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The observations of Neptune in the years 1950-1962, corrected for the effects of changing distance, indicate a decrease in blue magnitude from 8.26 to 8.23 (Fig. 9). During the period 1963-1966 the brightness was constant and equal to 8.24 mag. The steady decrease of the instrumental transformation coefficient A_8 in the years 1950-1960 (Fig. 10) throws some doubt on the reality of the changes in Neptune's brightness. If these changes are real they may be due either to intrinsic changes in Neptune's surface or to solar variability or to both.

The observations of Uranus indicate no changes in solar brightness from 1950 to 1966 if 22 percent darkening from the equator towards the pole of the planet is assumed. On this assumption the total range of the intrinsic change of the blue magnitude of Uranus is 0.038 mag., with a period of 42 years.

In our opinion, this long sequence of photoelectric observations has taught us more about the variations of solar-type stars than about the sun itself. The observations of 15 stars of spectral types F and G in the years 1955-1966 (Figs. 3,4) indicate that for none of these stars does the standard deviation of the yearly mean magnitude exceed 0.008, and for the stars 40 Leo, β CVn and η Boo this deviation is less than 0.004 mag. No evidence of variability in the stars which are similar to the sun has been detected during this program. If we assume the sun acts in similar fashion to each of these stars, its variability over a fifteen-year period probably does not exceed one-half of one percent.

Another by-product of this research results from one of the most extensive series of night-time extinction observations ever carried out at a single observatory.

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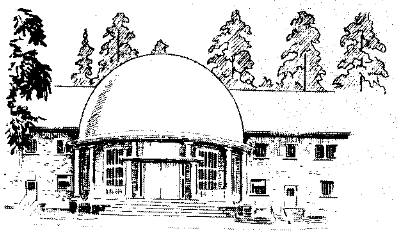

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THE SUN AS A VARIABLE STAR III

Photometric Observations of Uranus, Neptune, and F and G Type Stars

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Lowell Observatory

ABSTRACT

The observations of Neptune in the years 1950–1962, corrected for the effects of changing distance, indicate a decrease in blue magnitude from 8.26 to 8.23 (Figure 9). During the period 1963–1966 the brightness was constant and equal to 8.24 mag. The steady decrease of the instrumental transformation coefficient A_8 in the years 1950–1960 (Figure 10) throws some doubt on the reality of the changes in Neptune's brightness. If these changes are real they may be due either to intrinsic changes in Neptune's surface or to solar variability or to both.

The observations of Uranus indicate no changes in solar brightness from 1950 to 1966 if 22 percent darkening from the equator toward the pole of the planet is assumed. On this assumption the total range of the intrinsic change of the blue magnitude of Uranus is 0.038 mag., with a period of 42 years.

The observations of Uranus reported here will make it possible to solve the problem of solar variability only if they are repeated after about 22 years for the purpose of determining the amplitude of the intrinsic changes in Uranus' brightness. Very small scatter of the individual observations of Uranus (Figure 8) indicates that the short period variations of solar brightness do not exceed 0.003 mag.

In our opinion, this long sequence of photoelectric observations has taught us more about the variations of solar-type stars than about the sun itself. The observations of 15 stars of spectral types F and G in the years 1955–1966 (Figures 3, 4) indicate that for none of these stars does the standard deviation of the yearly mean magnitude exceed 0.008, and for the stars 40 Leo, β CVn and η Boo this deviation is less than 0.004 mag. No evidence of variability in the stars which are similar to the sun has been detected during this program. If we assume the sun acts in similar fashion to each of these stars, its variability over a fifteen-year period probably does not exceed one-half of one percent. The magnitudes and B—V colors of about 50 stars given here (Table V) have mean errors not exceeding ±0.003 mag. so that the third digit beyond the decimal is quite significant. Despite the fact that several different photomultipliers were used in this research, it has been possible to reduce the observed magnitudes and colors to the UBV system with a considerable amount of confidence.

Several methods of determining the extinction and transformation coefficients have been used from time to time during the course of this program. Two slightly different methods are presented in some detail. They lead to essentially the same results.

Another by-product of this research results from one of the most extensive series of night-time extinction observations ever carried out at a single observatory. The seasonal mean values of the extinction coefficients were determined with high accuracy (Figures 1, 2). The standard deviations of the nightly values of extinction coefficients k_1 and q_{y1} from the seasonal averages are ±0.009 and ±0.020 mag., respectively. The mean values of the second order extinction coefficients are $k_2 = -0.030$ and $q_{y2} = +0.013$.

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CONTENTS

I. INTRODUCTION

The method of detecting the possible variation of the solar energy output by means of photometric observations of the planets was first proposed in 1897 by Müller (1). The most suitable planets for this purpose are Uranus and Neptune because their apparent disks are small enough to be compared with point-like stellar images; the comparison stars, similar to the planets as far as the brightnesses and colors are concerned, can be easily found and, because of rather slow apparent motion of the planets, need not be changed more than once a year.

A program of photoelectric observations of Uranus and Neptune was begun in 1950 at the Lowell Observatory.* The first results were reported by Giclas (2) and by Hardie and Giclas (3). Observations made in the years 1953–1958 were summarized by Johnson and Iriarte (4, Paper I of the present series on the sun as a variable star). All the results obtained from 1953 until 1961 were published by Serkowski (5, hereafter referred to as Paper II). They were further discussed by Öpik (6) who found an upper limit of day-to-day variability to be ±0.3 percent for Uranus and ±0.2 percent for Neptune. According to Öpik, lack of correlation between the simultaneous observations of Uranus and Neptune leaves for the solar day-to-day variability an amplitude less than 0.3 percent. Mitchell (7, 8) found a correlation between the brightness of Neptune, as observed at the Lowell Observatory in the years 1953–1961, and the sunspot number. The preliminary results of the Lowell Observatory photometry of Uranus and Neptune up to 1965 have been briefly described elsewhere (9).

Since changes in the solar brightness seem most likely to occur in the shorter wavelengths, and, because the blue spectral region is the most suitable of those for which precise photometric observations are possible, the intercomparisons between the planets and their comparison stars were made through a blue filter. Also, in this spectral region the influence of the planetary absorption bands is relatively small.

Since 1954, in order to improve the accuracy of the magnitudes and colors of the comparison stars, the following procedure was applied:

Sixteen stars of spectral type similar to that of the sun were chosen. These stars, henceforth referred to as the Ten-Year Standards, are situated in the interval of right ascensions in which Uranus and Neptune were seen during the last decade. The V magnitudes and B—V colors of the Ten-Year Standards were determined on the same nights as the magnitudes and colors of the comparison stars, using the atmospheric extinction coefficients and the coefficients for the transformation to the BV system obtained from the observations of the primary standard stars of the UBV photometric system. The mean values of magnitudes and colors of the Ten-Year Standards, found during the years 1955–1961 (Paper II), were subtracted from the magnitudes and colors of the Ten-Year Standards derived from the observations made on each night when the Ten-Year Standards were observed. The mean of the differences was then taken and added to the results of the observations of the comparison stars as the correction to the system of the Ten-Year Standards. In this way, indirectly, the brightness of Uranus and Neptune is compared with the mean brightness of the Ten-Year Standards.

As an important by-product, the regular observations of the Ten-Year Standards give some idea of the variability of a sample of solar-type stars.

The present paper is the final report on the search for the solar variability conducted at the Lowell Observatory. No more observations of this kind are planned at this Observatory.

II. OBSERVERS AND INSTRUMENT

The observers working in the present program since 1961 and the photomultipliers used are listed in Table I. All the observations were made with the Lowell Observatory 21-inch reflecting telescope. The refrigerated 1P21 photomultiplier tube used

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since December 1957 was replaced in October 1964 by an unrefrigerated EMI 6256 S tube. The new tube has a red cutoff similar to that of the tube with which Johnson defined the UBV system (10). Moreover, its cathode sensitivity is appreciably higher than that of the previously used one and it shows no fatigue effect for a second magnitude star.

The filters and the D. C. amplifier are the same as those used in Paper II. Since 1963 the amplifier coarse gain-step calibration was done with the aid of the radioactive standard source by varying the voltage on the photocathode, and the resulting corrections were applied. The fine gain-step resistors were half magnitude within 0.05 percent, therefore no corrections were necessary.

III. TWO-COLOR OBSERVATIONS OF THE STANDARD AND COMPARISON STARS

The observing schedule for the two-color photometric observations in the years 1961–1966 was the same as described in Paper II, except that different amplifier gain-steps were usually used with the yellow and blue filters. The reductions of the observations made between November 1961 and June 1962 were carried out as described in Paper II. The transformation and extinction coefficients for these observations are listed in Table II. The subsequent two-color observations were reduced as described in Appendix I, using the IBM 1620 computer of Northern Arizona University in Flagstaff. All the results presented in Tables IV, VI, VII, and VIII of this paper were obtained on the assumption that the errors of photometric observations are proportional to the air mass. The observations give, however, some indication that the photometric errors are increasing with the air mass more rapidly than this assumption.

The extinction and transformation coefficients defined in Appendix I are listed in Table III. The formulae relating these coefficients to those used in Paper II are given in Appendix II. In the second column of Table III the number of standard stars used for determining the extinction and transformation coefficients is given; the standard stars used for this purpose will be called hereafter the primary standards and are so denoted in the last column of Table V. Usually several groups of primary standard stars were observed on each night, the first group at the beginning of the night and the last at the end. The extinction and transformation coefficients for each of these groups are given in a separate line of Table III.

The extinction coefficients k_1, and q_{y1} listed in Table III are plotted as a function of date in Figures 1 and 2. The following seasonal mean values of the extinction coefficients can be derived from these data:

EXTINCTION COEFFICIENTS

	B − V Color k_1	Yellow Magnitude q_{y1}	Blue Magnitude q_{b1}	
Jan.-Mar.10	$0^{m}081$	$0^{m}172$	$0^{m}253$	(n=50)
Mar.11-Apr.20	.090	.206	.296	(n=64)
Apr.21-Jun.15	.092	.212	.304	(n=64)

The second order extinction coefficients do not indicate seasonal changes. Their mean values are $k_2 = -0.030$, $q_{y2} = +0.013$, and $q_{b2} = -0.017$.

From the scatter in Figures 1 and 2 it can be estimated that the standard deviations of the nightly values of k_1 and q_{y1} from the seasonal averages are $\sigma(k_1) = \pm 0.009$ and $\sigma(q_{y1}) = \pm 0.020$ mag., re-

TABLE I

Observers and Photomultipliers

Period		Observer	Tube Type and Designation
From	To		
1961, Oct. 20	1962, Jun. 22	W. Krzeminski	1P21 12-Ref.
1962, Nov. 27	1963, Jun. 10	J. B. Priser	1P21 12-Ref.
1963, Dec. 20	1964, Jun. 15	M. Jerzykiewicz	1P21 12-Ref.
1964, Dec. 15	1965, Dec. 5	M. Jerzykiewicz	EMI 6256S Unref.
1966, Jan. 4	1966, May 15	K. Serkowski	EMI 6256S Unref.

TABLE II
Transformation and Extinction Coefficients
(Defined in Paper II)

Date U.T.		n	Transformation Coefficients			Extinction Coefficients				Corr. to System of 10-yr. Stds.		Remarks
			A_1	A_2	A_6	K_1	m.e.	Q_{y1}	m.e.	Δ_V	Δ_{B-V}	
1961												
Nov.	27	4	$1^{m}.478$	$1^{m}.029$	$-0^{m}.028$	$0^{m}.100$	$\pm\ ^{m}.005$	$0^{m}.101$	$\pm\ ^{m}.032$			Clouds at end
Dec.	21	4	1.480	1.032	-0.047	0.096	.005	0.114	.008			
	23	4	1.492	1.037	-0.048	0.104	.005	0.133	.005			Poor seeing
1962												
Jan.	12	6	1.518	1.031	-0.044	0.126	.005	0.098	.016			
	15	4	1.516	1.026	-0.050	0.127	.009	0.124	.004			
	29	6	1.519	1.032	-0.040	0.127	.007	0.121	.004			Poor seeing
	31	4	1.451	1.038	-0.036	0.066	.013	0.109	.025	$+0^{m}.003$	$+0^{m}.007$	
	31	4				0.067	.011	0.108	.022			
Feb.	2	10	1.509	1.038	-0.043	0.108	.006	0.129	.007	+0.004	+0.001	
	22	4	1.493	1.026	-0.033	0.107	.005	0.157	.005			
	28	4	1.461	1.037	-0.055	0.087	.014	0.160	.021			
Mar.	1	4	1.473	1.033	-0.050	0.097	.009	0.122	.009			Clouds at end
	4	11	1.513	1.037	-0.053	0.121	.006	0.151	.009	0.000	-0.003	
	13	8	1.484	1.037	-0.050	0.098	.010	0.138	.009			Clouds at horizon
	14	4	1.525	1.040	-0.045	0.122	.016	0.180	.016	+0.007	+0.006	
	14	6				0.130	.010	0.162	.010			
	24	4	1.490	1.026	-0.055	0.101	.030	0.187	.026			
	26	4	1.535	1.034	-0.038	0.130	.014	0.147	.015	+0.002	+0.001	
	26	6				0.133	.006	0.146	.006			
	28	4	1.518	1.039	-0.042	0.123	.005	0.183	.006			
	31	10	1.522	1.038	-0.040	0.124	.006	0.194	.006	0.000	-0.002	
Apr.	5	10	1.524	1.029	-0.041	0.146	.005	0.219	.007			
	11	10	1.546	1.036	-0.041	0.138	.004	0.174	.009	+0.004	-0.001	Poor seeing
	12	4	1.545	1.030	-0.037	0.133	.006	0.191	.018	+0.004	-0.004	
	22	6	1.530	1.028	-0.037	0.123	.006	0.173	.006	+0.001	-0.005	
	22	6				0.123	.008	0.167	.008			
	24	6	1.540	1.024	-0.040	0.135	.004	0.179	.006			
	30	6	1.512	1.029	-0.030	0.108	.025	0.157	.024			Clouds in evening
May	1	6	1.526	1.031	-0.042	0.119	.004	0.166	.004	+0.006	-0.002	Poor seeing
	1	6				0.123	.006	0.166	.006			
	2	4	1.509	1.035	-0.045	0.100	.005	0.173	.005			
	6	4	1.539	1.029	-0.036	0.132	.022	0.202	.017			Clouds at horizon
	6	4				0.132	.016	0.191	.012			
	9	4	1.567	1.035	-0.037	0.148	.005	0.183	.007			
	10	6	1.499	1.031	-0.038	0.104	.010	0.127	.009			Clouds at horizon
	19	5	1.526	1.035	-0.028	0.112	.018	0.098	.016			
	20	4	1.520	1.024	-0.025	0.108	.007	0.138	.013			Windy
	22	4	1.554	1.037	-0.046	0.129	.007	0.157	.006			Poor seeing
	23	4	1.515	1.024	-0.034	0.114	.005	0.151	.005			
	25	6	1.556	1.029	-0.040	0.130	.009	0.147	.007			Clouds at horizon
	26	4	1.522	1.025	-0.025	0.112	.005	0.186	.012			
Jun.	5	8	1.538	1.007	-0.021	0.136	.006	0.166	.005			
	6	4	1.529	1.031	-0.038	0.117	.005	0.201	.005			Windy
	7	10	1.512	1.031	-0.030	0.105	.012	0.170	.011	-0.005	-0.004	
	9	6	1.533	1.029	-0.032	0.128	.005	0.156	.017	-0.001	+0.003	
	10	4	1.542	1.036	-0.042	0.138	.005	0.207	.007			
	12	7	1.523	1.024	-0.013	0.122	.007	0.110	.011	-0.003	+0.001	
	18	6	1.512	1.036	-0.041	0.109	.005	0.177	.007			Windy
	19	6	1.525	1.035	-0.019	0.116	.004	0.127	.015	+0.006	0.000	
	20	6	1.529	1.029	-0.024	0.136	.004	0.165	.006			
	22	6	1.516	1.026	-0.031	0.115	.005	0.143	.008			

spectively. The deviations in the winter months are smaller than in the spring and summer. In the 1962–1963 season, when the extinction coefficients were determined on two nights only, the above seasonal mean values of the extinction coefficients were used on all the remaining nights.

The extinction and transformation coefficients derived from the observations of primary standard stars were used for computing the colors and magnitudes of program stars. Among the program stars were comparison stars used for the differential photometric observations of the planets Uranus and Neptune and sixteen solar-type stars called Ten-Year Standards.

To eliminate the influence of possible inaccuracies in the observations of primary standards and of

TABLE III
Transformation and Extinction Coefficients
(Defined in Appendix I)

Date U.T.		n	Transformation Coefficients a_1	a_2	a_6	Extinction Coefficients k_1	m.e.	q_{y1}	m.e.	k_2	q_{y2}	Corr. to System of 10-yr. Stds Δ_V	Δ_{B-V}	Remarks
1962														
Nov.	27	4	$-1^{m}.461$	$+0^{m}.975$	$+0^{m}.034$									
Dec.	4	6	-1.457	+0.970	+0.025									
	5	6	-1.460	+0.974	+0.030									
	6	6	-1.464	+0.978	+0.028									
	7	6	-1.433	+0.970	+0.030									
	8	4	-1.460	+0.975	+0.032									
	10	4	-1.432	+0.991	+0.015									
	21	4	-1.462	+0.976	+0.029									
	22	4	-1.469	+0.971	+0.038									
	30	6	-1.469	+0.973	+0.039							$+0^{m}.009$	$-0^{m}.007$	
1963														
Jan.	7	4	-1.477	+0.992	+0.016							+0.004	+0.004	
	9	6	-1.477	+0.982	+0.025							+0.001	-0.002	
	15	6	-1.463	+0.974	+0.035							+0.005	-0.005	
	17	6	-1.463	+0.972	+0.026							0.000	+0.003	
	21	4	-1.474	+0.979	+0.031							-0.004	-0.007	
	23	6	-1.480	+0.972	+0.027							+0.001	-0.002	
	25	6	-1.469	+0.970	+0.022							+0.004	-0.004	
	28	6	-1.456	+0.971	+0.031							-0.001	-0.007	
Feb.	3	6	-1.472	+0.973	+0.020	$0^{m}.079$	$\pm\ ^{m}.003$	$0^{m}.156$	$\pm\ ^{m}.041$	-0.028	+0.014			
	6	6	-1.477	+0.976	+0.026	0.085	.007	0.158	.029	-0.030	+0.008			
	16	6	-1.479	+0.971	+0.024									
	21	6	-1.483	+0.973	+0.024							-0.016	-0.003	
	21	6	-1.478	+0.978	+0.016									
Mar.	7	4	-1.503	+0.966	+0.032							0.000	-0.007	
	15	6	-1.487	+0.969	+0.024									
	20	6	-1.493	+0.958	+0.053							+0.003	-0.002	
	20	6	-1.491	+0.968	+0.022									
Apr.	4	4	-1.495	+0.965	+0.032							+0.001	-0.003	
	4	4	-1.495	+0.975	+0.015									
	12	4	-1.448	+0.962	+0.028									
	22	6	-1.467	+0.977	+0.030									
	24	4	-1.465	+0.967	+0.020							-0.004	-0.002	
	29	6	-1.457	+0.973	+0.025							+0.004	+0.007	
May	1	6	-1.472	+0.976	+0.011							-0.004	-0.003	
	3	6	-1.470	+0.975	+0.013							+0.005	-0.010	
	12	4	-1.472	+0.976	+0.008							-0.002	-0.003	
	13	6	-1.458	+0.966	+0.009							+0.001	0.000	
	16	6	-1.472	+0.978	+0.017							-0.003	+0.002	
	29	6	-1.464	+0.976	-0.004									
1964														
Jan.	6.53	4	-1.418	+0.967	+0.034	0.070	.005	0.202	.005	-0.029	+0.008			
Feb.	5.43	4	-1.468	+0.973	+0.029	0.091	.009	0.177	.001	-0.032	+0.012			
Apr.	10.19	4	-1.457	+0.976	+0.029	0.090	.018	0.255	.006					
	10.26	4	-1.471	+0.978	+0.019	0.096	.002	0.206	.007	-0.031	+0.010			
	10.36	4	-1.454	+0.985	+0.021	0.090	.017	0.254	.008	-0.028	+0.016			
	10.44	6	-1.463	+0.984	+0.020	0.102	.008	0.213	.014	-0.026	+0.016			
	11.14	6	-1.458	+0.988	+0.026	0.090	.022	0.197	.003					
	11.28	4	-1.456	+0.972	+0.016	0.098	.008	0.218	.008	-0.034	+0.011	+0.030 -0.001	+0.006	
	11.36	4	-1.460	+0.991	0.000	0.086	.000	0.203	.003					
	11.43	4	-1.444	+0.967	+0.023	0.094	.019	0.196	.001	-0.027	+0.008			
	12.26	4	-1.472	+0.981	+0.013	0.096	.018	0.232	.008	-0.034	+0.010			
	12.35	4	-1.459	+0.977	+0.008	0.095	.005	0.251	.007					
	12.43	4	-1.471	+1.003	-0.026	0.104	.005	0.259	.016	-0.026	+0.034			
	13.14	4	-1.464	+0.980	+0.027	0.088	.016	0.249	.014					
	13.27	4	-1.465	+0.983	+0.018	0.087	.007	0.234	.009	-0.032	+0.009	+0.009	+0.002	
	13.42	4	-1.451	+0.979	-0.013	0.085	.010	0.240	.004	-0.031	+0.024			
	14.14	4	-1.450	+0.972	+0.051	0.080	.033	0.224	.024					
	14.26	4	-1.454	+0.981	+0.017	0.076	.026	0.219	.018	-0.034	+0.013	+0.005	+0.002	
	14.40	4	-1.454	+0.980	0.000	0.077	.000	0.202	.002	-0.034	+0.010			
	15.14	4	-1.478	+0.977	+0.034	0.097	.017	0.176	.013					
	15.26	4	-1.482	+0.963	+0.022	0.114	.005	0.222	.010	-0.033	+0.008	+0.016: -0.010	-0.010	
	15.42	4	-1.449	+0.973	+0.010	0.091	.019	0.200	.010	-0.033	+0.011			
	16.26	4	-1.464	+0.975	+0.014	0.096	.008	0.223	.001	-0.033	+0.009	-0.001	0.000	
	16.40	6	-1.437	+0.974	0.000	0.090	.011	0.208	.009	-0.030	+0.013			
May	8.28	4	-1.491	+0.994	+0.029	0.109	.029	0.223	.007					
	8.37	6	-1.468	+0.998	+0.011	0.091	.040	0.225	.020	-0.032	+0.029			
	9.38	6	-1.453	+0.979	+0.031	0.086	.017	0.221	.002	-0.032	+0.006			
	12.19	4	-1.472	+0.969	+0.006	0.087	.001	0.189	.000	-0.030	+0.016			

TABLE III (cont'd)
Transformation and Extinction Coefficients
(Defined in Appendix I)

Date			Transformation Coefficients				Extinction Coefficients					Corr. to System of 10-yr Stds.		
	U.T.	n	a_1	a_2	a_6	k_1	m.e.	q_{y1}	m.e.	k_2	q_{y2}	Δ_V	Δ_{B-V}	Remarks
1964														
May	12.36	6	$-1^{m}.474$	$+0^{m}.984$	$+0^{m}.029$	$0^{m}.092$	$\pm{}^{m}.002$	$0^{m}.185$	$\pm{}^{m}.003$	-0.030	0.000			
	13.26	6	-1.470	+0.988	+0.017	0.101	.016	0.205	.007					
	13.35	6	-1.443	+0.992	+0.018	0.095	.004	0.199	.008	-0.032	+0.005			
	15.33	6	-1.470	+0.979	+0.044	0.087	.010	0.184	.006	-0.031	-0.001			
	16.16	4	-1.483	+0.978	+0.010	0.095	.008	0.192	.004	-0.032	+0.014			
												$+0^{m}.008$	$+0^{m}.001$	
	16.24	6	-1.461	+0.968	+0.020	0.084	.007	0.197	.002					
	16.33	6	-1.470	+0.980	+0.039	0.083	.009	0.180	.008	-0.032	-0.003			
	18.17	4	-1.467	+0.978	0.000	0.087	.003	0.196	.013	-0.031	+0.016			
												+0.010	+0.004	
	18.23	6	-1.448	+0.961	+0.025	0.082	.005	0.202	.006					
	20.23	6	-1.452	+0.971	+0.013	0.100	.005	0.260	.008					
	20.31	4	-1.462	+0.981	+0.010	0.113	.013	0.254	.012					
Jun.	7.18	6	-1.504	+0.996	+0.007	0.096	.010	0.191	.003					
	7.27	6	-1.467	+0.984	+0.037	0.076	.003	0.177	.003	-0.040	-0.005			
	9.17	6	-1.486	+0.986	+0.018	0.096	.011	0.279	.026					
	9.26	4	-1.489	+1.018	-0.020	0.098	.010	0.187	.000					
	10.18	4	-1.508	+0.997	+0.021	0.109	.005	0.192	.018					
	10.26	6	-1.480	+0.988	+0.023	0.094	.010	0.203	.004	-0.031	+0.005			
	11.25	4	-1.479	+0.981	+0.013	0.093	.002	0.195	.005	-0.031	+0.005			
	12.24	4	-1.489	+0.988	+0.025	0.096	.004	0.188	.002	-0.030	+0.002			
	15.24	4	-1.471	+0.985	+0.019	0.092	.001	0.206	.003	-0.031	+0.006			
1965														
Jan.	9.44	4	-1.039	+0.907	+0.021	0.085	.007	0.175	.017	-0.031	+0.013			
	9.51	4	-1.038	+0.923	+0.000	0.076	.024	0.187	.018	-0.031	+0.014			
	12.42	6	-1.009	+0.901	+0.002	0.078	.009	0.170	.014	-0.030	+0.016			
	12.52	4	-1.022	+0.919	-0.010	0.080	.004	0.166	.001	-0.028	+0.013			
	13.29	6	-1.001	+0.904	+0.015	0.068	.006	0.180	.005	-0.029	+0.012			
	13.42	6	-1.017	+0.922	+0.001	0.071	.007	0.181	.016	-0.030	+0.016			
	13.52	4	-1.032	+0.916	+0.006	0.086	.003	0.181	.007	-0.029	+0.013			
	26.38	6	-1.033	+0.916	+0.008	0.074	.010	0.201	.014	-0.031	+0.016			
	26.46	4	-1.037	+0.912	+0.015	0.080	.012	0.209	.016	-0.030	+0.011			
	31.34	6	-1.013	+0.909	+0.012	0.083	.017	0.159	.001	-0.030	+0.011			
	31.46	4	-1.014	+0.911	-0.002	0.085	.012	0.159	.005	-0.026	+0.013			
Feb.	4.33	6	-1.025	+0.922	-0.001	0.087	.013	0.195	.014	-0.033	+0.017			
	4.44	4	-1.014	+0.918	0.000	0.082	.001	0.169	.009	-0.028	+0.014			
	12.31	4	-1.036	+0.913	+0.014	0.081	.003	0.194	.024	-0.032	+0.017			
	18.28	6	-0.962	+0.910	+0.008	0.087	.003	0.173	.012	-0.031	+0.014			
	18.41	4	-0.972	+0.920	-0.010	0.089	.001	0.171	.013	-0.028	+0.011	+0.009	-0.001	
	18.52	4	-0.979	+0.920	-0.006	0.088	.016	0.143	.011	-0.036	0.000			
	19.28	6	-0.956	+0.913	+0.008	0.080	.005	0.153	.012	-0.031	+0.012			
	19.42	4	-0.974	+0.923	-0.006	0.090	.001	0.158	.004	-0.029	+0.014			
	20.27	4	-0.955	+0.907	+0.010	0.083	.015	0.143	.007	-0.030	+0.010			
	20.42	4	-0.962	+0.907	-0.005	0.088	.013	0.152	.006	-0.026	+0.014	-0.001	-0.004	
	20.51	4	-0.972	+0.910	-0.002	0.088	.009	0.150	.016	-0.032	+0.011			
	24.26	6	-0.955	+0.911	+0.006	0.082	.002	0.201	.008	-0.031	+0.015			
	24.40	4	-0.972	+0.917	+0.002	0.085	.013	0.178	.011	-0.025	+0.009	-0.001	-0.005	
	24.51	4	-0.971	+0.912	+0.003	0.081	.010	0.183	.010	-0.033	+0.015			
Mar.	6.24	4	-0.980	+0.903	0.000	0.099	.026	0.199	.001	-0.028	+0.015			
	14.52	4	-1.012	+0.925	+0.007	0.113	.020	0.193	.027	-0.034	+0.016			
	15.20	4	-0.967	+0.907	+0.001	0.087	.017	0.178	.001	-0.030	+0.013	-0.003	-0.001	
	15.34	4	-0.975	+0.916	-0.006	0.089	.007	0.182	.011	-0.030	+0.014			Clouds at end
	20.19	4	-0.926	+0.904	+0.005	0.080	.020	0.166	.001	-0.030	+0.012	0.000	-0.002	
	20.34	4	-0.947	+0.897	0.000	0.098	.014	0.164	.009	-0.027	+0.012			Clouds at end
	29.36	4	-1.029	+0.908	+0.004	0.095	.001	0.210	.007	-0.030	+0.015			
	29.48	4	-1.025	+0.902	+0.009	0.101	.002	0.190	.006	-0.030	+0.013			
	30.31	4	-1.015	+0.916	+0.004	0.092	.002	0.220	.002	-0.028	+0.007	-0.001	-0.001	
	30.48	6	-1.009	+0.908	+0.001	0.079	.005	0.206	.013	-0.031	+0.013			
Apr.	1.15	6	-0.997	+0.899	-0.010	0.098	.021	0.245	.013	-0.027	+0.021	-0.007	0.000	
	1.31	4	-1.003	+0.921	-0.004	0.088	.010	0.230	.005	-0.031	+0.006			
	14.14	4	-1.012	+0.901	+0.004	0.090	.025	0.205	.009	-0.028	+0.016			
	14.28	4	-1.027	+0.918	+0.002	0.088	.010	0.211	.006	-0.031	+0.009	+0.002	-0.001	
	14.36	4	-1.034	+0.908	+0.006	0.095	.007	0.206	.014	-0.030	+0.017			
	16.13	4	-1.005	+0.907	0.000	0.087	.016	0.195	.006	-0.030	+0.015			
	16.28	4	-1.024	+0.923	-0.005	0.090	.011	0.200	.007	-0.032	+0.011			
	19.42	4	-1.015	+0.906	0.000	0.086	.009	0.180	.016	-0.028	+0.015			
	23.24	4	-0.992	+0.913	-0.001	0.080	.002	0.192	.001	-0.028	+0.010	-0.001	0.000	
	23.41	4	-1.014	+0.906	-0.001	0.092	.003	0.199	.012	-0.029	+0.014			
	24.13	4	-0.997	+0.908	-0.004	0.064	.006	0.216	.006	-0.030	+0.013			
	24.24	4	-0.998	+0.923	-0.009	0.078	.005	0.203	.010	-0.028	+0.011			Clouds at end
	27.31	4	-1.011	+0.902	+0.007	0.093	.012	0.218	.002	-0.030	+0.017			
	27.40	4	-1.027	+0.902	+0.002	0.097	.011	0.205	.014	-0.028	+0.014			

TABLE III (cont'd)
Transformation and Extinction Coefficients
(Defined in Appendix I)

Date			Transformation Coefficients				Extinction Coefficients					Corr. to System of 10-yr. Stds.		
U.T.		n	a_1	a_2	a_0	k_1	m.e.	q_{y1}	m.e.	k_2	q_{y2}	Δ_V	Δ_{B-V}	Remarks
1965 Apr.	28.40	6	$-1^{\mathrm{m}}.015$	$+0^{\mathrm{m}}.901$	$+0^{\mathrm{m}}.002$	$0^{\mathrm{m}}.093$	$\pm\,^{\mathrm{m}}.012$	$0^{\mathrm{m}}.195$	$\pm\,^{\mathrm{m}}.014$	-0.027	+0.013			
	29.29	4	-1.027	+0.911	-0.042	0.089	.006	0.174	.016	-0.029	+0.008			
	29.41	6	-1.033	+0.902	+0.004	0.093	.002	0.181	.010	-0.029	+0.015			
	30.15	4	-0.989	+0.905	+0.011	0.087	.001	0.226	.006	-0.029	+0.008			
	30.23	4	-1.009	+0.917	-0.006	0.097	.002	0.222	.016	-0.030	+0.009			
	30.39	6	-1.017	+0.903	-0.003	0.109	.007	0.192	.005	-0.029	+0.012			
May	1.15	4	-0.993	+0.918	+0.012	0.112	.005	0.235	.009	-0.032	+0.007			
	1.22	4	-0.998	+0.925	-0.016	0.103	.010	0.244	.003	-0.029	+0.004	$+0^{\mathrm{m}}.005$	$0^{\mathrm{m}}.000$	
	1.39	6	-0.999	+0.907	-0.002	0.091	.009	0.196	.011	-0.030	+0.012			
	2.21	4	-1.005	+0.917	-0.004	0.092	.001	0.193	.008	-0.029	+0.012			Clouds at end
	5.21	4	-1.006	+0.916	+0.008	0.073	.011	0.253	.015	-0.029	+0.005	+0.007	+0.004	
	5.38	4	-1.038	+0.898	+0.001	0.098	.017	0.271	.005	-0.027	+0.010			
	6.20	4	-1.025	+0.921	+0.003	0.089	.006	0.242	.006	-0.030	+0.005			
	18.17	4	-0.978	+0.922	-0.015	0.102	.007	0.195	.009	-0.032	+0.012	+0.001	-0.004	
	18.28	4	-0.980	+0.913	-0.011	0.098	.008	0.184	.011	-0.031	+0.015			
	19.26	4	-0.997	+0.904	+0.002	0.090	.002	0.175	.010	-0.031	+0.014			
	19.34	4	-1.024	+0.916	-0.005	0.105	.021	0.182	.002	-0.026	+0.013			
	22.16	4	-0.991	+0.918	-0.014	0.096	.003	0.198	.005	-0.030	+0.010	+0.013	+0.007	
	22.33	4	-1.004	+0.910	-0.004	0.095	.003	0.198	.020	-0.029	+0.015			
	23.16	4	-0.990	+0.909	+0.004	0.083	.004	0.227	.007	-0.029	+0.007	-0.003	-0.003	
	23.33	4	-1.024	+0.900	+0.014	0.100	.008	0.219	.009	-0.029	+0.012			
	28.17	4	-1.000	+0.911	-0.004	0.092	.009	0.231	.009	-0.031	+0.007	-0.007	-0.005	
	28.31	4	-1.012	+0.905	-0.009	0.098	.002	0.201	.011	-0.030	+0.013			
	29.17	4	-1.000	+0.929	-0.022	0.086	.019	0.212	.005	-0.033	+0.009			
	29.30	4	-0.991	+0.912	-0.005	0.073	.007	0.225	.008	-0.031	+0.016			
	30.17	4	-0.988	+0.905	-0.003	0.100	.003	0.230	.010	-0.029	+0.014	-0.001	-0.004	
	30.30	4	-0.988	+0.906	-0.006	0.093	.003	0.243	.009	-0.030	+0.018			
	31.17	4	-0.996	+0.915	-0.010	0.093	.005	0.268	.002	-0.029	+0.011			
	31.28	4	-0.976	+0.904	-0.002	0.074	.001	0.300	.014	-0.032	+0.022			
Jun.	18.23	4	-0.997	+0.908	-0.003	0.080	.006	0.205	.007	-0.031	+0.014			
	20.23	4	-0.999	+0.911	+0.006	0.079	.006	0.173	.011	-0.031	+0.011			
	21.24	6	-0.979	+0.909	-0.006	0.070	.002	0.168	.016	-0.028	+0.015			
Dec.	5.46	6	-0.977	+0.915	+0.009	0.087	.001	0.143	.005	-0.031	+0.006			
1966 Jan.	4.50	4	-0.981	+0.918	-0.002	0.074	.011	0.189	.012	-0.031	+0.015			
	4.57	4	-0.991	+0.908	+0.005	0.088	.005	0.164	.005	-0.028	+0.016			
	6.48	4	-0.960	+0.902	-0.002	0.072	.010	0.175	.018	-0.030	+0.019			
	6.55	4	-0.980	+0.906	+0.015	0.076	.005	0.160	.020	-0.028	+0.019			
	7.49	4	-0.984	+0.916	-0.015	0.083	.006	0.151	.022	-0.026	+0.022			
	7.56	6	-0.976	+0.901	-0.013	0.088	.009	0.140	.013	-0.019	+0.015			
	12.38	6	-0.995	+0.922	+0.010	0.076	.010	0.148	.012	-0.034	+0.008			
	12.47	4	-0.986	+0.919	-0.012	0.082	.005	0.170	.011	-0.027	+0.018	-0.009	+0.002	Bad seeing
	12.57	4	-0.980	+0.910	0.000	0.074	.006	0.166	.006	-0.024	+0.011			
	25.31	4	-0.996	+0.914	+0.011	0.077	.005	0.183	.005	-0.030	+0.013			
	26.43	6	-0.995	+0.909	+0.016	0.082	.007	0.159	.015	-0.028	+0.018			
Feb.	3.13	6	-0.971	+0.893	+0.002	0.080	.010	0.153	.005	-0.013	+0.023	-0.002	-0.002	
	3.28	6	-0.988	+0.916	+0.008	0.075	.008	0.171	.008	-0.032	+0.011			Clouds passing
	3.43	4	-0.981	+0.904	-0.001	0.072	.005	0.164	.010	-0.027	+0.020			
	3.56	6	-0.995	+0.921	+0.013	0.074	.005	0.172	.014	-0.036	+0.021			
	22.40	4	-0.976	+0.912	-0.010	0.074	.008	0.192	.005	-0.026	+0.011			
	22.47	4	-0.967	+0.920	-0.011	0.062	.013	0.157	.005	-0.037	+0.009			Bad seeing
Mar.	4.12	4	-1.002	+0.916	+0.004	0.073	.006	0.192	.011	-0.034	+0.016			
	4.38	4	-1.008	+0.911	-0.004	0.084	.005	0.198	.007	-0.029	+0.012	-0.004	-0.006	
	4.55	4	-1.043	+0.934	-0.011	0.090	.005	0.173	.007	-0.033	+0.009			
	12.33	6	-0.980	+0.924	-0.023	0.079	.002	0.200	.007	-0.028	+0.013			
	17.48	6	-0.994	+0.911	-0.040	0.097	.004	0.224	.017	-0.035	+0.042			
	21.26	4	-0.994	+0.899	-0.014	0.102	.022	0.176	.005	-0.023	+0.012	+0.004	+0.004	
	21.37	4	-0.949	+0.934	-0.028	0.079	.006	0.194	.014	-0.034	+0.006			
	23.11	4	-0.936	+0.911	+0.004	0.074	.005	0.176	.005	-0.032	+0.010			
	23.27	4	-0.938	+0.905	-0.003	0.075	.013	0.182	.021	-0.022	+0.019	+0.006	-0.002	Bad seeing
	23.44	4	-0.949	+0.914	+0.012	0.069	.008	0.183	.005	-0.035	+0.013			
	23.51	4	-0.930	+0.912	+0.004	0.055	.017	0.173	.005	-0.028	+0.012			
	30.16	6	-0.945	+0.913	-0.024	0.094	.003	0.239	.015	-0.033	+0.028			
	30.26	4	-0.954	+0.905	-0.017	0.102	.005	0.240	.010	-0.032	+0.008	+0.005	-0.008	
	30.43	4	-0.980	+0.917	-0.018	0.104	.005	0.183	.008	-0.030	+0.013			
	30.51	6	-0.973	+0.906	-0.010	0.106	.006	0.184	.006	-0.028	+0.013			
	31.15	6	-0.936	+0.916	-0.006	0.084	.008	0.193	.006	-0.034	+0.015			
	31.32	6	-0.936	+0.906	-0.020	0.083	.002	0.186	.020	-0.025	+0.017	0.000	-0.005	
	31.50	6	-0.958	+0.905	+0.008	0.091	.001	0.185	.006	-0.027	+0.012			
Apr.	4.14	6	-0.950	+0.910	-0.010	0.094	.010	0.211	.002	-0.028	+0.016			
	4.32	6	-0.948	+0.899	+0.004	0.087	.006	0.200	.004	-0.026	+0.005	+0.004		
	4.48	4	-0.957	+0.913	-0.003	0.087	.005	0.184	.006	-0.031	+0.015			

TABLE III (cont'd)
Transformation and Extinction Coefficients
(Defined in Appendix I)

Date U.T.		n	Transformation Coefficients a_1	a_2	a_6	k_1	Extinction Coefficients m.e.	q_{y1}	m.e.	k_2	q_{y2}	Corr. to System of 10-yr. Stds. Δ_V	Δ_{B-V}	Remarks
1966														
Apr.	5.33	6	-0^m.952	+0^m.906	-0^m.001	0^m.087	± ^{m}.003	0^m.186	± ^{m}.018	-0.028	+0.017			
	5.47	4	-0.978	+0.910	+0.002	0.093	.005	0.180	.007	-0.031	+0.013			
	7.13	6	-0.910	+0.921	-0.001	0.068	.008	0.199	.011	-0.036	+0.009	+0^m.005	+0^m.002	
	7.43	6	-0.959	+0.913	-0.007	0.093	.004	0.191	.009	-0.031	+0.014			
	12.14	6	-0.946	+0.913	-0.008	0.086	.002	0.238	.005	-0.031	+0.018			
	15.27	6	-0.965	+0.912	-0.002	0.100	.004	0.162	.005	-0.029	+0.005	+0.028	-0.002	
	15.43	4	-0.952	+0.908	+0.004	0.094	.005	0.197	.005	-0.027	+0.008			
	30.14	4	-0.932	+0.911	+0.001	0.078	.005	0.210	.005	-0.029	+0.010			Clouds at end
May	2.14	4	-0.922	+0.916	-0.017	0.081	.006	0.215	.006	-0.030	+0.007			Clouds at end
	3.13	4	-0.924	+0.911	-0.017	0.082	.005	0.205	.006	-0.030	+0.013			
	3.30	6	-0.941	+0.911	-0.012	0.086	.007	0.231	.009	-0.034	+0.019	+0.004	-0.003	
	3.43	4	-0.955	+0.901	-0.019	0.111	.005	0.244	.019	-0.027	+0.028			

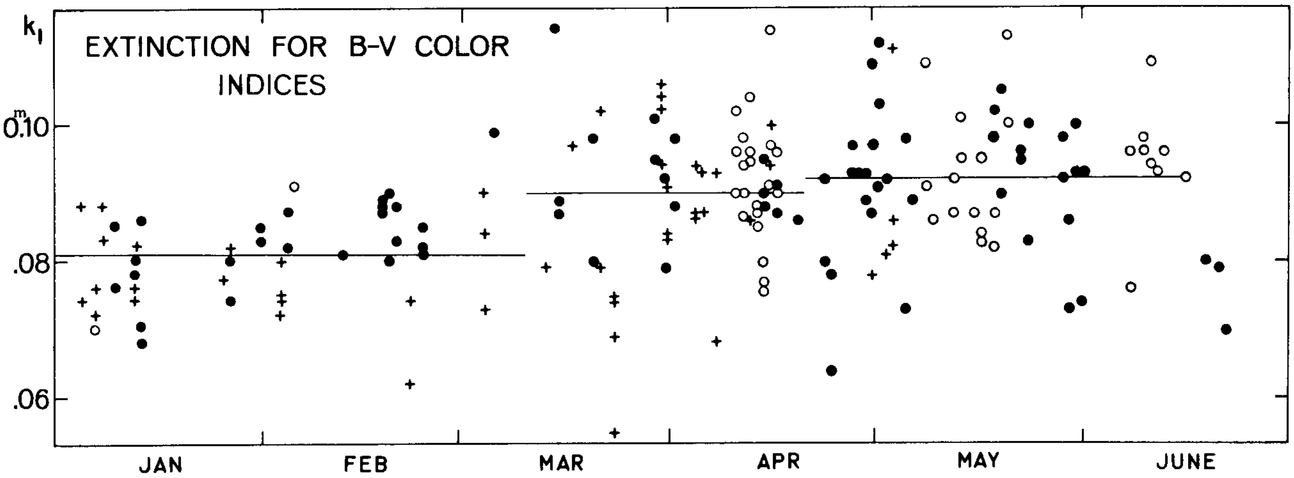

FIG. 1. The primary extinction coefficients for the B−V color k_1, plotted against date. Open circles are for the 1964 season (1P21 refrigerated), filled circles for the 1965 season (EMI 6256 S), and crosses for the 1966 season (also EMI 6256 S).

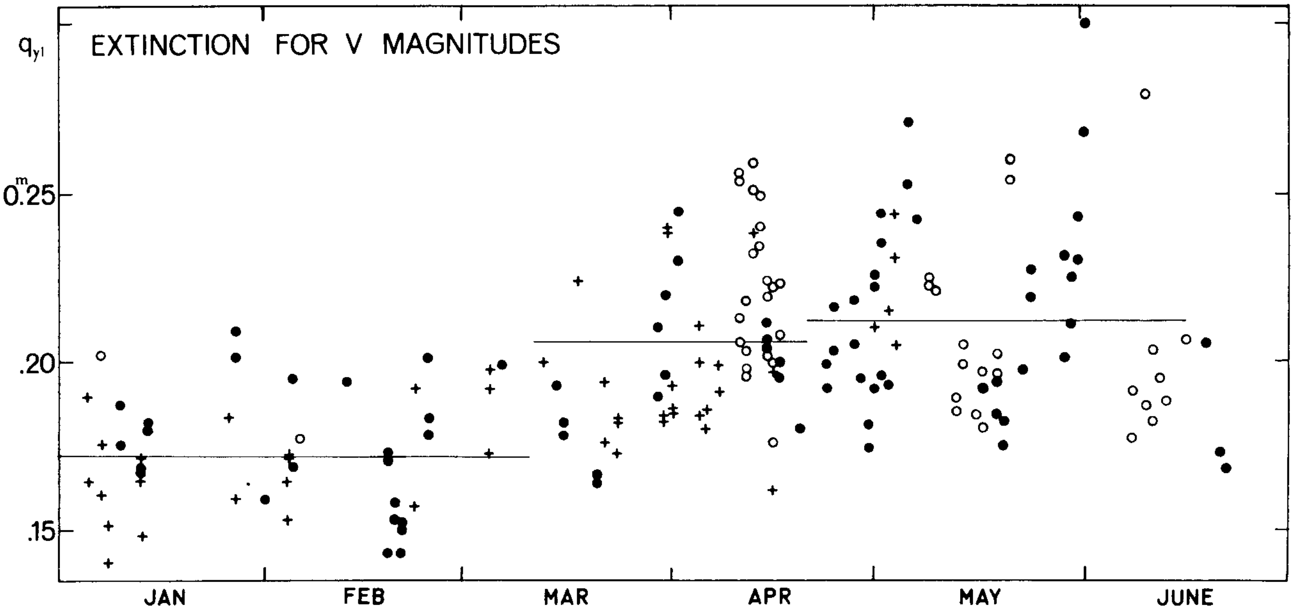

FIG. 2. The primary extinction coefficients for the V magnitudes q_{y1}, plotted against date. Symbols are the same as on Figure 1.

their variability, as well as variability of the comparison stars, the observations of comparison stars and Ten-Year Standards, listed in Table IV, are reduced to the system of Ten-Year Standards (cf. Introduction). This is achieved by adding the nightly corrections Δ_V and Δ_{B-V} to the magnitudes and colors of these stars. These corrections to the system of Ten-Year Standards, listed in columns eight and nine of Table II and in columns ten and eleven of Table III, are the differences between the mean colors and magnitudes of the Ten-Year Standards observed on this night and the mean colors and magnitudes taken from Table VI of Paper II for the same stars. (The mean values listed in Table V were not used for that purpose.) The corrections were computed only for the nights when at least eight Ten-Year Standards were observed. The values obtained for the Ten-Year Standard star ξ Bootis during the year 1964 were not taken into account when forming averages because at that time the brightness of this star was deviating by about 0.03 mag. from its mean value (cf. Figure 4 and Argue 13). There is no indication of variability of this star in other seasons; it was always observed

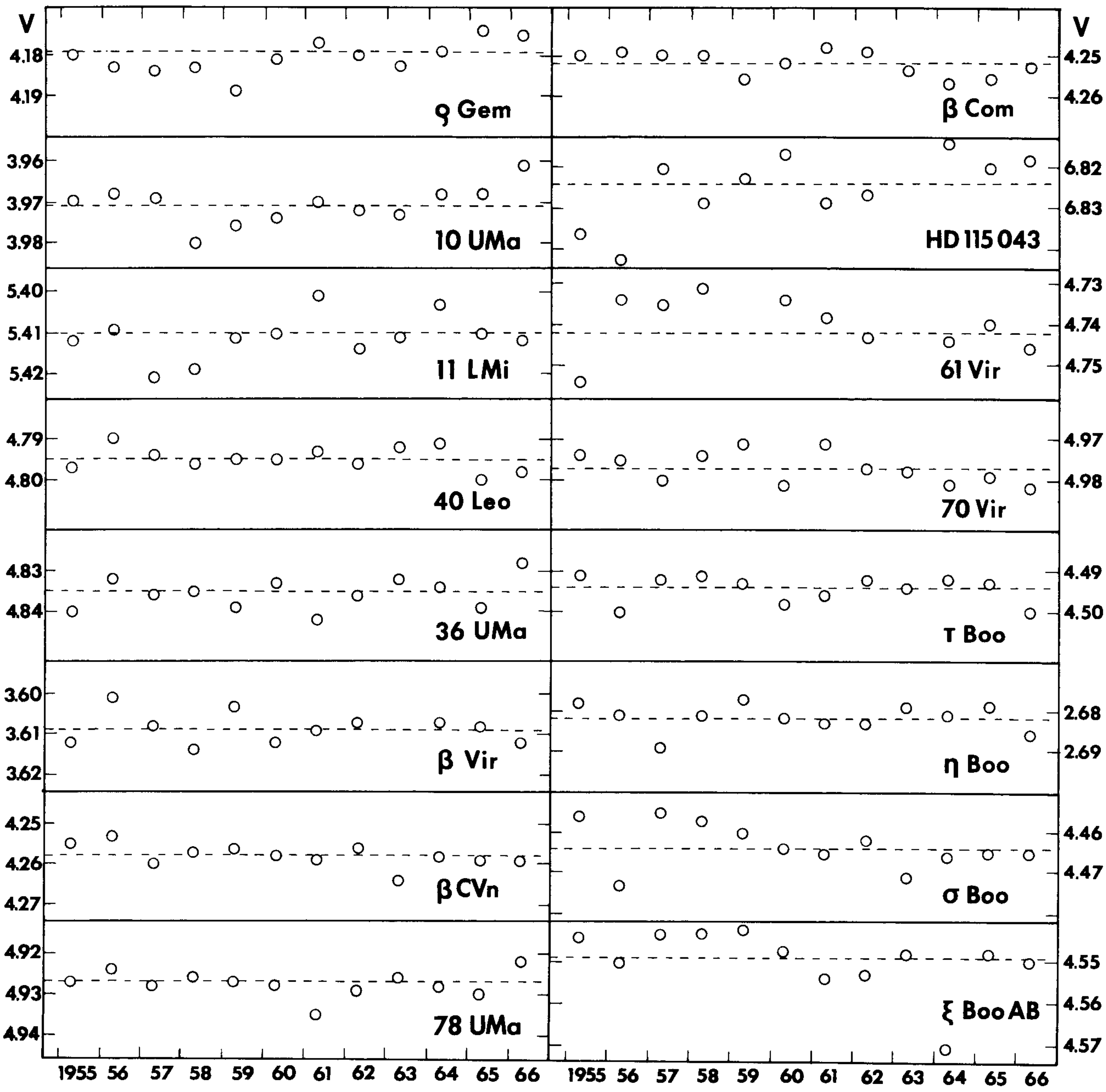

FIG. 3. The yearly mean yellow magnitudes of the Ten-Year Standard stars.

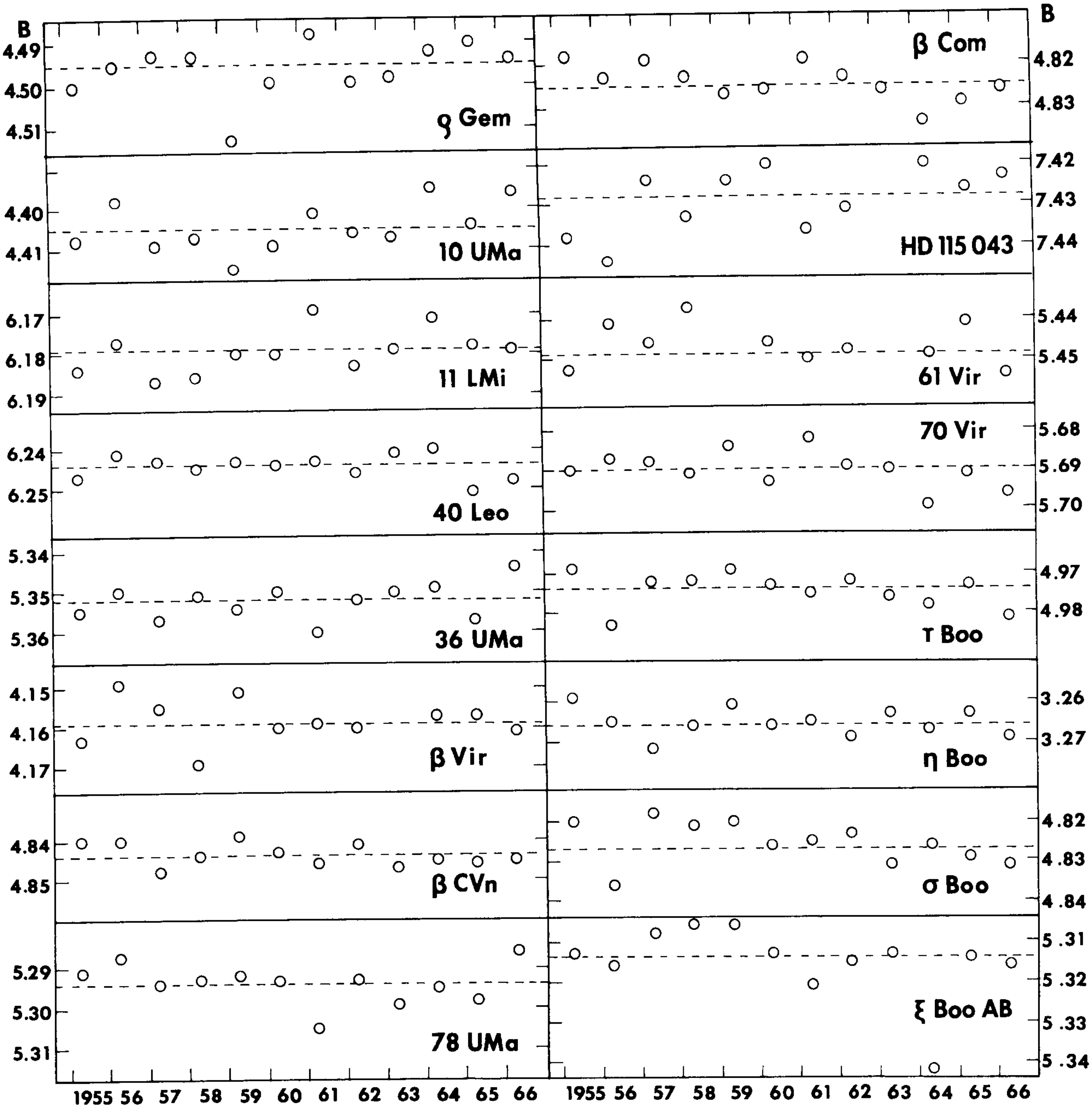

FIG. 4. The yearly mean blue magnitudes of the Ten-Year Standard stars.

together with its fainter red companion.

The weights listed in Table IV were computed in the same way as described in Paper II. The yearly weighted mean values of magnitudes and colors of the Ten-Year Standards expressed in the system of Ten-Year Standards are listed in Table IV and plotted in Figures 3 and 4. These figures indicate that for none of these stars except ξ Bootis does the standard deviation of yearly mean magnitude from the final mean value exceed ±0.008 mag. For the stars 40 Leo, β CVn, and η Boo such standard deviation does not exceed ±0.004 mag. over an interval of twelve years. The comparison stars do not indicate variability which cannot be accounted for by the observational errors.

The weighted mean values of magnitudes and colors of standard and comparison stars are given in Table V. The observations listed in Table IV and in Paper II were included in these mean values with proper weights. The number of nights on which each star was observed together with the Ten-Year Standards is given in column six of Table V. The MK classifications were taken from the Jaschek, Conde, and de Sierra catalog (11). The

TABLE IV
Observations of Comparison Stars and Ten-Year Standards

HD 41116

DATE	V	B-V	Wt.
1966 Mar. 4	$4\overset{m}{.}174$	$+0\overset{m}{.}828$	5
23	4.185	.820	4
31	4.182	.825	2
Apr. 4	4.191	.825	2
7	4.192	.819	2
30	4.185*	.844	1
May 3	4.179	.831	1
Mean	4.182	+0.828	16

HD 42087

DATE	V	B-V	Wt.
1966 Mar. 4	$5\overset{m}{.}740$	$+0\overset{m}{.}217$	5
23	5.756	.214	4
30	5.749	.209	3
31	5.748	.207	2
Apr. 4	5.763	.218	2
7	5.770	.228	2
30	5.776*	.223	1
May 3	5.757	.223	1
Mean	5.752	+0.216	19

HD 43261

DATE	V	B-V	Wt.
1966 Mar. 4	$6\overset{m}{.}081$	$+0\overset{m}{.}894$	5
23	6.092	.891	4
31	6.095	.884	3
Apr. 4	6.100	.893	3
7	6.095	.895	3
12	6.091*	.893	2
30	6.099*	.897	1
May 3	6.085	.895	2
Mean	6.091	+0.892	20

HD 47415

DATE	V	B-V	Wt.
1966 Mar. 4	$6\overset{m}{.}428$	$+0\overset{m}{.}516$	5
23	6.439	.517	4
31	6.437	.529	3
Apr. 4	6.442	.522	3
7	6.438	.514	3
12	6.439*	.517	3
30	6.453*	.514	1
May 3	6.431	.530	1
Mean	6.436	+0.520	19

HD 50692

DATE	V	B-V	Wt.
1966 Jan. 12	$5\overset{m}{.}753$	$+0\overset{m}{.}585$	3
Mar. 4	5.756	.586	5
23	5.766	.571	4
31	5.761	.573	4
Apr. 4	5.769	.576	5
7	5.764	.577	5
12	5.764*	.580	4
May 2	5.770*	.579	3
3	5.764	.573	2
Mean	5.762	+0.578	28

HD 55052

DATE	V	B-V	Wt.
1962 Jan. 31	$5\overset{m}{.}854$	$+0\overset{m}{.}376$	3
Feb. 2	5.876	.367	4
Mar. 4	5.857	.372	4
26	5.857	.381	4
Nov. 27	5.853*	.364	3
Dec. 4	5.861*	.384	3
5	5.855*	.386	3
6	5.856*	.374	3
1963 Jan. 17	5.870	.364	3
23	5.869	.369	3
Feb. 16	5.882*	.379	3
21	5.857	.373	3
1966 Jan. 12	5.843	.379	3
Feb. 3	5.877	.381	4
Mar. 4	5.847	.376	5
23	5.860	.368	5
31	5.857	.366	4
Apr. 30	5.874*	.372	2
Mean	5.860	+0.373	45

HD 58551

DATE	V	B-V	Wt.
1962 Jan. 31	$6\overset{m}{.}551$	$+0\overset{m}{.}458$	3
Feb. 2	6.557	.461	4
Mar. 4	6.545	.461	4
14	6.558	.444	3
26	6.544	.460	4
Nov. 27	6.533*	.455	3
Dec. 4	6.545*	.454	3
5	6.551*	.459	3
6	6.544*	.456	3
1963 Jan. 17	6.557	.455	3
23	6.552	.456	3
Feb. 16	6.573*	.469	3
21	6.540	.457	3
1966 Feb. 3	6.531	.474	3

HD 58551 (cont'd)

DATE	V	B-V	Wt.
1966 Mar. 4	$6\overset{m}{.}529$	$+0\overset{m}{.}475$	5
23	6.549	.442	4
Apr. 4	6.541	.477	3
7	6.542	.462	3
12	6.541*	.465	3
Mean	6.546	+0.460	45

HD 58899

DATE	V	B-V	Wt.
1962 Jan. 31	$7\overset{m}{.}165$	$+0\overset{m}{.}928$	3
Feb. 2	7.165	.933	4
Mar. 4	7.161	.927	4
14	7.156	.936	3
26	7.161	.921	4
Dec. 4	7.158*	.924	3
5	7.176*	.915	3
1963 Jan. 17	7.173	.921	3
23	7.172	.918	3
Feb. 21	7.169	.907	3
1966 Feb. 3	7.154	.933	3
Mar. 4	7.146	.926	5
23	7.158	.907	4
Apr. 4	7.156	.929	3
7	7.163	.912	3
12	7.161*	.915	3
Mean	7.161	+0.923	45

HD 58946

DATE	V	B-V	Wt.
1961 Dec. 21	$4\overset{m}{.}177$*	$+0\overset{m}{.}304$	5
23	4.174*	.311	5
1962 Jan. 15	4.172*	.329	4
31	4.181	.315	3
Feb. 2	4.182	.317	5
28	4.184*	.314	4
Mar. 1	4.176*	.310	4
4	4.177	.320	4
26	4.176	.327	4
31	4.179	.323	4
Apr. 5	4.174*	.322	4
11	4.180	.313	4
22	4.186	.316	3
May 1	4.181	.323	3
Mean	4.180	+0.319	30
1963 Jan. 17	4.190	.318	3
21	4.192	.319	3
23	4.186	.317	3
Feb. 21	4.167	.311	3
Mar. 20	4.183	.301	2
May 3	4.175	.319	2
Mean	4.183	+0.315	16
1964 Apr. 11	4.176	.312	3
13	4.178	.311	3
14	4.179	.311	4
15	4.183	.305	3
16	4.181	.324	4
Mean	4.179	+0.313	17
1965 Jan. 13	4.177	.314	5
Feb. 20	4.168	.318	4
24	4.185	.315	4
Mar. 15	4.168	.317	4
20	4.172	.320	4
Apr. 1	4.181	.317	3
14	4.158	.317	4
16	4.174	.307	4
24	4.186	.322	3
Mean	4.174	+0.316	35
1966 Jan. 12	4.166	.324	4
Feb. 3	4.177	.321	5
Mar. 4	4.166	.331	5
21	4.165	.324	3
23	4.173	.314	5
30	4.183	.313	5
31	4.171	.310	5
Apr. 4	4.183	.319	5
7	4.185	.317	5
12	4.175*	.320	4
May 3	4.167	.314	2
Mean	4.175	+0.319	44

HD 60914

DATE	V	B-V	Wt.
1962 Jan. 31	$6\overset{m}{.}981$	$+1\overset{m}{.}049$	3
Feb. 2	6.973	1.050	4
Mar. 4	6.977	1.043	4
14	6.964	1.051	3
26	6.963	1.054	4
Nov. 27	6.953*	1.047	3
Dec. 4	6.967*	1.052	3
6	6.969*	1.044	3
1963 Jan. 17	6.978	1.042	3
23	6.980	1.045	3
Feb. 21	6.968	1.049	3
1966 Feb. 3	6.958	1.052	3
Mar. 4	6.964	1.045	5
23	6.976	1.037	5
Apr. 4	6.973	1.037	4
7	6.971	1.037	3
12	6.974*	1.034	3
Mean	6.971	+1.045	47

TABLE IV (cont'd)
Observations of Comparison Stars and Ten-Year Standards

HD 61997

DATE	V	B-V	Wt.
1962 Jan. 31	$7\overset{m}{.}127$	$+0\overset{m}{.}414$	3
Feb. 2	7.136	.419	4
Mar. 4	7.129	.411	4
14	7.125	.412	3
26	7.121	.418	4
Nov. 27	7.124*	.412	3
Dec. 4	7.124*	.417	3
6	7.122*	.425	3
1963 Jan. 17	7.135	.416	3
23	7.137	.416	3
Feb. 21	7.121	.416	3
1966 Feb. 3	7.126	.425	3
Mar. 4	7.129	.416	5
23	7.134	.405	5
Apr. 4	7.143	.401	4
7	7.135	.405	3
12	7.132*	.413	3
Mean	7.131	+0.413	47

HD 62720

DATE	V	B-V	Wt.
1962 Mar. 1	$7\overset{m}{.}394$*	$+0\overset{m}{.}368$	4
4	7.412	.383	4
26	7.401	.387	4
May 1	7.416	.366	2
Dec. 4	7.401*	.384	3
6	7.404*	.384	3
1963 Jan. 17	7.410	.384	3
23	7.415	.388	3
Feb. 21	7.400	.393	3
1966 Feb. 3	7.403	.387	3
Mar. 23	7.416	.366	4
30	7.414	.389	4
Apr. 4	7.406	.395	3
12	7.412*	.373	3
Mean	7.409	+0.384	33

HD 63772

DATE	V	B-V	Wt.
1962 Mar. 1	$8\overset{m}{.}957$*	$+0\overset{m}{.}354$	5
4	8.955	.356	4
26	8.947	.353	4
May 1	8.957	.338	2
Dec. 4	8.941*	.348	3
6	8.951*	.346	3
1963 Jan. 17	8.965	.338	3
23	8.953	.351	3
Apr. 12	8.925*	.363	3
1966 Feb. 3	8.943	.347	4
Mar. 23	8.963	.326	4
30	8.962	.345	4
Apr. 4	8.951	.344	3
12	8.952*	.345	3
Mean	8.955	+0.345	31

HD 67228

DATE	V	B-V	Wt.
1962 Mar. 4	$5\overset{m}{.}310$	$+0\overset{m}{.}632$	4
14	5.307	.638	3
26	5.304	.630	4
May 1	5.311	.626	2
Dec. 6	5.298*	.637	3
1963 Jan. 17	5.305	.636	3
23	5.312	.630	3
Feb. 21	5.294	.638	3
1966 Feb. 3	5.304	.641	3
Mar. 23	5.306	.615	5
30	5.315	.627	4
Apr. 4	5.304	.639	3
12	5.302*	.630	3
Mean	5.307	+0.631	37

HD 68255-7

DATE	V	B-V	Wt.
1962 Mar. 4	$4\overset{m}{.}673$	$+0\overset{m}{.}533$	4
14	4.672	.532	3
26	4.667	.531	4
May 1	4.674	.528	2
1963 Jan. 17	4.678	.533	3
Feb. 21	4.669	.532	3
1966 Feb. 3	4.675	.531	4
Mar. 23	4.679	.514	4
Apr. 4	4.666	.544	3
12	4.671*	.542	3
Mean	4.673	+0.530	30

HD 72779

DATE	V	B-V	Wt.
1962 Mar. 4	$6\overset{m}{.}585$	$+0\overset{m}{.}680$	4
14	6.583	.682	3
26	6.584	.686	4
Apr. 12	6.590	.677	3
Dec. 6	6.587*	.671	3
7	6.597*	.657	3
1963 Jan. 17	6.585	.673	3
23	6.589	.671	3
Feb. 21	6.581	.679	3
1966 Jan. 12	6.570	.678	4
Feb. 3	6.593	.689	4
Apr. 4	6.582	.692	3
Mean	6.584	+0.681	34

HD 73665

DATE	V	B-V	Wt.
1962 Mar. 4	$6\overset{m}{.}390$	$+0\overset{m}{.}982$	4
26	6.387	.985	4
Apr. 12	6.399	.976	3
Dec. 10	6.405*	.958	3
1963 Jan. 17	6.403	.975	3
21	6.393	.981	3
23	6.401	.983	3
Feb. 21	6.394	.981	3
Mar. 15	6.415*	.961	3
20	6.393	.982	3
May 3	6.394	.980	3
1966 Jan. 12	6.382	.979	5
Feb. 3	6.408	.979	4
Mean	6.394	+0.980	38

HD 75470

DATE	V	B-V	Wt.
1962 Mar. 4	$6\overset{m}{.}721$	$+0\overset{m}{.}870$	4
14	6.720	.866	3
26	6.715	.867	4
Apr. 12	6.721	.862	3
Dec. 6	6.713*	.872	3
1963 Jan. 17	6.728	.858	3
23	6.723	.864	3
Feb. 21	6.722	.856	3
1966 Feb. 3	6.734	.861	4
Mar. 23	6.725	.857	5
31	6.727	.854	4
Mean	6.724	+0.861	36

HD 75974

DATE	V	B-V	Wt.
1962 Mar. 4	$6\overset{m}{.}676$	$+0\overset{m}{.}710$	4
14	6.679	.713	3
26	6.680	.699	4
Apr. 12	6.681	.696	3
Dec. 6	6.679*	.706	3
1963 Jan. 17	6.687	.700	3
23	6.678	.705	3
Feb. 21	6.677	.705	3
1966 Jan. 12	6.669	.697	5
Mar. 23	6.681	.705	5
31	6.686	.693	4
Mean	6.679	+0.702	37

HD 76943

DATE	V	B-V	Wt.
1962 Jan. 31	$3\overset{m}{.}961$	$+0\overset{m}{.}431$	4
Feb. 2	3.973	.436	4
28	3.971*	.429	5
Mar. 1	3.970*	.423	4
4	3.979	.434	4
9	3.970	.437	1
14	3.966	.438	3
26	3.969	.434	4
31	3.963	.450	3
Apr. 11	3.981	.424	5
12	3.976	.432	3
22	3.975	.430	4
May 1	3.966	.434	3
Mean	3.972	+0.434	38
1963 Jan. 7	3.970	.431	3
9	3.978	.439	3
15	3.992	.420	3
17	3.960	.445	3
21	3.974	.434	3
23	3.979	.432	3
28	3.974	.441	3
Feb. 21	3.980	.435	3
Mar. 20	3.969	.424	1
Apr. 29	3.947	.449	3
May 1	3.967	.429	3
3	3.976	.432	3
12	3.976	.426	3
13	3.966	.436	3
16	3.964	.428	3
Mean	3.973	+0.434	43
1964 Apr. 11	3.964	.432	4
13	3.965	.423	4
14	3.972	.421	5
15	3.965	.425	4
16	3.972	.432	5
Mean	3.968	+0.427	22
1965 Jan. 13	3.968	.432	5
Feb. 20	3.964	.435	5
24	3.976	.431	5
Mar. 15	3.959	.440	5
20	3.966	.436	5
Apr. 1	3.977	.436	4
14	3.966	.439	5
16	3.955	.441	5
24	3.980	.429	5
Mean	3.968	+0.436	44
1966 Jan. 12	3.949	.442	5
Feb. 3	3.974	.437	5
Mar. 4	3.972	.441	5
21	3.949	.447	4
23	3.960	.426	5
30	3.962	.434	5
31	3.954	.431	5
Apr. 4	3.962	.439	5
7	3.963	.427	5
12	3.955*	.433	5
May 3	3.964	.431	4
Mean	3.961	+0.435	43

TABLE IV (cont'd)
Observations of Comparison Stars and Ten-Year Standards

HD 79096

DATE	V	B-V	Wt.
1962 Mar. 4	6.^{m}503	+0.^{m}732	4
14	6.507	.735	3
26	6.499	.731	4
Apr. 12	6.498	.737	3
Dec. 6	6.499*	.732	3
1963 Jan. 17	6.511	.732	3
23	6.507	.737	3
Feb. 21	6.496	.735	3
Apr. 12	6.476*	.736	3
1966 Mar. 23	6.501	.732	4
31	6.506	.725	4
Mean	6.503	+0.732	31

HD 79499

DATE	V	B-V	Wt.
1962 Mar. 4	8.^{m}317	+0.^{m}443	4
14	8.318	.438	3
26	8.319	.436	4
Apr. 12	8.307	.450	3
Dec. 6	8.304*	.443	3
1963 Jan. 17	8.304	.450	3
23	8.306	.448	3
Feb. 21	8.302	.445	3
Apr. 12	8.264*	.444	3
1966 Feb. 3	8.321	.443	4
Mar. 23	8.306	.448	4
31	8.317	.442	4
Mean	8.313	+0.444	35

HD 61563

DATE	V	B-V	Wt.
1962 Mar. 4	8.^{m}279	+0.^{m}474	4
14	8.290	.473	3
26	8.284	.467	5
Apr. 12	8.284	.473	3
Dec. 6	8.278*	.477	3
1963 Jan. 17	8.284	.480	3
23	8.274	.482	3
Feb. 21	8.271	.485	3
Apr. 12	8.248*	.485	3
1966 Feb. 3	8.288	.491	4
Mar. 4	8.281	.473	4
23	8.286	.479	4
31	8.286	.471	4
Mean	8.283	+0.477	40

HD 82140

DATE	V	B-V	Wt.
1962 Mar. 4	8.^{m}375	+0.^{m}619	4
14	8.380	.634	3
26	8.375	.625	4
Apr. 12	8.383	.632	3
Dec. 6	8.378*	.634	3
1963 Jan. 17	8.386	.622	3
23	8.379	.629	3
Feb. 21	8.376	.627	3
Apr. 12	8.351*	.640	3
1966 Feb. 3	8.391	.630	4
Mar. 4	8.379	.631	4
23	8.384	.632	4
31	8.387	.623	4
Mean	8.381	+0.627	39

HD 82885

DATE	V	B-V	Wt.
1962 Jan. 31	5.^{m}415	+0.^{m}760	4
Feb. 2	5.418	.769	4
28	5.417*	.767	4
Mar. 1	5.410*	.759	4
4	5.407	.776	4
9	5.410	.772	2
14	5.413	.780	3
26	5.418	.766	4
31	5.406	.772	3
Apr. 11	5.422	.768	5
12	5.408	.772	3
22	5.418	.764	4
May 1	5.412	.766	3
Mean	5.414	+0.769	39
Dec. 30	5.410	.769	3
1963 Jan. 9	5.413	.777	3
15	5.414	.764	3
17	5.413	.770	3
21	5.417	.769	3
23	5.422	.767	3
28	5.412	.771	3
Feb. 21	5.418	.772	3
Mar. 20	5.400	.766	1
Apr. 24	5.410	.758	3
29	5.400	.757	3
May 1	5.409	.766	3
3	5.407	.769	3
12	5.399	.765	3
13	5.412	.774	3
16	5.412	.767	3
Mean	5.411	+0.768	46
1964 Apr. 11	5.405	.757	4
13	5.399	.759	4
14	5.402	.773	5
15	5.408	.766	4

HD 82885 (cont'd)

DATE	V	B-V	Wt.
1964 Apr. 16	5.^{m}402	+0.^{m}779	5
Mean	5.403	+0.768	22
1965 Jan. 13	5.397	.770	4
Feb. 20	5.417	.756	5
24	5.422	.761	5
Mar. 15	5.416	.768	5
20	5.410	.769	5
Apr. 1	5.416	.782	4
14	5.401	.770	5
16	5.397	.768	5
24	5.409	.767	5
Mean	5.410	+0.768	43
1966 Jan. 12	5.408	.769	5
Feb. 3	5.426	.764	5
Mar. 4	5.415	.766	5
21	5.403	.772	2
23	5.417	.762	5
30	5.418	.776	5
31	5.393	.770	5
Apr. 4	5.408	.770	5
7	5.411	.756	5
12	5.418*	.764	4
May 3	5.417	.766	3
Mean	5.412	+0.767	45

HD 63509

DATE	V	B-V	Wt.
1962 Jan. 31	7.^{m}024	+0.^{m}475	3
Feb. 2	7.035	.481	4
Mar. 4	7.035	.487	4
14	7.046	.470	3
26	7.029	.476	4
Dec. 5	7.035*	.466	3
6	7.029*	.480	3
1963 Jan. 17	7.041	.463	3
23	7.031	.489	3
Feb. 21	7.030	.467	3
Apr. 12	7.008*	.477	3
1964 Apr. 11	7.037	.462	3
13	7.037	.469	3
14	7.029	.472	4
15	7.017	.474	3
16	7.015	.486	4
1965 Jan. 13	7.034	.467	3
Feb. 18	7.045	.471	3
19	7.031*	.478	4
20	7.035	.470	4
24	7.036	.467	4
Mar. 20	7.033	.484	4
Apr. 1	7.035	.482	4
14	7.037	.472	4
16	7.029	.476	4
1966 Mar. 4	7.029	.473	4
Mean	7.033	+0.475	76

HD 83683

DATE	V	B-V	Wt.
1962 Jan. 31	6.^{m}958	+0.^{m}476	3
Feb. 2	6.964	.479	4
Mar. 4	6.971	.468	4
14	6.968	.473	3
26	6.964	.473	4
Dec. 6	6.958*	.480	3
1963 Jan. 17	6.967	.474	3
23	6.967	.474	3
Feb. 21	6.959	.483	3
Apr. 12	6.940*	.478	3
1964 Apr. 11	6.951	.469	3
13	6.959	.484	3
14	6.965	.474	4
15	6.942	.471	3
16	6.946	.471	4
1965 Jan. 13	6.957	.474	3
Feb. 18	6.972	.476	3
19	6.963*	.478	4
20	6.967	.469	4
24	6.967	.475	4
Mar. 20	6.967	.482	4
Apr. 1	6.964	.483	4
14	6.963	.481	4
16	6.962	.477	4
1966 Mar. 4	6.968	.470	4
Mean	6.962	+0.475	78

HD 86898

DATE	V	B-V	Wt.
1962 Jan. 31	7.^{m}806	+1.^{m}029	3
Feb. 2	7.799	1.037	4
28	7.794*	1.044	4
Mar. 4	7.790	1.035	4
9	7.808	1.042	1
14	7.810	1.037	3
15	7.790	1.042	3
26	7.797	1.035	4
31	7.799	1.038	4
Apr. 5	7.791*	1.027	4
11	7.808	1.035	4
12	7.807	1.028	3
22	7.797	1.031	4
Dec. 6	7.792*	1.036	3
1963 Jan. 17	7.803	1.036	3
23	7.791	1.042	3

TABLE IV (cont'd)
Observations of Comparison Stars and Ten-Year Standards

HD86898 (cont'd)

DATE	V	B-V	Wt.
1963 Feb. 21	7.^{m}796	+1.^{m}033	3
Apr. 12	7.774*	1.045	3
May 13	7.801	1.037	3
1964 Apr. 11	7.793	1.028	3
13	7.796	1.034	3
14	7.794	1.033	4
15	7.778	1.040	3
16	7.785	1.037	4
1965 Jan. 13	7.795	1.029	3
Feb. 18	7.812	1.037	3
19	7.816*	1.031	4
20	7.798	1.033	4
24	7.805	1.028	4
Mar. 20	7.813	1.035	4
Apr. 1	7.807	1.026	4
14	7.803	1.031	4
16	7.799	1.026	4
1966 Mar. 4	7.814	1.036	4
Mean	7.800	+1.034	100

HD 87176

DATE	V	B-V	Wt.
1962 Jan. 31	8.^{m}088	+0.^{m}536	3
Feb. 2	8.086	.542	4
28	8.096*	.530	4
Mar. 4	8.086	.537	4
14	8.090	.538	3
15	8.086	.540	3
26	8.088	.530	4
31	8.098	.546	4
Apr. 5	8.077*	.543	4
11	8.092	.529	4
12	8.085	.540	3
22	8.088	.538	4
Dec. 6	8.080*	.541	3
1963 Jan. 17	8.088	.531	3
23	8.083	.535	3
Feb. 16	8.100*	.541	3
21	8.080	.545	3
Apr. 12	8.059*	.542	3
1964 Apr. 11	8.075	.546	3
13	8.080	.548	3
14	8.086	.541	4
16	8.083	.552	4
1965 Jan. 13	8.074	.547	3
Feb. 18	8.099	.543	3
19	8.086*	.552	4
20	8.085	.545	4
24	8.101	.532	4
Mar. 20	8.089	.545	4
Apr. 1	8.096	.552	4
14	8.072	.550	4
16	8.083	.539	4
1966 Mar. 4	8.097	.551	4
Mean	8.087	+0.542	93

HD 89449

DATE	V	B-V	Wt.
1962 Jan. 31	4.^{m}786	+0.^{m}448	3
Feb. 2	4.795	.447	3
28	4.804*	.443	4
Mar. 1	4.795*	.452	3
4	4.800	.455	4
9	4.793	.453	2
14	4.794	.457	3
15	4.800	.438	3
26	4.793	.453	4
31	4.792	.460	4
Apr. 11	4.803	.439	4
12	4.792	.458	3
22	4.800	.448	4
May 1	4.798	.445	4
Jun. 7	4.801	.448	1
Mean	4.796	+0.450	42
1962 Dec. 30	4.800	.451	3
1963 Jan. 7	4.799	.449	3
9	4.794	.461	3
15	4.795	.445	3
17	4.793	.442	3
21	4.789	.451	3
23	4.795	.448	3
25	4.797	.448	3
28	4.799	.443	3
Feb. 21	4.774	.446	3
Mar. 7	4.796	.457	3
20	4.779	.450	1
Apr. 24	4.781	.452	3
29	4.786	.445	3
May 1	4.803	.443	3
3	4.798	.447	3
12	4.782	.448	3
13	4.790	.450	3
16	4.793	.455	3
Mean	4.792	+0.449	55
1964 Apr. 11	4.775	.452	4
13	4.800	.455	4
14	4.796	.445	5
15	4.773	.449	4
16	4.808	.445	5
Mean	4.791	+0.449	22
1965 Jan. 13	4.788	.450	4
Feb. 20	4.800	.450	5
24	4.804	.445	5
Mar. 20	4.805	.450	5

HD 89449 (cont'd)

DATE	V	B-V	Wt.
1965 Apr. 1	4.^{m}813	+0.^{m}450	4
14	4.796	.452	5
16	4.79[illegible]	.455	5
24	4.803	.454	5
Mean	4.800	+0.451	36
1966 Jan. 12	4.793	.455	5
Feb. 3	4.793	.445	4
Mar. 4	4.805	.452	4
21	4.792	.452	2
23	4.796	.453	5
30	4.815	.446	5
31	4.794	.447	4
Apr. 4	4.792	.452	4
7	4.791	.448	5
12	4.797*	.446	4
15	4.799	.449	3
May 3	4.799	.444	3
Mean	4.795	+0.450	44

HD 89762

DATE	V	B-V	Wt.
1962 Mar. 26	7.^{m}773	+0.^{m}443	4
31	7.761	.441	4
Apr. 12	7.762	.447	3
24	7.771*	.442	3
May 1	7.776	.445	3
26	7.765*	.459	4
Jun. 7	7.779	.450	1
Nov. 27	7.752*	.449	3
Dec. 4	7.765*	.450	3
5	7.777*	.432	3
6	7.764*	.450	3
7	7.779*	.425	3
10	7.786*	.413	3
21	7.753*	.469	3
22	7.769*	.465	3
30	7.773	.451	3
1963 Jan. 7	7.778	.448	3
9	7.775	.441	3
15	7.762	.462	3
17	7.760	.452	3
21	7.765	.452	3
23	7.770	.455	3
25	7.774	.441	3
26	7.766	.442	3
Feb. 3	7.765*	.457	4
6	7.765*	.442	4
16	7.784*	.454	3
21	7.764	.455	3
Mar. 7	7.764	.450	3
15	7.779*	.440	3
20	7.779	.443	3
Apr. 12	7.748*	.462	3
24	7.762	.452	3
29	7.764	.450	3
May 1	7.772	.459	3
3	7.774	.443	3
12	7.769	.443	3
13	7.771	.448	3
16	7.773	.441	3
1964 Apr. 11	7.779	.439	3
13	7.774	.452	3
14	7.775	.442	4
15	7.776	.446	3
16	7.776	.453	4
1965 Jan. 13	7.764	.455	3
Feb. 18	7.783	.445	3
19	7.779*	.453	4
20	7.772	.451	4
24	7.785	.451	4
Mar. 20	7.782	.451	4
Apr. 1	7.769	.448	4
14	7.753	.445	4
1966 Mar. 4	7.764	.460	4
Mean	7.771	+0.449	119

HD 90512

DATE	V	B-V	Wt.
1962 Mar. 26	6.^{m}654	+0.^{m}858	4
31	6.653	.859	4
Apr. 12	6.639	.859	3
24	6.642*	.861	3
May 1	6.641	.862	3
26	6.633*	.882	3
Jun. 7	6.659	.865	1
Nov. 27	6.633*	.854	3
Dec. 4	6.646*	.858	3
5	6.650*	.850	3
7	6.664*	.838	3
10	6.660*	.832	3
22	6.640*	.868	3
30	6.653	.852	3
1963 Jan. 7	6.659	.850	3
9	6.652	.854	3
15	6.644	.853	3
17	6.634	.864	3
21	6.641	.857	3
23	6.649	.857	3
25	6.649	.857	3
28	6.642	.856	3
Feb. 3	6.648*	.864	4
6	6.645*	.851	4
16	6.670*	.867	3
21	6.647	.861	3

TABLE IV (cont'd)
Observations of Comparison Stars and Ten-Year Standards

HD 90512 (cont'd)

DATE			V	B-V	Wt.
1963	Mar.	7	$6\overset{m}{.}645$	$+0\overset{m}{.}857$	3
		15	6.655*	.847	3
		20	6.658	.856	3
	Apr.	12	6.619*	.874	3
		24	6.643	.859	3
	May	1	6.652	.862	3
		3	6.651	.861	3
		12	6.649	.858	3
		13	6.647	.862	3
		16	6.644	.854	3
1964	Apr.	11	6.661	.855	3
		13	6.654	.859	3
		14	6.651	.857	4
		15	6.648	.864	3
		16	6.642	.857	4
1965	Jan.	13	6.637	.867	3
	Feb.	18	6.667	.862	3
		19	6.678*	.852	4
		20	6.650	.862	4
		24	6.656	.857	4
	Mar.	20	6.674	.873	4
	Apr.	1	6.656	.866	4
		14	6.637	.859	4
1966	Mar.	4	6.648	.858	4
		Mean	6.650	+0.859	116

HD 90839

DATE			V	B-V	Wt.
1962	Jan.	31	$4\overset{m}{.}841$	$+0\overset{m}{.}525$	3
	Feb.	2	4.830	.515	4
	Mar.	4	4.830	.521	4
		9	4.832	.516	2
		14	4.826	.518	3
		15	4.832	.511	3
		26	4.832	.512	4
		31	4.829	.520	4
	Apr.	11	4.835	.517	4
	May	1	4.840	.514	4
	Jun.	7	4.842	.516	2
		9	4.842	.514	3
		12	4.858	.511	3
		19	4.842	.515	2
		Mean	4.836	+0.516	45
1962	Dec.	30	4.839	.517	3
1963	Jan.	9	4.840	.515	3
		15	4.826	.529	3
		17	4.838	.523	3
		21	4.830	.518	3
		23	4.833	.520	3
		25	4.838	.532	3
		28	4.837	.514	3
	Feb.	21	4.818	.510	3
	Mar.	7	4.833	.521	3
		20	4.827	.518	2
	Apr.	4	4.833	.514	3
		24	4.825	.523	3
		29	4.833	.517	3
	May	1	4.833	.522	3
		3	4.836	.514	3
		12	4.830	.507	3
		13	4.831	.516	3
		16	4.828	.515	3
		Mean	4.832	+0.518	56
1964	Apr.	11	4.825	.513	3
		13	4.846	.518	3
		14	4.832	.511	4
		15	4.832	.515	3
		16	4.836	.517	4
		Mean	4.834	+0.515	17
1965	Jan.	13	4.827	.518	3
	Feb.	20	4.839	.515	4
		24	4.839	.518	4
	Mar.	15	4.839	.520	4
		20	4.843	.515	4
	Apr.	1	4.844	.526	4
		14	4.837	.514	4
		16	4.837	.513	4
		24	4.839	.521	4
		Mean	4.839	+0.518	35
1966	Jan.	12	4.825	.521	4
	Feb.	3	4.838	.515	4
	Mar.	21	4.826	.514	3
		23	4.818	.526	4
		30	4.840	.516	4
		31	4.819	.509	4
	Apr.	4	4.827	.515	3
		7	4.828	.507	4
		15	4.827	.517	3
	May	3	4.828	.526	3
		Mean	4.828	+0.516	36

HD 92323

DATE			V	B-V	Wt.
1962	Dec.	22	$7\overset{m}{.}496$*	$+0\overset{m}{.}447$	3
1963	Jan.	25	7.497	.440	3
	Feb.	3	7.490*	.451	4
		6	7.484*	.448	4
		21	7.488	.452	3
	Mar.	7	7.489	.446	3
		15	7.487*	.443	3
		20	7.506	.435	3
	Apr.	12	7.474*	.450	3
		29	7.490	.444	3
	May	13	7.484	.448	3

HD 92323 (cont'd)

DATE			V	B-V	Wt.
1963	May	16	$7\overset{m}{.}485$	$+0\overset{m}{.}444$	3
1964	Apr.	11	7.509	.442	3
		13	7.503	.443	3
		14	7.498	.445	4
		15	7.495	.450	3
		16	7.491	.447	4
	May	16	7.507	.447	4
		18	7.501	.452	4
1965	Jan.	13	7.492	.447	3
	Feb.	19	7.496*	.447	4
		20	7.496	.446	4
		24	7.507	.442	4
	Mar.	20	7.502	.454	4
	Apr.	1	7.496	.451	4
		14	7.503	.448	4
1966	Mar.	4	7.496	.439	4
		23	7.494	.456	4
		31	7.497	.444	4
	Apr.	7	7.507	.447	3
	May	3	7.502	.446	3
		Mean	7.498	+0.446	87

HD 94012

DATE			V	B-V	Wt.
1964	Apr.	11	$7\overset{m}{.}848$	$+0\overset{m}{.}486$	3
		13	7.851	.482	3
		14	7.843	.484	4
		15	7.849	.476	3
		16	7.844	.481	4
	May	16	7.851	.487	4
		18	7.857	.494	4
1965	Jan.	13	7.838	.485	3
	Feb.	19	7.850*	.487	4
		20	7.847	.489	4
		24	7.847	.488	4
	Mar.	20	7.846	.485	4
	Apr.	1	7.842	.482	4
1966	Mar.	4	7.844	.481	4
		23	7.845	.489	4
		30	7.838	.492	2
		31	7.852	.487	4
	Apr.	7	7.859	.483	3
	May	3	7.851	.480	3
		Mean	7.847	+0.485	64

HD 94057

DATE			V	B-V	Wt.
1965	Jan.	31	$8\overset{m}{.}519$*	$+0\overset{m}{.}480$	4
	Feb.	4	8.523	.480	3
		19	8.523*	.475	4
		24	8.541	.469	4
	Mar.	20	8.531	.472	4
	Apr.	1	8.509	.479	4
1966	Jan.	12	8.526	.473	3
	Feb.	3	8.524	.472	4
	Mar.	4	8.520	.466	4
		21	8.529	.477	3
		23	8.526	.472	4
		30	8.521	.469	3
		31	8.527	.469	4
	Apr.	7	8.542	.457	3
	May	3	8.529	.467	3
		Mean	8.527	+0.471	46

HD 95132

DATE			V	B-V	Wt.
1965	Jan.	13	$8\overset{m}{.}419$	$+0\overset{m}{.}489$	4
		31	8.410*	.490	4
	Feb.	4	8.414	.489	3
		19	8.406*	.490	4
		24	8.422	.492	4
	Mar.	20	8.410	.494	4
	Apr.	1	8.392	.485	4
1966	Jan.	12	8.411	.504	3
	Feb.	3	8.416	.490	4
	Mar.	21	8.420	.497	3
		23	8.416	.491	4
		30	8.401	.495	3
		31	8.416	.486	4
	Apr.	7	8.424	.479	3
	May	3	8.412	.492	3
		Mean	8.413	+0.491	46

HD 98697

DATE			V	B-V	Wt.
1966	Jan.	6	$6\overset{m}{.}700$*	$+0\overset{m}{.}518$	5
		12	6.701	.517	5
	Feb.	3	6.704	.523	4
		22	6.688*	.529	3
	Mar.	4	6.700	.517	5
		21	6.698	.526	5
		23	6.707	.526	5
		30	6.704	.521	5
		31	6.715	.511	5
	Apr.	4	6.704	.520	5
		7	6.704	.519	5
		12	6.703*	.518	4
	May	2	6.695*	.512	4
		3	6.696	.521	5
		Mean	6.705	+0.520	49

TABLE IV (cont'd)
Observations of Comparison Stars and Ten-Year Standards

HD 98947

DATE			V	B-V	Wt.
1966	Jan.	6	$6\overset{m}{.}907$*	$+0\overset{m}{.}863$	4
		12	6.910	.862	5
	Feb.	3	6.906	.865	4
		22	6.895*	.873	3
	Mar.	4	6.917	.857	5
		21	6.914	.871	4
		23	6.911	.871	5
		30	6.918	.867	5
		31	6.921	.860	5
	Apr.	4	6.906	.875	5
		7	6.915	.859	5
		12	6.913*	.860	4
	May	2	6.912*	.850	5
		3	6.906	.860	5
		Mean	6.912	+0.865	48

HD 102870

DATE			V	B-V	Wt.
1962	Jan.	31	$3\overset{m}{.}616$	$+0\overset{m}{.}555$	3
	Feb.	2	3.607	.556	2
	Mar.	4	3.613	.541	3
		9	3.610	.547	2
		14	3.613	.545	3
		15	3.611	.546	1
		26	3.605	.546	3
		31	3.608	.550	3
	Apr.	11	3.608	.558	3
		22	3.600	.557	3
	May	1	3.603	.557	3
	Jun.	7	3.599	.564	2
		12	3.614	.554	2
		19	3.588	.569	2
		Mean	3.607	+0.553	35
1964	Apr.	11	3.606	.544	3
		13	3.617	.544	2
		14	3.597	.553	3
		15	3.625	.544	2
	May	16	3.602	.555	3
		18	3.604	.558	3
		Mean	3.607	+0.550	16
1965	Feb.	20	3.610	.549	3
		24	3.608	.552	3
	Mar.	15	3.609	.544	3
		20	3.611	.550	3
		30	3.609	.545	3
	Apr.	1	3.601	.546	3
		16	3.604	.561	3
	May	1	3.611	.551	3
		5	3.614	.545	2
		18	3.604	.551	3
		22	3.606	.548	3
		23	3.610	.545	3
		28	3.607	.544	3
		Mean	3.608	+0.549	38
1966	Jan.	12	3.614	.549	3
	Feb.	3	3.611	.552	3
	Mar.	4	3.620	.549	3
		21	3.616	.551	3
		23	3.616	.549	3
		30	3.609	.551	3
		31	3.619	.543	3
	Apr.	7	3.613	.541	3
		12	3.612*	.543	3
		15	3.600	.550	3
	May	3	3.605	.553	3
		Mean	3.612	+0.549	30

HD 109358

DATE			V	B-V	Wt.
1962	Jan.	31	$4\overset{m}{.}264$	$+0\overset{m}{.}572$	4
	Feb.	2	4.264	.591	3
	Mar.	4	4.255	.584	5
		9	4.251	.583	3
		14	4.256	.588	3
		15	4.256	.579	3
		26	4.250	.585	4
		31	4.260	.585	4
	Apr.	11	4.251	.594	5
		22	4.252	.591	4
	May	1	4.256	.586	5
	Jun.	7	4.255	.586	3
		9	4.257	.586	3
		12	4.265	.582	4
		19	4.256	.583	4
		Mean	4.256	+0.585	57
1962	Dec.	30	4.265	.585	3
1963	Jan.	7	4.267	.581	3
		9	4.268	.585	3
		15	4.260	.591	3
		17	4.254	.582	3
		21	4.269	.579	3
		23	4.259	.590	3
		25	4.262	.581	3
		28	4.262	.580	3
	Feb.	21	4.261	.589	3
	Mar.	7	4.264	.582	3
		20	4.268	.588	3
	Apr.	4	4.251	.583	3
		24	4.264	.583	3
		29	4.267	.584	3
	May	1	4.258	.582	3
		3	4.262	.584	3
		12	4.272	.585	3
		13	4.267	.577	3

HD 109358 (cont'd)

DATE			V	B-V	Wt.
1963	May	16	$4\overset{m}{.}271$	$+0\overset{m}{.}576$	3
		Mean	4.264	+0.583	60
1964	Apr.	11	4.274	.583	4
		13	4.270	.589	4
		14	4.264	.586	5
		15	4.251	.590	4
		16	4.236	.585	5
	May	16	4.261	.589	5
		18	4.256	.585	5
		Mean	4.258	+0.587	32
1965	Feb.	18	4.255	.597	4
		20	4.258	.587	5
		24	4.260	.579	5
	Mar.	15	4.261	.586	5
		30	4.259	.585	5
	Apr.	1	4.256	.585	5
		14	4.266	.589	5
		16	4.262	.585	5
		23	4.260	.585	5
	May	1	4.266	.580	5
		5	4.262	.584	4
		18	4.258	.589	5
		22	4.256	.594	5
		23	4.255	.590	5
		28	4.252	.591	5
		29	4.262*	.594	5
		30	4.259	.587	5
		Mean	4.259	+0.587	78
1966	Jan.	12	4.264	.583	4
	Feb.	3	4.260	.585	4
	Mar.	4	4.262	.583	4
		21	4.262	.583	4
		30	4.255	.590	5
		31	4.261	.590	4
	Apr.	4	4.257	.592	5
		7	4.256	.584	5
		15	4.259	.590	5
	May	3	4.261	.582	4
		Mean	4.259	+0.586	44

HD 113139

DATE			V	B-V	Wt.
1962	Jan.	31	$4\overset{m}{.}921$	$+0\overset{m}{.}362$	3
	Feb.	2	4.933	.362	3
	Mar.	4	4.923	.363	4
		9	4.930	.356	3
		14	4.939	.362	3
		15	4.933	.361	3
		26	4.931	.362	4
		31	4.933	.358	4
	Apr.	11	4.923	.374	4
		22	4.922	.364	4
	May	1	4.931	.364	4
	Jun.	7	4.920	.363	3
		9	4.940	.363	3
		12	4.935	.356	4
		19	4.928	.366	4
		Mean	4.929	+0.364	53
1963	Jan.	7	4.926	.391	3
		9	4.930	.370	3
		15	4.931	.371	3
		17	4.927	.364	3
		21	4.926	.367	3
		23	4.920	.384	3
		25	4.924	.377	3
		28	4.929	.372	3
	Feb.	21	4.931	.369	3
	Mar.	7	4.926	.376	3
		20	4.931	.377	3
	Apr.	4	4.922	.374	3
		24	4.928	.364	3
	May	1	4.921	.389	3
		3	4.917	.361	3
		13	4.925	.364	3
		16	4.923	.378	3
		Mean	4.926	+0.373	51
1964	Apr.	11	4.943	.374	3
		13	4.936	.366	3
		14	4.933	.361	4
		15	4.920	.359	3
		16	4.926	.362	4
	May	16	4.925	.367	4
		18	4.915	.377	4
		Mean	4.926	+0.367	25
1965	Feb.	18	4.925	.369	3
		20	4.933	.372	4
		24	4.924	.374	4
	Mar.	15	4.931	.366	4
		30	4.925	.370	4
	Apr.	1	4.926	.366	4
		14	4.929	.367	4
		23	4.924	.370	4
	May	1	4.928	.366	4
		5	4.934	.358	3
		18	4.928	.381	4
		22	4.935	.366	4
		23	4.938	.360	4
		28	4.932	.371	4
		29	4.941*	.362	4
		30	4.941	.363	4
		Mean	4.930	+0.368	58
1966	Jan.	12	4.924	.368	4
	Feb.	3	4.937	.363	4
	Mar.	4	4.927	.364	4
		21	4.916	.364	4
		23	4.913	.364	4

TABLE IV (cont'd)
Observations of Comparison Stars and Ten-Year Standards

HD 113139 (cont'd)

DATE	V	B-V	Wt.
1966 Mar. 30	$4^{\mathrm{m}}.918$	$+0^{\mathrm{m}}.363$	4
31	4.923	.363	4
Apr. 4	4.912	.363	4
7	4.922	.362	4
15	4.919	.368	4
May 3	4.927	.367	4
Mean	4.922	+0.364	44

HD 113449

DATE	V	B-V	Wt.
1966 Mar. 4	$7^{\mathrm{m}}.723$	$+0^{\mathrm{m}}.849$	3
21	7.713	.844	2
23	7.707	.856	3
Apr. 4	7.709	.847	2
Mean	7.713	+0.850	10

HD 113772

DATE	V	B-V	Wt.
1966 Mar. 4	$8^{\mathrm{m}}.060$	$+0^{\mathrm{m}}.273$	3
21	8.059	.290	2
23	8.055	.300	3
Apr. 4	8.073	.291	3
Mean	8.062	+0.288	11

HD 114710

DATE	V	B-V	Wt.
1962 Jan. 31	$4^{\mathrm{m}}.249$	$+0^{\mathrm{m}}.571$	4
Feb. 2	4.247	.575	4
Mar. 4	4.248	.571	4
9	4.256	.572	3
14	4.256	.568	3
15	4.250	.571	3
26	4.249	.581	4
31	4.258	.571	5
Apr. 11	4.242	.587	5
22	4.248	.576	4
May 1	4.250	.574	5
Jun. 7	4.251	.568	3
9	4.243	.579	3
12	4.249	.576	5
19	4.247	.570	4
Mean	4.249	+0.574	59
1962 Dec. 30	4.251	.572	3
1963 Jan. 7	4.258	.563	3
9	4.256	.572	3
15	4.250	.568	3
17	4.246	.574	3
23	4.259	.563	3
25	4.253	.573	3
28	4.250	.570	3
Feb. 21	4.250	.583	3
Mar. 7	4.251	.576	3
20	4.258	.579	3
Apr. 4	4.247	.574	3
24	4.255	.577	3
29	4.255	.578	3
May 1	4.264	.564	3
3	4.251	.573	3
12	4.251	.578	3
13	4.268	.558	3
16	4.260	.573	3
Mean	4.254	+0.572	57
1964 Apr. 11	4.255	.577	4
13	4.270	.577	4
14	4.264	.579	5
15	4.251	.580	5
16	4.250	.568	5
May 16	4.256	.584	5
18	4.256	.574	5
Mean	4.257	+0.577	33
1965 Feb. 18	4.253	.582	4
20	4.259	.578	5
24	4.251	.572	5
Mar. 15	4.262	.569	5
30	4.255	.574	5
Apr. 1	4.250	.566	5
14	4.261	.568	5
16	4.256	.573	5
23	4.257	.573	5
May 1	4.253	.566	5
5	4.260	.569	4
18	4.262	.574	5
22	4.259	.576	5
23	4.258	.579	5
28	4.251	.576	5
29	4.259*	.604	5
30	4.255	.579	5
Mean	4.256	+0.573	78
1966 Feb. 3	4.253	.566	5
Mar. 4	4.258	.573	5
21	4.255	.566	5
23	4.254	.572	5
30	4.246	.581	5
31	4.260	.572	5
Apr. 4	4.252	.578	5
7	4.255	.577	5
15	4.252	.573	5
May 3	4.247	.574	5
Mean	4.253	+0.573	50

HD 115043

DATE	V	B-V	Wt.
1962 Jan. 31	$6^{\mathrm{m}}.828$	$+0^{\mathrm{m}}.601$	3
Feb. 2	6.822	.608	4
Mar. 4	6.825	.597	4
9	6.829	.604	3
14	6.819	.603	3
15	6.822	.615	3
26	6.828	.604	4
31	6.833	.599	4
Apr. 11	6.825	.606	4
22	6.833	.608	4
May 1	6.825	.599	4
Jun. 7	6.822	.596	3
9	6.832	.606	3
12	6.826	.606	4
19	6.836	.610	4
Mean	6.827	+0.604	54
1964 Apr. 11	6.809	.605	4
13	6.816	.607	3
14	6.828	.599	3
15	6.810	.603	4
16	6.812	.612	4
May 16	6.816	.611	4
18	6.813	.606	4
Mean	6.814	+0.606	26
1965 Feb. 20	6.821	.605	4
24	6.822	.603	4
Mar. 30	6.822	.609	4
Apr. 1	6.812	.602	4
14	6.823	.604	4
23	6.827	.604	4
May 1	6.807	.608	4
5	6.825	.607	3
18	6.817	.608	4
22	6.818	.608	4
23	6.825	.611	4
28	6.817	.605	4
29	6.829*	.613	4
30	6.825	.605	4
Mean	6.820	+0.606	51
1966 Feb. 3	6.824	.601	4
Mar. 4	6.824	.613	4
21	6.814	.599	4
23	6.810	.603	4
30	6.804	.611	4
31	6.817	.601	4
Apr. 4	6.819	.596	4
7	6.822	.602	4
15	6.817	.612	4
May 3	6.825	.610	4
Mean	6.818	+0.605	40

HD 115247

DATE	V	B-V	Wt.
1966 Mar. 4	$7^{\mathrm{m}}.693$	$+0^{\mathrm{m}}.565$	3
23	7.644	.619	3
Apr. 7	7.677	.604	3
Mean	7.671	+0.596	9

HD 115617

DATE	V	B-V	Wt.
1962 Jan. 31	$4^{\mathrm{m}}.758$	$+0^{\mathrm{m}}.736$	2
Feb. 2	4.738	.707	1
Mar. 4	4.738	.696	2
14	4.740	.700	1
15	4.739	.699	0
26	4.751	.689	2
31	4.735	.698	2
Apr. 11	4.744	.695	2
22	4.743	.707	2
May 1	4.739	.702	2
Jun. 7	4.738	.705	1
9	4.750	.702	1
19	4.736	.718	2
Mean	4.743	+0.705	20
1964 Apr. 11	4.754	.703	1
13	4.755	.708	1
14	4.740	.715	1
15	4.747	.715	2
16	4.732	.697	2
May 16	4.739	.702	2
18	4.752	.701	2
Mean	4.744	+0.705	11
1965 Feb. 18	4.745	.699	1
20	4.743	.692	2
24	4.736	.704	2
Mar. 30	4.740	.697	2
Apr. 14	4.744	.700	2
23	4.754	.696	2
May 1	4.733	.706	2
5	4.735	.710	1
18	4.749	.702	2
22	4.732	.701	2
23	4.733	.708	2
28	4.745	.699	2
29	4.740*	.702	2
30	4.737	.700	2
Mean	4.740	+0.701	24
1966 Jan. 12	4.744	.708	2
Feb. 3	4.730	.721	2
Mar. 4	4.741	.703	2
21	4.743	.702	1
23	4.753	.710	2
30	4.748	.704	2
31	4.750	.713	2
Apr. 4	4.754	.701	2

TABLE IV (cont'd)
Observations of Comparison Stars and Ten-Year Standards

HD 115617 (cont'd)

DATE	V	B-V	Wt.
1966 Apr. 7	$4^{\mathrm{m}}.752$	$+0^{\mathrm{m}}.711$	2
15	4.764	.677	0
May 3	4.737	.691	1
Mean	4.746	+0.708	18

HD 116681

DATE	V	B-V	Wt.
1966 Feb. 3	$8^{\mathrm{m}}.329$	$+0^{\mathrm{m}}.433$	3
Mar. 4	8.336	.447	3
21	8.336	.433	2
23	8.340	.436	3
30	8.325	.439	3
31	8.334	.432	4
Apr. 4	8.333	.432	4
7	8.339	.433	4
Mean	8.334	+0.435	26

HD 117176

DATE	V	B-V	Wt.
1962 Jan. 31	$4^{\mathrm{m}}.973$	$+0^{\mathrm{m}}.721$	3
Feb. 2	4.976	.709	4
Mar. 4	4.978	.713	4
9	4.980	.713	3
14	4.986	.705	3
15	4.976	.718	3
26	4.971	.715	4
31	4.980	.708	4
Apr. 11	4.980	.711	4
22	4.975	.712	4
May 1	4.977	.715	4
Jun. 7	4.971	.714	3
9	4.973	.712	3
12	4.978	.712	4
19	4.975	.705	4
Mean	4.977	+0.712	54
Dec. 30	4.980	.713	3
1963 Jan. 7	4.978	.707	3
9	4.977	.705	3
15	4.972	.713	3
17	4.980	.707	3
21	4.973	.716	3
23	4.972	.712	3
25	4.978	.707	3
28	4.980	.707	3
Feb. 21	4.987	.715	3
Mar. 7	4.970	.721	3
20	4.980	.716	3
Apr. 4	4.981	.708	3
24	4.976	.707	3
May 1	4.981	.713	3
3	4.973	.727	3
12	4.988	.712	3
13	4.975	.722	3
16	4.980	.708	3
Mean	4.978	+0.712	57
1964 Apr. 11	4.985	.724	3
13	4.986	.716	3
14	4.989	.710	3
15	4.984	.730	4
16	4.975	.712	4
May 16	4.979	.718	4
18	4.976	.717	4
Mean	4.981	+0.718	25
1965 Feb. 18	4.988	.705	3
20	4.977	.713	4
24	4.974	.716	4
Mar. 30	4.977	.717	4
Apr. 1	4.970	.709	4
14	4.983	.716	4
23	4.980	.713	4
May 1	4.983	.714	4
5	4.980	.712	3
18	4.986	.706	4
22	4.982	.709	4
23	4.976	.712	4
28	4.974	.714	4
29	4.976*	.712	4
30	4.975	.716	4
Mean	4.979	+0.712	54
1966 Jan. 12	4.977	.707	3
Feb. 3	4.973	.715	4
Mar. 4	4.983	.709	4
21	5.002	.707	4
23	4.985	.716	4
30	4.979	.714	4
31	4.983	.717	4
Apr. 4	4.983	.711	4
7	4.983	.723	4
15	4.973	.718	4
May 3	4.978	.712	4
Mean	4.982	+0.714	43

HD 118704

DATE	V	B-V	Wt.
1962 Mar. 15	$8^{\mathrm{m}}.499$	$+0^{\mathrm{m}}.536$	1
Apr. 22	8.490	.525	3
May 1	8.490	.545	3
Jun. 7	8.492	.553	2
9	8.497	.536	2
1963 Mar. 20	8.514	.524	1
Apr. 4	8.506	.529	2
24	8.493	.540	2

HD 118704 (cont'd)

DATE	V	B-V	Wt.
1963 Apr. 29	$8^{\mathrm{m}}.490$	$+0^{\mathrm{m}}.544$	2
May 1	8.501	.534	2
13	8.488	.548	2
1966 Feb. 3	8.490	.545	3
Mar. 4	8.483	.538	3
21	8.503	.547	2
23	8.503	.545	3
30	8.501	.538	2
31	8.500	.541	3
Apr. 7	8.501	.546	3
Mean	8.496	+0.541	41

HD 118705

DATE	V	B-V	Wt.
1962 Mar. 15	$9^{\mathrm{m}}.178$	$+0^{\mathrm{m}}.460$	1
Apr. 22	9.175	.457	3
May 1	9.175	.452	3
Jun. 7	9.158	.472	2
9	9.170	.466	2
1963 Mar. 20	9.202	.428	1
Apr. 4	9.180	.448	2
24	9.186	.441	2
29	9.173	.459	2
May 1	9.179	.462	2
13	9.179	.444	2
1966 Feb. 3	9.157	.475	3
Mar. 4	9.170	.467	3
21	9.178	.461	2
23	9.178	.469	2
30	9.163	.467	2
31	9.168	.471	3
Apr. 7	9.181	.466	2
Mean	9.173	+0.461	39

HD 119638

DATE	V	B-V	Wt.
1962 Mar. 15	$6^{\mathrm{m}}.897$	$+0^{\mathrm{m}}.545$	0
Apr. 22	6.916	.532	2
May 1	6.913	.537	2
1963 Mar. 20	6.921	.531	1
Apr. 4	6.898	.536	1
24	6.916	.529	1
29	6.907	.547	1
May 1	6.909	.550	1
13	6.903	.554	1
1966 Mar. 4	6.914	.535	2
31	6.913	.538	2
Apr. 7	6.917	.547	2
Mean	6.913	+0.539	16

HD 119869

DATE	V	B-V	Wt.
1962 Mar. 15	$8^{\mathrm{m}}.909$	$+0^{\mathrm{m}}.446$	1
May 1	8.898	.453	3
Jun. 7	8.894	.458	2
9	8.898	.448	2
1963 Mar. 20	8.916	.422	1
Apr. 4	8.907	.436	2
24	8.901	.455	2
29	8.897	.442	2
May 13	8.897	.444	2
1966 Feb. 3	8.881	.464	3
Mar. 4	8.875	.455	3
21	8.898	.456	2
23	8.900	.465	3
31	8.894	.459	3
Mean	8.895	+0.453	31

HD 120136

DATE	V	B-V	Wt.
1962 Jan. 31	$4^{\mathrm{m}}.490$	$+0^{\mathrm{m}}.489$	3
Feb. 2	4.493	.475	4
Mar. 4	4.502	.481	4
9	4.493	.484	3
14	4.488	.477	3
15	4.489	.484	3
26	4.492	.483	4
31	4.495	.481	4
Apr. 11	4.496	.476	4
22	4.490	.476	3
May 1	4.497	.484	3
Jun. 7	4.494	.494	3
9	4.487	.479	3
12	4.488	.479	4
19	4.488	.470	4
Mean	4.492	+0.480	52
Dec. 30	4.484	.482	3
1963 Jan. 7	4.484	.476	3
9	4.495	.474	3
15	4.490	.482	3
17	4.493	.477	3
21	4.490	.481	3
23	4.489	.481	3
25	4.490	.481	3
28	4.491	.486	3
Feb. 21	4.506	.481	3
Mar. 7	4.491	.479	3
20	4.502	.484	3
Apr. 4	4.492	.493	3
24	4.504	.486	3

TABLE IV (cont'd)
Observations of Comparison Stars and Ten-Year Standards

HD 120136 (cont'd)

DATE			V	B-V	Wt.
1963	May	1	$4^{\mathrm{m}}.487$	$+0^{\mathrm{m}}.484$	3
		3	4.494	.482	3
		12	4.501	.485	3
		13	4.498	.482	3
		16	4.496	.478	3
		Mean	4.494	+0.482	57
1964	Apr.	11	4.487	.487	3
		13	4.485	.475	3
		14	4.500	.489	3
		15	4.499	.494	4
		16	4.486	.481	4
	May	16	4.497	.489	3
		Mean	4.492	+0.486	20
1965	Feb.	18	4.495	.473	3
		20	4.491	.479	4
		24	4.491	.481	4
	Mar.	30	4.492	.481	4
	Apr.	14	4.496	.478	4
		23	4.490	.481	4
	May	1	4.491	.486	4
		5	4.489	.485	3
		18	4.494	.479	4
		22	4.490	.481	4
		23	4.497	.474	4
		28	4.495	.477	4
		29	4.485*	.485	4
		30	4.492	.482	4
		Mean	4.493	+0.480	50
1966	Jan.	12	4.496	.479	4
	Feb.	3	4.494	.477	4
	Mar.	4	4.499	.471	4
		21	4.511	.479	4
		23	4.508	.479	4
		30	4.500	.481	3
		31	4.499	.487	4
	Apr.	4	4.495	.483	4
		7	4.497	.495	4
		15	4.499	.481	4
	May	3	4.503	.482	4
		Mean	4.500	+0.481	43

HD 120186

DATE			V	B-V	Wt.
1962	Mar.	15	$7^{\mathrm{m}}.705$	$+0^{\mathrm{m}}.544$	1
	May	1	7.717	.535	3
	Jun.	7	7.706	.556	2
		9	7.710	.580	2
1963	Apr.	4	7.708	.541	2
		24	7.721	.538	2
	May	13	7.715	.539	2
1966	Feb.	3	7.698	.544	2
	Mar.	4	7.689	.540	3
		21	7.725	.538	2
		23	7.717	.546	3
		30	7.709	.546	2
		31	7.719	.543	3
		Mean	7.711	+0.545	29

HD 121111

DATE			V	B-V	Wt.
1962	Mar.	15	$7^{\mathrm{m}}.686$	$+0^{\mathrm{m}}.560$	1
	May	1	7.689	.538	3
1963	Mar.	20	7.702	.543	1
	Apr.	4	7.699	.545	3
		24	7.706	.545	3
		29	7.696	.551	3
	May	1	7.709	.542	3
		13	7.699	.552	3
1966	Mar.	4	7.696	.553	3
		31	7.702	.546	3
	Apr.	7	7.699	.556	3
		Mean	7.699	+0.548	29

HD 121370

DATE			V	B-V	Wt.
1962	Jan.	31	$2^{\mathrm{m}}.684$	$+0^{\mathrm{m}}.588$	3
	Feb.	2	2.679	.585	4
	Mar.	4	2.678	.592	4
		9	2.681	.592	3
		14	2.690	.579	3
		15	2.680	.592	4
		26	2.688	.588	4
		31	2.687	.579	4
	Apr.	11	2.687	.589	4
	May	1	2.682	.590	3
	Jun.	7	2.698	.571	3
		9	2.676	.585	3
		12	2.672	.591	4
		19	2.685	.574	4
		Mean	2.683	+0.586	50
	Dec.	30	2.674	.583	3
1963	Jan.	7	2.675	.577	3
		9	2.669	.584	3
		15	2.675	.586	3
		17	2.677	.582	3
		21	2.672	.593	3
		23	2.678	.580	3
		25	2.682	.581	3
		28	2.677	.581	3
	Feb.	21	2.687	.586	3
	Mar.	7	2.700	.559	0
		20	2.677	.590	3

HD 121370 (cont'd)

DATE			V	B-V	Wt.
1963	Apr.	4	$2^{\mathrm{m}}.684$	$+0^{\mathrm{m}}.579$	3
		24	2.689	.587	3
		29	2.681	.589	3
	May	1	2.678	.585	3
		3	2.677	.578	3
		12	2.676	.591	3
		13	2.683	.595	3
		16	2.682	.578	3
		Mean	2.679	+0.584	57
1964	Apr.	11	2.678	.588	4
		13	2.673	.593	4
		14	2.687	.595	4
		15	2.688	.583	5
		16	2.676	.588	5
	May	16	2.683	.572	4
		Mean	2.681	+0.586	26
1965	Feb.	18	2.675	.588	4
		20	2.676	.586	5
		24	2.679	.583	5
	Mar.	30	2.683	.582	5
	Apr.	14	2.680	.587	5
		23	2.684	.587	5
	May	18	2.677	.578	5
		Mean	2.679	+0.584	34
1966	Jan.	12	2.691	.576	4
	Feb.	3	2.678	.576	5
	Mar.	4	2.688	.591	5
		23	2.689	.581	4
		30	2.684	.582	3
		31	2.689	.581	4
	Apr.	4	2.687	.581	4
		7	2.687	.587	4
		15	2.680	.592	5
	May	3	2.690	.575	3
		Mean	2.686	+0.583	41

HD 121496

DATE			V	B-V	Wt.
1962	Mar.	15	$6^{\mathrm{m}}.845$	$+0^{\mathrm{m}}.479$	1
	Apr.	22	6.851	.462	2
	May	1	6.852	.467	3
	Jun.	7	6.845	.487	2
		9	6.834	.482	2
1963	Mar.	20	6.844	.474	1
	Apr.	4	6.850	.473	2
		24	6.848	.472	2
		29	6.844	.484	2
	May	1	6.848	.479	2
		13	6.848	.471	2
1966	Mar.	31	6.855	.479	3
	Apr.	5	6.850*	.482	3
		7	6.849	.478	3
		Mean	6.848	+0.475	27

HD 121608

DATE			V	B-V	Wt.
1962	Mar.	15	$7^{\mathrm{m}}.671$	$+0^{\mathrm{m}}.556$	1
	Apr.	22	7.686	.528	2
	May	1	7.687	.534	2
	Jun.	7	7.681	.556	1
1963	Mar.	20	7.687	.531	1
	Apr.	4	7.698	.530	2
		24	7.695	.542	2
		29	7.686	.542	2
	May	1	7.692	.541	2
		13	7.686	.540	2
1966	Mar.	31	7.686	.545	3
	Apr.	5	7.686*	.539	3
		7	7.686	.536	3
		Mean	7.688	+0.538	23

HD 123255

DATE			V	B-V	Wt.
1962	Mar.	15	$5^{\mathrm{m}}.461$	$+0^{\mathrm{m}}.352$	1
	Apr.	22	5.467	.336	2
	May	1	5.471	.336	3
	Jun.	7	5.461	.353	2
		9	5.463	.346	2
1963	Mar.	20	5.477	.337	1
	Apr.	4	5.472	.341	2
		24	5.469	.360	2
		29	5.468	.352	2
	May	1	5.472	.345	2
		16	5.460	.343	2
1966	Mar.	31	5.465	.346	3
	Apr.	5	5.472*	.351	3
		Mean	5.467	+0.345	24

HD 123453

DATE			V	B-V	Wt.
1962	Apr.	22	$7^{\mathrm{m}}.635$	$+0^{\mathrm{m}}.581$	2
	May	1	7.639	.571	2
	Jun.	12	7.648	.578	2
1963	Mar.	20	7.641	.579	1
	Apr.	4	7.630	.574	2
		24	7.624	.583	2
		29	7.625	.589	2
	May	1	7.638	.589	2
		16	7.623	.573	2
1966	Mar.	31	7.634	.576	2

TABLE IV (cont'd)
Observations of Comparison Stars and Ten-Year Standards

HD 123453 (cont'd)

DATE			V	B-V	Wt.
1966	Apr.	5	$7^{\mathrm{m}}.631$*	$+0^{\mathrm{m}}.599$	2
		Mean	7.633	+0.579	19

HD 124401

DATE			V	B-V	Wt.
1962	Apr.	22	$6^{\mathrm{m}}.989$	$+1^{\mathrm{m}}.007$	2
	May	1	6.994	1.002	2
	Jun.	7	6.988	1.029	1
		9	6.986	1.020	2
1963	Mar.	20	6.993	1.010	1
	Apr.	4	6.981	1.012	2
		22	6.986*	1.014	2
		24	6.979	1.020	2
		29	6.985	1.014	2
	May	1	6.992	1.022	2
		16	6.974	1.006	2
1966	Mar.	31	6.994	1.003	2
	Apr.	5	6.991*	1.020	2
		Mean	6.986	+1.012	20

HD 125337

DATE			V	B-V	Wt.
1962	Apr.	22	$4^{\mathrm{m}}.515$	$+0^{\mathrm{m}}.127$	2
	May	1	4.525	.133	2
	Jun.	7	4.519	.146	1
		9	4.506	.133	2
1963	Mar.	20	4.532	.126	1
	Apr.	4	4.524	.152	1
		22	4.520*	.135	1
		29	4.519	.140	1
	May	1	4.520	.144	1
		16	4.506	.138	1
1966	Mar.	31	4.527	.117	2
	Apr.	5	4.523*	.129	2
		7	4.524	.131	2
		Mean	4.520	+0.133	16

HD 126251

DATE			V	B-V	Wt.
1962	May	1	$6^{\mathrm{m}}.488$	$+0^{\mathrm{m}}.415$	2
	Jun.	7	6.495	.417	1
		9	6.484	.420	2
1963	Mar.	20	6.495	.406	1
	Apr.	4	6.502	.406	2
		22	6.512*	.398	2
	May	1	6.499	.411	2
		16	6.478	.416	2
1966	Mar.	31	6.491	.414	2
	Apr.	5	6.490*	.425	2
		Mean	6.490	+0.413	14

HD 126766

DATE			V	B-V	Wt.
1962	May	1	$6^{\mathrm{m}}.651$	$+0^{\mathrm{m}}.424$	2
	Jun.	7	6.656	.435	1
		9	6.641	.425	2
1963	Mar.	20	6.652	.413	1
	Apr.	4	6.657	.417	1
		22	6.652*	.416	1
		29	6.639	.442	1
	May	29	6.639*	.426	1
1966	Mar.	31	6.656	.431	2
	Apr.	5	6.646*	.430	2
		Mean	6.650	+0.427	10

HD 128167

DATE			V	B-V	Wt.
1962	Jan.	31	$4^{\mathrm{m}}.462$	$+0^{\mathrm{m}}.362$	3
	Feb.	2	4.460	.364	4
	Mar.	4	4.469	.358	5
		9	4.471	.357	3
		15	4.473	.359	3
		26	4.464	.364	4
		31	4.455	.362	4
	Apr.	11	4.457	.366	4
		22	4.458	.363	4
	May	1	4.473	.362	4
	Jun.	7	4.458	.362	4
		9	4.455	.361	4
		12	4.453	.363	5
		19	4.464	.353	4
		Mean	4.462	+0.361	55
1963	Jan.	17	4.462	.353	3
		21	4.466	.358	3
		23	4.463	.362	3
		25	4.467	.358	3
		28	4.463	.362	3
	Feb.	21	4.479	.364	3
	Mar.	7	4.462	.357	3
		20	4.474	.366	3
	Apr.	4	4.477	.357	3
		29	4.490	.347	3
	May	1	4.480	.361	3
		12	4.464	.371	3
		Mean	4.471	+0.360	36
1964	Apr.	11	4.462	.362	4
		13	4.461	.368	4
		14	4.468	.367	4

HD 128167 (cont'd)

DATE			V	B-V	Wt.
1964	Apr.	15	$4^{\mathrm{m}}.466$	$+0^{\mathrm{m}}.359$	5
		16	4.459	.363	5
	May	16	4.474	.353	5
		18	4.472	.352	5
		Mean	4.466	+0.360	32
1965	Feb.	18	4.459	.362	4
		20	4.463	.363	4
		24	4.466	.367	5
	Mar.	30	4.466	.367	5
	Apr.	23	4.462	.368	5
	May	1	4.463	.363	5
		5	4.463	.362	4
		18	4.466	.370	5
		22	4.468	.366	5
		23	4.465	.366	5
		28	4.472	.357	5
		29	4.463*	.370	5
		30	4.469	.361	5
		Mean	4.465	+0.364	57
1966	Jan.	12	4.471	.362	4
	Feb.	3	4.461	.361	5
	Mar.	4	4.442	.373	5
		23	4.471	.368	5
		30	4.460	.359	4
		31	4.466	.369	4
	Apr.	4	4.470	.361	5
		7	4.466	.371	5
		15	4.478	.362	5
	May	3	4.465	.373	5
		Mean	4.465	+0.366	47

HD 128429

DATE			V	B-V	Wt.
1962	May	1	$6^{\mathrm{m}}.197$	$+0^{\mathrm{m}}.465$	2
	Jun.	7	6.207	.463	1
		9	6.194	.475	2
1963	Mar.	20	6.197	.459	1
	Apr.	4	6.196	.461	2
		22	6.193*	.467	2
		29	6.192	.468	2
	May	29	6.189*	.460	2
1964	Apr.	11	6.196	.458	1
		13	6.189	.457	1
		14	6.198	.463	1
		15	6.196	.459	2
		16	6.188	.452	2
1965	Feb.	18	6.200	.455	2
		24	6.192	.467	2
	Mar.	29	6.185*	.456	2
	Apr.	14	6.185	.458	2
		23	6.194	.463	2
		30	6.189*	.470	1
	May	1	6.190	.460	2
		5	6.180	.470	2
		18	6.188	.458	2
		22	6.206	.471	2
		23	6.199	.462	2
		28	6.198	.463	2
		31	6.198*	.471	2
		Mean	6.194	+0.463	37

HD 128596

DATE			V	B-V	Wt.
1962	Mar.	4	$7^{\mathrm{m}}.482$	$+0^{\mathrm{m}}.639$	2
		31	7.480	.644	2
	Apr.	11	7.477	.635	2
	May	1	7.481	.647	2
1963	Mar.	20	7.479	.636	1
	Apr.	4	7.486	.641	2
		22	7.480*	.638	1
		29	7.477	.653	2
	May	29	7.469*	.653	2
1964	Apr.	11	7.474	.662	1
		13	7.470	.641	1
		14	7.476	.648	1
		15	7.483	.651	2
		16	7.469	.644	2
1965	Feb.	18	7.482	.647	2
		24	7.475	.664	2
	Mar.	29	7.464*	.658	2
	Apr.	14	7.463	.658	2
		23	7.471	.654	2
		30	7.482*	.641	1
	May	1	7.476	.641	2
		5	7.473	.639	2
		18	7.479	.651	2
		22	7.495	.654	2
		23	7.480	.653	2
		28	7.486	.645	2
		31	7.498*	.628	2
		Mean	7.478	+0.648	40

HD 129271

DATE			V	B-V	Wt.
1962	Mar.	4	$8^{\mathrm{m}}.055$	$+0^{\mathrm{m}}.795$	2
		31	8.047	.811	2
	Apr.	11	8.044	.796	2
	May	1	8.047	.809	2
	Jun.	9	8.043	.808	2
1963	Mar.	20	8.037	.821	1
	Apr.	4	8.040	.811	1
		22	8.038*	.814	1

TABLE IV (cont'd)
Observations of Comparison Stars and Ten-Year Standards

HD 129271 (cont'd)

DATE	V	B-V	Wt.
1963 Apr. 29	$8^{m}.032$	$+0^{m}.829$	1
May 29	8.035*	.813	1
1964 Apr. 11	8.053	.813	1
13	8.027	.818	1
14	8.033	.832	1
15	8.048	.810	2
16	8.042	.810	2
1965 Feb. 18	8.054	.807	2
24	8.060	.796	2
Mar. 29	8.020*	.819	2
Apr. 23	8.053	.799	2
30	8.045*	.810	1
May 1	8.041	.805	2
5	8.044	.799	2
18	8.042	.798	2
22	8.059	.817	2
23	8.041	.820	2
28	8.056	.812	2
31	8.051*	.811	2
Mean	8.046	+0.808	38

HD 130900

DATE	V	B-V	Wt.
1962 Apr. 11	$7^{m}.169$	$+0^{m}.557$	2
May 1	7.203	.564	2
Jun. 7	7.184	.590	2
9	7.195	.580	2
12	7.208	.575	2
19	7.180	.576	2
1963 Feb. 21	7.196	.585	1
Mar. 7	7.148	.578	0
20	7.189	.568	1
Apr. 4	7.195	.562	1
24	7.176	.588	1
29	7.181	.588	1
May 1	7.191	.577	1
12	7.208	.582	1
13	7.180	.584	1
16	7.171	.573	1
29	7.171*	.582	1
1964 Apr. 11	7.190	.578	1
13	7.162	.566	0
14	7.192	.573	1
15	7.197	.568	2
16	7.187	.578	2
1965 Feb. 18	7.189	.572	2
24	7.185	.579	2
Mar. 29	7.165*	.580	2
Apr. 23	7.196	.581	2
30	7.179*	.573	2
May 1	7.181	.567	2
5	7.172	.581	2
18	7.194	.582	2
22	7.204	.581	2
23	7.188	.582	2
28	7.194	.575	2
31	7.176*	.580	2
Mean	7.189	+0.577	45

HD 131156

DATE	V	B-V	Wt.
1962 Jan. 31	$4^{m}.551$	$+0^{m}.761$	3
Feb. 2	4.543	.760	3
Mar. 4	4.549	.762	4
26	4.559	.762	4
31	4.552	.754	4
Apr. 11	4.546	.759	4
22	4.550	.760	4
Jun. 7	4.564	.768	3
9	4.565	.773	3
12	4.551	.764	4
19	4.560	.765	4
Mean	4.553	+0.762	40
1963 Jan. 9	4.542	.758	3
17	4.539	.767	3
23	4.538	.764	3
25	4.546	.760	3
Feb. 21	4.545	.757	3
Mar. 20	4.555	.763	3
Apr. 4	4.555	.766	3
29	4.553	.773	3
May 1	4.536	.758	3
3	4.568	.768	3
12	4.552	.764	3
13	4.541	.766	3
16	4.548	.776	3
Mean	4.548	+0.765	39
1964 Apr. 11	4.565	.778	3
13	4.580	.759	3
14	4.574	.774	3
15	4.572	.779	4
16	4.566	.767	4
May 8	4.593*	.770	3
16	4.568	.769	4
Mean	4.571	+0.771	21
1965 Feb. 18	4.550	.762	3
20	4.558	.774	3
24	4.539	.770	4
Mar. 30	4.560	.768	4
Apr. 14	4.549	.761	4
23	4.536	.766	4
May 1	4.561	.767	4
5	4.537	.763	3
18	4.541	.756	4

HD 131156 (cont'd)

DATE	V	B-V	Wt.
1965 May 22	$4^{m}.560$	$+0^{m}.768$	4
23	4.540	.766	4
28	4.558	.770	4
29	4.542*	.770	4
30	4.532	.765	4
Mean	4.548	+0.766	49
1966 Jan. 12	4.569	.753	4
Feb. 3	4.554	.761	5
Mar. 4	4.537	.764	5
23	4.548	.766	5
30	4.548	.768	4
31	4.560	.768	4
Apr. 4	4.542	.766	5
7	4.552	.779	5
15	4.548	.769	5
May 3	4.549	.768	3
Mean	4.550	+0.766	45

HD 131196

DATE	V	B-V	Wt.
1964 Apr. 11	$7^{m}.715$	$+0^{m}.416$	1
13	7.685	.422	1
14	7.714	.426	1
15	7.724	.409	2
16	7.708	.406	2
May 16	7.716	.420	2
Jun. 7	7.729*	.406	1
9	7.696*	.406	1
1965 Feb. 18	7.720	.403	2
24	7.699	.426	2
Mar. 29	7.698*	.411	2
Apr. 23	7.725	.411	2
30	7.708*	.426	2
May 1	7.705	.425	2
5	7.701	.424	2
18	7.704	.418	2
22	7.727	.423	2
23	7.713	.417	2
28	7.720	.415	2
31	7.717*	.416	2
Mean	7.713	+0.417	27

HD 131789

DATE	V	B-V	Wt.
1962 May 1	$7^{m}.610$	$+0^{m}.319$	2
Jun. 9	7.608	.337	2
12	7.602	.308	2
19	7.598	.335	2
1963 Feb. 21	7.589	.338	1
Mar. 7	7.565	.340	0
20	7.599	.317	1
Apr. 4	7.612	.324	1
22	7.581*	.326	1
24	7.586	.341	1
29	7.608	.340	1
May 1	7.587	.332	1
12	7.621	.337	1
13	7.602	.330	1
16	7.574	.325	1
29	7.579*	.333	1
1964 Apr. 11	7.587	.323	1
13	7.564	.306	0
14	7.582	.322	1
15	7.583	.300	2
16	7.590	.314	2
1965 Feb. 18	7.596	.322	2
24	7.573	.324	2
Mar. 29	7.569*	.319	2
Apr. 23	7.592	.323	2
30	7.575*	.320	1
May 1	7.576	.340	2
5	7.581	.321	2
18	7.586	.319	2
22	7.607	.330	2
23	7.603	.333	2
28	7.591	.314	2
31	7.596*	.326	2
Mean	7.592	+0.324	41

HD 131790

DATE	V	B-V	Wt.
1963 Apr. 4	$7^{m}.998$	$+0^{m}.585$	1
22	7.987*	.590	1
May 13	7.994	.595	1
29	7.985*	.574	1
1964 Apr. 11	7.996	.590	1
13	7.960	.594	0
14	7.999	.600	1
15	8.002	.596	2
16	7.998	.591	2
May 16	7.998	.595	2
Jun. 7	7.999*	.593	1
9	7.982*	.570	1
1965 Feb. 18	8.000	.589	1
24	8.009	.576	2
Mar. 29	7.975*	.589	2
Apr. 23	8.008	.575	2
30	7.988*	.595	1
May 1	7.993	.591	2
5	7.990	.588	2
18	8.000	.576	2
22	8.008	.598	2

TABLE IV (cont'd)
Observations of Comparison Stars and Ten-Year Standards

HD 131790 (cont'd)

DATE	V	B-V	Wt.
1965 May 23	$8^{m}.009$	$+0^{m}.586$	2
28	8.010	.584	2
31	7.995*	.579	2
Mean	8.001	+0.591	27

HD 133913

DATE	V	B-V	Wt.
1965 Mar. 30	$7^{m}.778$	$+0^{m}.433$	2
Apr. 23	7.776	.445	2
30	7.774*	.430	2
May 1	7.771	.434	2
5	7.774	.423	2
18	7.789	.438	2
22	7.797	.440	1
23	7.772	.442	2
28	7.791	.427	2
29	7.780*	.450	2
30	7.777	.432	2
31	7.781*	.430	2
1966 Mar. 23	7.798	.436	2
31	7.775	.436	2
Apr. 5	7.787*	.428	2
May 3	7.801	.441	2
Mean	7.783	+0.435	23

HD 134701

DATE	V	B-V	Wt.
1965 Mar. 30	$7^{m}.965$	$+0^{m}.453$	2
Apr. 23	7.964	.468	2
30	7.957*	.454	2
May 1	7.955	.463	2
5	7.950	.458	2

HD 134701 (cont'd)

DATE	V	B-V	Wt.
1965 May 18	$7^{m}.974$	$+0^{m}.456$	2
22	7.987	.461	1
23	7.978	.457	2
28	7.976	.451	2
29	7.949*	.474	2
30	7.951	.462	2
31	7.959*	.459	2
1966 Mar. 4	7.967	.440	2
17	7.960*	.454	2
21	7.985	.457	2
23	7.978	.470	2
30	7.972	.445	2
31	7.968	.460	3
Apr. 4	7.967	.460	3
5	7.960*	.461	3
15	7.970	.461	2
May 3	7.967	.466	3
Mean	7.968	+0.458	36

HD 136407

DATE	V	B-V	Wt.
1966 Feb. 22	$6^{m}.127$*	$+0^{m}.380$	2
Mar. 4	6.127	.369	2
17	6.154*	.384	2
21	6.152	.391	2
23	6.154	.393	2
30	6.138	.382	3
31	6.138	.384	3
Apr. 4	6.141	.376	3
5	6.138*	.388	3
15	6.120*	.385	2
May 3	6.138	.379	3
Mean	6.140	+0.382	18

means corrections to the system of Ten-Year Standards in the years 1961–1966 equal $\Delta_V = +0.002$ and $\Delta_{B-V} = -0.001$ mag. Since they are so small the differences between the magnitudes and colors of the Ten-Year Standards given in Table V (reduced to the system of Ten-Year Standards) and those in the system of primary standards are negligible.

For computing the extinction and transformation coefficients in the years 1953–1961 the magnitudes and colors of the primary standards given by Johnson and Harris (12) were used for all stars while in the years 1962–1966 the values from Table VII of Paper II were used for the stars listed in this table. The influence of this change upon the magnitudes and colors of the Ten-Year Standards and the comparison stars listed in Tables IV and V is eliminated by reducing them to the system of Ten-Year Standards. For the stars used as primary standards in the years 1961–1966 the final magnitudes and colors were obtained by adding the weighted mean deviations of magnitudes and colors of these stars resulting from the least squares solution (c.f. Appendix I) to the values assumed when starting this solution. The mean values of magnitudes and colors so obtained are listed in Table V where the values from Table VII of Paper II are included in the averages.

For the stars observed on about 100 nights the mean errors of magnitudes and colors listed in Table V are about ±0.002 mag. and ±0.001 mag., respectively; for the stars observed on about 25 nights they are ±0.003 mag. and ±0.002 mag., respectively.

TABLE V
Magnitudes and Colors of Standard and Comparison Stars

HD	Star	MK	V	B-V	n	Remarks
41116	1 Gem		$4^{m}.182$	$0^{m}.824$	6	UC 50
42087	3 Gem	B2.5Ib	5.752	0.216	7	UB 50
43261	8 Gem	G5III	6.091	0.892	6	UA 50
47415	HR 2439		6.436	0.520	6	UB 51
50692	37 Gem		5.762	0.578	7	UA 51,52 = UB 53
55052	48 Gem		5.860	0.371	23	UB 52 = UA 53
58551	HR 2835		6.545	0.460	24	UC 54
58899			7.160	0.924	23	UD 54
58946	ρ Gem	F0V	4.179	0.316	99	10-Yr. Std.
60914			6.968	1.046	24	UB 54
61997			7.130	0.412	24	UA 54
62720			7.409	0.383	21	UB 55
63772			8.955	0.347	20	UA 55
67228	μ Cnc	G2IV	5.305	0.633	28	UA 56
68255-7	ζ CncABC		4.673	0.530	24	UB 56
69267	β Cnc	K4III	3.535	1.478	68	Prim. Std.
72779	35 Cnc	G0III	6.584	0.679	25	UA 57
73665	39 Cnc	K0III	6.393	0.978	24	UB 57
74280	η Hya	B3V	4.299	-0.195	59	Prim. Std.
75470			6.721	0.862	31	UA 58
75974		K0V	6.682	0.700	30	UB 58
76508	HR 3558	K1III	6.173	1.001	18	Prim Std.
76943	10 UMa	F5V	3.971	0.434	114	10-Yr. Std.
79096	81 Cnc		6.505	0.731	29	UA 59
79499			8.314	0.445	30	UB 59
81563			8.281	0.477	25	UA 60
82140			8.379	0.631	25	UB 60
82885	11 LMi	G8IV-V	5.410	0.769	115	10-Yr. Std.
83509			7.035	0.473	43	UB 61
83683			6.965	0.474	43	UA 61
86898			7.799	1.035	36	UB 62
87176			8.088	0.542	35	UA 62
89449	40 Leo	F6IV	4.795	0.449	122	10-Yr. Std.
89782			7.771	0.449	37	UA 63
90512			6.650	0.859	36	UB 63
90839	36 UMa	F8V	4.835	0.517	124	10-Yr. Std.
91316	ρ Leo	B1Ib	3.850	-0.140	7	Prim. Std.
92323			7.498	0.446	25	UA 64
93521		09Vp	7.030	-0.234	3	
94012			7.847	0.485	18	UB 64
94057			8.527	0.471	13	UA 65
95132			8.413	0.491	13	UB 65
98697			6.705	0.520	10	UA 66
98947			6.912	0.865	10	UB 66
100600	90 Leo	B3V	5.946	-0.158	92	Prim. Std.
102870	β Vir	F8V	3.609	0.550	105	10-Yr. Std.
103095	HR 4550	G8Vp	6.448	0.753	84	Prim. Std.
109358	β CVn	G0V	4.258	0.586	134	10-Yr. Std.
111632			8.964	0.506	2	

TABLE V (cont'd)
Magnitudes and Colors of Standard and Comparison Stars

HD	Star	MK	V	B-V	n	Remarks
111943			$9^{m}.301$	$0^{m}.662$	2	
111998	38 Vir		6.118	0.480	4	
112048	HR 4896		6.461	1.079	4	
112250			7.263	0.786	4	
112283			7.658	0.477	4	
113139	78 UMa	F2V	4.927	0.367	132	10-Yr. Std.
113449		G5V	7.713	0.850	4	NA 50
113772			8.062	0.288	4	NB 50,51,52
114710	β Com	G0V	4.252	0.573	133	10-Yr. Std.
115043		G1.5V	6.824	0.604	111	10-Yr. Std.
115247			7.671	0.596	3	NA 51 = NA 52
115341			7.847	0.577	4	
115617	61 Vir	G6V	4.742	0.707	90	10-Yr. Std.
116681AB			8.334	0.435	8	NA 53
117176	70 Vir	G5IV-V	4.977	0.713	132	10-Yr. Std.
118704			8.495	0.541	27	NA 54
118705			9.173	0.461	27	NB 54
119638			6.912	0.541	20	NA 56
119869			8.896	0.455	22	NB 55
120136	τ Boo	F7V	4.494	0.480	131	10-Yr. Std.
120186			7.712	0.545	21	NA 55
121111			7.695	0.549	23	NB 56
121370	η Boo	G0IV	2.682	0.584	122	10-Yr. Std.
121496			6.847	0.473	20	NB 57
121608			7.686	0.540	23	NA 57
123255	95 Vir		5.466	0.344	23	NB 58
123453AB			7.632	0.577	25	NA 58
124401			6.985	1.015	28	NA 59
125337	λ Vir	Am	4.517	0.132	25	NB 59
126251	HR 5393		6.491	0.416	22	NA 60
126766			6.651	0.424	20	NB 60
128167	σ Boo	F2V	4.464	0.363	116	10-Yr. Std.
128429	HR 5455	F6IV-V	6.197	0.462	38	NB 61
128596			7.481	0.649	40	NA 61 = NB 62
128986			6.977	1.629	26	Prim. Std.
129271			8.047	0.812	30	NA 62
130109	109 Vir	A0V	3.733	-0.008	62	Prim. Std.
130900			7.189	0.577	28	NA 63
131156	ξ Boo AB	G8V+K4V	4.549	0.765	104	10-Yr. Std.
131196			7.713	0.417	15	NB 64
131789			7.592	0.324	26	NB 63
131790			8.001	0.591	16	NA 64
133913			7.783	0.435	12	NA 65
134701			7.968	0.458	17	NB 65 = NB 66
135742	β Lib	B8V	2.608	-0.109	31	Prim. Std.
136407	ο Lib		6.140	0.382	7	NA 66
140573	α Ser	K2III	2.640	1.170	33	Prim. Std.
143107	ε CrB	K3III	4.145	1.231	89	Prim. Std.
147394	τ Her	B5IV	3.894	-0.151	66	Prim. Std.

TABLE VI
Two-Color Observations of Uranus and Neptune

URANUS

Date	B'
1953 Oct. 30	6^m.109
Nov. 6	6.109
1954 Feb. 17	(6.189)
23	(6.193)
24	(6.210)
28	(6.188)
Mar. 30	6.107
Apr. 1	6.098
6	6.095
22	6.109
26	6.112
Mean	6.106
1955 Apr. 11	6.054
12	6.084
20	6.106
21	6.112
25	6.083
May 4	6.113
Mean	6.090
Oct. 27	6.076
28	6.083
30	6.073
31	6.073
Nov. 4	6.101
16	6.093
19	6.092
20	6.104
27	6.087
1956 Jan. 17	6.096
Feb. 3	6.089
10	6.084
14	6.089
Mar. 5	6.106
14	6.087
19	6.096
Apr. 5	6.084
18	6.104
Mean	6.090
1957 Mar. 23	6.090
24	6.111
26	6.095
31	6.106
Apr. 5	6.080
9	6.094
15	6.097
16	6.101
19	6.090
20	6.092
May 3	6.108
5	6.083
Mean	6.096
1959 Jan. 5	6.093
12	6.081
24	6.098
29	6.078
31	6.085
Feb. 4	6.092
5	6.092
26	6.093
Mar. 1	6.096
3	6.108
Mean	6.091
1960 Jan. 20	6.087
28	6.094
29	6.084
Feb. 17	6.079
18	6.084
21	6.088
23	6.103
25	6.102
Mar. 15	6.101
17	6.093
18	6.090
19	6.098
21	6.089
26	6.095
30	6.096
Apr. 3	6.087
6	6.103
Mean	6.092
1961 Feb. 8	6.067
10	6.086
24	6.088
Mar. 23	6.095
31	6.093
Apr. 4	6.061
8	6.057
12	6.098
Mean	6.083

URANUS

Date	V	B-V	Wt.	B'
1962 Jan. 31	5^m.395	+0^m.516	3	6^m.082
Feb. 2	5.399	.523	4	6.093
28	5.407*	.507	4	6.087
Mar. 4	5.396	.525	4	6.093
9	5.392	.526	2	6.088
14	5.403	.526	3	6.095
15	5.407	.525	3	6.096
26	5.411	.524	4	6.089
31	5.427	.519	4	6.093
Apr. 5	5.425*	.505	4	6.068
11	5.444	.522	4	6.095
Apr. 12	5.438	.521	3	6.086
22	5.465	.513	4	6.087
May 1	5.488	.548	4	6.129
26	5.508*	.539	4	6.090
Mean			54	6.092
1964 Apr. 11	5.451	.504	4	6.100
14	5.436	.512	4	6.088
Mean			8	6.094
1965 Jan. 13	5.451*	.497	4	6.100
31	5.420*	.496	4	6.097
Feb. 4	5.412*	.495	4	6.089
19	5.406*	.490	4	6.092
24	5.396	.494	4	6.087
Mar. 20	5.404	.496	4	6.097
Apr. 24	5.456*	.482	4	6.093
30	5.462*	.493	4	6.099
Mean			32	6.095
1966 Jan. 6	5.473*	.482	4	6.086
12	5.458	.487	4	6.087
Feb. 3	5.417	.499	4	6.092
Mar. 4	5.404	.488	4	6.092
21	5.400	.492	4	6.093
23	5.414	.487	4	6.099
30	5.411	.485	4	6.093
31	5.424	.480	4	6.099
Apr. 4	5.418	.486	4	6.093
7	5.423	.479	4	6.087
12	5.433*	.481	4	6.093
May 2	5.455*	.468	4	6.074
3	5.458	+0.479	4	6.088
Mean			52	6.090

NEPTUNE

Date	B'
1954 May 31	8^m.272
Jun. 2	8.274
12	8.267
14	8.274
16	8.244
17	8.251
Mean	8.265
1955 Apr. 21	8.257
25	8.260
May 4	8.274
Jun. 20	8.266
Mean	8.263
1956 Jan. 17	8.245
19	8.230
20	8.235
Feb. 3	8.216
10	8.216
Mar. 19	8.257
Apr. 5	8.248
18	8.244
Mean	8.242
1957 Mar. 23	8.251
24	8.239
28	8.295
Apr. 5	8.246
6	8.222
May 1	8.184
3	8.249
30	8.230
Mean	8.241
1959 Jan. 12	8.245
24	8.253
Feb. 4	8.253
5	8.224
28	8.232
Mar. 1	8.223
3	8.233
Mean	8.239

NEPTUNE

Date	B'
1960 Jan. 28	8^m.230
Feb. 21	8.215
23	8.220
Mar. 15	8.239
17	8.223
18	8.217
19	8.253
21	8.258
30	8.248
Apr. 3	8.271
Mean	8.237
1961 Mar. 1	8.267
8	8.228
23	8.249
31	8.243
Apr. 8	8.216
12	8.236
Mean	8.243

Date	V	B-V	Wt.	B'
1962 Mar. 4	7^m.859	+0^m.419	2	8^m.207
31	7.844	.421	2	8.223
Apr. 11	7.828	.410	2	8.208
22	7.820	.431	2	8.217
May 1	7.826	.422	2	8.223
Jun. 7	7.844	.438	2	8.234
12	7.862	.428	2	8.248
19	7.844	.421	2	8.226
Mean			16	8.222
1964 Apr. 11	7.850	.427	1	8.241
14	7.856	.430	1	8.252
16	7.844	.420	2	8.233
May 8	7.823*	.418	2	8.204
16	7.843	.428	2	8.241
Jun. 7	7.853*	.430	2	8.242
9	7.829*	.427	1	8.214
Mean			11	8.232
1965 Mar. 29	7.846*	.402	2	8.217
30	7.864	.399	2	8.233
Apr. 23	7.858	.397	2	8.241
30	7.844*	.399	2	8.233
May 1	7.840	.397	2	8.227
5	7.830	.410	2	8.230
18	7.859	.401	2	8.250
22	7.866	.405	2	8.260
23	7.850	.392	2	8.230
28	7.857	.399	2	8.244
29	7.841*	.410	2	8.238
30	7.833	.409	2	8.228
31	7.856*	.384	2	8.226
Mean			26	8.235
1966 Feb. 22	7.906*	.397	2	8.238
Mar. 4	7.891	.392	2	8.227
17	7.877*	.398	2	8.242
30	7.869	.407	2	8.253
31	7.872	.400	2	8.249
Apr. 5	7.854*	.407	2	8.241
15	7.876	.378	2	8.241
May 3	7.856	+0.392	2	8.246
Mean			16	8.242

TABLE VII
Differential Observations of Uranus in Blue Spectral Region

Date U.T.	ΔB(UB-UA)	Dist. Corr.	Phase Corr.	Oblat. Corr.	Blue Mag. Uranus	Remarks
1961						
Oct. 20.48	$+0\overset{m}{.}201$	$+0\overset{m}{.}019$	$-0\overset{m}{.}002$	$-0\overset{m}{.}032$	$6\overset{m}{.}094$	
24.48	.205	.026	-0.002	-0.032	6.086	
Nov. 5.49	.208	.048	-0.003	-0.032	6.085	
15.50	.209	.068	-0.003	-0.032	6.085	
18.49	.207	.074	-0.003	-0.032	6.081	
27.49	.208	.092	-0.003	-0.032	6.080	clouds at end
Dec. 5.47	.204	.109	-0.003	-0.032	6.084	
6.49	.204	.111	-0.003	-0.032	6.084	
21.44	.205	.140	-0.002	-0.032	6.082	
23.44	.209	.144	-0.002	-0.032	6.082	
1962						
Jan. 3.51	.207	.162	-0.001	-0.032	6.081	
12.47	.207	.176	-0.001	-0.032	6.083	
15.33	.205	.179	-0.001	-0.032	6.079	
29.42	.207	.194	0.000	-0.031	6.083	poor seeing
31.41	.212	.195	0.000	-0.031	6.085	
Feb. 2.39	.210	.196	0.000	-0.031	6.086	
22.37	.212	.201	0.000	-0.031	6.081	
28.33	.211	.200	0.000	-0.031	6.081	
Mar. 3.32	.207	.199	0.000	-0.031	6.082	clouds at end
9.28	.208	.195	0.000	-0.030	6.081	
13.20	.210	.192	-0.001	-0.030	6.081	
15.26	.215	.190	-0.001	-0.030	6.082	
25.31	.210	.180	-0.001	-0.030	6.082	
31.19	.209	.172	-0.001	-0.030	6.087	
Apr. 5.22	.204	.165	-0.002	-0.030	6.087	
11.22	.210	.155	-0.002	-0.030	6.083	poor seeing
22.25	.210	.136	-0.002	-0.030	6.085	
24.19	.204	.132	-0.002	-0.030	6.088	
May 6.21	.208	.109	-0.003	-0.030	6.084	
9.20	.209	.103	-0.003	-0.030	6.087	
10.20	.211	.101	-0.003	-0.030	6.087	
19.22	.210	.083	-0.003	-0.030	6.089	
20.20	.207	.081	-0.003	-0.030	6.088	
Jun. 1.14	.210	.058	-0.003	-0.030	6.083	
	Mean+0.208				6.084	
Nov. 27.52	-0.710	.087	-0.003	-0.035	6.087	
Dec. 4.49	.707	.102	-0.003	-0.035	6.089	
5.53	.712	.104	-0.003	-0.035	6.089	
7.52	.703	.108	-0.003	-0.035	6.089	
8.53	.712	.110	-0.003	-0.035	6.093	
10.52	.711	.113	-0.003	-0.035	6.085	
21.51	.711	.136	-0.002	-0.035	6.088	
22.50	.712	.138	-0.002	-0.035	6.089	
28.50	.717	.150	-0.002	-0.035	6.089	
30.48	.713	.153	-0.002	-0.035	6.089	
1963						
Jan. 7.48	.714	.167	-0.002	-0.035	6.089	
9.46	.710	.170	-0.001	-0.035	6.085	
15.44	.717	.179	-0.001	-0.035	6.086	
21.35	.715	.186	-0.001	-0.034	6.088	
25.44	.709	.191	-0.001	-0.034	6.084	
28.41	.710	.194	0.000	-0.034	6.084	
Feb. 3.38	.701	.200	0.000	-0.034	6.086	
6.35	.710	.202	0.000	-0.034	6.088	
19.35	---	.206	0.000	-0.034	6.098	
25.32	.702	.207	0.000	-0.034	6.084	
Mar. 15.25	.709	.200	0.000	-0.033	6.090	
	Mean-0.710				6.088	
Dec. 20.48	+0.385	.129	-0.002	-0.037	6.095	
23.48	.386	.135	-0.002	-0.037	6.092	
28.49	.383	.144	-0.002	-0.037	6.091	
1964						
Jan. 6.49	.382	.161	-0.002	-0.037	6.091	
8.46	.384	.164	-0.002	-0.037	6.088	
9.45	.386	.166	-0.002	-0.037	6.091	
13.43	.386	.172	-0.002	-0.037	6.089	
25.42	.381	.189	-0.001	-0.036	6.097	
Feb. 5.39	.380	.201	0.000	-0.036	6.086	
8.39	.378	.204	0.000	-0.036	6.084	
9.38	.387	.204	0.000	-0.036	6.086	
11.35	.386	.206	0.000	-0.036	6.085	
18.35	.388	.209	0.000	-0.036	6.096	
19.37	.385	.210	0.000	-0.036	6.097	
21.35	.390	.210	0.000	-0.036	6.093	
22.32	.382	.211	0.000	-0.036	6.099	
24.31	.386	.211	0.000	-0.036	6.088	
Mar. 11.29	.384	.209	0.000	-0.036	6.094	
19.27	.389	.204	0.000	-0.036	6.093	
21.26	.390	.202	0.000	-0.036	6.092	
29.24	.388	.195	-0.001	-0.036	6.093	
Apr. 9.22	.386	.181	-0.001	-0.036	6.094	clouds at end
10.22	.390	.180	-0.001	-0.036	6.089	
12.22	.382	.177	-0.002	-0.035	6.094	
13.22	.388	.175	-0.002	-0.035	6.094	
15.23	.386	.172	-0.002	-0.035	6.096	
16.22	.385	.171	-0.002	-0.035	6.098	
May 11.17	.390	.126	-0.003	-0.035	6.094	
12.17	.387	.124	-0.003	-0.035	6.102	
	Mean+0.386				6.093	
Dec. 15.52	-0.097	.114	-0.003	-0.038	6.094	
17.52	.098	.118	-0.003	-0.038	6.094	
1965						
Jan. 2.50	.095	.149	-0.002	-0.037	6.095	
9.48	.099	.162	-0.002	-0.037	6.094	
12.48	.098	.167	-0.002	-0.037	6.098	
13.47	.098	.169	-0.002	-0.037	6.096	
26.43	.098	.188	-0.001	-0.037	6.099	
31.40	.101	.194	-0.001	-0.037	6.096	
Feb. 4.39	.100	.199	-0.001	-0.037	6.093	
19.38	.092	.211	0.000	-0.037	6.096	
20.37	.096	.211	0.000	-0.037	6.096	
Mar. 20.30	.090	.209	0.000	-0.037	6.095	clouds at end
31.25	.096	.200	-0.001	-0.037	6.095	clouds at end
Apr. 16.21	-0.091	+0.181	-0.001	-0.037	6.096	

TABLE VII (cont'd)
Differential Observations of Uranus in Blue Spectral Region

Date U.T.	ΔB(UB-UA)	Dist. Corr.	Phase Corr.	Oblat. Corr.	Blue Mag. Uranus	Remarks
Apr. 23.18	$-0\overset{m}{.}097$	$+0\overset{m}{.}170$	$-0\overset{m}{.}002$	$-0\overset{m}{.}037$	$6\overset{m}{.}093$	
24.20	.095	.169	-0.002	-0.037	6.096	clouds at end
30.19	.097	.159	-0.002	-0.037	6.096	
May 1.18	.097	.157	-0.002	-0.037	6.097	
2.18	.097	.155	-0.002	-0.037	6.097	
5.17	.101	.150	-0.002	-0.036	6.095	
6.17	.097	.148	-0.002	-0.036	6.094	
	Mean-0.097				6.096	
Dec. 5.53	+0.550	.083	-0.003	-0.038	6.093	
1966						
Jan. 4.53	.556	.144	-0.002	-0.038	6.094	
6.52	.546	.147	-0.002	-0.038	6.098	
7.52	.554	.149	-0.002	-0.038	6.095	
12.50	.552	.157	-0.002	-0.038	6.092	bad seeing
25.43	.557	.180	-0.001	-0.038	6.093	
26.46	.553	.182	-0.001	-0.038	6.092	
Feb. 3.47	.550	.192	-0.001	-0.038	6.093	
22.43	.558	.210	0.000	-0.038	6.094	bad seeing
Mar. 4.35	.554	.214	0.000	-0.038	6.094	
12.34	.557	.215	0.000	-0.038	6.092	
21.32	.555	.212	0.000	-0.038	6.096	
23.30	.551	.212	0.000	-0.038	6.094	bad seeing
30.31	.557	.207	0.000	-0.038	6.096	
31.28	.550	.206	0.000	-0.038	6.098	
Apr. 4.26	.553	.202	-0.001	-0.038	6.092	
7.26	.552	.200	-0.001	-0.038	6.094	
12.26	.549	.193	-0.001	-0.038	6.094	
15.23	.551	.190	-0.001	-0.038	6.094	
May 2.22	.555	.165	-0.002	-0.038	6.098	clouds at end
3.19	.549	+0.163	-0.002	-0.038	6.098	
	Mean+0.553				6.094	

TABLE VIII
Differential Observations of Neptune in Blue Spectral Region

Date U.T.	ΔB(NB-NA)	Dist. Corr.	Phase Corr.	Blue Mag. Neptune	Remarks
1950					
Feb. 19.43	---	$-0\overset{m}{.}056$	$-0\overset{m}{.}001$	$8\overset{m}{.}249$	
21.46	$-0\overset{m}{.}208$	.054	-0.001	8.266	
22.43	.214	.053	-0.001	8.266	
23.42	.202	.052	-0.001	8.254	
24.45	.218	.052	-0.001	8.262	
25.43	.198	.051	-0.001	8.276	
Mar. 23.37	.197	.035	0.000	8.263	
28.37	.204	.034	0.000	8.262	
29.35	.208	.034	0.000	8.260	
Apr. 11.31	.193	.033	0.000	8.252	
19.32	.230	.034	0.000	8.252	
20.29	.207	.035	0.000	8.258	
May 6.29	---	.042	0.000	8.266	
8.23	.211	.043	0.000	8.232	
17.23	---	.050	-0.001	8.252	
23.20	---	.056	-0.001	8.259	
	Mean-0.208			8.258	
1951					
Feb. 10.46	---	.068	-0.002	8.244	
Mar. 6.37	---	.046	-0.001	8.236	
19.35	---	.038	0.000	8.268	
29.38	+0.101	.035	0.000	8.255	
Apr. 8.32	.092	.034	0.000	8.256	
10.33	---	.034	0.000	8.259	
11.33	---	.033	0.000	8.270	
12.37	.124	.033	0.000	8.252	
13.30	---	.033	0.000	8.258	
May 8.31	.079	.042	-0.001	8.250	
10.30	.130	.043	-0.001	8.242	
11.29	.120	.044	-0.001	8.266	
25.23	.109	.055	-0.001	8.265	
26.23	.115	.056	-0.001	8.272	
31.20	.108	.060	-0.001	8.268	
Jun. 2.23	.085	.062	-0.001	8.251	
3.26	---	.063	-0.001	8.266	
5.24	.119	.065	-0.001	8.261	
6.22	.095	.066	-0.001	8.246	
7.22	.088	.066	-0.001	8.258	
	Mean+0.105			8.255	
1952					
Apr. 4.30	+0.105	.036	0.000	8.257	
5.30	.073	.036	0.000	8.258	
15.29	---	.036	0.000	8.239	
24.33	.084	.038	0.000	8.248	
May 2.26	.100	.041	0.000	8.272	
3.27	.095	.041	0.000	8.271	
14.23	.092	.047	-0.001	8.244	
15.26	.077	.048	-0.001	8.231	
22.23	.132	.053	-0.001	8.256	
24.23	.083	.055	-0.001	8.242	
28.23	.084	.059	-0.001	8.252	
Jun. 11.23	.103	.072	-0.002	8.263	
12.21	.087	.074	-0.002	8.246	
13.22	.072	.075	-0.002	8.251	
14.23	.100	.076	-0.002	8.252	
17.22	---	.079	-0.002	8.239	
19.22	---	.081	-0.002	8.266	
20.21	.126	.082	-0.002	8.250	
21.22	---	.084	-0.002	8.261	
22.21	---	.085	-0.002	8.242	
	Mean+0.094			8.252	
1962					
Feb. 19.50	-0.731	.089	-0.002	8.229	
22.48	-0.729	-0.085	-0.002	8.222	

TABLE VIII (cont'd)
Differential Observations of Neptune in Blue Spectral Region

Date U.T.	ΔB(NB-NA)	Dist. Corr.	Phase Corr.	Blue Mag. Neptune	Remarks
1962					
Mar. 2.48	$-0\overset{\mathrm{m}}{.}735$	$-0\overset{\mathrm{m}}{.}076$	$-0\overset{\mathrm{m}}{.}002$	$8\overset{\mathrm{m}}{.}224$	
9.48	.735	.068	-0.001	8.228	clouds
15.46	.732	.062	-0.001	8.224	
28.43	.732	.051	-0.001	8.224	
31.43	.736	.049	-0.001	8.226	
Apr. 12.35	.733	.042	0.000	8.224	
30.37	.735	.037	0.000	8.225	
May 2.30	.732	.037	0.000	8.226	
5.36	.736	.037	0.000	8.225	clouds
6.30	.731	.037	0.000	8.227	clouds
20.28	.737	.040	0.000	8.226	
23.29	.734	.041	0.000	8.226	
25.24	.734	.042	0.000	8.225	clouds
Jun. 1.26	.733	.046	-0.001	8.227	
6.22	.732	.049	-0.001	8.226	
10.23	.732	.052	-0.001	8.232	
11.23	.734	.052	-0.001	8.227	
18.20	.734	.058	-0.001	8.233	
20.20	.734	.060	-0.001	8.230	
22.20	.729	.062	-0.001	8.225	
Jul. 2.21	.735	.077	-0.002	8.216	
	Mean-0.733			8.226	
1963					
Feb. 24.50	+0.139	.085	-0.002	8.244	
May 12.27	.154	.037	0.000	8.236	
16.26	.158	.038	0.000	8.234	
21.28	.149	.039	0.000	8.240	
Jun. 10.22	.139	.049	-0.001	8.248	
	Mean+0.148			8.241	
1964					
Mar. 9.47	-0.444	.072	-0.002	8.249	
Apr. 8.39	.450	.046	0.000	8.236	
10.40	.450	.044	0.000	8.239	
11.39	.456	.044	0.000	8.241	
12.39	.448	.043	0.000	8.240	
13.38	.458	.043	0.000	8.245	
14.36	.458	.042	0.000	8.245	
15.38	.459	.042	0.000	8.242	
16.36	.461	.041	0.000	8.244	
May 8.33	.450	.036	0.000	8.238	
9.32	.456	.036	0.000	8.244	
12.32	.455	.036	0.000	8.240	
13.31	.452	.037	0.000	8.240	clouds at end
15.29	.455	.037	0.000	8.239	
16.29	.457	.037	0.000	8.241	
20.28	.457	.038	0.000	8.241	
Jun. 7.23	.455	.046	-0.001	8.242	
9.23	.454	.047	-0.001	8.247	
10.22	.457	.048	-0.001	8.241	
11.22	.456	.049	-0.001	8.243	
12.21	.456	.049	-0.001	8.241	
15.20	.457	.052	-0.001	8.242	
	Mean-0.455			8.241	
1965					
Mar. 14.48	+0.202	.067	-0.002	8.239	
29.44	.208	.055	-0.001	8.241	
30.44	.207	.054	-0.001	8.240	
Apr. 19.38	.206	.041	0.000	8.245	
23.38	.204	.039	0.000	8.243	
27.36	.209	.038	0.000	8.241	
28.35	.208	.038	0.000	8.238	
29.35	.209	.037	0.000	8.243	
30.34	.208	.037	0.000	8.241	
May 1.34	.209	.037	0.000	8.239	
5.34	.209	.036	0.000	8.241	
19.30	.208	.037	0.000	8.244	
22.29	.204	.038	0.000	8.245	
23.29	.207	.038	0.000	8.241	
28.28	.203	.040	0.000	8.246	
29.25	.204	.040	0.000	8.244	
30.25	.203	.040	0.000	8.242	
31.25	.206	.041	0.000	8.241	
Jun. 15.20	.208	.050	-0.001	8.244	
18.19	.206	.052	-0.001	8.241	
20.20	.209	.053	-0.001	8.241	
	Mean+0.207			8.241	
1966					
Mar. 4.52	+1.906	.083	-0.002	8.238	
17.50	1.892	.069	-0.002	8.240	
21.48	1.903	.065	-0.001	8.241	clouds at end
23.50	1.903	.063	-0.001	8.240	bad seeing
30.47	1.902	.056	-0.001	8.242	
31.44	1.903	.055	-0.001	8.241	
Apr. 4.44	1.906	.052	0.000	8.242	
5.42	1.899	.051	0.000	8.238	
15.39	1.905	.044	0.000	8.242	
May 3.37	1.908	.037	0.000	8.240	
15.30	1.902	-0.036	0.000	8.240	
	Mean+1.903			8.240	

IV. TWO-COLOR OBSERVATIONS OF URANUS AND NEPTUNE

The two-color observations of Uranus and Neptune made in the years 1953–1966 are listed in Table VI. The directly observed V magnitudes and B—V colors are given only for the observations made in the years 1962–1966. For the previous years they are listed in Table VIII of Paper II. They were obtained in the same way as the magnitudes and colors of comparison stars listed in Table IV of the present paper; the directly observed colors of the planets were used for determining the extinction and transformation to the BV system.

Since it seems more justifiable to use the gradient color indices of the planets for that purpose, by equations 28 and 29 given in Paper II, the corrections

$$\Delta_c = [(B - V)' - (B - V)](A_8 - Q_{b2}\overline{M}) \qquad (1)$$

were added to the directly observed blue magnitudes of the planets; here $(B - V)'$ is the gradient color index, B—V the directly observed color index of the planet, A_8 the transformation coefficient defined by equation 7 of Paper II, and the average value of the term $-Q_{b2}\overline{M}$, describing the color dependence of the atmospheric extinction, equal to 0.038 for Uranus and 0.050 for Neptune was assumed.

The final blue magnitudes B′ of the planets given in Table VI were obtained from the formula

$$B' = V + (B - V) + \Delta_c + \Delta_d + \Delta_i + \Delta_o\,, \qquad (2)$$

where Δ_c and Δ_i are the distance and phase corrections defined in Paper II, and Δ_o is the oblateness correction for Uranus defined in the next paragraph of this paper. This oblateness correction is computed on the assumption that the surface brightness of Uranus increases by 22 percent from the poles toward the equator of the planet.

The yearly weighted mean values of the blue magnitudes, B′, obtained from the two-color observations are plotted in Figure 5. The observations reduced to the system of the Ten-Year Standards and those left in the system of the primary standards (denoted by the asterisk following the V values in Table VI) were treated together when computing these mean values.

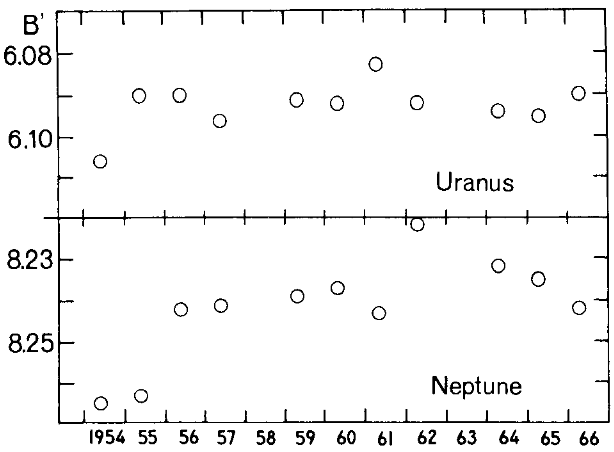

FIG. 5. The yearly mean blue magnitudes of Uranus and Neptune derived from the two-color observations. Darkening by 22 percent from the equator toward the pole of Uranus was assumed. These data are much less accurate than the results of the differential observations shown in Figure 9.

V. OBSERVATIONS OF URANUS AND NEPTUNE IN BLUE LIGHT

The differential observations of planets in the years 1962–1966 were made similarly as described in Paper II except that since 1965 the observing schedule was

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where symbols are the same as on p. 205 of Paper II. The gradient color indices given by equations 28 and 29 of Paper II were used for all reductions.

The resulting blue magnitudes of the planets, obtained using the blue magnitudes of comparison stars derived from the data of Table V, and the magnitude differences between the two comparison stars are listed in Tables VII and VIII. Table VIII contains also the differential observations of Neptune made by H. L. Giclas in the years 1950–1952 by the same methods as his observations of Uranus published previously (2). Since on each night he recorded only 5 deflections for Neptune, on the average, the accuracy of these observations is lower than in following years. In the years 1950–1952 Neptune was observed always at the same gain-step of the amplifier as the comparison stars. The transformation coefficient $A_8 = 0.115$, resulting from the transformation equations given by Giclas (2), was used for reducing these observations. The observations of Uranus in the years 1950–1952 published in the aforementioned paper (2) and re-reduced using the gradient color index of Uranus, give the newly derived magnitudes of comparison stars, listed in Table V, the yearly mean magnitudes listed in Table IX.

The corrections for the photometric effects of oblateness were calculated for Uranus in Paper II on the assumption that the distribution of surface brightness over the apparent disk of the planet is uniform. This assumption, leading to the increase of the planet's brightness by over 0.04 mag. since 1953, does not seem justified. Both Jupiter and Saturn have appreciably smaller surface brightness at the poles than at the equator (14, 15). Richardson (16) found that distribution of the surface brightness on the disk of Uranus is similar to that on the disk of Jupiter. Darkening toward the poles of Uranus is also visible on the drawings reproduced by Alexander (17).

The integrations for obtaining the brightness of the planet at different geocentric longitudes were performed with an IBM 1620 computer. The coefficient of limb darkening $x = 1.2$ (cf. Harris 18), independent of geocentric longitude, was assumed. The darkening toward the pole described by the expression

$$J(\phi) = J(0)(1 - y + y \cos\phi)$$

was assumed, where ϕ is uranographic latitude and $J(\phi)$ the surface brightness.

The blue magnitude of Uranus, as observed in the years 1950–1966, is constant if the coefficient of darkening toward the pole $y = 0.22$ is assumed. The same changes of brightness with geocentric latitude as for $x = 1.2$ and $y = 0.22$ are obtained for $x = 1.3$ and $y = 0.23$ which means that these changes are almost independent of x. The oblateness corrections for Uranus, computed for these values of x and y and denoted by Δ_0, are listed in Table VII. They were used for obtaining the blue magnitudes of Uranus given in Tables VI, VII, in column six of Table IX, and in Figures 5, 8 and 9. The relation between Δ_0 and the oblateness corrections used in Paper II is shown in Figure 6. The yearly mean blue magnitudes of Uranus are calculated using the oblateness corrections from Paper II and given in column five of Table IX.

In the year 1966 the rotational axis of Uranus is almost perpendicular to the line of sight, and the absolute values of the oblateness corrections assume their maximum values. The observations of Uranus, listed in Paper II and reduced on the assumption of the uniform surface brightness on the disk of Uranus, indicate the decrease of brightness during each season as the oblateness correction increases. The mean deviations of planetary brightness from the yearly mean value are plotted in

TABLE IX

The Mean Blue Magnitudes, B, for Uranus and Neptune Reduced to the Opposition Positions in 1950 and to the Pole-On Position of Uranus

	URANUS					NEPTUNE			Uranus (Uncorrected for Oblateness) Minus Neptune
	Uncorrected for Oblateness			Oblateness Correction from Paper II	Oblateness Correction for x = 1.2 y = 0.22				
Opposition	from Star A	From Star B	Mean			from Star A	from Star B	Mean	
1950	———	———	6.080	6.073	**6.079**	8.260	8.256	**8.258**	—2.178
1951	———	———	6.090	6.078	**6.088**	8.264	8.246	**8.255**	—2.165
1952	———	———	6.108	6.091	**6.105**	8.256	8.247	**8.252**	—2.144
1953	6.093	6.091	6.092	6.069	**6.087**	8.253	———	**8.253**	—2.161
1954	6.100	6.099	6.100	6.070	**6.094**	8.251	8.250	**8.250**	—2.150
1955	6.109	6.111	6.110	6.073	**6.101**	8.246	8.246	**8.246**	—2.136
1956	6.109	6.101	6.105	6.060	**6.093**	8.243	8.243	**8.243**	—2.138
1957	6.107	6.103	6.105	6.052	**6.090**	8.243	8.240	**8.242**	—2.137
1958	6.112	6.110	6.111	6.050	**6.093**	8.229	8.237	**8.233**	—2.122
1959	6.111	6.113	6.112	6.043	**6.091**	8.234	8.229	**8.232**	—2.120
1960	6.117	6.118	6.118	6.042	**6.093**	8.234	8.237	**8.236**	—2.118
1961	6.115	6.116	6.115	6.032	**6.087**	8.232	8.233	**8.232**	—2.117
1962	6.117	6.113	6.115	6.026	**6.084**	8.224	8.229	**8.226**	—2.111
1963	6.123	6.122	6.122	6.028	**6.088**	8.240	8.242	**8.241**	—2.119
1964	6.128	6.130	6.129	6.032	**6.093**	8.244	8.238	**8.241**	—2.112
1965	6.132	6.134	6.133	6.034	**6.096**	8.241	8.241	**8.241**	—2.108
1966	6.133	6.132	6.132	6.033	**6.094**	8.240	8.241	**8.240**	—2.108

Figure 7 as a function of the deviation of the oblateness correction (as given in Table IX of Paper II) from its mean value for each of the observing seasons 1954–1962; the years 1963–1966 are not included because oblateness corrections were almost constant during this period. Each point in this figure corresponds to from 8 to 15 successive nights.

Figure 7 indicates that the magnitude of Uranus during each observing season (i.e. during several months around opposition) would be approximately constant if the oblateness corrections were not added at all! While neglecting the oblateness corrections completely would not be justified, Figure 7 indicates at least that the oblateness corrections applied in Paper II were too large. Another effect which could cause the brightness of Uranus to decrease during several observing seasons is a systematic increase in the transformation coefficient A_8 caused by increasing temperature. These changes of A_8 were neglected in Paper II where for most seasons the yearly mean value of A_8 was assumed. The oblateness corrections were always larger in spring than in the preceding winter; therefore the instrumental temperature effects may be difficult to separate from the effects of oblateness for the seasons when A_8 was not determined on every night.

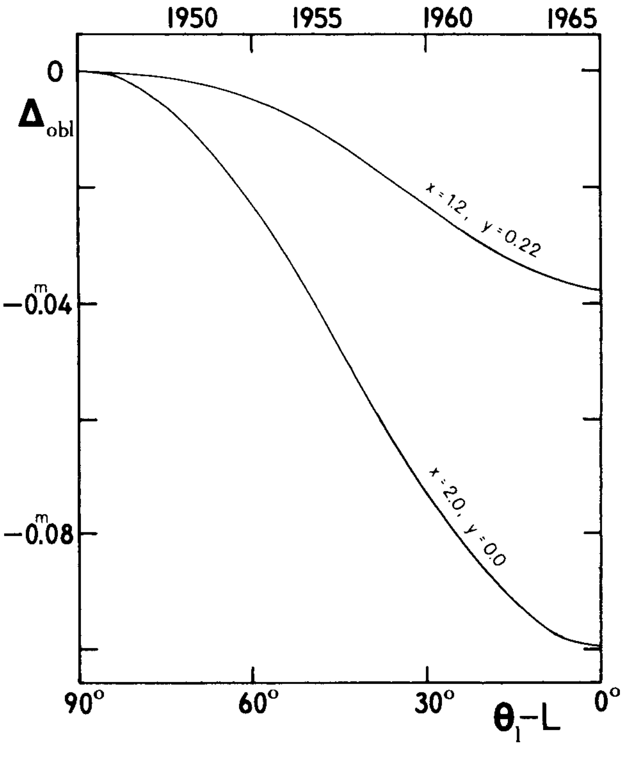

FIG. 6. The oblateness corrections for Uranus for different values of limb darkening, x, and darkening toward the pole, y; L denotes the geocentric longitude of Uranus and $\theta_l \cong 166^{\circ}.65$.

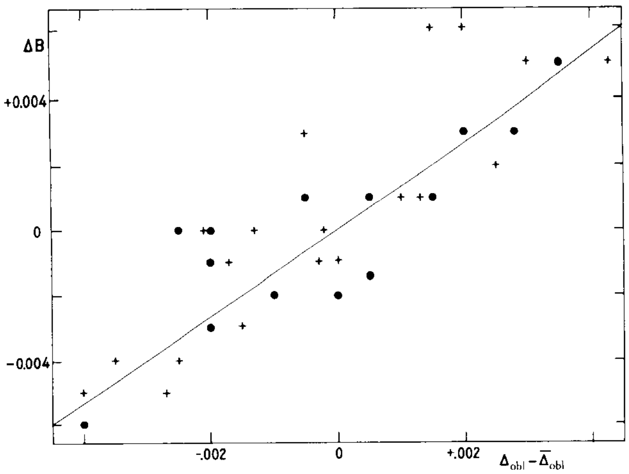

FIG. 7. Deviations of blue magnitudes of Uranus, with oblateness corrections defined in Paper II, from seasonal mean values plotted as a function of the deviations of these oblateness corrections from their seasonal mean values. The symbols are explained in the text.

The values for seasons in which the mean color index of two comparison stars was smaller by at least 0.13 mag. than the gradient color index of Uranus are denoted by crosses in Figure 7 while the values for the remaining seasons, when this difference was between —0.11 and 0.00 mag., are denoted by full circles. There is not much difference between these two sets of values which indicates that it is the assumed gradient color index of Uranus which may need improvement.

All magnitudes of the planets are reduced to the mean opposition distance to the sun which is 19.1910 A.U. for Uranus and 30.0707 A.U. for Neptune according to the *American Ephemeris and Nautical Almanac for the Year 1950*, p. XVII. The presently applied oblateness corrections reduce the brightness of Uranus to the situation when the planet is seen pole-on.

VI. DISCUSSION

The final blue magnitudes of Uranus and Neptune are given in Table VIII which contains also the magnitudes derived from each comparison star separately. The values listed in columns six and nine of Table IX are plotted in Figure 9. The coefficient y for the oblateness correction of Uranus was chosen so as to make the blue magnitude of Uranus approximately constant. The blue magnitudes of Neptune plotted in Figure 9 decrease from 8.26 to 8.23 during the years 1950–1962 while in the years 1963–1966 they have a constant value of 8.24.

The increase of the magnitude of Neptune in the years 1950–1960 is accompanied by the steady decrease of the transformation coefficient A_8 which describes the properties of the photomultiplier and filter used (Figure 10). Because of this change of A_8 the changes of Neptune's brightness shown in Figure 9 could be almost nullified if the directly observed color index of Neptune was used instead of the gradient color-index (cf. paragraph IVD of Paper II). However, the observations of Neptune in the years 1965–1966 with an EMI photomultiplier tube and the spectrophotometry of Neptune made recently by J. S. Hall (9) does not seem to justify such procedure. The observed changes of Neptune's brightness seem therefore to be real. It can not be decided from the present data whether these are intrinsic changes of Neptune's brightness or if they reflect the changes of solar brightness.

The increase of Neptune's brightness between 1954 and 1956 is also indicated by the blue magnitudes derived from the two-color observations, plotted in Figure 5; their accuracy is considerably smaller than the accuracy of values plotted in Figure 9. In 1962 all the observations (two-color and differential) indicate the maximum in brightness of both Uranus and Neptune.

The yearly mean magnitude differences between Uranus (uncorrected for oblateness) and Neptune are listed in the last column of Table IX and plotted in Figure 11. The best fit is obtained for the Uranus darkening coefficients $x = 1.2$, $y = 0.18$ (solid line in Figure 11); for these values the magnitude of Uranus would not change if corrected for the supposed changes of solar brightness derived from the Neptune observations.

The Uranus observations will give no information about the variations of solar brightness unless the Uranus brightness is measured again after 22

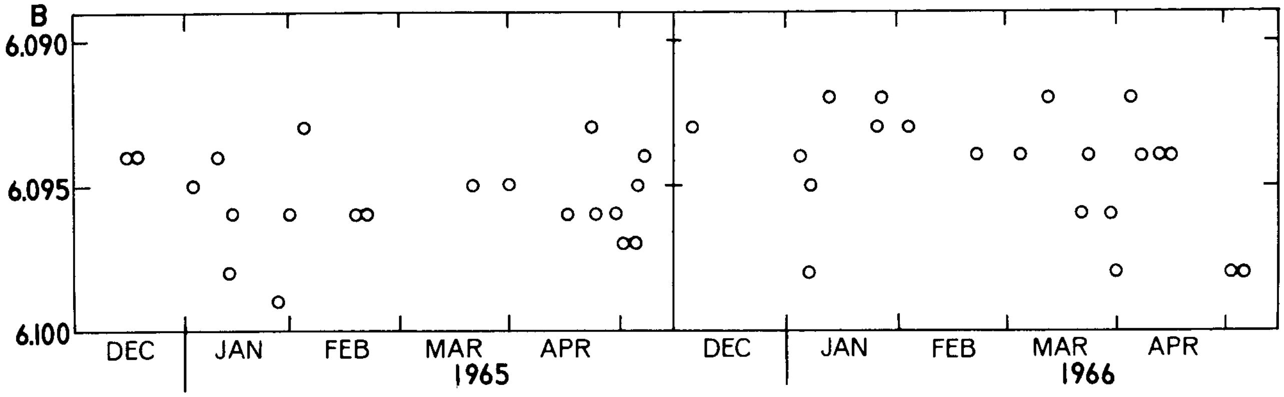

FIG. 8. Blue magnitudes of Uranus derived from the differential observations in 1965 and 1966.

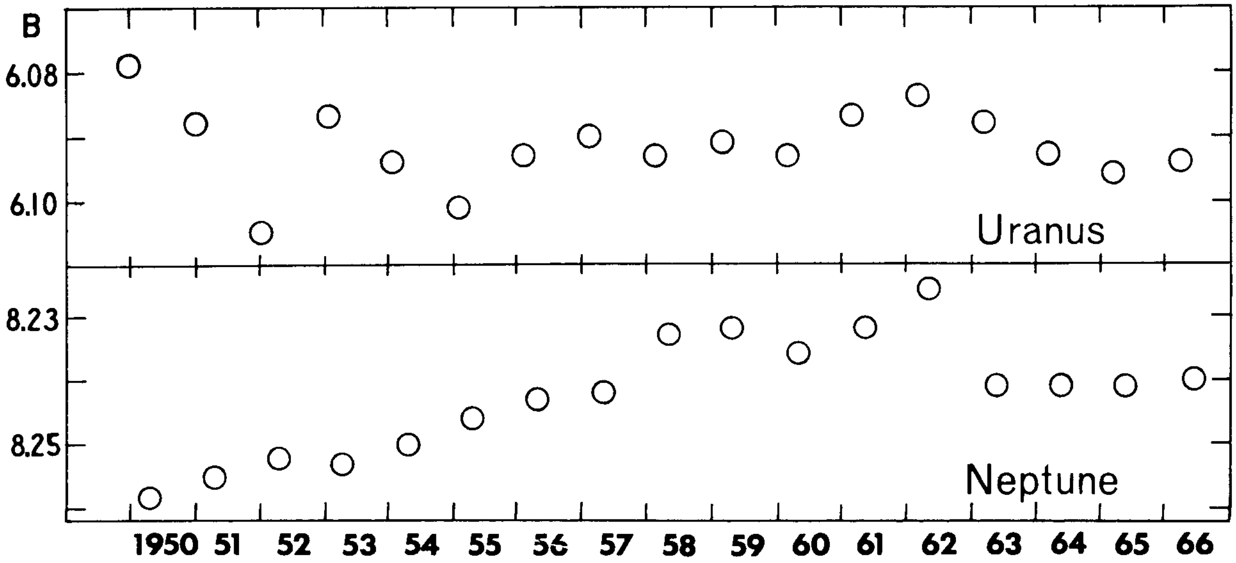

FIG. 9. The yearly mean blue magnitudes of Uranus and Neptune derived from the differential observations. Darkening by 22 percent from the equator toward the pole of Uranus was assumed.

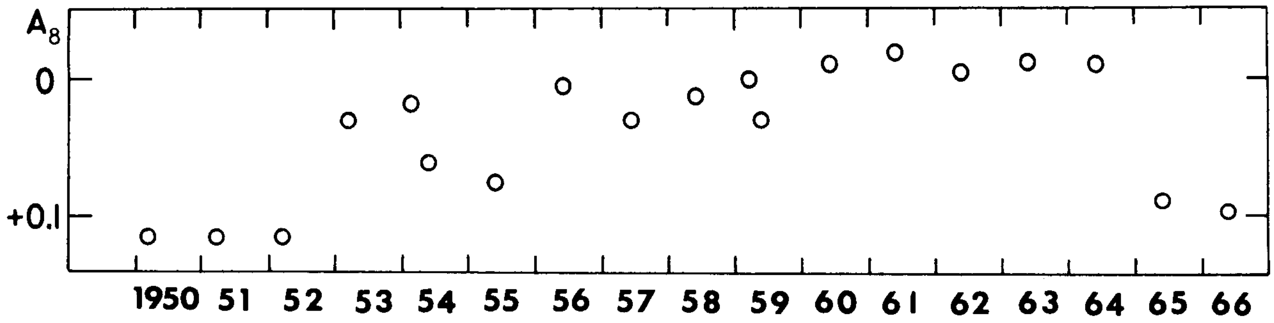

FIG. 10. The yearly mean values of the transformation coefficient A_8 used for reducing the Neptune observations.

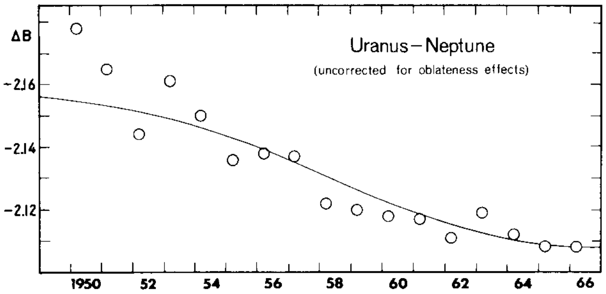

FIG. 11. The yearly mean differences between the blue magnitudes of Uranus (uncorrected for oblateness and darkening effects) and Neptune. The solid line computed for the Uranus oblateness effect was calculated for $x = 1.2$, $y = 0.18$.

years, when the planet will be seen pole-on, and the true size of the oblateness effect is evaluated.

The individual observations of Uranus plotted in Figure 8 indicate that the short period variations of Uranus, and hence solar brightness, do not exceed 0.003 mag.

ACKNOWLEDGMENTS

It is a pleasure to acknowledge our indebtedness to H. L. Giclas, W. Krzeminski, and J. B. Priser whose observations were incorporated into this paper, to Mrs. K. Serkowska who reduced some of the observations; and to John S. Hall for his constant advice and encouragement and for many helpful suggestions on reading the manuscript.

September 7, 1966

APPENDIX I

Atmospheric Extinction and Transformation to the BV System in the Years 1963–1966

by M. Jerzykiewicz

Starting with November 1962 the following equations were used to reduce the observed colors and magnitudes to no atmosphere (3):

$$C_y = C_{yo} - (k_1 + k_2\, C_{yo})M, \tag{3}$$

$$m_y = m_{yo} - (q_{y1} + q_{y2}\, C_{yo})M, \tag{4}$$

$$m_b = m_{bo} - (q_{b1} + q_{b2}\, C_{yo})M, \tag{5}$$

where C_y, m_y and m_b denote the blue-yellow color-index and yellow and blue magnitudes, respectively, expressed in the instrumental photometric system; the directly observed values of these quantities are denoted by subscript $_o$. The air mass is denoted by M and the extinction coefficients for blue-yellow color-index and for yellow and blue magnitudes by

$k_1 + k_2C_{yo}$, $q_{y1} + q_{y2}C_{yo}$, and $q_{b1} + q_{b2}C_{yo}$,
respectively.

The transformation of our instrumental system to the BV system has been made by the linear relations:

$$C_y = a_1 + (B-V)a_2, \tag{6}$$

$$m_y = V + a_5 + (B-V)a_6, \tag{7}$$

$$m_b = B + a_7 + (B-V)a_8, \tag{8}$$

where a_k ($k = 1$, 2, 5, 6, 7 and 8) are the transformation coefficients.

We have assumed also that the mean error of a photometric observation is proportional to the air mass through which the observation was taken.

It follows from the above equations that when the extinction and transformation coefficients for the color and either magnitude are known the coefficients for the other magnitude might be computed, viz.:

$$a_7 = a_1 + a_5, \tag{9}$$

$$a_8 = a_2 + a_6 - 1, \tag{10}$$

$$q_{b1} = q_{y1} + k_1, \tag{11}$$

$$q_{b2} = q_{y2} + k_2. \tag{12}$$

In order to determine the extinction and transformation coefficients and their possible changes during a night, groups consisting of four or six standard stars were observed at the beginning, at the end, and often in the middle of every night when two-color observations of the program stars were made. The standard stars were so chosen that in each group half of them were observed close to the zenith and the rest through 2 to 3 air masses. Also, among high- as well as low-altitude standard stars, stars with widely different colors were represented. Then the solution of equations 3 and 6 for k_1, k_2, a_1 and a_2 as unknowns, i.e. the solution for the color, as well as of equations 4 and 7, i.e. the solution for the V magnitude has been carried out for every group of standard stars. In case of the solution for the color the procedure has been as follows.

Using the mean atmospheric extinction coefficients as a first approximation, rough instrumental colors were computed from equation 3 for each standard star in a group, and a set of corresponding equations, 6, was then solved by least squares. That gave a first approximation of the transformation coefficients a_1 and a_2 and another set of approximate instrumental colors from equation 6, which are almost as far from the true ones as those computed previously from equation 3, mostly because of the uncertainty of a_1. If, however, pairs of equations, 3, for standard stars of similar (B—V) and observed through widely different air masses ($\Delta M > 1$) are solved for k_1 only (assuming an approximate k_2), the result will be independent of a_1 and very little affected by possibly erroneous values of a_2 and k_2, yielding k_1 very close to the true one. Furthermore, a pair of equations, 3, for standard stars of different colors but observed at the same altitude ($\Delta(C_{yo}M) > 1$) gives k_2 almost independent of the transformation and primary extinction coefficients. Therefore, such pairs of equations, 3, were solved for k_1 and then for k_2. Since each group of standard stars yields two or three independent values of k_1 as well as k_2, the weighted means of k_1 and of k_2, together with their errors were computed.

The weighted means were taken as the second approximation of the extinction coefficients, then the second approximation of the transformation coefficients a_1 and a_2 was computed in the same way as the first one. The third and further approximations can be done easily, since programs for the IBM 1620 have been written to perform the computations and the data cards once punched can be used any number of times. It was found, however, that a 25% error in the first approximation of both extinction coefficients k_1 and k_2 causes only about 1 percent error in the first approximation of a_2. The extinction and transformation coefficients obtained as the second approximation were therefore assumed to be final and used to reduce the observations of the program stars.

The solution for the V magnitude (equations 4 and 7) is analogous to the just-described solution for the color, and therefore will not be described in detail. In that case the second approximation was also found to be satisfactory. The coefficients for the B magnitude, which are needed to reduce the blue observations of the planets were computed from equations 9 through 12.

It should be pointed out that in order to obtain correct results by means of the iteration procedure described above, the already mentioned conditions concerning the colors of the standard stars and the altitudes at which they are observed must be fulfilled. When this is the case, the extinction coefficients are independent of the transformation coefficients, i.e. of the combination of the photomultiplier and the filters employed, as long as equations 3 through 8 hold.

The extinction and transformation coefficients obtained as described here were used to reduce two-color observations of the program stars. The procedure applied was as follows:

1. In order to account for changes of the atmospheric extinction and of the response of the photometer the linear interpolation of the coefficients between every two of their determinations was performed.

2. With the interpolated coefficients the observations of the program stars were corrected according to equations 3 and 6 for the (B—V) color, and equations 4 and 7 for the V magnitude.

APPENDIX II

Comparison of Different Methods of Determining the Extinction and Transformation Coefficients

In reducing the photometric observations two procedures are possible:

1. Correcting the observed magnitudes and colors for the atmospheric extinction and then reducing them to the BV system; or

2. First reducing the observations to the BV system and then correcting them for the atmospheric extinction.

The first procedure is described in Appendix I while the second procedure is described in Section IIA of Paper II. The magnitudes and colors obtained with these two procedures are not identical; however, the differences in the results are very small as will be apparent from the subsequent discussion.

The advantage of the first procedure is that the transformation to the BV system is made for the observations already corrected for the atmospheric extinction; therefore it is evident that B—V should be used as the coefficients on the right-hand side of equations 7 and 8. On the other hand, in the second method an ambiguity arises; it is not obvious whether the color indices corrected or uncorrected for the atmospheric extinction should be used as coefficients at A_6 and A_8 in equations 4 and 5 of Paper I.

The transformation coefficients a_1 and a_2 defined in the first method by equation 6 are more practical than the coefficients A_1 and A_2 of Paper II because, when they are determined by the least squares method from the observations of standard stars, the coefficients at a_2 in equation 6 are known values of B—V. On the other hand, in the second method the observed, not accurately known, value of C_{y0} is used for the coefficient at A_2 in equation 3 of Paper II; therefore this equation had to be replaced by equation 18 of Paper II to make possible the correct least squares solution. Moreover, formulas 10 and 12 for computing a_8 and q_{b2} are simpler than the corresponding formulas 7 and 9 of Paper II.

The advantage of the second procedure described in Paper II is that the extinction corrections are applied to magnitudes and colors already transformed to the BV system. Therefore the extinction coefficients are obtained (denoted by capital letters) which refer to the magnitudes and colors expressed in the BV system and not to instrumental magnitudes and colors as in the first procedure. In the second procedure, first the color-indices $B_0 - V_0$ and magnitudes V_0 expressed in the BV system, but not corrected for the atmospheric extinction, are computed from the equations

$$B_0 - V_0 = A_1 + C_{y0} A_2, \tag{13}$$

$$V_0 = m_{y0} + A_5 + (B - V)A_6. \tag{14}$$

Then these colors and magnitudes are corrected for extinction by means of the equations

$$B - V = B_0 - V_0 - [K_1 + (B - V)K_2]M, \quad (15)$$

$$V = V_0 - [Q_{y1} + (B - V)Q_{y2}]M. \quad (16)$$

Substituting the values of $B_0 - V_0$ and V_0 from equations 13 and 14 of this Appendix into equations 15 and 16 the equations 3 and 4 of Paper II are obtained.

The extinction coefficients denoted by the capital letters and defined by the equations 15 and 16 are expected to be more independent of the properties of photomultipliers and filters than the extinction coefficients defined in Appendix I. However, since even in the originally defined UBV system (10) the $B - V$ colors were larger by 1.04 mag. than the C_y colors, the extinction coefficients K_1 refer to a longer wavelength interval between B and V than ever realized in BV photometry and are therefore systematically larger by at least 0.03 mag. than the coefficients k_1. Probably the best solution would be to define k_1 as referring to C_y computed for a certain fixed value of a_1, e.g. equal to -1.0 mag.

In both procedures discussed here the problem arises whether the color-indices corrected or uncorrected for extinction should be used in coefficients of k_2, q_{y2}, q_{b2}, K_2 and Q_{y2} in equations 3 to 5, 15 and 16. Using $B_0 - V_0$ in these coefficients, the equations 15 and 16 take the form

$$B-V = B_0 - V_0 - [K_1' + (B_0 - V_0)K_2']M, \quad (17)$$

$$V = V_0 - [Q_{y1}' - (B_0 - V_0)Q_{y2}']M, \quad (18)$$

where, following Hardie (19), the extinction coefficients are denoted by primes to distinguish them from those defined by equations 15 and 16.

The change in magnitudes and colors caused by using the equations 17 and 18 instead of equations 15 and 16 is negligibly small. This may be shown by substituting $B_0 - V_0$ obtained from equation 17, into the right-hand sides of equations 17 and 18. Now substituting

$$1/(1-K_2'M) \cong 1 + K_2'M + (K_2')^2M^2$$

and neglecting the terms proportional to $K_1'(K_2')^2$, $K_1'K_2'Q_{y2}'$, and $(K_2')^2Q_{y2}'$, we get

$$\begin{aligned} B - V = B_0 - V_0 - [K_1' + (B - V)K_2']M \\ -[K_1' + (B - V)K_2']K_2'M^2, \end{aligned} \quad (19)$$

$$\begin{aligned} V = V_0 -[Q_{y1}' + (B - V)Q_{y2}']M \\ -[K_1' + (B - V)K_2']Q_{y2}'M^2. \end{aligned} \quad (20)$$

The low altitude stars for determining the extinction were observed usually when the air mass was about 2.5, and the high altitude stars were $M \cong 1.0$. The maximum difference between the values of V and $B - V$ read from the parabolic curves, described by equations 19 and 20, and from the straight lines described by equations 15 and 16 and crossing the parabolic curves at $M = 1.0$ and 2.5 (Figure 12) cannot be greater than 0.002 mag. for $B - V$ and 0.001 mag. for V. These maximum values arise for the air masses of about 1.75 and are negligibly small for the purposes of the present paper.

The numerical integrations of the transmittance curves of the Earth's atmosphere and of the filters defining the UBV system, made by Blanco (20), indicate that the extinction for $B - V$ colors is best represented by the equations similar to 19 but with a coefficient of M^2 about 2.5 times smaller than indicated by this equation. This shows that probably the true colors and magnitudes are somewhere midway between the results obtained assuming $(B - V)M$ as coefficients at K_2 and Q_{y2} in equations 15 and 16 and the results obtained assuming $(B_0 - V_0)M$ as these coefficients.

While the magnitudes and colors of program stars obtained using the two procedures here discussed are practically identical, this cannot be said about the values of transformation and extinction coefficients. To find the relations between the coefficients defined in these procedures we assume that half of the standard stars used for determining the atmospheric extinction are observed at air mass $\overline{M} - \Delta M$ and half of them at $\overline{M} + \Delta M$. We assume further that the mean value of C_{y0} is the same for each of these two groups. We write differences and sums of mean $B - V$ values for high altitude and

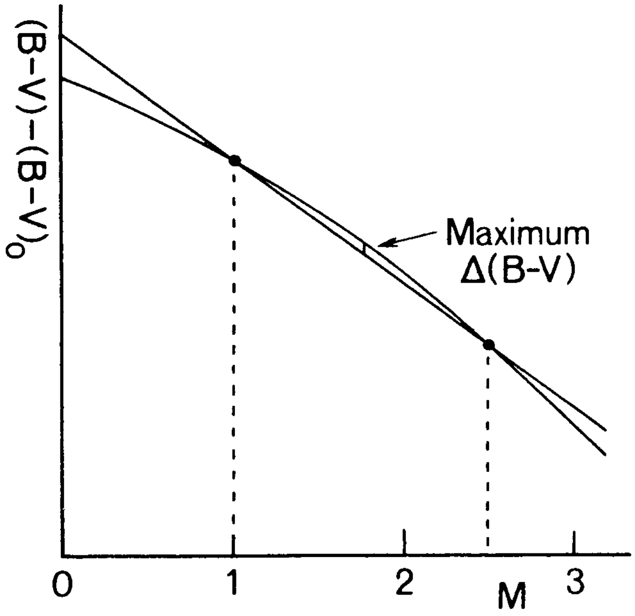

FIG. 12. See text for explanation.

low altitude stars using first the values of $(B - V)$ derived from equations 3 and 6 and then from equation 3 of Paper II. Comparing the coefficients at M, $C_{yo}\ M$, $\overline{M}$, C_{yo}, etc. in these sums and differences we find the relations between the extinction and transformation coefficients defined in the two procedures. In the same way the relations for the V magnitudes are found. Neglecting the terms proportional to $K_1\ K_2^2$, K_2^3, $A_6\ K_1\ K_2$, $Q_{y2}\ K_1\ K_2$, and $Q_{y2}\ K_2$ these relations take the following form

$$a_1 = -(A_1 - K_1\ K_2\ [(\overline{M})^2 - M^2])/A_2\,, \tag{21}$$

$$a_2 = 1/(1 - K_2^2\ [(\overline{M})^2 - M^2])/A_2\,, \tag{22}$$

$$a_5 = -A_5\,, \tag{23}$$

$$a_6 = -A_6\,, \tag{24}$$

$$k_1 = [(K_1 + A_1\ K_2)\ (1 - 2\ K_2\ \overline{M})]/A_2\,, \tag{25}$$

$$k_2 = (1 - 2\ K_2\ \overline{M})K_2\,, \tag{26}$$

$$q_{y1} = Q_{y1} - (A_1 + K_1 + A_1K_2)Q_{y2}\,, \tag{27}$$

$$q_{y2} = (1 - K_2)A_2\ Q_{y2}\,. \tag{28}$$

After substituting the above values of the coefficients into the equations 3, 4, 6 and 7 for the air masses $\overline{M} - \Delta M$ or $\overline{M} + \Delta M$ the equations 3 and 4 of Paper II are obtained. The largest discrepancy between the two values of $B - V$ obtained by the two procedures occurs for $M = \overline{M}$ when the difference between the two values of $B - V$ equals

$$(K_1 + A_1\ K_2 + A_2\ K_2\ C_{yo})\ K_2\ (\Delta M)^2.$$

For $\Delta M = 0.7$ and the values of the coefficients as given in Paper II this difference does not exceed 0.0013 mag. which is negligibly small for the purposes of this paper.

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