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THE CONSTANCY OF THE LIGHT OF RED STARS

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CHAPTER XV

THE CONSTANCY OF THE LIGHT OF RED STARS

It is well known that many of the red stars show small variations in light, conspicuous examples being α Orionis, α Herculis, μ Cephei, and several other naked eye objects. The changes usually are confined within a range of less than one magnitude in the course of several months, and up to the present no satisfactory period or light-curve has been found for any star of this class. Because of their color, these stars are difficult to observe visually; the presence of haze or moonlight combined with the Purkinje phenomenon gives rise to subjective effects which make it unusually difficult to establish real changes unless they are quite large, say several tenths of a magnitude. Betelgeuse is the most usual bait for the beginner, and more than one enthusiast has tried to get a period for this star on the basis of eye-estimates, only to give it up after several months or even several years of effort.

The observations described in the present paper have been made mostly in the years 1926 to 1929 as a first survey or test for light-variations of about two hundred red stars, with a photo-electric photometer attached to the 15-inch refractor. The instrument was the same as described in Part 1 of the present volume, except that in June 1927 a Lindemann electrometer was substituted for the swinging string electrometer. This new arrangement is fully as sensitive as the old one, and the convenience and speed of observing is much greater, the time to secure a given number of measures being reduced to three-fourths or even to two-thirds of what it was before. The same potassium photo-electric cell, our number QK302, was used throughout this work.

For each observation of four stars, *a*, *b*, *c*, and *d*, the measures were taken in the symmetrical order *a b c d a*, *a d c b a*, and a similar arrangement was made for three stars. Such a double series comprises what we call two sets, and all observations contain two sets unless the measures were interrupted by clouds or other poor conditions. The minimum number of observations of a group of stars was three, the average being five or six, extending over at least two months, while for two-thirds of the groups the interval ranged from six months up to two years.

The observing program included all M-stars of visual magnitude 6.0 or brighter, north of −10° declination. The list numbering 190 and a summary of the results for each object are given in Table IV. The first column contains the number from *Harvard Annals*, Vol. **50,** from which the data in the next four columns are also taken. The visual magnitude of a variable red star can not be very accurate, but it is copied here from the Harvard volume. The absolute magnitude and spectrum are from Mount Wilson.[1] In the Mount Wilson system the classification from M0 to M6 is based upon the intensities of the bands of titanium oxide. For convenience this sequence will be called the order of increasing redness of the stars, though because of

[1]*Contributions from the Mount Wilson Observatory,* **14,** 307, 1926.

the absorption bands the measured color-index does not necessarily increase from M0 to M6. In Table IV the number of observations, the interval in days, range of variation, and average deviation of one observation, are all from Table VI which contains the detailed results of the present work. In the column marked "Var." in Table IV the conclusion regarding the variation of each object is shown; "S" denotes suspicious and "V" variable. This has been derived uniformly on the following basis. A star is considered constant if the average deviation of an observation is less than $\pm 0^{M}.025$; a star with average deviation equal to or greater than $\pm 0^{M}.025$ is called suspicious or variable, suspicious if the range is less than $0^{M}.10$, and variable if the range is equal to or greater than $0^{M}.10$. A discussion of the variables and of the special cases will be given in the sequel.

The average deviations of Table IV may be converted into probable errors by multiplying by the factor $0.845n/\sqrt{n(n-1)}$ which ranges from 0.98 for four observations to 0.88 for fourteen observations. When this is done and the limit of $\pm 0^{M}.025$ is still maintained for the probable error, it is found that only one suspicious star would be re-classified as constant, all of the variables remaining in the same category. There is therefore no advantage in making the division strictly logical by computing probable errors for these limited series of observations.

Table V contains the comparison stars, 200 in number, the data in the first five columns being the same as for the M-stars. In the last column the spectrum is from the Mount Wilson list,[2] supplemented by data kindly furnished by Dr. Adams. Where the stars have not been observed at Mount Wilson the classification from the Draper Catalogue is noted in italics. As the spectra of the comparison stars range from G3 to K9 these objects will be denoted simply as K-stars in contra-distinction to the red M-stars.

In Table VI are given the detailed results of the present observations. The groups are arranged according to the number of the first M-star, the H. R. reference numbers being used throughout. The first column gives the Julian Day, Greenwich mean time beginning at noon. The remaining columns give the differences of magnitude, the symbol (>) meaning "brighter than." At the foot of each column is the mean difference of magnitude and the average deviation of one observation. The time interval and range of magnitude for each star are readily derived by inspection, and are entered in Table IV together with the average deviation. In Table VI an M-star is usually referred to the mean of two comparison stars if these are available, and the last column then gives the inter-comparison of the K-stars, as shown by the headings of the table.

When a shade glass was used to equalize the light of the stars of a group, that fact is indicated in the remarks. The assigned values of the shades are only rough, and should not be used for precise determinations of magnitude; it is only differences of magnitude with the same cell and shade glass that we are concerned with here.

Rejected observations are indicated by parentheses. There were of course many occasions when observing was started but the discordance of successive readings would

[2]*Contributions from the Mount Wilson Observatory*, **9**, 423, 1920.

show that the sky was not uniform; then the measures were not even reduced. When half of a double set was apparently satisfactory the result was marked "One set," but every retained observation comprises at least two complete sets of four to six readings on each star, taken forward and backward through the group. The number of rejected observations is 31 out of 777, or about four per cent, which is a fair measure of the proportion of cases which the observer let go as probably worth something but which are not good enough for the detection of variable stars.

In addition to the usual checks for elimination of errors the original measures which fix the range of variation of each star have been re-examined for possible presence of poor conditions, and it is believed that no object is marked as variable that does not belong in that class.

All of the observations in Table VI have been corrected for atmospheric extinction according to the scheme on page 16 of the present volume. The factors for different quality of sky have been revised, however, as follows

Quality of Sky	*Scale*	*f*
Fine	4½	1.45
Good	4	1.6
Fair	3½	2.0
Poor	3	2.4

It is assumed that there is no appreciable difference in the extinction for K- and M-stars. An extended investigation has given the ratio of the factors for K0- and A0-stars, respectively, to be 0.93 ±0.011 (p. e.), and the slight difference between K and M may be neglected. Ordinarily the observing was limited if possible to the interval when the tabular differential extinction between two stars was $0^{M}.01$, but this at times was extended to $0^{M}.02$. The actual corrections for extinction were less than $0^{M}.02$ in four-fifths of the cases, and exceeded $0^{M}.05$ on only a few occasions.

In the discussion of the present results we take up first the comparison stars. Among the 200 stars there are just the three pairs given in Table I that have turned out to be suspicious with average deviations of $\pm 0^{M}.025$ or greater. In no other case does this figure exceed $\pm 0^{M}.020$.

TABLE I

H. R.	Name	Visual Mag.	Spectrum	No. Obs.	Days	Range	Av. Dev.
828	40 Arietis	6.04	G8	11	434	$0^{M}.09$	$0^{M}.026$
951	δ Arietis	4.53	K0				
1601	π^6 Orionis	4.73	K3	5	464	0.08	0.025
1709	Boss 1247	5.82	K3				
8729	51 Pegasi	5.59	G4	13	763	0.10	0.030
8796	56 Pegasi	4.98	K0p				

The first pair in Table I is suspicious but the evidence for the variation in the second pair is not very strong with only five observations; the third pair almost certainly contains a variable as shown by the run of the measures in Table VI. In none of these three cases is it possible to tell which star is causing the discordances, but it happens that H. R. 8796, 56 Pegasi, is the only star in the entire list of two hundred which is marked as having a peculiar spectrum. The period, if there is one, must be several years.

One of the results of the present work then is that the K-stars are usually constant within the limits of measurement. Another check upon this conclusion is a comparison of the means of the average deviations of one observation for stars of different spectral classes, as shown in Table II.

TABLE II

Spectrum	B, A, F	G5-K1	K2-K9	M0	M1	M2	M3	M4	M5-M6
Number of Stars	120	38	40	39	31	43	35	16	13
Mean of Average Deviations	$\pm 0^{M}\!.012$	$\pm .012$	$\pm .012$	$\pm .014$	$\pm .016$	$\pm .023$	$\pm .028$	$\pm .050$	$\pm .067$

The data for the B-, A-, and F-stars are taken from page 28 of the present volume. The comparison stars in the third and fourth columns are divided into about equal groups as they happen to come according to the later spectrum of each pair, and the M-stars were of course compared with these same K-stars.

The first result in Table II is that the stars from B to K when compared with each other show the same average deviations. It was something of a surprise to find that the K-stars gave as good an accordance as the white stars which had been observed in groups of two and three, instead of three and four for the K- and M-stars. The exact agreement of $\pm 0^{M}\!.012$ for the three spectral divisions is not significant, as there were fourteen cases rejected among the B-, A-, and F-stars, and one rejected in G5-K1. It seems therefore that with the present instrument and methods we get the same degree of accordance throughout the spectral range from B to K.

For the M-stars, however, the progression of the average deviation with increasing redness is conspicuous in Table II, the M0-stars being slightly more variable than the K's. Among the M's the stars omitted are the long-observed objects, α Orionis, α Herculis, and ψ^1 Aurigae, the assumed variable ρ Persei, and g Herculis the inclusion of which would still further emphasize the average variability of class M6.

A better demonstration of the variability of the M-stars is given in Table III where under each spectral class are given the numbers of constant, suspicious, and variable stars, together with those previously known or suspected of variation. The next to the last column of Table III contains six Ma- and Mb-stars not observed at Mount Wilson, together with the two N-stars, Y Canum Venaticorum and 19 Piscium, the variations of which are confirmed. The tendency to variability with increasing redness is shown by there being three variables among the seventy-one stars of classes

TABLE III

	G3-K9	M0	M1	M2	M3	M4	M5	M6	Ma, Mb, N	Totals, M and N
Constant	197	38	27	30	19	0	0	0	3	117
Suspicious	2	1	2	3	2	1	1	0	1	11
Variable	1	1	2	11	14	16	10	4	4	62
Totals	200	40	31	44	35	17	11	4	8	190

M0 and M1, while in M4, M5, and M6 together there are thirty certain variables out of thirty-two observed. Classes M2 and M3 give intermediate proportions of variables. In a preliminary report on the present work[3] the number of new variables was estimated at forty, but this is now increased to fifty-one, which with eleven previously-known or suspected variables makes the total of sixty-two in the last column of Table III. Therefore one-third of the 190 red stars observed have shown variation to the extent of at least a tenth of a magnitude, while only one star is surely variable among 200 yellow comparison stars. Twenty-five of the new variables have a range of $0^{M}.20$ or more, while of course all of the visual variables may be expected to fluctuate up to half a magnitude.

These results in Table III are also shown in Figure 1, which is the upper right-hand corner of Russell's well known diagram of absolute magnitude against spectral class. As the faintest absolute magnitude is +0.7, all of the stars on our program are classed as giants; the dwarfs on the Mount Wilson list are from one to four magnitudes too faint to be reached with the photometer on the 15-inch telescope.

In a discussion of this work with Dr. Adams in the summer of 1927 he suggested that we would probably find an increasing tendency to variability as we passed from fainter to brighter absolute magnitude, and this seems to be the case where there are enough stars from which to judge. In classes M2 and M3 the variables are clearly brighter on the average than the constant stars, while the only variable of spectrum M0 is ψ^1 Aurigae, the brightest of that class. Either extreme luminosity or extreme redness seems to go with variability.

Before drawing too many conclusions from the variations of stars detected in this work, perhaps we might stop and ask whether the measures can be in any way affected by unknown errors, and whether these small fluctuations are mere illusions. To begin with, it must be emphasized that any subjective effects due to the observer are absolutely eliminated. The observer never knows whether his measures are indicating that a star is fainter or brighter than normal, and we can not see how any prejudice could creep in.

It may be pointed out that in a number of instances the variability of a star has been fixed by a single discordant observation. We believe that not one of these cases

[3] *Proceedings of the National Academy of Sciences*, **14**, 491, 1928.

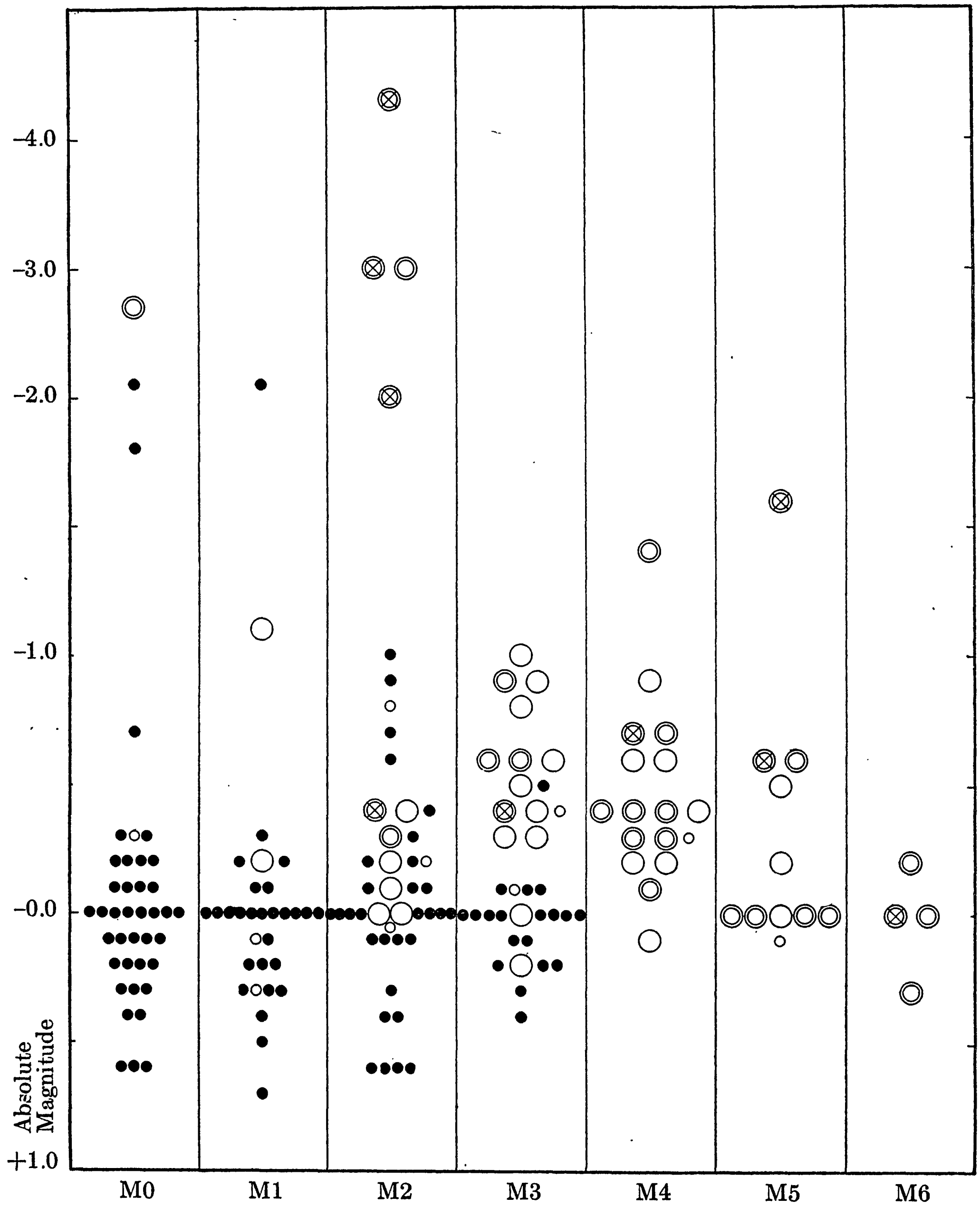

FIGURE 1—Variability of Red Stars

Dots	Constant stars.
Small circles	Suspicious stars.
Large circles	Variable stars, range $0^{M}.10$ to $0^{M}.19$.
Double circles	Variable stars, range $0^{M}.20$ or more.
Crossed circles	Previously known variable stars.

is due to observing a wrong star. The procedure at the telescope is to set with the coarse circles on the first star of a group, and then the next object is picked up by making the regular setting in declination and a differential setting in hour angle. When the change in hour angle is less than five or six minutes, the observer simply watches in the finder, which has a field of one degree, and turns the instrument as indicated by the assistant. To pick up a wrong star the same mistake must be made going forward and backward in the group, since the photometer readings show at once if the same object is not being measured the second time. If there were any such observing blunders they ought to show among the comparison stars, and not alone among the red stars which are so easy to identify at the telescope.

Again, we have not overlooked the consideration that a residual error in the extinction might cause a star to appear variable, but such an effect should show for all red stars in a group, and for all neighboring red stars on the same night. As most of the corrections for the extinction were less than $0^{M}.02$, it would be difficult to introduce an error of five times that amount.

We conclude then that the variations which we measure are real changes in the stars, and that we have not fallen into the same errors that have beset visual observers so often in the past.

Notwithstanding the considerable amplitude of variation of many of these stars, we have had little success in the determination of periods. A special study is being made of the three stars, α Orionis, α Herculis, and ψ^1 Aurigae, for which we have measures extending over twenty, twelve, and ten years, respectively, but in no one of these three cases has it been possible to derive a really satisfactory period. If we use the term "period" to mean the time interval between any two successive maxima or successive minima indicated by our fragmentary observations, then an inspection of the results for the sixty-two variables gives something like the following. For thirth-nine stars the periods must be greater than 100 days, for twelve stars the periods may be less than 100 days, and for the remaining eleven stars no guess can be made. So uncertain are these figures that we have trouble in making the same count twice in succession.

Thus far we have ignored the previous observations of red stars by visual observers, extending over a century or more. A summary of our present knowledge of these irregular variables is given by Ludendorff[4] who classes them as μ-Cephei stars. The results of eye-estimates are such a mixture of facts and illusions that almost nothing has been agreed upon except that some of these stars vary irregularly and that their changes are most difficult to determine. We can state without offense to other observers that the photo-electric photometer gives results with errors at least five times smaller than anything we ourselves can secure by direct eye-estimates. A variation of a tenth of a magnitude measured with the instrument is as well established as a change of half a magnitude derived by comparing visually a suspected variable with differently colored stars in the same neighborhood. Other observers may do better, but we are sure that the figure of a five-fold improvement by means of the instrument is a conservative one so far as our own eyes are concerned.

[4] *Handbuch der Astrophysik,* **6**, p. 166.

Yet despite our conventional suspicion of everything that has been previously done on these red stars we find ourselves forced to exactly the same conclusions that have heretofore been held about the variations. Many of the stars of spectrum class M do have a tendency to vary by several tenths of a magnitude in the course of a few months, but the irregularities in period and amplitude are such that it is next to impossible to derive any law for these fluctuations.

Similarly the increased precision of the photo-electric measures has given no new clue to the unknown causes of the variations of red stars. The tendency to light-variation is found to follow exactly the spectral sequence, namely, constant light in class K, increasing variability in M0 to M6, and then the great changes in the long-period stars of spectrum Me. It is among these latter with variations of a thousand fold or more that we might hope for a solution of the problem of the causes of variability. According to current theories of stellar evolution the trend of a diffuse giant star is toward contraction and increased surface temperature, which means a motion from right to left on the diagram in Figure 1, with little change up or down in absolute magnitude. The long-period variables are therefore the youngest stars of all, while the irregular variables of the present study form a series of definite connecting links between the stars with great light-changes and the steady stars of class K. What the corresponding progression is among the dwarf red stars is a matter for the future to determine.

SUMMARY

1. A survey with the photo-electric photometer has been made of 190 red stars of spectrum class M, comparing them with 200 yellow stars of spectrum roughly class K.

2. The measures of the comparison stars show the same degree of accordance that was previously secured in similar observations of B-, A-, and F-stars. Only one variable was detected in 200 objects tested.

3. For the red stars there is an increasing amount of discordance as we pass from M0 to M6, and one-third of these objects show variability to the extent of a tenth of a magnitude. Either late spectral type or bright absolute magnitude seems to be accompanied by light-variations.

4. The number of new variables is fifty-one; in addition there are eleven previously known variables and eleven suspicious stars.

5. Because of the irregularities in the light fluctuations no periods have been found; most of the stars require three months or more to complete a single irregular cycle of change.

6. These results all refer to giant stars, and indicate that probably no diffuse red star is really constant in light over an interval of a few months or years.

7. The red stars of the present study form a definite connection, both as to spectrum and as to light-variation, between the long-period variables and the steady stars of class K.

TABLE IV

RED STARS

H. R.	Name	R. A. 1900		Decl. 1900		Vis. Mag.	Abs. Mag.	Spec.	No. Obs.	Days	Range	Av. Dev.	Var.
		h	m	°	′						M	M	
45	χ Pegasi	0	9.4	+19	39	4.94	+0.7	M1	6	62	0.05	0.014	....
46	....	0	9.4	− 8	21	5.36	−0.2	M4	6	384	.12	.032	V
103	47 Piscium	0	22.8	+17	21	5.33	−0.6	M3	6	62	.25	.070	V
117	12 Ceti	0	24.9	− 4	31	6.04	+0.2	M0	3	331	.02	.010	....
211	57 Piscium	0	41.3	+14	55	5.58	+0.1	M4	4	106	.13	.040	V
248	20 Ceti	0	47.9	− 1	41	4.92	−0.2	M0	3	331	.02	.007	....
337	β Androm.	1	4.1	+35	5	2.37	+0.3	M0	7	773	.10	.019	....
450	....	1	29.4	+17	57	6.05	+0.3	M2	4	85	.03	.014	....
587	....	1	55.5	− 9	1	5.72	0.0	M5	4	763	.11	.031	V
631	15 Arietis	2	5.1	+19	2	5.92	−0.1	M3	6	410	.08	.019	....
648	19 Arietis	2	7.6	+14	48	5.99	+0.1	M1	6	410	.04	.010	....
689	69 Ceti	2	16.8	− 0	4	5.56	0.0	M1	4	86	.04	.016	....
750	15 Trianguli	2	29.7	+34	15	5.62	−0.3	M3	9	453	.14	.035	V
843	17 Persei	2	45.4	+34	39	4.67	+0.3	M0	9	453	.06	.017	....
867	45 Arietis	2	50.2	+17	55	5.94	0.0	M6	11	434	.45	.122	V
881	....	2	52.8	+79	1	5.66	0.0	M2	6	87	.03	.012	....
911	α Ceti	2	57.1	+ 3	42	2.82	+0.1	M2	5	817	.06	.017	....
921	ρ Persei	2	58.8	+38	27	var.	−0.7	M4	......	......	....	....	V
935	....	3	1.6	− 6	28	5.56	0.0	M3	4	378	.04	.018	....
1009	....	3	16.0	+64	14	5.55	−1.8	M0	5	87	.04	.014	....
									4	111	.06	.020	
1105	....	3	33.5	+62	54	5.32	−0.6	M4	10	529	.15	.038	V
									4	111	.12	.049	
1155	....	3	40.4	+65	13	4.71	−1.1	M1	12	861	.18	.045	V
1335	....	4	13.1	+60	30	5.67	−0.3	M0	5	132	.05	.017	....
1451	47 Eridani	4	29.4	− 8	27	5.45	−0.6	M3	9	490	.20	.047	V
1527	....	4	42.7	+63	20	5.81	0.0	M2	5	143	.03	.010	....
1556	4 Orionis	4	46.9	+14	5	5.19	−0.4	M4	9	490	.11	.028	V
1562	5 Orionis	4	48.2	+ 2	20	5.67	0.0	M1	5	464	.05	.012	....
1722	....	5	11.1	+42	41	5.88	−0.4	M4	7	464	.20	.058	V
1802	17 Camelop.	5	20.7	+62	59	5.75	−0.3	M1	5	143	.04	.012	....
1834	31 Orionis	5	24.7	− 1	11	4.97	0.0	M0	5	392	.04	.010	....
1845	119 Tauri	5	26.3	+18	32	4.73	−3.0	M2	9	490	.36	.080	V
1866	....	5	28.4	+54	20	5.96	−0.2	M0	4	72	.03	.010	....
2011	υ Aurigae	5	44.2	+37	16	4.99	+0.3	M1	9	910	.06	.011	....
2061	α Orionis	5	49.8	+ 7	23	var.	−4.3	M2	......	7366	.6±	....	V
2091	π Aurigae	5	52.5	+45	56	4.59	−1.0	M3	9	910	.17	.046	V
2215	1 Lyncis	6	8.7	+61	33	5.30	−0.6	M3	8	910	.11	.030	V
2216	η Gemin.	6	8.8	+22	32	var.	−0.4	M3	8	511	.27	.071	V
2269	....	6	14.4	+14	41	6.02	0.0	M0	3	57	.02	.008	....
2275	....	6	15.0	− 2	54	5.18	0.0	M1	5	403	.06	.016	....
2286	μ Gemin.	6	16.9	+22	34	3.19	−0.4	M3	8	511	.14	.038	V
2289	ψ¹ Aurigae	6	17.2	+49	20	5.10	−2.7	M0	......	3774	.6±	....	V
2469	....	6	37.2	− 9	4	5.32	+0.3	M0	5	398	.04	.013	....
2508	....	6	42.8	− 8	54	5.26	−2.1	M1	5	398	.06	.018	....
2609	51 H. Cephei....	6	53.7	+87	12	5.26	0.0	M2	9	515	.14	.039	V
2639	....	6	57.0	− 5	35	5.38	−0.6	M2	4	398	.04	.011	....

TABLE IV—*Continued*

H. R.	Name	R. A. 1900		Decl. 1900		Vis. Mag.	Abs. Mag.	Spec.	No. Obs.	Days	Range	Av. Dev.	Var.
		h	*m*	°	′						M	M	
2703	....	7	5.6	+51	36	5.69	+0.2	M3	7	408	0.14	0.035	V
2717	51 Gemin.	7	7.6	+16	20	5.31	−0.4	M4	9	754	.44	.079	V
2725	52 Gemin.	7	8.6	+25	5	6.02	+0.3	M1	5	377	.08	.030	S
2738	53 Gemin.	7	9.7	+28	5	5.87	+0.1	M1	5	377	.08	.028	S
2742	....	7	10.1	+82	36	5.11	−0.1	M4	9	515	.24	.056	V
2747	....	7	10.3	+ 8	10	5.97	......	*Mb*	4	358	.08	.027	S
2795	56 Gemin.	7	16.1	+20	38	5.16	+0.1	M0	9	754	.06	.013	....
2903	....	7	29.3	+46	24	5.80	+0.2	M1	4	82	.02	.012	....
2905	υ Gemin.	7	29.8	+27	7	4.22	+0.1	M0	5	377	.05	.014	....
2938	74 Gemin.	7	33.7	+17	55	5.24	−0.3	M0	4	409	.08	.033	S
2967	....	7	36.4	+14	26	5.81	−0.8	M3	4	409	.10	.026	V
2983	76 Gemin.	7	38.1	+26	1	5.40	0.0	M0	5	377	.05	.014	....
2999	....	7	40.0	+37	46	5.45	0.0	M3	7	461	.08	.020	....
3013	π Gemin.	7	41.1	+33	40	5.29	−0.1	M1	7	461	.08	.024	..
3319	27 Cancri	8	21.2	+13	0	5.75	−0.9	M3	6	417	.21	.062	V
3357	θ Cancri	8	25.9	+18	26	5.57	+0.3	M1	6	417	.05	.014	....
3576	ρ Urs. Maj.	8	53.5	+68	1	4.99	+0.1	M3	9	754	.07	.021	....
3609	σ^1 Urs. Maj.	8	59.6	+67	17	5.33	−0.1	M0	9	754	.04	.010	....
3660	17 Urs. Maj.	9	8.5	+57	10	5.48	0.0	M0	4	91	.05	.016	....
3698	....	9	14.4	+57	8	5.98	......	*Mb*	7	408	.24	.089	V
3705	40 Lyncis	9	15.0	+34	49	3.30	−0.3	M0	7	413	.04	.013	....
3769	8 Leo Min.	9	25.5	+35	33	5.52	+0.2	M1	7	413	.07	.016	....
3820	....	9	30.8	+31	37	5.74	−0.1	M2	7	413	.09	.019	....
3866	ψ Leonis	9	38.3	+14	29	5.62	−0.1	M2	{ 4	345	.03	.012 }	....
									{ 4	345	.05	.017 }	....
3870	44 Lyncis	9	39.5	+57	35	5.36	−0.9	M3	7	408	.16	.039	V
3876	....	9	40.9	+ 7	10	5.99	0.0	M1	3	49	.01	.005	....
3950	π Leonis	9	54.9	+ 8	31	4.89	0.0	M2	5	81	.02	.007	....
4035	37 Leonis	10	11.3	+14	13	5.74	+0.4	M2	{ 4	345	.03	.012 }	....
									{ 3	297	.02	.008 }	....
4088	44 Leonis	10	20.0	+ 9	17	5.92	+0.1	M3	5	405	.06	.016	....
4092	....	10	20.8	− 6	34	5.85	0.0	M2	3	51	.03	.012	....
4122	....	10	26.0	− 7	7	6.40	+0.6	M0	3	51	.04	.015	....
4127	46 Leonis	10	26.9	+14	39	5.74	−0.2	M2	{ 4	345	.05	.016 }	S
									{ 3	297	.08	.035 }	
4267	56 Leonis	10	50.8	+ 6	43	6.05	−0.6	M5	4	75	.28	.085	V
4299	61 Leonis	10	56.8	− 1	57	4.97	+0.2	M1	5	81	.04	.011	....
4333	....	11	3.9	+36	51	5.99	......	*Mb*	4	350	.05	.014	....
4336	....	11	4.0	+43	45	6.03	......	*Ma*	4	350	.06	.017	....
4362	72 Leonis	11	9.9	+23	39	4.87	−0.8	M2	4	354	.08	.037	S
4371	75 Leonis	11	12.1	+ 2	34	5.44	+0.6	M0	5	81	.02	.008	....
4434	λ Draconis	11	25.5	+69	53	4.06	−0.2	M0	9	377	.07	.021	....
4483	ω Virginis	11	33.3	+ 8	42	5.47	+0.3	M6	9	835	.22	.045	V
4517	ν Virginis	11	40.7	+ 7	5	4.20	−0.2	M1	9	835	.07	.018	....
4726	71 Urs. Maj.	12	20.3	+57	19	5.99	+0.4	M3	6	354	.04	.011	....
4745	73 Urs. Maj.	12	22.8	+56	16	5.84	+0.6	M2	6	354	.02	.007	....
4765	4 Draconis	12	25.7	+69	45	5.25	−0.3	M4	7	324	.20	.056	V
4807	....	12	33.3	+ 2	25	6.02	+0.2	M3	7	427	.09	.022	....

TABLE IV—*Continued*

H. R.	Name	R. A. 1900		Decl. 1900		Vis. Mag.	Abs. Mag.	Spec.	No. Obs.	Days	Range	Av. Dev.	Var.
		h	*m*	°	′						M	M	
4846	*Y* Can. Ven.	12	40.4	+45	58	var.	....	*Nb*	6	326	0.62	0.159	V
4909	....	12	50.4	+47	45	6.02	....	*Mb*	10	433	.36	.091	V
4910	δ Virginis	12	50.6	+ 3	56	3.66	0.0	M3	5	106	.03	.010	....
4920	36 Com. Ber.	12	54.0	+17	57	4.96	+0.1	M0	6	381	.07	.018	....
4949	40 Com. Ber.	13	1.5	+23	9	5.90	−0.2	M5	6	381	.19	.062	V
4998	....	13	9.5	+11	52	5.81	0.0	M0	4	103	.04	.012	....
5015	σ Virginis	13	12.6	+ 6	0	5.01	−0.2	M2	5	106	.03	.010	....
5095	74 Virginis	13	26.8	− 5	45	4.83	+0.2	M3	6	408	.07	.021	....
5123	....	13	32.3	+25	7	5.90	....	*Ma*	6	356	.05	.013	....
5150	82 Virginis	13	36.4	− 8	12	5.16	+0.1	M2	6	408	.07	.015	....
5154	83 Urs. Maj.	13	36.9	+55	12	4.75	+0.1	M2	5	298	.06	.017	....
5200	υ Boötis	13	44.6	+16	17	4.28	+0.6	M0	6	131	.03	.010	....
5215	....	13	46.7	+35	10	6.00	0.0	M1	10	433	.08	.018	....
5219	....	13	47.4	+34	57	4.96	−0.3	M2	10	433	.20	.053	V
5226	10 Draconis	13	48.5	+65	13	4.77	−0.4	M3	13	505	(.13)	.029	S
5299	....	14	3.9	+44	20	5.44	−0.7	M4	10	698	.22	.048	V
5300	13 Boötis	14	4.6	+49	56	5.44	0.0	M2	10	698	.13	.033	V
5334	....	14	10.2	+69	54	5.36	+0.4	M2	13	505	(.10)	.022	....
5352	101 Virginis	14	12.7	+15	44	6.05	0.0	M3	6	131	.05	.015	....
5452	....	14	31.2	+49	48	5.90	−0.2	M1	{ 8	607	.14	.031 }	V
									{ 5	360	.10	.016 }	
5490	*W* Boötis	14	39.0	+26	57	4.93	−0.5	M3	5	103	.05	.021	....
5589	....	14	56.0	+66	20	4.86	0.0	M5	20	558	.29	.068	V
5590	....	14	56.1	− 2	21	5.68	0.0	M1	5	100	.08	.024	....
5594	2 Serpentis	14	56.7	+ 0	14	5.91	−0.9	M2	5	100	.06	.019	....
5654	....	15	7.5	+19	22	5.98	−0.2	M4	7	465	.15	.048	V
5739	τ¹ Serpentis	15	21.2	+15	47	5.46	−0.1	M1	7	465	.06	.015	....
5763	ν Boötis	15	27.3	+41	10	5.15	−0.1	M0	4	77	.04	.013	....
5800	μ Coronae	15	31.5	+39	21	5.44	0.0	M2	4	77	.03	.009	....
5879	κ Serpentis	15	44.2	+18	27	4.28	0.0	M1	6	361	.04	.011	....
5924	....	15	50.2	+20	36	5.76	−0.7	M0	6	361	.03	.007	....
5932	2 Herculis	15	51.3	+43	26	5.54	−0.1	M3	4	77	.04	.013	....
6010	47 Serpentis	16	3.6	+ 8	48	5.90	−0.3	M3	5	353	.10	.036	V
6039	10 Herculis	16	7.3	+23	45	5.96	−0.3	M4	11	512	.21	.058	V
6056	δ Ophiuchi	16	9.1	− 3	26	3.03	0.0	M0	3	101	.01	.005	....
6086	....	16	15.6	+60	0	5.64	−0.6	M4	6	136	.18	.063	V
6107	20 Coronae	16	18.6	+34	2	5.36	0.0	M2	8	387	.08	.014	....
6128	....	16	22.3	− 7	23	5.45	−0.1	M2	3	101	.04	.018	....
6146	*g* Herculis	16	25.4	+42	6	var.	0.0	M6	13	516	.70	.140	V
6159	29 Herculis	16	27.9	+11	42	4.92	+0.1	M0	{ 6	353	.05	.017 }	....
									{ 3	56	.03	.014 }	
6200	42 Herculis	16	36.0	+49	7	5.14	0.0	M2	13	516	.05	.013	....
6227	....	16	40.9	+15	56	5.78	−0.1	M3	6	353	.08	.034	S
6228	43 Herculis	16	41.0	+ 8	46	5.38	0.0	M1	3	56	.05	.022	....
6258	50 Herculis	16	46.7	+29	59	5.86	0.0	M1	6	341	.03	.009	....
6337	32 Ophiuchi	16	58.6	+14	14	5.10	+0.2	M3	44	1273	.09	.016	....
6393	37 Ophiuchi	17	7.8	+10	42	5.56	−0.4	M2	3	56	.04	.016	....

TABLE IV—*Continued*

R.	Name	R. A. 1900		Decl. 1900		Vis. Mag.	Abs. Mag.	Spec.	No. Obs.	Days	Range	Av. Dev.	Var.
		h	m	°	′						M	M	
6406	α Herculis	17	10.1	+14	30	var.	−1.6	M5	......	4237	0.5±	....	V
6452	....	17	15.9	+18	10	5.17	−0.2	M2	6	397	.16	0.035	V
6464	74 Herculis	17	17.5	+46	20	5.77	−0.1	M0	8	393	.08	.020	....
6702	....	17	53.9	+45	23	6.22	−0.2	M6	6	368	.36	.121	V
6728	....	17	57.1	+45	31	5.92	+0.2	M0	6	368	.08	.024	....
6765	98 Herculis	18	1.8	+22	13	5.32	−0.2	M2	12	415	.06	.014	....
6815	104 Herculis	18	8.2	+31	22	5.02	0.0	M3	12	415	.14	.036	V
6868	106 Herculis	18	16.1	+21	55	4.98	0.0	M0	4	67	.04	.012	....
6882	....	18	18.0	+23	14	5.66	+0.2	M0	4	67	.03	.010	....
6891	....	18	19.0	+49	4	5.09	0.0	M3	5	106	.04	.015	....
7139	δ² Lyrae	18	51.0	+36	47	4.52	−1.4	M4	18	801	.34	.068	V
7157	*R* Lyrae	18	52.3	+43	49	var.	−0.6	M5	5	104	.26	.085	V
7405	6 Vulpec.	19	24.5	+24	28	4.63	+0.3	M1	7	750	.05	.015	....
7414	36 Aquilae	19	25.4	− 3	0	5.22	−0.2	M1	3	159	.03	.014	....
7514	....	19	40.4	+41	32	6.04	0.0	M0	3	61	.02	.007	....
7536	δ Sagittae	19	42.9	+18	17	3.78	−1.0	M2	14	388	.09	.020	....
7566	19 Cygni	19	47.0	+38	27	5.43	−0.4	M2	6	380	.12	.036	V
7635	γ Sagittae	19	54.3	+19	13	3.71	−0.2	M0	14	388	.03	.007	....
7645	13 Sagittae	19	55.6	+17	15	5.56	−0.4	M4	4	78	.24	.069	V
7676	64 Draconis	20	0.4	+64	32	5.43	0.0	M1	5	111	.04	.011	....
7804	....	20	19.6	+68	34	5.99	0.0	M5	5	111	.25	.065	V
7851	ω² Cygni	20	28.2	+48	53	5.57	+0.6	M2	5	117	.04	.017	....
7951	3 Aquarii	20	42.5	− 5	24	4.60	0.0	M3	4	80	.05	.016	....
8044	....	20	55.9	+18	57	5.96	+0.3	M3	5	116	.05	.011	....
8163	9 Equulei	21	16.2	+ 6	56	6.01	0.0	M3	3	61	.04	.014	....
8225	2 Pegasi	21	25.5	+23	12	4.76	0.0	M1	5	116	.04	.010	....
8284	75 Cygni	21	36.3	+42	49	5.35	+0.4	M1	4	126	.01	.004	....
8289	7 Pegasi	21	37.3	+ 5	14	5.63	−0.3	M2	3	79	.04	.014	....
8306	....	21	39.1	+40	42	5.54	+0.1	M2	3	74	.01	.004	....
8316	μ Cephei	21	40.4	+58	19	var.	−3.0	M2	4	126	.23	.066	V
8339	12 Cephei	21	44.5	+60	14	5.64	+0.5	M1	4	126	.02	.008	....
8383	*VV* Cephei	21	53.8	+63	9	5.35	−2.0	M2e	8	478	.23	.079	V
8416	18 Cephei	22	0.8	+62	38	5.46	+0.1	M5	8	478	.09	.027	S
8424	....	22	1.9	+44	31	5.32	+0.1	M0	6	412	.06	.020	....
8562	36 Pegasi	22	24.1	+ 8	38	5.82	−0.1	M0	3	77	.03	.013	....
8572	5 Lacertae	22	25.4	+47	11	4.61	−2.1	M0	6	412	.09	.020	....
8621	....	22	34.7	+56	17	5.47	−0.3	M4	8	478	.09	.030	S
8698	λ Aquarii	22	47.4	− 8	7	3.84	−0.1	M2	{ 9	392	.10	.026 }	V
									{ 3	90	.09	.036 }	
8699	15 Lacertae	22	47.5	+42	47	5.17	+0.2	M0	3	55	.03	.010	....
8775	β Pegasi	22	58.9	+27	32	2.61	−0.4	M2	18	857	.31	.074	V
8795	55 Pegasi	23	2.0	+ 8	52	4.69	+0.6	M2	3	77	.01	.004	....
8815	57 Pegasi	23	4.5	+ 8	8	5.41	−0.9	M4	7	791	.11	.030	V
8834	φ Aquarii	23	9.1	− 6	35	4.40	−0.6	M2	3	90	.02	.008	....
8850	χ Aquarii	23	11.7	− 8	16	5.14	0.0	M5	{ 12	832	.27	.057 }	V
									{ 3	90	.15	.064 }	
8860	8 Androm.	23	13.1	+48	28	4.99	0.0	M2	4	133	.04	.010	....

TABLE IV—*Continued*

H. R.	Name	R. A. 1900	Decl. 1900	Vis. Mag.	Abs. Mag.	Spec.	No. Obs.	Days	Range	Av. Dev.	Var
		h m	° ′						M	M	
8876	10 Androm.	23 15.1	+41 31	5.98	+0.4	M0	3	55	0.04	0.016	....
8882	63 Pegasi	23 15.9	+29 52	5.78	+0.4	M0	5	353	.04	.010	....
8904	4 Cassiop.	23 20.4	+61 44	5.20	−0.7	M2	4	156	.06	.017	....
8940	71 Pegasi	23 28.5	+21 57	5.51	0.0	M5	18	857	.30	.055	V
8991	77 Pegasi	23 38.3	+ 9 46	5.39	0.0	M2	7	791	.09	.028	S
9004	19 Piscium	23 41.3	+ 2 56	5.30	....	*Na*	5	465	.16	.052	V
9036	φ Pegasi	23 47.4	+18 34	5.23	0.0	M3	7	791	.05	.013	....
9047	....	23 49.7	− 0 27	5.98	−0.5	M5	5	465	.16	.047	V
9064	ψ Pegasi	23 52.7	+24 35	4.75	−0.1	M3	6	509	.07	.021	....
9089	30 Piscium	23 56.8	− 6 35	4.66	−0.5	M3	6	384	.14	.041	V

REMARKS ON TABLE IV

921 ρ Persei, visual, 3.4–4.2, not observed.
2061 α Orionis, visual, 0.9±, many measures.
2216 η Geminorum, visual, 3.2–4.2.
2289 ψ^1 Aurigae, many measures.
4846 *Y* Canum Venaticorum, visual, 4.8–6.0.
5490 *W* Bootis, constant.
6146 *g* Herculis, visual, 4.7–6.0.
6337 32 Ophiuchi, with α Herculis.
6406 α Herculis, visual, 3.1–3.9, many measures.
7157 *R* Lyrae, visual, 4.0–4.7.
8316 μ Cephei, visual, 4–5.
8383 *VV* Cephei, photographic.
8775 β Pegasi, suspected visual.
9004 19 Piscium, suspected visual.

TABLE V

COMPARISON STARS

H. R.	Name	R. A. 1900		Decl. 1900		Vis. Mag.	Spectrum
		h	m	°	′		
3	33 Piscium	0	0.2	− 6	16	4.68	K0
29	....	0	5.2	− 5	49	5.95	*G5*
94	....	0	19.4	− 2	47	6.28	*K0*
166	54 Piscium	0	34.2	+20	43	6.08	K0
167	55 Piscium	0	34.6	+20	54	5.57	G7
213	58 Piscium	0	41.8	+11	25	5.68	K0
319	75 Piscium	1	1.3	+12	25	6.22	G7
352	τ Piscium	1	6.2	+29	34	4.70	K1
360	φ Piscium	1	8.3	+24	3	4.64	G7
414	94 Piscium	1	21.3	+18	44	5.63	G8
475	105 Piscium	1	34.3	+15	54	6.11	K1
563	ι Arietis	1	51.9	+17	20	5.16	G6
609	....	1	58.3	+17	46	6.42	K5
737	....	2	26.3	+ 1	50	5.44	K2
739	75 Ceti	2	27.1	− 1	28	5.53	*K0*
752	77 Ceti	2	29.8	− 8	17	5.82	*K0*
759	80 Ceti	2	31.0	− 8	16	5.71	*K5*
774	....	2	33.3	+81	2	5.92	*K0*
828	40 Arietis	2	42.9	+17	52	6.04	G8
876	....	2	51.7	+38	13	6.08	*K0*
882	24 Persei	2	52.9	+34	47	4.97	K2
907	ρ¹ Eridani	2	56.2	− 8	3	5.94	*G5*
917	ρ² Eridani	2	57.8	− 8	5	5.52	*G5*
947	ω Persei	3	4.8	+39	14	4.82	K1
951	δ Arietis	3	5.9	+19	21	4.53	K0
996	κ Ceti	3	14.1	+ 3	0	4.96	G5
1030	ο Tauri	3	19.4	+ 8	41	3.80	G7
1080	....	3	27.4	+75	24	6.38	*G5*
1112	....	3	34.5	+59	39	5.98	K5
1205	....	3	48.6	+60	49	5.22	K4
1313	....	4	8.8	+57	37	5.80	*K0*
1332	....	4	12.4	− 6	43	6.09	*K0*
1452	....	4	29.4	− 9	11	5.50	K5
1457	α Tauri	4	30.2	+16	19	1.06	K5
1467	3 Camelop.	4	32.0	+52	53	5.31	G6
1580	ο² Orionis	4	50.7	+13	21	4.28	K1
1601	π⁶ Orionis	4	53.4	+ 1	33	4.73	K3
1684	....	5	6.0	+15	55	5.36	K5
1709	Boss 1247	5	9.4	+ 5	3	5.82	K3
1720	....	5	11.0	+62	33	5.88	K4
1725	....	5	11.6	+40	21	6.32	*K0*
1773	σ Aurigae	5	17.9	+37	17	5.22	K5
1830	....	5	24.4	− 3	32	6.06	*K0*
1874	....	5	29.0	− 1	32	6.22	*K0*
1907	φ² Orionis	5	31.4	+ 9	15	4.39	G2
1925	....	5	33.2	+53	26	6.41	K0
1941	24 Aurigae	5	34.6	+56	33	6.19	K0
1995	τ Aurigae	5	42.3	+39	9	4.64	G5
2012	ν Aurigae	5	44.6	+39	7	4.18	K1
2152	37 Camelop.	6	1.1	+58	57	5.42	G8

TABLE V—*Continued*

H. R.	Name	R. A. 1900		Decl. 1900		Vis. Mag.	Spectrum
		h	m	°	′		
2165	36 Camelop.	6	2.8	+65	44	5.39	*K0*
2219	κ Aurigae	6	9.0	+29	33	4.45	G8
2235	....	6	10.6	+17	12	6.47	*K0*
2277	....	6	15.6	+17	49	6.46	*K0*
2334	77 Orionis	6	22.1	+ 0	21	5.29	G8
2335	78 Orionis	6	22.2	− 0	13	5.82	*K0*
2381	....	6	27.0	− 8	5	5.59	*K0*
2427	ψ² Aurigae	6	32.2	+42	35	5.09	*G5*
2459	ψ⁴ Aurigae	6	35.8	+44	38	5.17	K5
2655	....	6	59.1	− 5	10	5.88	K1
2663	....	7	0.2	+ 9	18	6.02	*K0*
2701	20 Monoc.	7	5.2	− 4	5	5.02	K0
2713	....	7	6.8	+ 5	39	6.22	*G5*
2737	....	7	9.7	+52	18	6.04	*K0*
2804	....	7	17.1	+52	5	5.91	*K2*
2864	6 Can. Min.	7	24.2	+12	13	4.85	K4
2924	70 Gemin.	7	32.0	+35	17	5.61	G3
2935	....	7	33.5	+38	34	5.89	*K5*
2939	....	7	33.8	+48	22	5.77	G7
3066	26 Lyncis	7	47.4	+47	49	5.69	K5
3128	3 Cancri	7	55.1	+17	35	5.79	K4
3366	η Cancri	8	26.9	+20	47	5.52	K5
3403	π² Urs. Maj.	8	31.5	+64	40	4.76	K2
3461	δ Cancri	8	39.0	+18	31	4.17	K0
3751	....	9	22.9	+81	46	4.58	K4
3815	11 Leo. Min.	9	29.7	+36	16	5.48	K1
3826	8 Leonis	9	31.6	+16	54	5.92	K1
3827	1 Sextantis	9	31.9	+ 7	17	5.14	*K0*
3834	2 Sextantis	9	33.2	+ 5	6	4.78	K3
3877	18 Leonis	9	41.0	+12	17	5.87	K5
3922	....	9	50.2	+57	54	5.99	G4
3980	31 Leonis	10	2.6	+10	30	4.58	K5
4004	19 Sextantis	10	7.6	+ 5	7	5.91	G9
4059	....	10	14.5	− 4	37	6.44	*K0*
4193	35 Sextantis	10	38.1	+ 5	16	5.99	K1
4208	51 Leonis	10	41.0	+19	25	5.64	K2
4209	52 Leonis	10	41.2	+14	43	5.64	G5
4291	58 Leonis	10	55.4	+ 4	9	5.05	K1
4335	ψ Urs. Maj.	11	4.0	+45	2	3.15	K0
4358	....	11	8.8	+ 8	37	5.90	K3
4418	τ Leonis	11	22.8	+ 3	24	5.18	G7
4432	87 Leonis	11	25.2	− 2	27	5.07	K5
4433	86 Leonis	11	25.3	+18	58	5.74	K0
4461	2 Draconis	11	30.2	+69	53	5.36	G5
4495	92 Leonis	11	35.6	+21	54	5.43	G7
4504	3 Draconis	11	36.9	+67	18	5.48	K2
4659	....	12	10.4	+70	45	5.89	*K0*
4695	16 Virginis	12	15.3	+ 3	53	5.10	K0
4762	75 Urs. Maj.	12	25.4	+59	19	6.22	*K0*
4795	6 Draconis	12	30.5	+70	34	5.18	*K0*

TABLE V—*Continued*

H. R.	Name	R. A. 1900		Decl. 1900		Vis. Mag.	Spectrum
		h	*m*	°	′		
4837	....	12	38.5	− 1	1	6.08	*G0*
4863	7 Draconis	12	43.5	+67	20	5.67	K3
4878	37 Virginis	12	46.5	+ 3	36	6.12	K4
4919	....	12	52.6	+46	44	6.22	*K0*
4945	....	13	1.4	+45	48	5.72	K4
4960	....	13	4.3	+10	33	5.95	K0
4962	....	13	4.8	+17	22	6.18	*K0*
4986	....	13	7.6	+12	5	5.82	*K5*
5102	....	13	28.1	+24	52	6.18	*G5*
5111	80 Virginis	13	30.3	− 4	53	5.75	*K0*
5149	2 Boötis	13	36.3	+23	1	5.80	G6
5161	....	13	38.3	+35	30	5.98	*K0*
5213	....	13	46.5	+61	59	6.05	*K0*
5254	....	13	53.8	+15	8	6.02	K5
5310	....	14	6.9	+32	45	6.24	*K2*
5370	20 Boötis	14	15.1	+16	46	4.97	K4
5420	24 Boötis	14	25.2	+50	18	5.61	*G5*
5464	....	14	34.5	+44	4	5.92	*K0*
5544	ξ Boötis	14	46.8	+19	31	4.64	G5
5573	1 Serpentis	14	52.4	+ 0	14	5.71	K1
5600	ω Boötis	14	57.7	+25	24	4.93	K5
5616	ψ Boötis	15	0.2	+27	20	4.67	K2
5690	....	15	13.3	− 0	6	6.04	*K5*
5737	....	15	21.0	+63	42	5.78	K5
5785	....	15	29.6	+64	33	5.88	*G5*
5795	τ^3 Serpentis	15	31.0	+18	0	6.06	G7
5840	τ^6 Serpentis	15	36.4	+16	21	5.97	G5
5855	π Coronae	15	40.1	+32	50	5.60	G9
5899	ρ Serpentis	15	46.9	+21	17	4.88	K5
5901	κ Coronae	15	47.5	+35	59	4.77	K1
5922	....	15	50.0	+56	7	5.92	*K0*
5947	ε Coronae	15	53.4	+27	10	4.22	K0
5966	5 Herculis	15	56.7	+18	6	5.28	G7
5976	43 Serpentis	15	58.8	+ 5	16	6.18	*K0*
6057	....	16	9.3	+ 6	9	6.44	*G5*
6068	....	16	11.7	+27	41	6.30	*K2*
6075	ε Ophiuchi	16	13.0	− 4	27	3.34	G7
6108	21 Coronae	16	18.7	+33	56	5.28	K4
6130	....	16	22.5	+61	56	5.64	*G5*
6220	η Herculis	16	39.5	+39	7	3.61	G5
6239	....	16	43.5	+13	46	6.32	*G5*
6292	56 Herculis	16	50.9	+25	54	6.33	G4
6299	κ Ophiuchi	16	52.9	+ 9	32	3.42	K0
6333	....	16	58.2	+25	40	5.95	*K0*
6433	66 Herculis	17	13.9	+10	58	5.28	K7
6542	....	17	29.2	+16	25	5.66	G9
6574	82 Herculis	17	34.0	+48	38	5.54	*K0*
6607	....	17	39.1	+51	52	6.12	*K0*
6638	....	17	44.1	+20	36	5.77	G5
6791	....	18	4.5	+43	27	5.11	*G5*

TABLE V—*Continued*

H. R.	Name	R. A. 1900		Decl. 1900		Vis. Mag.	Spectrum
		h	m	°	′		
6824	....	18	9.5	+41	8	6.36	*K0*
6860	105 Herculis	18	15.1	+24	24	5.49	K4
6966	....	18	28.6	+23	33	5.99	K5
6983	....	18	31.6	+52	16	5.42	G5
7137	....	18	50.7	+50	35	4.97	G5
7146	....	18	51.7	+41	29	5.57	G8
7192	λ Lyrae	18	56.3	+32	0	5.11	K4
7314	θ Lyrae	19	12.9	+37	57	4.46	K0
7319	23 Aquilae	19	13.5	+ 0	55	5.32	*K0*
7349	....	19	17.2	− 0	26	5.95	G6
7417	β Cygni	19	26.7	+27	45	3.24	K0
7468	....	19	33.6	+44	29	5.16	K1
7478	φ Cygni	19	35.5	+29	56	4.79	G8
7487	....	19	36.6	+45	43	6.34	*G5*
7488	β Sagittae	19	36.6	+17	15	4.45	G8
7517	15 Cygni	19	40.7	+37	7	5.02	G7
7662	....	19	58.8	+18	14	6.14	*K2*
7679	η Sagittae	20	0.7	+19	42	5.26	K0
7685	ρ Draconis	20	2.3	+67	35	4.66	K3
7689	27 Cygni	20	2.7	+35	42	5.52	G3
7831	69 Aquilae	20	24.4	− 3	13	5.11	*K0*
7873	70 Aquilae	20	31.5	− 2	54	5.22	*K5*
7969	....	20	44.6	+47	28	5.65	*K0*
8003	....	20	49.8	+44	48	5.59	G7
8066	3 Equulei	20	59.6	+ 5	7	5.93	K5
8090	....	21	3.5	+ 6	36	6.38	*K5*
8165	34 Vulpec.	21	16.5	+23	27	5.82	G9
8228	71 Cygni	21	25.8	+46	6	5.34	G9
8252	ρ Cygni	21	30.2	+45	9	4.22	G5
8312	....	21	39.7	+58	48	6.21	*K2*
8374	....	21	52.3	+61	4	6.22	*K5*
8393	19 Pegasi	21	56.2	+ 7	47	5.85	K4
8413	ν Pegasi	22	0.6	+ 4	34	4.90	K5
8426	20 Cephei	22	2.0	+62	18	5.39	K5
8610	κ Aquarii	22	32.6	− 4	45	5.33	K1
8632	11 Lacertae	22	36.1	+43	46	4.64	K2
8712	....	22	49.5	+39	51	5.94	*K2*
8729	51 Pegasi	22	52.5	+20	14	5.59	G4
8796	56 Pegasi	23	2.2	+24	56	4.98	K0p
8804	4 Androm.	23	3.1	+45	51	5.56	K8
8833	....	23	8.5	+10	31	5.94	*K0*
8841	ψ¹ Aquarii	23	10.7	− 9	38	4.46	K0
8874	11 Androm.	23	14.8	+48	4	5.42	G9
8893	66 Pegasi	23	18.0	+11	46	5.28	*K0*
8894	....	23	18.1	+59	35	5.93	K5
8912	9 Piscium	23	22.1	+ 0	34	6.44	G6
8943	72 Pegasi	23	29.0	+30	46	5.21	K4
8997	78 Pegasi	23	39.0	+28	49	4.98	G7
9008	τ Cassiop.	23	42.1	+58	6	5.09	K0
9033	22 Piscium	23	46.9	+ 2	23	5.85	K5

TABLE VI

PHOTOMETRIC TESTS OF RED STARS

J. D. 242	45, M1 > (166, 167)	103, M3 > (166, 167)	166, K0 < 167, G7
	M	M	M
4784.68	0.320	−0.103	0.306
4793.83	.353	− .058	.314
4815.67	.342	+ .042	.301
4830.59	.304	+ .030	.290
4840.66	.336	+ .146	.294
4846.61	.342	+ .088	.294
	0.333 ± .014	+0.024 ± .070	0.300 ± .007

J. D. 242	9089, M3 < 3, K0	46, M4 < 3, K0	3, K0 > 29, G5
	M	M	M
5235.59	0.283	0.174	....
5276.54	.221	.250	....
5496.80	.314	.274	0.469
5526.71	.357	.277	.440
5574.60	.350	.299	.464
5619.58	.354	.281	.470
	0.313 ± .041	0.259 ± .032	0.461 ± .010

Shade 0.86 on 9089 and 3.

J. D .242	117, M0 > 94, K0	248, M0 > 94, K0	
	M	M	
5235.61	0.092	0.267	
5554.65	.072	.282	
5566.61	.068	.283	
	0.077 ± .010	0.277 ± .007	

Shade 0.86 on 248.

J. D. 242	211, M4 < (213, 319)	213, K0 > 319, G7	
	M	M	
5517.68	0.238	0.601	
5545.71	.108	.632	
5574.61	(.260)	(.565)	Clouds?
5610.60	.128	.634	
5623.54	.158	.630	
	0.158 ± .040	0.624 ± .012	

J. D. 242	337, M0 > (352, 360)	352, K1 > 360, G7	
	M	M	
4801.75	0.113	0.118	
4811.65	.051	.086	
4840.69	.092	.124	
4855.61	.110	.110	
5517.69	.112	.110	
5526.83	.147	.121	
5574.70	.107	.114	
	0.105 ± .019	0.112 ± .008	

Shade 1.80 on 337.

J. D. 242	450, M2 < (414, 475)	414, G8 > 475, K1	
	M	M	
5210.70	0.464	0.494	
5233.66	.496	.493	
5278.54	.474	.503	
5295.54	.498	.499	
	0.483 ± .014	0.497 ± .004	

J. D. 242	587, M5 > (752, 759)	752, K0 < 759, K5	
	M	M	
5235.63	0.098	0.065	
5276.56	.114	.065	
5526.82	.046	.028	
5586.68	(.018)	(.055)	Poor
5998.57	.156	.048	
	0.104 ± .031	0.052 ± .014	

J. D. 242	631, M3 > 609, K5	648, M1 > 609, K5	563, G6 > 609, K5
	M	M	M
5233.68	0.375	0.421	....
5276.59	.388	.399	....
5295.55	.325	.402	....
5545.73	.405	.391	0.195
5554.76	.392	.390	.205
5643.58	.369	.379	.188
	0.376 ± .019	0.397 ± .010	0.196 ± .006

Shade 1.31 on 563.

TABLE VI—*Continued*

J. D. 242	689, M1 < (737, 739)	737, K2 < 739, K0	
	M	M	
5190.70	0.388	0.123	
5223.63	.364	.153	
5248.57	.390	.121	
5276.58	.352	.140	
	0.374 ± .016	0.134 ± .012	

J. D. 242	750, M3 > 876, K0	843, M0 > 876, K0	876, K0 < 882, K2
	M	M	M
5190.72	0.453	0.646	....
5233.72	.383	.595	....
5268.66	.398	.597	....
5280.54	.472	.609	....
5295.59	.476	.601	....
5308.56	.465	.608	....
5574.75	.526	.656	0.527
5619.63	.502	.617	.532
5643.60	.499	.626	.526
	0.464 ± .035	0.617 ± .017	0.528 ± .002

Shade 0.86 on 843 and 882.

J. D. 242	867, M6 > (828, 951)	828, G8 > 951, K0	
	M	M	
5179.80	+0.028	0.261	
5235.68	− .367	.260	
5251.59	− .011	.248	Moon
5278.55	− .378	.249	
5280.55	− .320	.307	
5295.56	− .127	.317	
5301.57	− .116	.307	
5308.55	− .085	.226	
5554.78	− .122	.278	
5574.73	− .026	.265	
5613.64	+ .076	.304	
	−0.132 ± .122	0.275 ± .026	

Shade 1.80 on 951.

J. D. 242	881, M2 > (774, 1080)	774, K0 > 1080, G5	
	M	M	
5235.72	0.170	0.230	
5250.67	.146	.220	
5276.68	.178	.186	
5295.62	.146	.206	
5302.56	.155	.217	
5322.56	.168	.219	
	0.160 ± .012	0.213 ± .011	

J. D. 242	911, M2 > (996, 1030)	996, G5 > 1030, G7	
	M	M	
4801.76	0.336	0.306	
4840.70	.282	.292	
5179.78	.273	.282	
5235.70	.286	.306	
5618.60	.285	.280	
	0.292 ± .017	0.293 ± .010	

Shade 1.31 on 911 and 1030.

J. D. 242	935, M3 < (907, 917)	907, G5 < 917, G5	
	M	M	
5235.65	0.219	0.506	
5251.61	.226	.537	
5297.56	.256	.530	
5613.62	.263	.515	
	0.241 ± .018	0.522 ± .012	

J. D. 242	1009, M0 > 1112, K5	1105, M4 > 1112, K5	
	M	M	
5543.91	0.321	0.821	
5586.82	.297	.702	
5619.65	.346	.772	
5654.60	.352	.696	
	0.329 ± .020	0.748 ± .049	

TABLE VI—*Continued*

J. D. 242	1009, M0 < 1205, K4	1105, M4 < 1205, K4	1155, M1 > 1205, K4
	M	M	M
4793.84	....	0.260	0.254
4815.70	....	.289	.248
4922.58	....	.231	.314
4954.66	....	.168	.378
4970.59	....	.204	.357
5235.74	0.616	.139	.397
5250.69	.610	.182	.425
5280.57	.620	.268	.365
5302.60	.644	.218	.343
5322.57	.645	.206	.309
5615.76	....	....	.274
5654.61	....	....	.326
	0.627 ± .014	0.216 ± .038	0.332 ± .045

J. D. 242	1335, M0 > (1313, 1467)	1313, K0 > 1467, G6
	M	M
5190.77	−0.008	0.019
5235.78	+ .001	.030
5278.74	± .000	.043
5302.62	+ .046	.044
5322.59	+ .022	.076
	+0.012 ± .017	0.042 ± .014

Shade 0.86 on 1467.

J. D. 242	1451, M3 > (1332, 1452)	1332, K0 < 1452, K5	
	M	M	
5188.79	+0.010	0.392	
5233.78	+ .064	.409	
5251.62	+ .152	.365	
5287.62	+ .113	.382	
5308.59	+ .050	.368	
5323.56	+ .036	.360	
5573.82	+ .022	.377	
5613.68	− .048	.336	
5637.57	(− .004)	(.426)	Moon
5678.57	− .024	.376	
	+0.042 ± .047	0.374 ± .015	

J. D. 242	1527, M2 > 1720, K4	1802, M1 > 1720, K4
	M	M
5179.84	0.296	0.222
5235.80	.323	.195
5278.78	.312	.233
5302.68	.300	.201
5322.62	.321	.212
	0.310 ± .010	0.213 ± .012

J. D. 242	1556, M4 > 1684, K5	1845, M2 > 1684, K5	1580, K1 > 1684, K5
	M	M	M
5188.81	0.179	0.413	....
5248.58	.235	.364	....
5276.66	.201	.236	0.033
5287.64	.180	.208	.028
5308.60	.172	.187	.046
5323.57	.255	.170	.005
5613.73	.149	.048	.024
5637.59	.158	.123	.047
5678.58	.210	.222	.047
	0.193 ± .028	0.219 ± .080	0.033 ± .012

Shade 1.31 on 1580.

J. D. 242	1562, M1 > (1601, 1709)	1601, K3 < 1709, K3
	M	M
5190.75	0.124	0.345
5248.68	.134	.370
5276.64	.130	.336
5619.68	.171	.330
5654.58	.138	.410
	0.139 ± .012	0.358 ± .025

Shade 1.31 on 1601.

TABLE VI—*Continued*

J. D. 242	1722, M4 > (1725, 1773)	1725, K0 < 1773, K5	
	M	M	
5190.78	−0.001	0.452	
5228.84	+ .158	.434	
5278.80	+ .055	.438	
5287.68	(+ .104)	(.382)	Clouds
5308.66	+ .076	.435	
5320.64	+ .168	.392	
5615.78	+ .095	.414	
5654.63	+ .197	.401	
	+0.107 ± .058	0.424 ± .018	

Shade 0.86 on 1773.

J. D. 242	1834, M0 > (1830, 1874)	1830, K0 > 1874, K0	
	M	M	
5251.65	0.244	0.404	
5287.66	.245	.443	
5308.62	.236	.436	
5613.75	.210	.444	
5643.63	.230	.428	
	0.233 ± .010	0.431 ± .012	

Shade 0.86 on 1834.

J. D. 242	1866, M0 < (1925, 1941)	1925, K0 < 1941, K0	
	M	M	
5235.83	0.235	0.071	
5267.72	.209	.072	
5287.61	.216	.053	
5307.64	.232	.050	
	0.223 ± .010	0.062 ± .010	

J. D. 242	2011, M1 < 1995, G5	2091, M3 > 1995, G5	1995, G5 < 2012, K1
	M	M	M
4805.77	0.106	0.198	....
4840.74	.079	.307	....
4921.67	.080	.284	....
4954.64	.070	.278	....
5320.66	.063	.286	....
5329.58	.076	.239	....
5619.75	.082	.198	0.396
5654.68	.078	.139	.374
5715.61	.044	.276	.405
	0.075 ± .011	0.245 ± .046	0.392 ± .012

Shade 0.86 on 1995 and 2012.

J. D. 242	2215, M3 < (2152, 2165)	2152, G8 > 2165, K0	
	M	M	
4805.78	0.176	0.185	
4840.76	.182	.185	
4922.67	.188	.199	
4954.68	.247	.190	
4970.65	.156	.192	
5619.73	.216	.206	
5654.70	.281	.166	
5715.62	.264	.156	
	0.206 ± .030	0.185 ± .012	

J. D. 242	2216, M3 < 2219, G8	2286, M3 > 2219, G8	
	M	M	
4811.84	−0.007	0.223	
4817.88	+ .016	.174	
4846.74	− .001	.173	
4915.72	+ .264	.206	
4954.62	+ .130	.134	
4970.57	+ .135	.274	
5302.69	+ .054	.138	
5322.64	+ .065	.148	
	+0.082 ± .071	0.184 ± .038	

Shade 0.86 on 2216 and 2286.

TABLE VI—*Continued*

J. D. 242	2269, M0 > (2235, 2277)	2235, K0 < 2277, K0	
	M	M	
5266.69	0.447	0.485	
5297.73	.462	.479	
5323.59	.441	.450	
5358.59	(.466)	(.440)	Smoke
	0.450 ± .008	0.471 ± .014	

J. D. 242	2275, M1 > (2334, 2335)	2334, G8 > 2335, K0	
	M	M	
5251.67	0.174	0.502	
5266.71	.212	.498	
5310.57	.238	.521	
5619.70	.219	.499	
5654.67	.222	.500	
	0.213 ± .016	0.504 ± .007	

J. D. 242	2469, M0 > 2381, K0	2508, M1 < 2381, K0	
	M	M	
5266.73	0.111	0.075	
5308.63	.134	.068	
5328.58	.094	.093	
5623.67	.131	.031	
5664.66	.110	.052	
	0.116 ± .013	0.064 ± .018	

J. D. 242	2609, M2 < 3751, K4	2742, M4 < 3751, K4	
	M	M	
4805.68	0.185	+0.233	
4840.78	.120	+ .099	
4922.60	.205	+ .064	
4944.74	.170	+ .055	
4966.72	.137	+ .008	
4992.63	.164	+ .126	
5006.63	.183	+ .056	
5301.76	.068	− .006	
5320.67	.088	− .012	
	0.147 ± .039	+0.069 ± .056	

Shade 0.86 on 3751.

J. D. 242	2639, M2 < (2655, 2701)	2655, K1 < 2701, K0	
	M	M	
5266.74	0.038	0.189	
5308.65	.002	.250	
5623.64	.013	.206	
5664.69	.010	.227	
	0.016 ± .011	0.218 ± .020	

Shade 0.86 on 2701.

J. D. 242	2703, M3 > (2737, 2804)	2737, K0 > 2804, K2	
	M	M	
5267.79	0.170	0.159	
5287.79	.164	.212	
5307.71	.197	.161	
5346.72	.223	.162	
5365.64	.156	.167	
5623.62	.186	.167	
5675.66	.299	.157	
	0.199 ± .035	0.169 ± .012	

J. D. 242	2717, M4 < 2864, K4	2795, M0 < 2864, K4	
	M	M	
4921.64	0.214	0.061	
4970.61	.154	.036	
5235.85	.447	.039	
5297.75	.206	.056	
5323.61	.010	.058	
5329.61	.099	.059	
5351.60	.247	.059	
5623.74	.201	.078	
5675.64	.146	.022	
	0.192 ± .079	0.052 ± .013	

Shade 0.86 on 2864.

TABLE VI—*Continued*

J. D. 242	2725, M1 < (2905, 2983)	2738, M1 < (2905, 2983)	2905, M0 < 2983, M0
	M	M	M
5287.80	0.304	0.315	0.396
5308.72	.298	.290	.400
5349.62	.288	.321	.362
5637.66	.349	.362	.410
5664.74	.371	.374	.382
	0.322 ± .030	0.332 ± .028	0.390 ± .014

Shade 1.56 on 2905.

J. D. 242	2747, Mb < (2663, 2713)	2663, K0 > 2713, G5	
	M	M	
5306.69	0.007	0.060	
5351.59	.014	.095	
5623.68	.088	.042	
5654.76	(.034)	(.079)	Sky?
5664.70	.042	.086	
	0.038 ± .027	0.071 ± .020	

J. D. 242	2903, M1 < (2939, 3066)	2939, G7 > 3066, K5	
	M	M	
5267.80	0.396	0.260	
5287.82	.373	.290	
5308.74	.398	.263	
5349.63	.374	.266	
	0.385 ± .012	0.270 ± .010	

J. D. 242	2938, M0 > 3128, K4	2967, M3 < 3128, K4	
	M	M	
5306.70	0.278	0.278	
5329.66	.345	.243	
5623.75	.268	.340	
5654.78	(.346)	(.242)	One set, sky doubtful
5678.67	(.322)	(.261)	One set, sky doubtful
5715.64	.333	.285	
	0.306 ± .033	0.286 ± .026	

J. D. 242	2999, M3 > 2935, K5	3013, M1 > 2935, K5	2924, G3 > 2935, K5
	M	M	M
5287.84	0.547	0.585	....
5320.72	.579	.585	0.725
5349.65	.591	.599	.753
5365.65	.606	.629	.753
5678.65	.613	.615	.772
5715.66	.610	.643	.744
5748.61	.627	.663	.757
	0.596 ± .020	0.617 ± .024	0.751 ± .011

J. D. 242	3319, M3 < 3461, K0	3357, M1 > 3461, K0	3366, K5 > 3461, K0
	M	M	M
5306.71	0.103	0.087	....
5329.63	.154	.116	....
5359.60	.089	.135	....
5634.71	.299	.097	0.363
5688.56	.126	.121	.390
5723.64	.214	.106	.383
	0.164 ± .062	0.110 ± .014	0.379 ± .010

Shade 1.80 on 3461.

J. D. 242	3576, M3 > 3403, K2	3609, M0 < 3403, K2
	M	M
4921.65	0.243	0.113
4944.75	.255	.113
4948.74	.251	.127
4954.71	.259	.115
4992.66	.227	.118
5365.67	.193	.135
5386.63	.192	.136
5634.73	.243	.093
5675.78	.257	.112
	0.236 ± .021	0.118 ± .010

Shade 0.86 on 3403.

TABLE VI—*Continued*

J. D. 242	3660, M0 > 3922, G4	3698, Mb < 3922, G4	3870, M3 < 3922, G4
	M	M	M
4970.73	....	0.313	0.455
4992.70	....	.471	.442
5000.69	....	.550	.487
5287.85	0.131	.338	.328
5308.78	.161	.309	.410
5359.62	.111	.490	.489
5378.61	.118	.499	.425
	0.130 ± .016	0.424 ± .089	0.434 ± .039

Shade 0.86 on 3870.

J. D. 242	3705, M0 < 3815, K1	3769, M1 < 3815, K1	3820, M2 < 3815, K1
	M	M	M
5310.77	0.349	0.641	0.803
5324.69	.328	.574	.766
5349.68	.359	.595	.856
5363.73	.321	.585	.820
5634.75	.338	.606	.817
5675.80	.344	.611	.839
5723.66	.315	.593	.819
	0.336 ± .013	0.601 ± .016	0.817 ± .019

Shade 1.80 on 3705.

J. D. 242	3866, M2 > (3826, 3877)	3826, K1 > 3877, K5	
	M	M	
5378.62	0.110	0.114	
5634.80	.123	.116	
5675.82	.160	.117	
5723.71	.110	.111	
	0.126 ± .017	0.114 ± .002	

J. D. 242	3866, M2 > 4035, M2	3866, M2 > 4127, M2	4035, M2 > 4127, M2
	M	M	M
4970.69	(0.124)	(0.166)	(0.040)
5006.61	.095	.190	.094
5300.74	.070	.198	.128
5320.74	.083	.172	.088
5351.62	.062	.151	.088
	0.078 ± .012	0.178 ± .016	0.100 ± .014

4970.69 Doubtful.

J. D. 242	3876, M1 > (3827, 3834)	3827, K0 < 3834, K3	
	M	M	
5300.76	0.022	0.089	
5320.75	.009	.118	
5349.69	.018	.077	
	0.016 ± .005	0.095 ± .016	

Shade 1.31 on 3827 and 3834.

J. D. 242	3950, M2 < 3980, K5		
	M		
4565.79	0.442		
4577.68	.426		
4587.70	.445		
4617.65	.432		
4646.62	.444		
	0.438 ± .007		

J. D. 242	4035, M2 < (4208, 4209)	4127, M2 < (4208, 4209)	4208, K2 < 4209, G5
	M	M	M
5378.63	0.414	0.577	0.188
5634.81	.408	.494	.213
5675.83	.429	.501	.177
5752.61	(.400)	(.439)	(.173)
	0.417 ± .008	0.524 ± .035	0.193 ± .014

5752.61 Moon.

TABLE VI—*Continued*

J. D. 242	4088, M3 < (4004, 4193)	4004, G9 < 4193, K1	
	M	M	
4970.70	0.256	+0.014	
5006.60	.240	− .009	
5300.80	.238	− .010	
5322.73	(.172)	(− .022)	Smoke?
5351.64	.265	+ .005	
5375.63	.202	+ .032	
	0.240 ± .016	+0.006 ± .013	

J. D. 242	4092, M2 > 4059, K0	4122, M0 < 4059, K0	
	M	M	
5300.82	0.258	0.246	
5323.65	.252	.208	
5351.66	.236	.236	
	0.249 ± .008	0.230 ± .015	

J. D. 242	4267, M5 < (4291, 4358)	4291, K1 > 4358, K3	
	M	M	
5300.84	0.328	0.216	
5323.64	.424	.190	
5351.67	.606	.202	
5375.65	.486	.231	
	0.461 ± .085	0.210 ± .014	

Shade 0.86 on 4291.

J. D. 242	4299, M1 < (4291, 4432)	4371, M0 < (4291, 4432)	4291, K1 > 4432, K5
	M	M	M
4565.81	0.165	0.520	0.230
4577.70	.159	.516	.179
4587.72	.146	.502	.221
4617.66	.128	.505	.222
4646.64	.153	.525	.221
	0.150 ± .011	0.514 ± .008	0.215 ± .014

J. D. 242	4333, Mb < 4335, K0	4336, Ma < 4335, K0	
	M	M	
4970.74	0.152	0.304	
4992.73	.151	.270	
5300.85	.171	.335	
5320.83	.122	.300	
	0.149 ± .014	0.302 ± .017	

Shade 2.95 on 4335.

J. D. 242	4362, M2 > (4433, 4495)	4433, K0 < 4495, G7	
	M	M	
4970.72	0.204	0.366	
4992.74	.204	.365	
5303.79	.270	.351	
5324.71	.286	.341	
	0.241 ± .037	0.356 ± .010	

J. D. 242	4434, M0 > (4461, 4504)	4659, K0 < (4461, 4504)	4461, G5 > 4504, K2
	M	M	M
4577.76	0.328	....	0.364
4617.69	.277	....	.357
4623.61	.320	0.512	.353
4636.61	.306	.481	.364
4646.67	.342	.540	.375
4658.64	.296	.518	.406
4686.70	.279	.496	.356
4922.66	.275	.517	.350
4954.74	.324	.488	.357
	0.305 ± .021	0.507 ± .016	0.365 ± .012

Shade 0.86 on 4434.

TABLE VI—*Continued*

J. D. 242	4483, M6 < (4418, 4695)	4517, M1 < (4418, 4695)	4418, G7 > 4695, K0
	M	M	M
4577.74	0.736	0.150	0.154
4587.74	.772	.151	.197
4623.65	.826	.134	.175
4635.63	(.574)	(.128)	(.200)
4636.62	.646	.130	....
4658.62	.813	.134	.151
5349.71	(.755)	(.146)	(.145)
5356.70	.831	.165	.153
5373.67	.785	.168	.171
5389.63	.866	.110	.142
5412.64	.790	.180	.193
	0.785 ± .045	0.147 ± .018	0.167 ± .017

Shade 0.86 on 4517.
4635.63 One set.
5349.71 Poor.

J. D. 242	4726, M3 < 4762, K0	4745, M2 < 4762, K0
	M	M
4978.78	0.296	0.114
4992.76	.279	.107
5056.68	.260	.095
5094.62	.259	.089
5303.74	.285	.110
5324.74	.275	.103
	0.276 ± .011	0.103 ± .007

J. D. 242	4765, M4 > (4795, 4863)	4795, K0 > 4863, K3
	M	M
5000.71	+0.001	0.658
5022.72	− .001	.698
5056.70	+ .008	.680
5094.63	+ .148	.655
5113.59	+ .002	.679
5303.75	+ .110	.670
5324.76	− .050	.686
	+0.031 ± .056	0.675 ± .012

J. D. 242	4807, M3 < (4837, 4878)	4837, G0 > 4878, K4
	M	M
5303.80	0.178	0.424
5324.80	.164	.404
5356.64	.172	.424
5373.69	.141	.439
5664.76	.190	.447
5698.70	.218	.428
5730.66	.129	.422
	0.170 ± .022	0.427 ± .010

J. D. 242	4846, Nb < 4945, K4	4909, Mb < 4945, K4	4919, K0 < 4945, K4
	M	M	M
5000.74	0.390	0.338	....
5027.67	0.380	.562	....
5062.66	0.493	.486	....
5070.63	0.504	.448	0.405
5101.61	0.401	.579	.357
5326.71	1.005	.676	.390
5356.80	....	.499	.393
5365.76	....	.602	.378
5397.66	....	.679	.399
5433.65	....	.698	.370
	0.529 ± .159	0.557 ± .091	0.385 ± .014

J. D. 242	4910, M3 > 5015, M2
	M
4565.91	0.107
4577.77	.091
4609.71	.084
4637.63	.115
4671.62	.104
	0.100 ± .010

Shade 1.31 on 4910.

TABLE VI—*Continued*

J. D. 242	4920, M0 > 4962, K0	4949, M5 > 4962, K0	
	M	M	
4970.80	0.374	0.122	
5000.72	.364	.197	
5013.65	.304	.219	
5303.82	.343	.054	
5324.81	.326	.031	
5351.76	.340	.164	
	0.342 ± .018	0.131 ± .062	

Shade 0.86 on 4920.

J. D. 242	4998, M0 < (4960, 4986)	4960, K0 > 4986, K5	
	M	M	
5303.83	0.076	0.371	
5324.82	.034	.414	
5349.76	(.138)	(.379)	Sky?
5375.68	.062	.388	
5406.66	.060	.410	
	0.058 ± .012	0.396 ± .016	

J. D. 242	5095, M3 > 5111, K0	5150, M2 > 5111, K0	
	M	M	
4970.79	0.436	0.127	
5000.75	.460	.196	
5038.69	.497	.153	
5324.84	.426	.148	
5356.73	.442	.144	
5378.68	.471	.143	
	0.455 ± .021	0.152 ± .015	

J. D. 242	5123, Ma > (5102, 5149)	5102, G5 > 5149, G6	
	M	M	
5000.80	+0.040	0.310	
5038.72	+ .030	.308	
5063.67	+ .046	.287	
5101.62	+ .018	.256	
5303.85	+ .022	.283	
5356.61	− .004	.266	
	+0.025 ± .013	0.285 ± .017	

Shade 0.86 on 5149.

J. D. 242	5154, M2 > 5213, K0		
	M		
5004.65	+0.040		
5038.74	+ .022		
5062.68	− .004		
5101.64	+ .051		
5302.78	+ .041		
	+0.030 ± .017		

Shade 0.86 on 5154.

J. D. 242	5200, M0 > 5254, K5	5352, M3 < 5254, K5	5254, K5 > 5370, K4
	M	M	M
5306.82	0.226	0.025	....
5336.76	.249	.079	....
5349.79	.249	.066	....
5375.73	.248	.060	0.316
5406.69	.235	.049	.283
5437.66	.260	.076	.308
	0.244 ± .010	0.059 ± .015	0.302 ± .013

Shade 1.56 on 5200 and 5370.

TABLE VI—*Continued*

J. D. 242	5215, M1 < 5310, K2	5219, M2 > 5310, K2	5161, K0 > 5310, K2
	M	M	M
5000.81	0.062	0.338	....
5038.76	.028	.313	....
5062.69	.077	.377	....
5079.65	.010	.418	....
5116.59	.042	.456	....
5326.72	.069	.260	....
5356.75	.053	.305	0.479
5375.71	.080	.287	.491
5406.68	.085	.383	.465
5433.67	.055	.402	.451
	0.056 ± .018	0.354 ± .053	0.472 ± .014

Shade 0.86 on 5219.

J. D. 242	5452, M1 < 5420, G5	5452, M1 < 5464, K0	5420, G5 < 5464, K0
	M	M	M
5116.61	+0.101	....	....
5306.83	− .041	....	....
5346.69	+ .006	....	....
5363.84	+ .022	0.083	0.060
5406.71	+ .036	.130	.094
5429.73	(+ .052)	(.078)	(.024)
5458.63	− .011	.069	.080
5675.85	+ .021	.099	.078
5723.86	+ .058	.096	.039
	+0.024 ± .031	0.095 ± .016	0.070 ± .017

Shade 0.86 on 5420.
5429.73 One set.

J. D. 242	5299, M4 < 5420, G5	5300, M2 < 5420, G5	
	M	M	
4648.64	0.300	0.304	
4668.71	.264	.320	
4676.73	.340	.274	
4686.72	.198	.350	
4722.65	.179	.249	
4748.62	.395	.333	
4966.74	.245	.339	
5000.79	.285	.288	
5060.66	.306	.217	
5072.62	.264	.311	
5116.61	− .438	− .401	Shade 0.86 on 5420
5306.83	− .552	− .410	
5346.69	− .465	− .401	
	+0.278 ± .048	+0.298 ± .033	
	−0.485 ± 045	−0.404 ± .004	

See next group.

J. D. 242	5490, M3 < (5544, 5616)	5600, K5 > (5544, 5616)	5544, G5 > 5616, K2
	M	M	M
4565.87	0.088	0.028	0.395
4578.80	.124	.020	.399
4625.66	.072	.060	.377
4647.74	.074	.050	.367
4668.76	.122	.056	.377
	0.096 ± .021	0.043 ± .015	0.383 ± .011

Shade 0.86 on 5544 and 5616.

TABLE VI—*Continued*

J. D. 242	5589, M5 > (5737, 5785)	5226, M3 > (5737, 5785)	5334, M2 < (5737, 5785)	5737, K5 < 5785, G5	
	M	M	M	M	
5329.80	+0.046	0.047	0.529	0.248	
5351.83	+ .143	.092	.512	.242	
5429.67	− .118	.086	.480	.227	
5431.65	− .106	.051	.511	.256	
5433.63	(− .054)	(.144)	(.428)	(.244)	Sky?
5437.68	− .028	....	....	.244	
5442.63	+ .022	.072	.523	.228	
5458.61	− .038	....	....	.251	
5504.60	+ .094	.095	.472	.246	
5511.59	− .082	....	....	.226	
5664.81	+ .028	.015	.577	.230	Moon
5763.70	+ .068	.039	.540	.232	
5777.73	+ .072	.089	.509	.240	
5791.68	− .117	.009	.562	.254	
5819.63	+ .172	.035	.510	.217	
5828.62	+ .034	.069	.540	.210	
5834.62	− .048	.140	.512	.228	
5837.62	− .059	....	.....	.252	
5849.66	(− .088)	....	....	(.216)	Smoke
5851.60	(− .074)	....	....	(.244)	Smoke
5861.59	+ .023	....	....	.241	
5866.62	+ .044	....	....	.257	
5871.58	(+ .033)	....	....	(.205)	One set
5887.55	− .036	....	....	.271	
	+0.006 ± .068	0.065 ± .029	0.521 ± .022	0.240 ± .012	

Shade 0.86 on M-stars.
5226 and 5334 taken with 5589; hence variation of 5226 is marked as suspicious only.

J. D. 242	5590, M1 > 5690, K5	5594, M2 > 5690, K5	5573, K1 > 5690, K5
	M	M	M
5306.85	0.189	0.156	....
5336.77	.218	.123	....
5360.76	.153	.097	....
5375.76	.188	.143	0.664
5406.73	.236	.152	.661
5431.68	(.201)	(.184)	(.652)
	0.197 ± .024	0.134 ± .019	0.662 ± .002

5431.68 One set.

J. D. 242	5654, M4 < 5795, G7	5739, M1 > 5795, G7	5795, G7 < 5840, G5
	M	M	M
4993.76	0.281	0.437	....
5042.72	.293	.426	....
5063.71	.269	.415	....
5122.60	(.203)	(.455)	....
5336.79	.144	.374	....
5363.79	.234	.393	0.155
5411.74	.224	.411	.150
5433.70	.144	.412	.157
5458.64	(.182)	(.443)	(.110)
	0.227 ± .048	0.410 ± .015	0.154 ± .003

5122.60 Poor.
5458.64 One set, clouds.

TABLE VI—*Continued*

J. D. 242	5763, M0 > 5855, G9	5800, M2 < 5855, G9	5932, M3 < 5855, G9
	M	M	M
4578.81	(0.050)	(0.034)	(0.260)
4591.78	.061	.023	.258
4625.69	.091	.002	.247
4647.71	.099	.035	.234
4668.83	.095	.023	.218
	0.086 ± .013	0.021 ± .009	0.239 ± .013

4578.81 One set, clouds.

J. D. 242	5879, M1 > 5899, K5	5924, M0 < 5899, K5	5899, K5 < 5966, G7
	M	M	M
5107.65	0.583	0.019	....
5136.60	(.570)	(.054)	....
5343.73	.618	.032	....
5363.81	.586	.029	0.794
5412.67	.588	.017	.806
5433.73	.588	.004	.782
5468.68	.604	.021	.816
	0.594 ± .011	0.020 ± .007	0.800 ± .012

Shade 0.86 on 5879 and 5899.
5136.60 One set, poor.

J. D .242	6010, M3 > (5976, 6057)	5976, K0 > 6057, G5	
	M	M	
4993.78	+0.004	0.389	
5042.69	+ .060	.384	
5062.72	+ .095	.370	OK
5079.66	− .004	.378	
5346.77	+ .072	.353	
	+0.045 ± .036	0.375 ± .011	

J. D .242	6039, M4 > (5947, 6068)	5947, K0 > 6068, K2	
	M	M	
4993.79	+0.084	0.158	
5042.76	− .090	.197	
5060.75	− .030	.142	
5079.71	+ .108	.186	
5094.67	− .100	.162	
5113.61	+ .018	.145	
5363.82	+ .082	.140	
5412.69	− .024	.161	
5442.74	− .044	.127	
5468.66	+ .008	.171	
5505.59	+ .053	.132	
	+0.006 ± .058	0.156 ± .018	

Shade 1.80 on 5947.

J. D. 242	6056, M0 < 6075, G7	6128, M2 < 6075, G7	
	M	M	
5000.83	(0.053)	(0.643)	One set Poor
5031.83	(.054)	(.758)	
5060.67	.034	.660	
5077.64	.043	.698	
5101.65	.047	.656	
	0.041 ± .005	0.671 ± .018	

Shade 1.80 on 6056 and 6075.

J. D. 242	6086, M4 < (5922, 6130)	5922, K0 < 6130, G5	
	M	M	
5004.68	0.165	0.148	
5056.72	.257	.139	
5079.73	.244	.134	
5094.72	.104	.127	
5107.66	.074	.151	
5140.56	.112	.134	
	0.159 ± .063	0.139 ± .007	

TABLE VI—*Continued*

J. D. 242	6107, M2 < (6108, 6220)	6108, K4 < 6220, G5	
	M	M	
4690.75	0.120	0.524	
4751.64	.156	.547	
4779.56	.162	.556	
4966.80	.156	.536	
4993.74	.170	.540	
5031.85	.198	.548	
5060.68	.156	.538	
5077.63	.141	.550	
	0.157 ± .014	0.542 ± .008	

Shade 1.80 on 6220.

J. D. 242	6146, M6 < 5901, K1	6200, M2 < 5901, K1	
	M	M	
4565.88	0.495	0.509	
4625.72	.640	.541	
4636.69	.567	.549	
4646.71	.657	.557	
4658.66	.694	.532	
4668.81	.743	.534	
4676.78	(.710)	(.538)	One set
4686.75	.729	.527	
4751.60	.964	.562	
4966.79	.642	.517	
4993.73	.266	.527	
5013.66	.636	.544	
5060.72	.420	.533	
5081.68	.342	.555	
	0.600 ± .140	0.537 ± .013	

J. D. 242	6159, M0 > 6239, G5	6227, M3 > 6239, G5	
	M	M	
4993.80	0.345	0.108	
5042.78	.339	.114	
5062.74	.313	.186	
5081.69	.310	.179	
5138.57	.340	.114	
5346.78	.297	.174	
	0.324 ± .017	0.146 ± .034	

Shade 0.86 on 6159.
6227 probably variable.

J. D. 242	6159, M0 > 6433, K7	6228, M1 < 6433, K7	6393, M2 < 6433, K7
	M	M	M
5386.84	0.239	0.102	0.365
5413.68	.210	.153	.405
5442.75	.242	.105	.374
	0.230 ± .014	0.120 ± .022	0.381 ± .016

J. D. 242	6258, M1 < (6292, 6333)	6292, G4 < 6333, K0	
	M	M	
5101.67	0.322	0.183	
5122.62	.332	.225	
5138.58	.308	.216	
5365.78	.339	.206	
5413.71	.328	.230	
5442.77	.315	.208	
	0.324 ± .009	0.211 ± .012	

J. D. 242	6452, M2 > (6542, 6638)	6542, G9 > 6638, G5	
	M	M	
5116.62	0.204	0.016	
5140.57	.121	.040	
5365.79	.130	.057	
5412.73	(.078)	(.053)	One set
5443.66	.092	.033	
5469.65	.120	.040	
5513.58	.039	.020	
	0.118 ± .035	0.034 ± .011	

TABLE VI—*Continued*

J. D. 242	6464, M0 < (6574, 6607)	6574, K0 > 6607, K0	
	M	M	
5101.68	0.201	0.566	
5122.63	.205	.562	
5138.64	.208	.595	
5142.62	.202	.573	
5365.71	.231	.542	
5433.77	.151	.586	
5458.73	.160	.607	
5494.62	.187	.600	
	0.193 ± .020	0.579 ± .018	

J. D. 242	6702, M6 < 6791, G5	6728, M0 > 6791, G5	6791, G5 > 6824, K0
	M	M	M
5101.70	0.499	0.118	....
5122.69	.443	.201	....
5140.58	.614	.171	....
5168.55	.482	.166	....
5433.79	.740	.123	0.090
5469.69	.798	.152	.067
	0.596 ± .121	0.155 ± .024	0.078 ± .012

Shade 1.31 on 6791.

J. D. 242	6765, M2 > 6860, K4	6815, M3 > 6860, K4	
	M	M	
4690.77	0.182	0.308	
4751.65	.193	.170	
4765.58	.210	.202	
4772.60	.195	.208	
4779.57	.157	.257	
4803.55	.193	.276	
4993.85	.150	.192	
5031.88	.166	.196	
5060.63	.191	.165	
5071.74	.183	.254	
5081.70	.188	.201	
5105.67	.199	.203	
	0.184 ± .014	0.219 ± .036	

J. D. 242	6868, M0 > 6966, K5	6882, M0 > 6966, K5	
	M	M	
5101.74	0.091	0.283	
5122.70	.118	.289	
5140.60	.133	.312	
5168.57	.120	.287	
	0.116 ± .012	0.293 ± .010	

Shade 0.86 on 6868.

J. D. 242	6891, M3 < (6983, 7137)	6983, G5 > 7137, G5	
	M	M	
5062.78	0.082	0.190	
5094.76	.086	.166	
5116.64	.068	.162	
5140.62	.096	.194	
5168.58	.106	.181	
	0.088 ± .015	0.179 ± .012	

Shade 0.86 on 7137.

J. D. 242	7139, M4 > (7192, 7314)	7192, K4 < 7314, K0	
	M	M	
4693.75	0.376	0.044	
4719.82	.431	.060	
4742.68	.410	.050	
4772.61	.480	.076	
4779.58	.476	.064	
4803.57	.509	.075	
5000.84	.258	.061	OK
5062.76	.352	.055	
5071.76	.374	.067	
5081.72	.410	.043	
5094.77	.368	.060	
5107.68	.354	.062	
5122.72	.464	.067	
5142.63	.408	.084	
5379.82	.530	.075	
5413.73	.520	.070	
5443.68	.598	.075	
5494.63	.518	.057	
	0.435 ± .068	0.064 ± .009	

Shade 0.86 on 7314.

TABLE VI—*Continued*

J. D. 242	7157, M5 > (7146, 7314)	7146, G8 < 7314, K0
	M	M
5064.66	+0.110	0.227
5094.78	− .082	.225
5107.70	− .081	.204
5142.64	+ .034	.207
5168.62	− .150	.221
	−0.034 ± .085	0.217 ± .009

Shade 0.86 on 7157 and 7314.

J. D. 242	7405, M1 < (7417, 7478)	7417, K0 < 7478, G8
	M	M
4693.82	0.182	0.074
4719.84	.150	.084
4748.69	.166	.079
4772.63	.172	.075
4803.58	.202	.029
5412.81	.200	.070
5443.70	.170	.090
	0.177 ± .015	0.072 ± .012

Shade 1.80 on 7417.

J. D. 242	7414, M1 < (7319, 7349)	7319, K0 > 7349, G6
	M	M
5113.63	0.104	0.666
5128.66	.070	.659
5172.55	.076	.661
	0.083 ± .014	0.662 ± .003

J. D. 242	7514, M0 < (7468, 7487)	7468, K1 > 7487, G5
	M	M
5107.74	0.315	0.377
5138.66	.320	.375
5168.64	.302	.348
	0.312 ± .007	0.367 ± .012

Shade 0.86 on 7468.

J. D. 242	7536, M2 > 7488, G8	7635, M0 < 7488, G8
	M	M
4693.83	0.218	0.250
4719.85	.250	.253
4748.70	.299	.258
4749.69	.293	.263
4755.60	.311	.260
4765.60	.273	.260
4772.64	.251	.271
4779.59	.229	.269
4797.57	.250	.248
4830.55	.258	.270
4993.84	.273	.279
5031.86	.261	.262
5060.77	.235	.275
5081.76	.266	.266
	0.262 ± .020	0.263 ± .007

Shade 0.86 on 7635.

J. D. 242	7566, M2 > (7517, 7689)	7517, G7 > 7689, G3
	M	M
5063.72	+0.067	0.399
5105.71	+ .024	.381
5138.68	+ .037	.410
5168.66	− .028	.425
5413.74	− .050	.430
5443.72	+ .040	.410
	+0.015 ± .036	0.409 ± .013

Shade 0.86 on 7517 and 7689.

J. D. 242	7645, M4 > (7662, 7679)	7662, K2 < 7679, K0
	M	M
5094.80	0.100	0.449
5116.67	.254	.448
5142.66	.015	.455
5172.56	.098	.455
	0.117 ± .069	0.452 ± .003

Shade 0.86 on 7679.

TABLE VI—*Continued*

J. D. 242	7676, M1 > 7685, K3	7804, M5 < 7685, K3
	M	M
5063.74	0.466	+0.037
5094.82	.463	− .021
5116.70	.454	− .066
5142.68	.451	+ .016
5174.59	.426	+ .186
	0.452 ± .011	+0.030 ± .065

Shade 1.31 on 7685.

J. D. 242	7851, M2 < (7969, 8003)	7969, K0 < 8003, G7
	M	M
5063.75	0.141	0.449
5094.86	.120	.423
5116.75	.099	.414
5142.72	.143	.434
5180.60	.102	.420
	0.121 ± .017	0.428 ± .011

J. D. 242	7951, M3 > (7831, 7873)	7831, K0 > 7873, K5
	M	M
5094.85	0.260	0.358
5116.69	.219	.368
5142.70	.223	.362
5174.60	.206	.346
	0.227 ± .016	0.358 ± .006

J. D. 242	8044, M3 < 8165, G9	8225, M1 < 8165, G9
	M	M
5064.70	0.550	0.064
5101.78	.534	.102
5138.69	.528	.080
5144.59	.530	.085
5180.55	.504	.094
	0.529 ± .011	0.085 ± .010

Shade 0.86 on 8225.

J. D. 242	8163, M3 > (8066, 8090)	8066, K5 > 8090, K5
	M	M
5113.67	0.090	0.511
5137.63	.078	.512
5174.61	.052	.528
	0.073 ± .014	0.517 ± .007

J. D. 242	8284, M1 < (8228, 8252)	8306, M2 < (8228, 8252)	8228, G9 > 8252, G5
	M	M	M
5064.68	0.328	....	0.081
5116.78	.338	0.760	.064
5142.76	.329	.765	.076
5190.60	.326	.772	.048
	0.330 ± .004	0.766 ± .004	0.067 ± .011

Shade 1.31 on 8252.

J. D. 242	8289, M2 > (8393, 8413)	8393, K4 < 8413, K5
	M	M
5101.79	0.122	0.042
5137.65	.145	.004
5180.57	.160	.038
	0.142 ± .014	0.028 ± .016

Shade 0.86 on 8413.

J. D. 242	8316, M2 > (8312, 8374)	8339, M1 > (8312, 8374)	8312, K2 > 8374, K5
	M	M	M
5064.72	0.532	0.532	0.262
5113.69	.604	.544	.278
5142.78	.622	.524	.257
5190.56	.762	.542	.279
	0.630 ± .066	0.536 ± .008	0.269 ± .010

Shade 0.86 on 8316.

TABLE VI—*Continued*

J. D. 242	8383, M2e < 8426, K5	8416, M5 < 8426, K5	8621, M4 < 8426, K5
	M	M	M
4690.83	±0.000	0.104	0.097
4751.79	+ .029	.088	.037
4784.56	+ .043	.128	.124
4840.57	+ .211	.124	.050
5081.80	− .016	.180	.042
5107.75	+ .169	.159	.098
5144.60	+ .150	.118	.049
5168.74	+ .155	.171	.039
	+0.093 ± .079	0.134 ± .027	0.067 ± .030

J. D. 242	8698, M2 > 8834, M2	8850, M5 < 8698, M2	8850, M5 < 8834, M2
	M	M	M
4754.73	0.428	0.701	0.272
4784.63	.448	.567	.120
4801.66	.408	.409	.000
4811.58	.350	.454	.104
4830.56	.421	.464	.044
4840.56	.419	.557	.138
5081.83	.454	.540	.086
5116.76	.384	.408	.014
5146.68	.386	.433	.046
5496.76	....	....	.089
5547.63	....	....	.202
5586.56	....	....	.066
	0.411 ± .026	0.504 ± .078	0.098 ± .057

Shade 0.86 on 8698 and 8834.
8834 probably constant.

J. D. 242	8424, M0 < 8632, K2	8572, M0 < 8632, K2	
	M	M	
5142.80	0.105	0.112	
5168.69	.089	.134	
5190.64	.094	.140	
5412.83	(.125)	(.200)	Poor
5450.75	.068	.202	
5494.66	.059	.155	
5554.63	.044	.151	
	0.076 ± .020	0.149 ± .020	

Shade 0.86 on 8572 and 8632.

J. D. 242	8698, M2 > 8610, K1	8834, M2 < 8841, K0	8850, M5 < 8841, K0
	M	M	M
5496.75	0.139	0.362	0.451
5547.62	.071	.385	.588
5586.55	.165	.371	.436
	0.125 ± .036	0.373 ± .008	0.492 ± .064

Shade 0.86 on 8698, 8834, and 8841.
See preceding group.

J. D. 242	8562, M0 < 8833, K0	8795, M2 > 8833, K0	
	M	M	
5113.76	0.224	0.124	
5146.66	.229	.112	
5190.62	.196	.116	
	0.216 ± .013	0.117 ± .004	

Shade 0.86 on 8795.

J. D. 242	8699, M0 < 8712, K2	8876, M0 < 8712, K2	
	M	M	
5168.73	0.201	0.288	
5190.66	.171	.272	
5223.56	.184	.316	
	0.185 ± .010	0.292 ± .016	

Shade 0.86 on 8699.

TABLE VI—*Continued*

J. D. 242	8775, M2 < 8796, K0p	8940, M5 < 8796, K0p	8729, G4 < 8796, K0p
	M	M	M
4690.85	0.682	0.671	....
4752.74	.696	.806	....
4758.74	.688	.850	....
4765.71	.639	.787	....
4772.69	.761	.739	....
4784.65	.774	.874	0.014
4801.69	.764	.779	.021
4811.59	.913	.833	.023
4840.64	.796	.845	.051
4846.57	.920	.883	.083
4855.58	.819	.796	.075
5081.81	.606	.752	.084
5101.81	.888	.751	.116
5146.70	.875	.748	.114
5180.66	.785	.888	.133
5470.72	.798	.966	.094
5512.66	.818	.819	.098
5547.67	.890	.863	.074
	0.784 ± .074	0.814 ± .055	0.075 ± .030

Shade 2.60 on 8775.

J. D. 242	8815, M4 < 8893, K0	8991, M2 < 8893, K0	9036, M3 < 8893, K0
	M	M	M
4811.61	0.213	0.306	0.194
4830.57	.178	.330	.223
4840.59	.201	.288	.233
4846.59	.245	.374	.218
5470.76	.285	.288	.218
5513.76	.209	.298	.187
5554.58	(.231)	(.362)	(.283)
5602.57	.256	.353	.224
	0.227 ± .030	0.320 ± .028	0.214 ± .013

5554.58 Sky doubtful.

J. D. 242	8860, M2 > (8804, 8874)	8804, K8 < 8874, G9	
	M	M	
5077.80	0.204	0.157	
5137.67	.188	.175	
5168.70	.165	.184	
5210.66	.185	.166	
	0.186 ± .010	0.170 ± .009	

J. D. 242	8882, M0 < (8943, 8997)	9064, M3 < (8943, 8997)	8943, K4 < 8997, G7
	M	M	M
5077.81	....	0.008	0.413
5113.78	(0.195)	(.099)	(.415)
5233.58	.209	.080	.411
5470.74	.218	.018	.447
5512.68	.211	.032	.424
5554.56	.224	.064	.435
5586.66	.185	.039	.427
	0.209 ± .010	0.040 ± .021	0.426 ± .010

Shade 0.86 on 8943, 8997, and 9064.
5113.78 General smoke.

J. D. 242	8904, M2 > (8894, 9008)	8894, K5 < 9008, K0	
	M	M	
5077.79	0.363	0.430	
5168.76	.382	.426	
5210.68	.366	.393	
5233.64	.324	.424	
	0.359 ± .017	0.418 ± .013	

Shade 0.86 on 9008.

J. D. 242	9004, Na < 9033, K5	9047, M5 < 9033, K5	8912, G6 < 9033, K5
	M	M	M
5101.82	+0.137	0.356	....
5180.68	+ .131	.198	....
5496.78	+ .077	.308	0.250
5526.69	− .023	.243	.273
5566.63	+ .036	.291	.235
	+0.072 ± .052	0.279 ± .047	0.253 ± .014