18.5	17.35	17.6:	15.55	17.8	18.1	17.6	17.5:
6861	71.730	17.2	18.3	18.45	16.9	17.65	15.35	18.15	18.4	16.95	17.55:
6864	.797	17.35	18.1	18.8	17.35	17.7	15.45	18.2	18.6	16.9	17.6:
6870	72.642	17.5	18.0	18.5	18.4		15.65		18.0	17.2	16.75
6875	.747	17.05	18.35	18.4	18.5	17.75	15.55	18.1	18.1	16.9	
6930	97.722						15.6:				
6938	99.705	17.25:	18.5:	17.0:	18.5:		16.1	17.7:		16.85	
6951	200.696						16.3:				
7923	549.662	17.4	18.9	18.65	18.0	17.9:	16.0		18.0	17.0	17.6:
7927	.750	17.3	19.5:	18.9:	18.1	17.6:	15.9		17.6	16.85	18.6:
7937	50.686	17.7	18.4	18.25	17.85	17.65	16.05	18.0	18.4	16.85	17.2

Plate	Julian Day	No. 3	No. 8	No. 12	No. 13	No. 14	No. 17	No. 18	No. 20	No. 27	No. 31
7940	30550.727	17.55	18.2	18.5	17.9	17.5	16.15	18.55	18.6	16.95	17.05
7943	.806	17.15	18.05	18.35	18.25	17.95:	16.05	18.1	17.6	16.6	17.0:
7949	52.679	17.75	18.05	18.15	18.3	17.4:	15.85	17.9	17.8	16.75	
7955	53.644	17.1	18.55	18.3	18.5	17.8	15.75	18.2	18.3	16.85	16.9
7961	.720	17.4	18.4	18.55	18.3	17.85:	15.65	18.35	17.6	16.75	17.05
7964	.779	17.3	18.05	18.8	17.4	18.1:	15.7	18.3	18.0	16.85	
7974	54.656	16.9	17.75	18.35	18.5	18.1	15.45	18.1	18.7	16.85	17.0:
7979	.739	17.1	18.05	18.45	18.5	17.8:	15.65	18.05	17.8	16.85	
8014	56.686	17.0	17.85	18.3	18.45	18.25:	15.45	17.8	18.0	16.9	18.0:
8020	.748	16.95	17.8	18.55	18.55	17.8	15.65	17.0	18.5	16.85	17.65:
8117	86.604	17.15	18.45	18.5	17.55	17.45	16.05	18.3	17.9	16.65	17.0
8895	899.685	17.05	17.9	16.9	18.25	18.1	15.85	18.1	18.2	16.9	16.95:
8902	.754	17.3	17.75	17.35	18.35	18.1	15.85	16.75	17.9	16.85	17.6
8907	.811	17.75	18.1	18.15	18.65	17.5	15.95	17.25	18.2	16.8	17.8:
8919	900.675	17.05	18.35	17.3	17.65	18.0	16.15	18.3	18.7	16.85	16.55
8926	.766	17.25	18.05	17.6	18.25	17.3	16.25	17.1	18.0	17.0	17.1:
8930	.813	17.4:	18.8	17.55:			16.0	17.2:	18.0	16.75	
9002	32.617	17.5	18.25	18.55	18.8	17.7:	15.5	18.7	18.2	16.8	17.35:
9003	.627	17.5	18.05	18.45	18.75	18.0:	15.5	17.7:	18.2	16.75	17.3:
9005	.652	17.55	18.05	18.55	18.9	17.55	15.5	17.8:	17.9	16.6	17.2:
9006	.661	17.6	18.2	18.4	18.75	18.1	15.55	18.3	18.0	16.65	18.05
9008	.685	17.65	18.15	18.75	18.7	18.5	15.55	18.2	17.8	16.7	17.8:
9009	.694	17.7	18.1	18.8	19.0	18.2	15.45	18.0	18.0	16.65	18.0
9011	.714	17.85	18.3	18.8	18.5	18.35	15.4	18.5	18.2	16.7	17.2:
9012	.724	17.75	18.2	18.45	18.2	18.0	15.4	18.5	18.2	16.65	17.8
9013	.734	17.5	18.3	18.65	17.95	17.8:	15.45	18.6	18.1	16.55	17.9
9022	33.600	17.45	18.2	18.2	18.75	18.0:	15.55	18.7	18.5	16.7	17.15
9023	.610	17.3	18.25	18.3	18.9	17.7:	15.55	18.3	18.7	16.7	17.0
9025	.635	17.5	18.7	18.75	19.0	18.1	15.6	18.05	18.6	16.75	17.0
9027	.658	17.55	18.3	18.6	18.4	18.1	15.55	17.9	18.4	16.65	16.85:

Plate	Julian Day	No. 3	No. 8	No. 12	No. 13	No. 14	No. 17	No. 18	No. 20	No. 27	No. 31
9030	30933.687	17.75	18.6	18.9	18.55	18.1:	15.5	18.3	18.0	16.85	17.1:
9033	.717	17.55	18.15	18.45	18.45	18.6:	15.6	18.4	17.8	16.7	17.05:
10134	1259.731	17.3	19.0:		17.65:	17.9:	15.55	17.65	17.8		
12045	969.756	17.4:	18.25:				15.65:		18.0:		
12051	.817	17.6	18.2		18.7:		15.55	18.2:	18.4:	16.95	
12070	70.779	17.5:	17.9:				15.7:				
12143	77.736	17.2	18.2	17.45	19.1:	18.2:	16.0	17.35	18.7	17.35	17.3
12260	99.693	17.3	18.7	18.45	18.3	17.9	16.15	17.8	18.2	17.8	16.9:
12345	2005.706	17.4	17.45	18.75	18.35	18.6	15.35	18.05	18.1	17.35	17.3:
12349	.758	17.4	18.15	18.45	17.45	18.6:	15.5	18.2	18.0	17.9	17.5:
12361	06.641	17.35	18.5	18.55	18.5	18.3	15.45	18.05	18.3	17.75	17.5:
12364	.677	17.3	18.4	18.5	18.5	18.5	15.55	18.1	18.6	17.85	17.85
12370	.747	17.35	18.45	18.7	18.55	18.7	15.45	18.5	18.5	17.75	17.2
13424	355.697	16.9	18.25	17.35	18.25		15.6	16.95	17.6	17.25	17.3:
13431	.756	17.45	18.2	18.15	17.9	18.3:	15.35	17.2	17.6	16.95	17.5:
13436	.828	17.75	18.7	18.7:	17.4:		15.45	17.3:	18.2	16.95	
13445	56.657	16.7	18.5	17.1	18.35	18.0	15.3	17.0	18.6	17.05	17.95:
13448	.710	17.05	18.75	17.55	18.75	18.4	15.6	17.05	18.5	16.95	17.7:
13460	57.655	16.65	18.15	17.15	18.45	18.5	15.75	16.85	18.1	17.1	17.55:
13464	.701	16.85	18.05		18.6	18.6	15.45	17.65:	18.9	17.2	17.8:
13488	60.659	18.1	18.9	16.95	17.05		15.85	17.75	18.4	17.0	17.15
13492	.723	17.3	18.45	17.55	17.55	17.05	15.85	18.4	18.0	17.15	18.1:
13497	.793	16.7	18.9	18.1	17.9	17.35:	15.85	17.95	18.1	16.9	
14580	740.637	16.85	18.2	17.1	17.3	17.5	15.45	18.5	18.3	16.8	17.35:
14584	.683	17.0	18.3	17.6	17.45	18.2:	15.6	18.05	18.4	16.9	17.6:
14591	.762	17.1	18.5	18.4	17.85	18.2	15.6	18.1	17.8	16.75	17.2:
14604	41.638	17.55	18.4	17.1	18.3	17.9	15.7	18.5	18.4	16.8	17.1
14609	.692	16.55	18.9	17.5	17.25	18.1:	15.6	17.9:	18.6	16.9	17.0:
14624	42.621	17.75	17.9	17.1	18.35	17.8	15.35	17.95	18.0	16.7	16.9:
14629	.673	17.55	18.3	17.45	18.55	18.4	15.6	18.15	18.2	17.05	

Plate	Julian Day	No. 3	No. 8	No. 12	No. 13	No. 14	No. 17	No. 18	No. 20	No. 27	No. 31
14638	32742.779	16.85	18.25	18.1	17.1	18.9	15.5	17.1	18.6	16.85	17.2
14756	70.616	17.55	17.85	18.45	17.35	18.5	16.05	17.0	18.2	17.15	18.0:
14764	.697	17.6	17.85	18.35	17.75	18.3:	15.85	17.85	18.5	16.95	18.3:
21395	4929.638	17.1	18.0	18.35	17.15		15.45	17.5:	17.8	16.6	
21402	.752	16.95	17.85	18.05	18.35	18.5:	15.4	17.7	18.2	16.55	17.6:
21426	31.665	17.4	18.6	18.8	18.55		15.7	17.6:	18.6	16.45	
21431	.719	17.1	17.75	18.8	16.85		15.8	16.6:	17.8	16.55	
22343	5273.697	17.05	19.1:	18.45	17.1	18.3:	16.2	17.4	18.6	16.8	17.5:
22348	.765	17.25	18.45	18.35	17.55	18.1	16.3	17.1	17.9	16.85	17.5:
22363	74.691	16.85	18.3	18.7	18.7		16.05	16.7:	18.4	16.9	
22371	.796	16.9	17.9:		16.9		16.05	17.5:	18.0	16.7	
22380	75.701	16.8		18.2	18.4	17.8:	16.05		18.1	16.9	
22385	.814	16.8	18.2	18.3	17.7:		15.95	17.6:	18.9		
22516	309.632	16.85	19.0	18.65	17.9	17.85:	16.55	17.35	18.1	17.0	17.3:
22521	.679	17.15	18.35	18.35	17.9	18.05	16.45	17.0	18.1	16.95	17.15
22540	10.624	16.7	17.7:	18.5	17.3	17.9:	16.2	16.85	18.5	16.95	17.1
23295	685.610	17.55	19.0:	18.4	18.55	18.1:	15.85	17.45:	18.3:	17.15	17.65:
23315	87.621	17.5	18.5	18.5	18.35	18.3:	15.6	17.4:	18.2	17.2	
23332	88.633	17.25	18.2	18.7	17.6	17.95:	15.4	17.2:	17.7	17.15	
23909	6044.661	17.25	18.6	18.05	18.5	17.5:	16.25	16.85:	18.0	17.1	16.9:
23913	44.697	16.75	18.45	17.65	18.2	17.6:	16.3	17.3:	18.1	16.95	
B1715	52.669	16.35:			17.5:		15.7:				
B1742	67.646	16.9:		18.1:			15.65:		18.0:	16.55:	
B1765	70.652	17.35:	18.0:		17.35:		16.1:			17.05:	
B1782	72.686	17.75:	17.75:		18.2:		15.8:		18.6:	16.95:	
B1789	73.640						15.6:				
24773	750.679	16.95	18.2	17.95	18.3	18.1:	15.9		17.9	16.85	
24779	.739	17.25	18.25	17.9	18.55		15.7	16.9	18.3	16.7	17.1:
24785	52.640	16.85	18.15	17.2	18.1	17.75:	15.45	17.05	18.4	16.75	17.25
24793	.733	17.05	18.25	17.95	18.2	17.75	15.55	17.35	17.8	16.9	17.6:

Plate	Julian Day	No. 3	No. 8	No. 12	No. 13	No. 14	No. 17	No. 18	No. 20	No. 27	No. 31
24808	36753.648	16.85	18.5	17.35	17.6	17.9:	15.6	16.75	18.4	16.85	17.35:
24813	.762	17.05	18.5	18.15	18.05	17.9	15.4	17.6	18.0	16.7	17.2:
26203	7849.648	17.15	18.25	17.7	16.9	18.4:	15.8	17.65:	18.3	17.35	17.8:
26204	.661	17.15	18.25	17.35	16.8	17.8:	15.9	17.8	18.3	17.9	17.6
26205	.682	17.4	18.0	16.95	16.95	17.8:	15.8	16.95	18.6	17.7	17.7:
26207	.707	17.4	18.2	16.8	17.05	18.0:	15.95	17.0	18.8	17.9	17.4:
26210	.750	17.0:	18.4	17.5	17.5	17.6	15.95	17.1	18.4	17.6	17.4:
26222	50.672	17.45	18.45	17.2	18.65	17.65:	15.6	16.7	18.2	17.65	17.4:
26225	.700	17.3	18.4	17.05	18.1	17.8:	15.55	16.95	18.2	17.5	16.9
26227	.733	16.95:	18.8	17.15	16.65	17.55:	15.65	17.25:	18.6	17.45	17.2
26829	8198.704	17.5	18.55	18.2	17.55		16.15	17.3:	17.8	17.1	
26835	.763	17.0	18.0	18.2	18.15		16.3	17.5	17.8	17.05	
26837	.783	16.85	18.4	18.45	18.9		16.25	18.35:	17.7	16.95	
26851	99.690	17.5	18.1	18.4	16.75	17.65:	16.05	17.9	18.8	17.05	
26853	.712	17.5	18.3	18.5	16.65	18.1:	15.8	17.6	18.3	17.1	17.7:
26857	.754	17.55	18.45	18.85	17.15	18.15:	16.0	17.65	17.8	17.1	17.95:
27559	587.693	17.45		18.8	17.1		15.55	17.45:	17.8	17.0	

Plate	Julian Day	No. 34	No. 37	No. 51	No. 59	No. 61	No. 62	No. 68	No. 71	No. 75	No. 76
103	2419536.939										16.8
2637	20726.750	18.6	18.9	18.0	18.4	17.8	18.6	19.0:	18.7	16.8	16.6
2649	48.705	17.9	18.7	17.85	18.3	18.3		17.8	18.4	17.7	16.9
4397	1690.895		16.8:			17.5		18.1:		17.05	16.8
20544	6915.824	18.5	18.8	18.15	19.0	18.3	18.4		18.3	17.8	16.7
20559	21.824	18.4			17.5	17.9	18.4	18.4	18.4	17.9	16.3
20571	23.785							18.7			16.2:
20587	24.824						18.1:		17.8:		16.8
20597	25.776						18.2:			17.5:	16.4
20647	44.781					17.7:		17.1:	18.2:	17.4:	16.8

Plate	Julian Day	No. 34	No. 37	No. 51	No. 59	No. 61	No. 62	No. 68	No. 71	No. 75	No. 76
20675	26946.742					16.6:					16.6:
21377	7272.784			17.5:		17.7:	18.2	18.7:	18.25:	19.0:	16.85
21380	.864	17.6		18.5:		17.1:	18.5	18.1:	19.0:	17.1	16.85
21386	73.788	18.7:	19.0:	17.75	18.7	17.4	18.2	18.4	18.1	18.1	16.6
21399	74.776	18.4	19.5:	18.45	17.9	17.7	18.8	19.5:	18.7	18.3	16.7
21406	.891	19.0		17.7	18.8:	17.3	>18.1	17.8	18.5:	17.7	17.1
21412	75.768	18.6	19.0:	18.2	18.7:	17.4	18.5	18.8	18.7	18.0	16.55
21416	.856	18.0		18.45	17.7:	17.2	18.6	18.8	18.05	18.2	16.8
21515	306.776	17.5:			18.0:	18.0		18.0	18.3:	17.2	17.1
21538	07.799	18.5:	17.3	18.0				17.4:	18.1:	17.0	16.45
21556	08.800										17.3:
23178	639.790	18.7		18.25	17.8	17.8	18.4	18.2	18.45	17.9	16.6
23237	58.749	18.05	18.7	17.75	17.9	18.3	18.1	18.4	18.8	18.2	16.25
23240	.811	18.1:		18.25	18.2	18.0	18.3	18.5	18.7	18.0	16.2
23252	59.760	18.9	18.9	17.8	17.55	17.7	18.6	18.7	18.25	18.3	16.9
23255	.823	18.0		17.7:	18.0	17.4	18.4	18.4	17.85:	18.2	16.85
23256	.840	18.0		17.6:			18.2		17.9:		17.0
23306	64.765	17.85	18.35	18.4	17.3	17.0	18.6	18.4	18.65	17.95	16.4
23308	.802	18.5	17.4	18.1	17.6	17.0:	18.4	18.1	17.4	18.0	16.4
23522	713.649									17.4:	16.3
23529	14.663		18.1	18.0	19.0:	17.9	18.6	18.9	18.8	17.7	16.85
23538	15.661	17.8:	17.5					17.5:	19.0:	16.7:	15.95
23600	28.630									17.7:	16.5
91	8015.608	18.6	18.7	18.0	19.0	17.35	18.1	17.8	17.25	17.2	16.75
92	.677	18.1:			18.2:	17.8	18.2	17.0		17.5	16.5:
100	16.610	18.1			18.4:	16.8:	18.4	17.6		16.7	16.45
101	.628	18.3	18.6:		18.2:	16.7:	18.4		17.2:	17.15	16.5
102	.674						18.3:				16.3:
103	.693						>18.1				16.5:
104	.711			18.3:		16.4:				16.55:	16.5

Plate	Julian Day	No. 34	No. 37	No. 51	No. 59	No. 61	No. 62	No. 68	No. 71	No. 75	No. 76
105	28016.732										16.5:
169	37.599				17.2	16.6:	>18.1	17.4:		17.3	16.6
170	.617										17.1:
185	38.569	18.7	19.0:	17.8	18.9	17.0	18.1	18.5	18.55	17.5	16.7
186	.582	18.4	18.2:	17.6		16.6		18.2		17.3	16.5
187	.608	19.5:			17.8:	16.5	18.1	17.3:		17.0:	16.25
189	.644				17.6:	16.4	>18.1	17.0:		17.6	16.2
192	.701					16.4:	18.0:				15.9
217	43.571	18.8	18.5:	17.9	18.1:	17.2	18.5:		18.6:	17.6	16.85
219	.610	18.1:	18.4:	17.7	18.4	16.8	18.3	18.4	17.7	17.8	16.8
223	.677	18.2:				16.35:	18.0	17.1:		17.7	16.9
836	309.767	18.7:		17.6:		16.1:		16.7:		17.4:	16.5
837	.781					16.1:	>18.1	16.4:			16.65
840	.835					16.2:					16.6
1109	65.637	19.0:					>18.1			16.5:	16.1
1110	.656					16.25:	>18.1				16.1
1112	.706			18.8:		16.75	18.5	17.8:	17.75:	17.4	16.1
1113	.723					16.6		17.0:	18.1:	17.1	16.1
1115	.770					16.4:	>18.1		18.5:	17.1:	16.2
1123	66.631		17.6:			17.3		17.6:		18.5	17.0
1124	.658	17.4:		18.05		17.2:	18.1:	17.4:		17.4	16.7
1127	.729					16.2:	>18.1			16.9	17.0
1226	91.592						18.2			17.7:	17.0
1227	.613					16.5:	>18.1		17.65:	17.0:	16.7
1229	.678						>18.1			17.3:	16.6
1230	.699										17.1
1240	92.603	18.2	17.6:	18.0	17.5	16.7:	18.1	17.5	17.85:	17.5	16.5
1241	.623	17.8	17.8:	17.6	17.2	16.8:	>18.1	17.6		17.6	16.55
1244	.695	18.4:	18.6:	17.9:	17.8	16.8:		17.5	17.4:	17.9	16.4
1267	98.587					16.7:		17.3:		17.4:	16.7

Plate	Julian Day	No. 34	No. 37	No. 51	No. 59	No. 61	No. 62	No. 68	No. 71	No. 75	No. 76
1268	28398.609			17.75:		16.8:	18.1	17.1:		17.4:	16.55
1271	.653					16.0:	18.1:				16.5
1272	.679	17.9		17.8:		16.35	17.9	17.7:	18.1:	17.9	16.55
1284	99.582	18.8	18.8:	18.45	18.4	16.9	18.4	17.4:	17.5	17.4	16.45
1287	.630			17.95	18.5	17.2	18.1	17.8:	17.5	17.5	16.35
1290	.695					16.7:					16.7:
1980	688.713	17.7:		17.8:	17.6:	16.3:				17.5:	16.6
1982	.759	17.6:		18.3:	17.3	16.45	18.5	17.5:	17.4	17.7:	16.4
1984	.822			17.9:	18.4:	17.0	18.1	17.6:		17.5:	16.2
1994	89.720	18.3	18.3:	18.35	18.6	18.3	18.6	17.7	18.7	17.8	16.8
1997	.804	19.0		17.6	19.0	17.0	18.2	18.2	17.45	18.3	17.0
2013	93.746				17.5:	16.6:				17.5:	16.8
2021	95.759		17.5:	17.6		16.9:		16.7:		17.2:	16.8
2033	96.679									17.1:	16.3
2035	.722	18.5:	16.9:	17.8:		16.5	18.5	16.5	18.1	17.4	16.35
2037	.776	18.1	17.9	17.5	18.3	16.9	18.5	17.15:	17.95	17.9	16.4
2111	715.675	18.2	18.4:		18.4:	16.4:	18.6	17.25		16.7	16.3
2114	.747		18.9:	18.1:	18.3:	17.4	18.5	18.4:	18.35	17.2	16.65
2115	.770	19.0:		18.1:		17.3	18.5	17.7:	17.85:	17.7	16.5
3249	29071.710	18.7		18.05	18.7	17.0	18.2	17.9	17.35	17.2	
3252	.798	18.7		17.75	18.7	17.05:	18.1	18.1	18.05	17.45	16.8
3263	72.780	18.6	18.5	18.0	17.9	17.3	18.4	18.5	17.8	18.1	16.4
3275	73.709	18.5		17.7	18.7	17.2:	18.3	18.0	17.7	18.1	16.7
3278	.783	18.1:	17.8	18.2	18.5:	17.75	18.5	17.7	17.45:	18.4	16.8
3290	76.742	19.5:		18.8		16.15:	18.2		18.0	17.1:	16.65
3303	77.702	19.0		17.85	17.7:	16.5:	18.3		17.6:	17.5:	16.75
3318	78.722	17.9		17.7	18.5	17.05	18.2	17.3:	17.85	17.6	16.5
4209	405.920										16.6:
4228	06.956										16.0:
4584	30.738	18.5	18.7:	18.5	18.6	17.3	18.4	17.9	18.4	18.3	16.5

Plate	Julian Day	No. 34	No. 37	No. 51	No. 59	No. 61	No. 62	No. 68	No. 71	No. 75	No. 76
4684	29462.653			17.7:		16.4:			17.85	17.8:	16.65
4693	63.648			17.8	18.6	16.45	18.3	16.8	18.1	18.0	16.35
4703	64.653	18.8		18.7:		17.0	18.5	16.8	18.1	18.2	16.8
4795	87.614					15.95:	>18.1				16.7
4807	89.702	18.5:		17.9	19.0	17.9		17.7	18.0:	17.9	16.8
4819	90.657	17.75	18.5	18.05	17.85	17.55	18.2	18.0	18.25	17.5	16.5
4973	519.568	18.6		17.8	19.0	17.4	18.6	18.0	18.05	17.55	16.9
5702	785.764	18.5:		17.6	18.3:	17.8	>18.1	17.4		17.9	17.0
5717	86.812			17.6			17.9:		17.15:		16.7
5728	87.784	18.7	18.2	18.1	17.6	18.2	18.6	17.5	18.0	17.3	16.6
5729	.840	17.5	17.7	17.95	17.7	18.0	18.3	17.4	18.2	17.9	16.6
5808	813.677	18.9	18.9	18.0	19.0	17.5	18.5	17.7	18.1	18.4	16.45
5812	.784	18.5:	17.8	18.4	19.0	17.6	18.5	18.6	17.55	18.7:	16.35
5820	14.672	18.0		17.9	19.0	16.85	18.5	17.5	18.15	18.0	17.0
5825	.770	18.7		17.7	18.9	17.0	18.2	17.7	17.0		16.75
5835	15.657									17.4:	16.4
5836	.711	18.0	17.8	18.25	17.9:	17.2	18.5	17.25:	18.4	17.55	16.3
5840	16.631	18.1	18.4	17.75	18.9	17.3:	18.4	17.15:	18.55	16.8	16.8
5843	.690	18.4	17.7	18.25	18.1	18.6	18.0	17.6	18.35	17.45	17.0
5846	.733	19.0	18.05	18.5	17.35	17.6	18.0	17.95	18.7	17.55	16.8
5848	.780	18.3:	18.6:	18.05	17.8	17.6	18.0	18.3:	18.35	17.8	16.85
5948	41.688	18.9		17.95:	17.5:	16.9	17.9	17.3:	16.95	16.55	16.2
5964	42.703					16.8:			17.0:		16.55
5974	43.623	17.8	17.8:	18.4	19.0	17.3	18.3	17.8		18.4	16.15
5980	.732	17.7		18.1:	19.0:	16.35	18.1:	17.7	17.4	17.8:	16.45
6836	30169.693					16.8:	18.6:			17.6:	16.8
6837	.722	18.1:		18.1:	18.5:	16.9	18.4:	16.9	18.0	17.5:	16.6
6838	.751	18.3:	17.4:	17.9:	18.3:	17.3	18.0		17.4	17.7	16.9
6839	.789		17.7	18.0:	18.2:	16.7:	18.0	17.15	16.95	17.8	16.65
6847	70.715	18.4:	18.8:	17.9	17.8	17.3	18.3	17.05	17.9	18.2	16.1

Plate	Julian Day	No. 34	No. 37	No. 51	No. 59	No. 61	No. 62	No. 68	No. 71	No. 75	No. 76
6861	30171.730	18.6	17.9	17.95	17.8	18.3	18.0	17.7	18.4	17.5	16.9
6864	.797	18.05	18.05	18.2	17.85	17.9	18.3	17.7	18.5	17.95	17.1
6870	72.642	18.6:		18.3	18.2:		18.2	17.8:	17.55:	16.8	16.3
6875	.747	18.4	17.9:	17.55	18.4	17.6	18.2	17.4	18.05	17.55	16.35
6938	99.705			17.5:		17.1				17.6:	16.45
7923	549.662	18.8		17.9	18.2:	17.2	17.9		17.55	17.7	16.7
7927	.750	17.7		18.3	18.4:	16.5	17.9		17.7	18.2	16.85
7937	50.686	18.65	19.0	17.75	18.1	17.75	18.2	18.3	17.6	17.9	16.15
7940	.727	18.7	18.0	17.8	17.8	17.7	18.4	18.4	17.8	18.0	16.4
7943	.806	18.7		18.65	18.4:	17.0:	18.6		17.65:	17.9	16.2
7949	52.679	18.6:		18.2	18.5:	16.7:	18.2	17.6:	17.1	17.4	16.3
7955	53.644	18.6:	18.35	17.65	18.4	18.0	18.2	17.55	18.25	18.05	16.9
7961	.720	18.8	18.2	18.05	18.6	16.9	18.4	18.2	17.15	18.3	16.8
7964	.779	18.6	17.9:	18.2	18.9	17.0	18.4		17.25	17.3	17.15
7974	54.656	17.85	17.9	18.1	17.9	17.55	18.6	17.4	18.25	18.25	16.3
7979	.739	18.2		17.45	18.6:		18.0		17.65:	18.2	16.3
8014	56.686	18.6	19.0:	18.0	18.8	17.05	18.0	17.95:	17.9	18.0	16.35
8020	.748	18.9		18.1	18.45	17.0:	17.9	18.05	18.15:	18.2	16.3
8117	86.604	18.6	18.5	18.15	18.8	17.6	18.2	17.5	17.95	17.5	16.35
8895	899.685	18.5	18.8:	18.05	17.3	17.1	18.0	18.15	18.25	18.0	16.9
8902	.754	18.1	19.0:	18.15	18.1	17.4	18.5	19.0	17.25	18.0	16.9
8907	.811	17.75	19.0:	17.9	18.8	17.6	18.6	18.7	17.55	17.8	16.7
8919	900.675	19.0	18.6	17.7	19.0	17.75	18.6	17.3	18.4	16.95	16.35
8926	.766	19.0:	18.4:	17.9	17.4	16.8	18.2	18.4	17.7	17.45	16.5
8930	.813					16.3	18.0		16.6	17.5:	16.6
9002	32.617	18.1	18.9	17.6	18.7	17.15	18.4	17.75	18.0	18.1	16.35
9003	.627	18.1	18.9:	17.75	18.5	16.8	18.6	17.7	18.3	18.0	16.4
9005	.652	18.7:	18.8	17.65	18.5	16.6	18.2	17.65	18.2	18.0	16.3
9006	.661	18.15	18.6	17.45	18.4	16.8	18.2	17.9	18.1	18.1	16.5
9008	.685	18.35	17.9	17.65	19.0	17.0	18.2	18.4	18.1	18.5	16.3

Plate	Julian Day	No. 34	No. 37	No. 51	No. 59	No. 61	No. 62	No. 68	No. 71	No. 75	No. 76
9009	30932.694	18.3	17.4	17.65	18.9	16.95	18.0	18.3	17.95	18.0	16.25
9011	.714	18.5	18.0	17.9	19.0	16.9	18.0	18.9	18.6	18.5	16.35
9012	.724	18.5	17.9	17.85	18.4	17.25	17.8	17.85:	18.3	18.25	16.45
9013	.734	18.4	17.9	18.0	18.7	17.1	18.0	17.75:	18.1	18.1	16.45
9022	33.600	19.0	19.2:	18.15	18.2	17.7	18.4	18.0	17.8	18.1	16.9
9023	.610	19.5	19.5:	18.1	18.2	17.3	18.5	18.1	17.65	17.95	16.85
9025	.635	18.7:	19.0:	18.45	18.35	17.4	18.4	17.75	18.1	18.2	16.85
9027	.658	18.55	18.3	18.15	18.3	17.75	18.3	18.3	17.9	18.3	16.75
9030	.687	18.7	18.2:	17.8	18.6	17.35	18.4	18.1	17.85:	18.1	16.9
9033	.717	18.6:	18.7	17.6	18.9	17.45	18.6	18.3	17.95	18.5	16.85
10134	1259.731	18.4:	18.3:	17.4	17.6	16.7:		17.1	18.9:	17.7	16.35
12045	969.756			17.15:			18.1:				16.6
12051	.817	17.7		17.5:	17.5	16.8:	18.2:	16.65	18.5:	17.7	16.4
12070	70.779										17.1:
12143	77.736	17.6	19.5:	17.4:	18.6:	17.2	18.5	19.0	18.55	18.2	16.4
12260	99.693	18.2:	18.6:	17.75	19.0	17.9	17.9	18.2	17.8	18.0	16.75
12345	2005.706	18.0	18.25	17.75	18.6	17.05	18.6	19.0	18.35	18.4	16.45
12349	.758	18.2	18.6	17.95	19.0	17.8	18.6	19.0	18.4	18.1	16.35
12361	06.641	19.0	18.3	18.1	18.3	18.1	18.0	18.9	18.45	18.2	16.7
12364	.677	18.8	18.2	18.05	18.8	18.4	18.0	19.0	18.65	18.1	16.8
12370	.747	19.0	18.9	17.65	19.0	17.25	18.2	19.0	18.55	18.35	16.7
13424	355.697	17.9		17.4	18.3:	17.1:	18.4	18.5:	17.7	17.85	16.3
13431	.756	18.4		17.85	18.6	17.5	18.3	18.7:	17.85	18.15	16.35
13436	.828	18.7:		17.8:			18.2		18.7:	18.8:	16.35
13445	56.657	18.7	19.0:	17.95	18.7	17.0	18.1	18.8	17.2	18.05	16.75
13448	.710	18.9	19.2	17.5	18.8	17.65:	18.3	18.9	17.55	18.2	16.95
13460	57.655	18.7		18.15	18.4	17.65	18.6	19.0:	16.95	17.4	16.25
13464	.701	18.7		18.35	18.4	17.75	18.3		17.3	18.1	16.15
13488	60.659	18.4:	19.0	18.0	19.0	16.9	18.5	18.6:	18.6	17.7:	16.9
13492	.723	18.6	18.3	17.6	18.9	17.2	18.5	18.9	18.65	18.0	17.0

Plate	Julian Day	No. 34	No. 37	No. 51	No. 59	No. 61	No. 62	No. 68	No. 71	No. 75	No. 76
13497	32360.793	19.0		17.5	19.0	17.15	18.5		16.9	18.3	16.6
14580	740.637	18.8	19.0:	17.8	18.8	17.9	18.4	19.0:	17.45	18.0	16.7
14584	.683	18.7:	19.5:	18.05	18.9	17.3	18.4	19.0	17.7	18.5	16.7
14591	.762	18.9	18.6	17.95	18.7	16.9	18.3	17.65	18.0	18.4	16.65
14604	41.638	18.4	19.0	17.45	18.3	17.85	18.2	19.2:	17.1	18.0	16.5
14609	.692	19.0		17.65	18.9	17.4:	18.4		17.25	18.4	16.7
14624	42.621	18.6:		18.05	18.9	17.6	18.6	19.0:	17.55	17.4	16.7
14629	.673	17.9	18.4	17.65	17.65	18.1	18.6	19.5:	17.05	17.65	16.7
14638	.779	18.5:	18.9	17.8	18.4	18.0	18.1	18.7	17.8	18.3	16.6
14756	70.616	18.1		17.7	18.5:	17.9:	18.3		17.3	18.3	16.85
14764	.697	18.9	19.0:	17.25	18.7:	17.55:	18.4	17.95	17.65	18.3	16.95
21395	4929.638	19.0:		17.55			18.0		17.75:		16.4
21402	.752	18.8		18.25	18.4:	17.55	18.4		17.65:	17.3	16.1
21426	31.665			18.05		16.6:	18.4		17.6	18.0:	16.25
21431	.719			17.75			18.2		17.4:		16.25
22343	5273.697	19.0:	19.0:	17.3	18.4:	17.0	18.2		18.1	17.8	16.2
22348	.765	19.0		17.7	18.4:	17.15	18.1		17.9	17.2	16.05
22363	74.691	18.4		17.7			18.5		18.2	18.2	16.65
22371	.796			17.7:	17.6:	16.9:	18.5		18.5:	18.0:	17.0
22380	75.701	18.7		17.95	18.3:	17.2	18.0	18.2:	17.95	17.8	16.15
22385	.814	18.0:		17.4:		16.85:	18.1			18.2:	16.25
22516	309.632	18.7	19.0	17.85	18.9	17.35	18.3	18.5	17.65	17.9	16.2
22521	.679	18.7	19.0:	17.4	18.25	17.7	18.4	18.6	16.95	18.1	16.1
22540	10.624	18.4		18.0	18.6:	16.95	18.1	18.3:	18.35	17.95	16.75
23295	685.610	19.0		17.6	18.8	16.7	18.4:		18.2	17.9	16.8
23315	87.621	19.0		17.6	18.4	17.3:	18.2		17.9	17.1	16.2
23332	88.633	18.7:		18.25	18.2:	17.5:	17.8		17.75	18.05:	16.7
23909	6044.661	18.6		18.05	18.15:	17.05	18.3	18.0:	18.15:	17.9	16.7
23913	.697	18.6:		17.55	17.9:	17.2	18.2	17.6:	17.45:	17.8:	16.9
B1705	51.660										16.9:

Plate	Julian Day	No. 34	No. 37	No. 51	No. 59	No. 61	No. 62	No. 68	No. 71	No. 75	No. 76
B1715	36052.669										16.6:
B1742	67.646			18.1:		17.4:					16.1:
B1752	68.663										17.5:
B1765	70.652			17.25:							17.3:
B1782	72.686			17.75:		17.6:		16.5:	17.95:		16.5:
B1789	73.640										16.6:
24773	750.679			17.45	18.3:	16.7:	18.2		16.9	18.1:	16.6
24779	.739			17.5	18.4:	17.4	18.5		17.25	18.7	16.7
24785	52.640	18.9		17.65	18.6	17.6	18.4		17.9	17.6:	16.8
24793	.733	18.9	19.0:	17.95	18.25	18.2	18.4	18.8	17.8	18.15	16.75
24808	53.648	18.05	19.0:	17.4	18.8	17.85	18.1	18.8	17.9	17.1	16.2
24813	.762	18.35	19.0:	18.1	18.5	17.55	18.4	18.4:	18.05	17.55	16.15
26203	7849.648	19.5:	19.0:	18.1	18.9	18.2	18.4	18.8:	18.15	17.3	16.95
26204	.661	18.9		18.0	18.4:	17.45	18.3	18.6	18.7	16.9	16.8
26205	.682	19.0		17.7		17.6	18.5	18.2:		16.9	16.9
26207	.707	19.0:		18.1	18.7	17.65	18.4	18.7:	18.3	17.5	17.0
26210	.750	18.6		17.95	19.0	17.05	18.1	17.9:	18.15:	17.7	16.8
26222	50.672			17.8	18.1	18.1	18.2	18.3:	18.35	17.9	16.55
26225	.700	19.0:		18.1	18.4	17.7	18.5	18.4	18.3	18.1	16.65
26227	.733			17.65	17.9:	17.55	18.5		17.85	17.35	16.6
26829	8198.704	18.1:		17.55			18.2		17.4	17.3	16.6
26835	.763			17.6		17.4:	18.6		17.95	17.9	16.8
26837	.783	18.1:		17.55		17.4:	18.3		18.1	17.7:	16.9
26851	99.690			18.6		17.3	18.0		17.8	17.65	16.25
26853	.712	18.7		18.05	18.3	17.2	18.0		17.6	17.3	16.1
26857	.754	19.1		17.65	18.9	17.75	18.2		17.8	17.3	16.25
27559	587.693	18.8:		17.7		17.2	18.5:		17.85:	17.95:	16.6

and the magnitude from the photometer reading. Some of these stars in the second group are substantially fainter than any in Paper I. This means that measures for them on many of the early plates, both of the Dominion Astrophysical Observatory and of the David Dunlap Observatory until the mirror was aluminized before the 1942 season, give uncertain results because the variable is close to the limiting magnitude of the plate. We found that in such cases the eye estimates made by one of us (H.S.H.) were as reliable as the photometer measures made by the other (A.W.) and resulted in less scatter in the light curve. Accordingly, for the two variables for which the effect was most noticeable, Variables 20 and 62, the published measures are usually means of photometer and eye estimates.

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