RADIAL VELOCITIES, SPECTRAL TYPES, AND LUMINOSITY CLASSES OF 820 STARS*

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ABSTRACT

Radial velocities and spectral and luminosity classes are given for 820 stars of types F–M in the HD photographic magnitude range of 8.5–8.6. The velocities were determined with a one-prism dispersion of 75 A/mm and were reduced to the Lick system by means of observations of 260 brighter stars having velocities based on three-prism Mills spectrograms. Two plates were obtained for two-thirds of the stars, and three plates for most of the remaining stars. The average probable error is ± 3.6 km/sec for one plate of unit weight. Comparison of velocities in common with Victoria and Mount Wilson determinations indicates that the systematic errors are satisfactorily small, of the order of 1 km/sec or less.

The spectral-class estimates agree well with the HD, Yerkes, and Mount Wilson classifications, except among the early F stars, where the Lick estimates average somewhat later. The luminosity-class assignments are on the Yerkes system, and those for the bright-star velocity standards show no appreciable deviation from the classes given by Morgan, Keenan, and Kellman in their *Atlas of Stellar Spectra*. Because of the basis for selection, statistically significant data on the luminosity function are obtained only for the class IV stars (subgiants). The frequency maximum for these stars appears to be at F4–F5, and practically no stars are found later than K1 or K2, as previously noted by several other investigators.

Solar-motion solutions for giants (III), subgiants (IV), and main-sequence dwarfs (V) give results that show hardly any real differences depending on luminosity: solar motions of 24, 23, and 19 km/sec for class III, IV, and V stars, respectively, toward essentially the same apex at $\alpha_0 = 280°$ and $\delta_0 = +44\frac{1}{2}°$. No significant K-terms were found, and the mean residual velocities show the usual tendency to increase with advancing spectral class.

Two solutions including a galactic-rotation term were made for the giants. The first, for 348 class III stars (including a few II–III and III–IV) and with assumed values of $K = 0$ and $L_0 = 325°$, gave $\bar{r}A = 4.2 \pm 1.9$ km/sec. The second, for 147 class III stars in the galactic zone limited by $b = \pm 20°$ and based on the residual velocities, gave $\bar{r}A = 6.7 \pm 1.5$ km/sec and $L_0 = 309° \pm 7°$. These results show that the giants included in this material participate in the differential galactic rotation characteristic of the region around the sun.

I. INTRODUCTION

The Lick Observatory general program of radial velocities included all stars to visual magnitude 5.51. In the course of this program many velocities of fainter stars were obtained, but without systematic selection. After the completion of the program of bright stars, it was decided to extend the Lick system of radial velocities to a representative group of fainter stars. In order to avoid too much duplication of work at other observatories on stars fainter than about magnitude 5.5, it was decided to select a group of stars within the rather narrow range of photographic magnitude from 8.5 to 8.6, inclusive, as given in the *Henry Draper Catalogue*.

With the general aim of providing data for studies of the apparent and peculiar motions of a representative sample of faint stars of spectral classes F–M, the observational program was made up more specifically as follows:

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† [Dr. Moore was engaged in preparing this material for publication at the time of his death on March 15, 1949. Dr. Paddock had retired from the Lick Observatory. While all the basic data, such as those in Table 1, had been obtained and several of the least-squares solutions were finished or well along toward completion, hardly any text had been written. The responsibility for finishing the calculations, writing the brief discussion, and preparing the final copy for publication was assumed by the undersigned, who wishes to make grateful acknowledgment to Messrs. H. F. Weaver and O. J. Eggen for their expert advice.—N. U. Mayall.]

1. The selection of the stars was on the basis of random distribution of the line of sight to the star, that is to say, stars were selected so as to give a fairly uniform distribution over the sky from declination $-21°$ to $+90°$. Over this part of the sky, however, there are many more HD stars of $m_{pg} = 8.5$–8.6 than can be observed in a reasonable time. Accordingly, for spectral classes F, G, and K, only those stars in the even zones of declination were chosen. No such limitation was needed for the K5 and M stars, because of their relatively small number.

2. A dispersion of 75 A/mm was chosen because experience with a one-prism 12-inch camera spectrograph showed that this instrument, in combination with the 36-inch refractor, would yield velocities having probable errors of ± 3 to ± 4 km/sec for a single observation—a precision that appeared sufficient for the purpose.

3. A brightness of $m_{pg} \sim 8.5$ was decided upon because, with good seeing, it resulted in reasonably constant exposure times, 1–1½ hours, for the fastest available emulsion, Eastman 40, regardless of spectral class.

In the early part of the work, three plates were taken of each star to find out how accordant the measures would be. It was soon found that the velocities from two or three plates generally were in good agreement, and thereafter only two satisfactory plates were taken for each star. The frequency distribution of the number of observations per star is given in the accompanying tabulation. The majority of the plates were taken by Moore

No. of obs. per star....	1	2	3	4	5	6
No. of stars..........	14	562	208	26	8	2
Percentage...........	1.7	68.5	25.4	3.2	1.0	0.2

and Paddock, a few by some of the assistants. Observations for the program were begun in July, 1928, and were completed in December, 1937.

II. THE RADIAL VELOCITIES

MEASUREMENT AND REDUCTION

In order to refer the one-prism velocities for these fainter stars to the Lick three-prism Mills spectrograph system, 260 brighter stars having velocities determined with the Mills spectrograph were observed with the one-prism spectrograph. This set of plates for the brighter stars and that for the fainter stars, totaling over two thousand spectrograms, were measured on a Hartmann spectrocomparator. Paddock measured all plates, and Miss Mary L. Miller about two-thirds of the total.

For the Hartmann standards, five plates of bright stars of spectral classes F, G, K, K5, and M were selected, as noted below. Each one-prism plate was measured against the Hartmann standard of nearest corresponding spectral class. Such a measurement yielded for every plate a velocity difference, ΔV, which may be written as

$$\Delta V = (V_1 - \odot) - V_s , \quad (1)$$

where V_1 is the star's velocity reduced to the sun, $\odot$ is the sun reduction, and V_s is the velocity of the Hartmann standard. Once V_s is known, the velocity of any star may be found.

In order to obtain V_s and, at the same time, to refer the one-prism velocities to the three-prism system, the measures of the 260 brighter stars were used. For each of these stars a three-prism velocity, V_3, was available from *Lick. Obs. Pub.*, Volume **16**, 1928. Therefore, to refer the one-prism system to the three-prism system, V_1 was replaced by V_3 in equation (1), and each bright star gave an equation for V_s as follows:

$$V_s = (V_3 - \odot) - \Delta V . \quad (2)$$

Average values, $\overline{V}_s$, were computed for each Hartmann standard for each measurer, as indicated in the accompanying tabulation.

VELOCITIES FOR HARTMANN STANDARD SPECTROGRAMS

Spectral Class	Star	One-Prism Plate No.	$\overline{V}_s$ (Km/Sec)	
			GFP	MLM
F..........	α Per	16396 T	+22.10	+22.11
G..........	Sky	16404 M	− 3.35	+ 1.55
K..........	β Gem	16402 P	+13.43	+14.43
K5.........	α Tau	16397 N	+73.03	+76.64
M..........	δ Oph	16559 Q	−20.21	−21.31

Because some of the plates were measured by only one person, those plates measured in common were compared, and the average systematic differences were evaluated according to spectral class, in order to reduce the smaller set of measures to the larger, as follows:

Spectral class...........	F	G	K	K5	M
GFP–MLM (km/sec)....	+2.23	−0.84	+0.06	+2.77	−1.32

These differences have been applied as corrections to Miss Miller's measures to make the latter consistent with Paddock's. The average of Paddock's measures and those of Miss Miller, including the above corrections, are the velocities listed in column 9 of Table 1.

ACCURACY

The internal consistency of these radial-velocity determinations may be indicated as follows: From 1796 plates of 820 stars, the average probable error of one observation of unit weight was found to be ±3.6 km/sec.

The external consistency, or systematic errors, of these radial velocities may be indicated by a comparison of the results for stars observed in common at the Lick, Mount Wilson, and Victoria observatories. The data for comparison are in column 11 of Table 1, which notes the determinations from other observatories,[1] the stars of variable ("var") or probably variable ("var?") velocity, and the number of observations in parentheses. In the following comparisons, the variable (var) and probably variable (var?) velocities have been omitted. Because of the rather small number of stars included, comparisons also are given for averages omitting differences greater than 10 km/sec.

Mount Wilson: 51 stars, MW−LO = −0.87 km/sec
47 stars, MW−LO = +0.60 km/sec (HD 37453, 123598, 125455, 217580 omitted)

Victoria: 27 stars, DAO−LO = −2.18 km/sec
24 stars, DAO−LO = −0.75 km/sec (HD 81069, 175545, 183681 omitted)

The smallness of these average differences suggests that the radial velocities in Table 1 are not affected by any serious systematic errors.

[1] Through the kindness of Dr. R. E. Wilson, of the Mount Wilson Observatory, a number of his unpublished measures were made available for comparison. These velocities, indicated in column 11 by "MW*," were obtained from plates of comparable dispersion. Since many depend on only one plate, a number of above-average differences may be expected.

TABLE 1

RADIAL VELOCITIES, SPECTRAL CLASSES, AND LUMINOSITIES OF 820 STARS

HD (1)	α (1900) (2)	δ (1900) (3)	Vis. Mag. (4)	Spec. Cl. HD (5)	Spec. Cl. LO (6)	Lum. Class (7)	No. Obs. (8)	V (Km/Sec) (9)	p.e. (Km/Sec) (10)	Remarks (11)
153..	0^h01^m3	+42°11′	8.0	G0	G1	V	2	−32	±1.0	
233..	02.0	−16 24	8.2	F5	F5	V	2	−10	0.2	
334..	02.9	− 8 06	8.2	F5	F5	V	2	−22	0.5	
377..	03.3	+ 6 04	8.0	F8	G2	V	3	− 4	0.3	
489..	04.3	+18 33	7.8	G5	G3	V	2	−24	1.9	
502..	04.4	+18 59	7.8	G5	G8	IV	3	+ 2	2.0	
615..	05.4	+14 41	8.2	F5	F6	V	3	− 4	3.0	
737..	06.6	+26 58	8.1	F5	F5	V	3	− 9	3.0	
949..	08.8	+43 57	8.2	F5	F4	V	1	+15	....	
966..	08.9	− 4 27	7.5	K0	G6	III	2	−23	2.5	
975..	09.0	+34 51	8.1	F5	F5	V	2	+ 1	1.5	
982..	09.1	+43 17	8.0	F8	F8	V	1	+17	....	
1228..	11.5	+ 1 18	7.3	Ma	M5	III	2	− 4	1.0	MW −7.9±1.6 (4)
1364..	12.7	+19 41	7.3	Mb	M4	II–III	2	+ 9	1.7	
1552..	14.7	+42 19	8.2	F2	F2	III	2	+15	0.6	
1736..	16.5	−16 45	8.2	F5	F5	IV	2	− 5	0.1	
2344..	22.2	+ 2 15	7.7	G5	G4	III	3	0	2.9	
2506..	23.7	+58 55	7.8	G5	G4	III	2	−55	1.0	
2624..	24.7	− 0 53	7.7	G5	G6	III	3	+14	7.4	Var?
2730..	25.7	+42 49	8.1	F8	F7	V	2	−11	1.6	
2779..	26.2	+20 16	7.4	K5	K4	III	3	+ 4	1.1	
2841..	26.7	+19 05	7.3	K5	K5	III	3	+ 4	0.8	
3070..	28.8	+ 2 46	7.8	G5	G4	III	2	−10	2.8	
3141..	29.6	+42 09	7.7	G5	K0	IV	2	+ 1	2.8	
3265..	30.7	+37 42	7.4	K5	M0	III	2	−16	2.6	
3370..	31.5	+26 29	8.2	F2	F3	IV	3	− 1	0.4	
3397..	31.8	+30 57	8.2	F0	F0	III	2	+11	0.1	
3726..	35.0	+26 08	8.0	F8	F6	V	3	−10	3.6	
3790..	35.5	+30 34	8.2	F5	F4	V	2	+14	3.7	
3989..	37.4	+45 21	7.4	K5	K5	III	2	−24	1.7	MW −18.7±0.9 (4)
4270..	40.0	+14 37	8.2	F0	F3	IV	4	−14	5.3	Var?
4277..	40.1	+54 26	8.0	F8	F8	V	2	−17	4.1	
4549..	42.4	+26 34	7.8	G5	G4	III	2	−26	1.4	
4565..	42.5	− 2 52	7.3	K5	M1	III	2	+20	1.4	
4647..	43.4	+56 32	7.2	Ma	M2	III	2	−36	0.2	
5072..	47.5	+38 29	8.0	G0	F7	IV	3	−11	2.0	
5308..	49.8	+22 53	8.2	F5	F5	V	2	− 2	2.1	
5362..	50.4	− 0 31	7.6	K0	K4	III	4	−29	2.9	
5453..	51.2	− 8 07	8.2	F5	F6	IV	2	+ 6	0.7	
5494..	51.6	+34 20	8.2	F5	F7	V	2	−33	1.9	
5650..	53.1	+26 15	7.5	K2	K5	III	3	−19	3.1	
5892..	55.3	+ 6 49	8.2	F5	F5	V	3	− 3	1.0	
6064..	56.8	+ 2 00	8.0	F8	F6	V	3	+ 1	3.7	
6262..	58.5	+38 09	7.3	Ma	M3	III	2	−30	1.0	
6424..	1 00.0	+10 48	8.1	F5	F5	V	3	+ 9	2.6	
6529..	01.1	− 0 47	8.2	F2	F4	IV	2	− 1	4.0	
6645..	02.1	+46 19	7.5	K2	K0	II–III	2	−26	1.9	
6664..	02.3	+38 44	8.0	F8	G1	V	2	+ 6	2.9	
6876..	04.2	+34 05	8.1	F5	F5	IV	2	+ 8	1.3	
7189..	07.1	+46 39	7.7	G5	G6	III	2	−21	1.3	
8262..	16.8	+18 10	8.0	F8	G3	V	3	+ 4	1.4	MW 0±2 (3)
8447..	18.5	−18 28	7.2	Ma	M3	III	3	0	2.2	
8507..	19.0	+46 39	7.8	G5	G5	II	2	−28	4.2	
8583..	19.7	+46 36	7.7	G5	G4	III	2	−10	0.9	
8586..	19.7	+22 25	8.1	F8	F5	V	3	− 6	1.1	
8626..	20.0	+15 44	7.4	K5	K5	III	3	− 4	3.1	
8865..	22.3	− 0 28	8.3	F2	F3	V	3	+23	1.7	

TABLE 1—*Continued*

HD (1)	α (1900) (2)	δ (1900) (3)	Vis. Mag. (4)	Spec. Cl. HD (5)	Spec. Cl. LO (6)	Lum. Class (7)	No. Obs. (8)	V (Km/Sec) (9)	p.e. (Km/Sec) (10)	Remarks (11)
8884. .	1h22m5	+42° 16′	7.7	G5	G7	III	2	− 17	± 2.9	
9500. .	28.2	+35 06	7.3	Ma	M4	III	2	+ 1	3.0	MW* +5 (1)
9956. .	32.2	+22 04	8.1	F5	F6	V	2	+ 47	6.1	Var?
10100. .	33.6	−16 23	7.5	K0	K1	III	2	+ 28	2.8	
10108. .	33.8	+54 20	8.2	F0	F4	IV	2	− 15	2.8	
10572. .	37.9	−20 40	7.3	K0	K4	III	2	+ 25	4.6	
11012. .	43.1	+46 45	8.2	F0	F2	IV	2	+ 7	0.8	
11170. .	44.7	+ 6 44	7.9	G0	G1	IV	2	− 14	0.5	
11274. .	45.6	−12 50	8.1	F5	F5	V	2	+ 17	4.8	
11719. .	49.9	+42 34	7.5	K2	K4	III	3	+ 2	1.8	
11961. .	52.3	+30 39	7.2	Mb	M6	III	2	− 46	0.7	MW* −47 (1)
12102. .	53.7	+ 6 11	8.3	F2	F3	IV	4	+ 2	2.0	
12246. .	55.1	+34 49	8.1	F5	F3	V	2	+ 24	3.1	
12460. .	57.0	−12 18	8.1	F5	F6	V	2	+ 8	2.0	
12568. .	58.1	+62 28	8.0	F8	G1	II	2	+ 12	0.1	
12637. .	58.7	+38 58	8.1	F5	F3	III	2	+ 10	2.4	
12783. .	2 00.2	− 0 10	8.0	G0	G5	V	3	+ 22	0.9	
13364. .	05.5	+22 45	8.2	F2	F5	IV	2	− 13	2.1	
13565. .	07.3	+30 06	7.8	G5	G4	III	2	+ 14	1.7	
13830. .	09.7	+62 43	8.0	F8	F6	IV	2	− 22	2.1	
13834. .	09.7	+46 13	8.2	F5	F4	V	2	− 9	2.0	
14376. .	14.2	−19 59	7.1	K5	M0	III	2	− 7	1.4	
14385. .	14.3	+ 2 22	7.8	G5	G5	III	2	+ 11	2.7	
14625. .	16.6	− 0 36	7.6	K0	G8	III	2	+ 5	1.5	
14738. .	17.5	+26 15	8.1	F8	F6	II	2	− 11	0.9	
14797. .	18.0	+46 55	7.6	K0	M0	III	4	+ 26	1.8	
15084. .	20.7	+18 27	8.0	G0	F7	V	3	+ 20	0.9	
15128. .	21.1	+30 50	8.1	F5	F6	V	2	+ 18	0.1	
15164. .	21.4	+10 08	8.3	F0	F2	IV	3	+ 34	0.6	
16090. .	30.0	+30 44	7.9	G0	G1	IV	2	+ 2	1.9	
16314. .	32.0	+ 2 00	8.2	F0	F5	III	4	− 16	2.1	
16497. .	33.7	+14 05	8.2	F5	F5	IV	3	+ 3	1.2	
16638. .	34.9	+26 12	8.1	F5	F7	V	2	+ 1	4.7	
16708. .	35.6	+ 2 28	7.8	G5	G5	IV	3	+ 65	1.8	
17055. .	39.2	+22 58	8.1	F8	F6	III	3	+ 13	4.1	
17238. .	40.9	+42 59	7.6	K0	G9	III	2	− 27	1.1	
18142. .	49.7	+30 38	7.2	Ma	M3	II–III	2	− 25	2.8	MW* −21 (1)
19178. .	3 00.0	−12 33	8.2	F5	F5	V	2	+ 3	0.7	
19258. .	00.8	+11 17	7.3	K5	M1	III	3	− 74	1.7	
19286. .	01.1	+74 41	8.2	F5	F2	V	2	+ 52	2.2	
19301. .	01.2	+38 42	8.2	F0	F3	V	2	− 2	0.9	
19511. .	03.1	+ 6 21	7.8	G5	G4	III	2	+ 20	0.2	
19522. .	03.2	−12 25	8.0	G0	G3	IV	3	+ 50	2.5	
19534. .	03.5	+73 51	7.2	Ma	M2	III	1	+ 12	. . . .	MW* +16 (1)
19790. .	05.9	+ 6 47	8.3	F0	F3	III	3	− 3	2.0	
19808. .	06.1	+34 36	8.1	F8	F5	IV	2	+ 38	7.7	Var?
19855. .	06.5	+81 47	7.3	Ma	M2	III	2	− 7	3.1	
19882. .	06.7	+38 36	8.3	F0	F3	IV	2	− 13	1.1	
20358. .	11.4	−12 22	7.5	K2	K4	III	2	− 24	2.5	
20692. .	14.8	+38 22	8.1	F5	F5	V	2	− 4	4.7	
20909. .	17.2	−12 41	8.2	F5	F4	V	2	+ 8	2.1	
20988. .	18.1	+ 2 30	8.3	F0	F4	V	3	+ 7	2.6	
21183. .	20.0	+34 59	8.1	F8	F9	V	3	0	1.2	
21910. .	26.9	+74 26	7.6	K0	G9	IV	2	−104	1.3	
21971. .	27.4	+62 59	7.6	K0	K4	III	2	− 22	1.0	
22007. .	27.7	− 0 50	8.0	G0	G5	IV	5	+ 18	1.9	
22156. .	29.1	+46 14	7.7	G5	G6	III	2	− 26	0.8	
22373. .	31.0	+34 50	8.1	F8	F9	V	1	− 9	. . . .	

* Unpublished Mount Wilson measures (see n. 1).

TABLE 1—*Continued*

HD (1)	α (1900) (2)	δ (1900) (3)	Vis. Mag. (4)	Spec. Cl. HD (5)	Spec. Cl. LO (6)	Lum. Class (7)	No. Obs. (8)	V (Km/Sec) (9)	p.e. (Km/Sec) (10)	Remarks (11)
22872. .	3h35m3	+50° 51′	7.9	G0	F9	V	2	+ 56	± 4.9	
23107. .	37.4	+38 04	7.4	K5	K5	III	2	+ 12	3.2	MW +15.7±1.0 (3)
23141. .	37.7	+26 04	7.5	K0	K0	III	2	− 28	0.8	
23317. .	39.1	− 8 11	7.8	G5	G6	III	2	− 16	1.4	
23393. .	39.7	−12 22	8.2	F0	F0	III	2	− 1	0.5	
23450. .	40.2	+66 51	7.7	G5	G8	III	2	+ 6	1.6	
23502. .	40.6	+10 15	7.7	G5	G8	III	2	+ 3	1.7	
23806. .	42.9	+ 2 28	8.3	F	F2:	V:	2	+ 32	2.2	Weak plates
23825. .	43.0	+10 31	7.9	G0	G3	IV	2	− 13	2.1	
23962. .	44.1	+33 45	7.4	K5	K5	III	2	+ 16	10.2	Var?
24107. .	45.3	− 4 12	7.5	K0	K1	II	2	+ 39	0.8	
24301. .	46.9	+26 22	8.0	G0	G0	IV	2	+ 22	1.7	
24622. .	49.8	− 0 17	8.3	F0	F3	IV	3	+ 24	1.8	
24694. .	50.4	−20 47	8.8	F0	F0	. . . .	3	+ 45	13.7	V. br. lines; Var?
25189. .	55.0	−20 37	7.7	K0	K2	II	2	+ 14	0.1	
25322. .	56.3	+22 09	8.2	F5	F5	V	2	− 13	2.8	
25391. .	57.0	+14 47	8.0	G0	G0	V:	2	− 39	3.0	Plates underexposed
25518. .	58.1	+38 38	8.1	F5	F5	IV	2	− 29	1.9	
25661. .	59.2	−20 26	7.4	K2	K2	II	2	+ 24	0.6	
25749. .	59.9	+14 02	7.6	K0	G9	III–II	2	− 41	2.2	
25921. .	4 01.2	−10 34	7.3	Mb	M4	III	3	+ 49	1.6	
26004. .	01.9	−19 47	7.6	K5	K0	II	2	− 12	0.4	
26297. .	04.5	−16 10	7.7	G5	G1	V	2	+ 15	3.0	
26395. .	05.4	+42 39	8.2	F5	F4	V	2	+ 31	20.7	Var?
26596. .	07.3	+54 44	8.0	F8	F9	IV:	2	+ 2	3.1	Weak plates
26717. .	08.5	+62 20	8.0	G0	F7	V	2	− 15	1.1	
27129. .	11.9	+22 06	8.2	F5	F5	IV	2	+ 15	0.5	
27135. .	12.0	+70 36	8.2	F0	F4	III	2	+ 17	0.5	
27372. .	14.1	+14 03	7.8	G5	G7	III	2	− 17	3.0	
27498. .	15.3	− 2 52	7.3	Mb	M4	III	2	+ 86	2.0	
27598. .	16.2	−17 04	7.3	Ma	M5	II	4	+ 99	0.9	
27816. .	18.4	+58 01	8.1	F8	F7	IV	2	+ 11	1.9	
28159. .	21.4	− 0 44	7.5	K2	M1	II	4	− 6	0.3	
28387. .	23.5	−18 04	7.5	K5	K5	II	2	+ 26	0.3	
28395. .	23.6	+ 2 09	8.2	F5	F3	V	3	− 37	4.5	
28486. .	24.4	+14 06	8.0	G0	F7	V	2	− 49	3.5	
28487. .	24.4	+ 4 56	7.2	Mb	M3	II	2	− 6	1.0	
29146. .	30.3	+78 58	8.1	F5	F4	V	2	− 7	4.4	
29936. .	37.9	− 0 47	7.8	G5	F9	V	2	+ 3	6.7	Var?
30247. .	40.8	+14 21	8.2	F0	F2	V	2	+ 22	3.8	
30436. .	42.6	− 0 16	8.2	F2	F4	III	2	− 12	2.3	
31324. .	49.7	+58 28	7.8	G5	G7	III	3	+ 35	1.7	
31355. .	50.0	+ 2 49	8.2	F2	F3	IV	2	+ 18	4.1	
31706. .	53.0	+30 55	8.0	F8	F5	IV	1	+ 19	. . . .	
31923. .	54.5	−12 55	8.3	F2	F4	IV	3	+ 46	1.4	
32024. .	55.2	− 0 20	8.2	F2	F4	III	3	+ 41	2.4	
33053. .	5 02.5	+14 25	7.7	G5	G3	III	2	− 18	0.8	
33072. .	02.6	−20 14	8.6	F2	F4	IV	2	+ 29	0.1	
33239. .	03.7	−20 15	7.3	K0	G9	II	2	− 11	1.2	
34616. .	13.7	−16 18	7.6	K0	G9	III	2	+ 24	1.8	
34624. .	13.8	+42 16	7.8	G5	G6	III–IV	2	+ 9	0.8	
34786. .	14.9	+58 51	7.8	K5	G8	III	3	− 17	3.9	
34860. .	15.4	− 4 54	8.1	F5	F6	V	2	+ 18	1.5	
35062. .	16.9	+18 55	7.6	K0	G8	III	2	+ 39	0.4	
35146. .	17.6	+18 31	7.5	K2	K5	III	3	+ 9	2.1	DAO +10 (1)
35441. .	19.6	−20 49	7.8	K2	K2	III	2	+ 15	2.0	
36042. .	23.8	+34 08	7.8	G5	G7	III	2	+ 7	4.5	
36067. .	24.0	+50 57	7.6	K0	K1	II	2	− 15	0.3	

TABLE 1—*Continued*

HD (1)	α (1900) (2)	δ (1900) (3)	Vis. Mag. (4)	Spec. Cl. HD (5)	Spec. Cl. LO (6)	Lum. Class (7)	No. Obs. (8)	V (Km/Sec) (9)	p.e. (Km/Sec) (10)	Remarks (11)
36724..	5h28m7	+26° 54′	8.0	F8	F6	IV	3	− 19	± 4.0	
37453..	33.6	+30 02	8.2	F5	F4	III	2	+ 56	1.6	MW +22 (1)†
37847..	36.3	−20 20	7.0	K0	G4	III	2	+ 36	3.0	
38092..	38.1	+38 27	7.5	K0	G9	III	2	+ 30	1.0	
38164..	38.7	+ 6 29	7.7	G5	G5	III	2	+ 36	1.0	
38411..	40.5	+10 45	8.3	F0	F3	III	3	+ 28	0.6	MW +19 (1)
38455..	40.8	−12 29	7.6	K0	G7	IV	2	− 33	1.6	
38699..	42.5	−16 41	7.6	K0	K4	III	2	+ 30	0.1	
39008..	44.6	− 0 23	7.4	K2	K3	III	2	− 12	1.5	
39116..	45.3	+30 43	8.2	F5	F4	V	2	+ 4	0.5	
39645..	48.8	+22 30	7.6	K0	G7	III	3	+ 19	1.0	
39688..	49.0	−16 17	7.9	G0	F7	V	2	+ 3	0.8	
39699..	49.1	+17 23	7.4	K5	K5	III	3	+ 32	0.2	DAO +28 (1)
39967..	50.9	+42 50	8.0	F8	F6	IV	2	− 60	7.2	Var?
40170..	52.1	−20 02	8.4	G0	F6	V	2	− 6	1.0	
40259..	52.1	+ 2 04	8.3	F0	F0	V	2	− 30	5.4	
40300..	52.8	+ 6 31	8.1	F8	F3	IV	2	− 12	0.3	
40512..	54.2	+ 2 28	8.1	F5	F5	IV	2	+ 45	0.1	
40567..	54.6	+66 58	8.2	F5	F5	IV	2	− 9	5.8	
40931..	56.9	+13 02	7.4	K5	M0	III	2	+ 17	1.8	DAO +13 (1)
40960..	57.1	+18 00	7.8	G5	K1	III	3	+ 42	2.7	
41028..	57.5	+14 21	8.2	F5	F4	IV	3	− 3	3.1	
41159..	58.2	+74 32	8.1	F8	F5	III	2	− 19	0.9	
41255..	58.8	−16 02	8.0	G0	F7	V	2	− 3	0.6	
41456..	6 00.2	+26 32	7.6	K0	G5	III	2	− 19	2.8	
41563..	00.8	+26 40	7.5	K0	G6	III	2	− 5	1.5	DAO −9 (1)
41608..	01.1	− 5 52	7.2	Ma	M1	III	3	+ 7	4.7	
41658..	01.4	+18 49	8.3	F0	F3	III	2	+ 22	1.3	
42061..	03.6	+70 42	7.8	G5	G7	III	2	+ 13	0.2	
42106..	03.8	+30 34	7.8	G5	G7	III	2	+ 24	3.7	
42176..	04.2	+30 59	8.1	F8	F7	V	2	− 43	3.7	
42820..	07.8	+42 10	8.0	F8	F8	V	2	+ 22	5.0	
42911..	08.3	− 4 58	7.5	K0	G7	III	2	+ 43	2.3	DAO +40 (1)
43236..	10.0	−19 30	7.9	Ma	M3	III	3	+ 72	0.8	
43502..	11.4	−20 10	7.5	K0	K0	III	2	+ 49	2.4	
43748..	12.9	+78 02	7.8	G5	G5	III–IV	3	+ 8	3.1	
43795..	13.1	+42 50	7.8	G5	G6	III	2	− 50	0.7	
43856..	13.4	+ 6 46	8.1	F5	F6	V	3	− 58	1.4	
44019..	14.3	− 0 53	7.6	K0	K2	IV	2	+ 39	0.4	
44073..	14.7	+18 05	7.6	K0	G7	III	2	+ 16	1.1	
44252..	15.7	+22 57	8.1	F5	F3	IV	3	+ 35	0.8	MW +37.3 ±2.5 (4)
44415..	16.6	+14 44	8.3	F0	F4	Ib	3	+ 27	1.8	
44420..	16.6	− 0 29	7.7	G5	G4	V	3	+ 5	1.4	
44630..	17.7	+58 47	8.0	F8	F5	IV	2	− 38	0.1	
44894..	19.2	−20 53	8.3	K0	G6	II–III	2	+ 19	2.8	
45379..	21.9	− 0 59	8.2	F0	F3	III	3	+ 25	1.5	
45528..	22.9	+62 50	7.6	K0	G9	III	2	− 47	1.9	
46122..	26.4	+ 6 51	7.7	G5	G3	IV	2	− 8	3.2	
46217..	27.0	+54 08	8.0	F8	F7	V	2	+ 17	2.4	
46377..	27.9	+ 1 20	7.4	K5	K4	III	2	+ 15	1.3	DAO +14 (1)
46423..	28.2	+14 22	8.2	F5	F6	V	2	+ 14	0.6	
47194..	32.3	+34 23	8.2	F0	A8	....	3	+ 8	1.6	
47668..	34.7	−18 06	7.4	K5	M2	III	2	+ 5	3.3	
47821..	35.4	− 6 15	7.2	Ma	M3	III	2	− 14	1.1	
47930..	35.9	+57 01	7.2	Ma	M2	III	2	+ 22	3.2	
48688..	39.5	+10 52	7.9	G0	G0	III	2	+ 32	1.6	
48796..	41.1	+ 9 18	7.4	K5	K5	III	2	+ 21	2.1	
49068..	41.5	−20 45	7.5	K2	K0	Ib	2	+ 22	0.1	

† Bright hydrogen lines, cF5e, Merrill, *Pub. A.S.P.*, **54**, 155, 1942.

TABLE 1—*Continued*

HD (1)	α (1900) (2)	δ (1900) (3)	Vis. Mag. (4)	Spec. Cl. HD (5)	Spec. Cl. LO (6)	Lum. Class (7)	No. Obs. (8)	V (Km/Sec) (9)	p.e. (Km/Sec) (10)	Remarks (11)
49317. .	6^h42^m7	−20° 34′	8.4	F8	G6	III	2	+ 24	± 0.7	
49367. .	43.0	+ 6 19	7.7	G5	K1	II	2	+ 2	0.2	
49435. .	43.3	− 1 43	7.4	K5	K5	III	2	+ 70	1.8	DAO +74 (1)
49633. .	44.3	+46 38	7.6	K0	G8	II	2	+ 6	0.9	
50060. .	46.4	+10 55	7.8	G5	F9	V	2	+ 71	1.4	
50067. .	46.4	− 9 58	7.4	K5	K4	III	2	+ 7	0.2	
50372. .	47.8	+ 2 52	7.7	G5	G6	II	2	+ 15	0.2	
50434. .	48.2	+14 53	7.8	G5	G5	III	2	− 5	1.9	
50735. .	49.3	− 8 39	8.3	F0	F0	V	2	+ 55	7.7	V. br. lines
50746. .	49.4	+ 2 44	8.1	F8	F7	V	3	+ 41	4.0	
51002. .	50.5	+14 38	8.2	F5	F4	IV	2	+ 26	0.1	
51710. .	53.4	+42 13	7.8	G5	G7	IV	2	+ 12	0.3	
51833. .	53.8	+30 26	7.8	K0	G8	III	2	+ 55	2.0	
52340. .	55.8	+ 2 16	8.3	F2	F4	V	2	− 5	4.8	
53561. .	7 00.4	+14 08	7.4	K5	K5	III	3	+ 42	2.7	
53590. .	00.5	− 0 38	7.6	K0	G8	IV	2	+ 15	2.0	
53598. .	00.5	−20 41	7.2	K2	M0	II	2	+ 54	1.5	
54489. .	03.9	+ 2 25	7.5	K0	G9	III	2	+ 20	4.2	
54519. .	04.0	−20 42	6.9	K2	K5	II	2	+ 15	0.5	
54684. .	04.7	+70 41	7.8	G5	G2	IV	2	− 38	2.3	
54983. .	06.0	+50 44	8.2	F0	A9	. . . . . .	2	+ 28	2.3	
55054. .	06.3	+10 41	7.9	G0	F7	V	2	− 45	2.8	
55055. .	06.3	+ 6 55	8.2	F0	F0	V	2	+ 1	4.6	
55438. .	07.8	− 8 32	8.3	F0	F0	IV	2	+ 34	9.1	Var?
55760. .	09.1	−20 57	8.4	F0	A9	. . . . . .	2	− 26	19.0	Var?
55847. .	09.6	+22 09	7.4	K5	K5	III	3	+ 62	3.2	
56274. .	11.3	−12 52	7.7	G5	G0	V	3	+ 63	0.5	MW +57.0±1.5 (3)
56418. .	11.8	+26 31	7.6	K0	G7	III	3	− 4	4.3	Var (−16 to +5)
56819. .	13.5	+70 09	8.2	F0	A9:	. . . . . .	4	+ 10	19.0	Var (+76 to −60)
56965. .	14.1	+10 35	7.4	K2	M0	III	2	+ 29	1.5	DAO +23 (1)
57046. .	14.5	+46 25	8.0	F8	F8	V	2	− 27	0.8	
57267. .	15.4	+26 21	7.9	G0	G5	III	3	+ 15	5.0	Var?‡
57362. .	15.8	+30 01	8.1	F5	F4	V	4	− 16	1.5	
57840. .	17.9	− 8 51	8.3	F0	A9	III	2	+ 47	0.1	
57890. .	18.1	−20 19	7.4	Mb	M6	III	2	+ 36	0.7	
58121. .	19.1	+ 6 21	7.7	G5	G7	III	2	+ 14	0.7	
58477. .	20.7	+18 44	8.3	F0	F2	IV	2	+ 39	6.9	Var?
59058. .	23.2	+38 40	7.7	G5	G5	V	2	+ 14	2.9	
59076 and 77	23.2	−20 57	7.7	G0+A2	G5+A	III	2	+ 20	19.2	Var (−9 to +49)
59980. .	27.3	− 0 17	8.1	F5	F6	III	2	+ 28	1.7	
60265. .	28.5	−20 35	8.6	F0	. . . .	. . . . . .	2	+ 52	7.5	Var?
60381. .	29.1	+54 36	8.1	F5	F4	IV	2	− 6	0.4	
60618. .	30.3	+30 00	8.2	F2	F5	IV	2	0	0.8	
60983. .	32.0	+54 41	8.0	F8	F5	III	2	+ 8	0.9	
61367. .	33.8	− 0 02	7.3	Ma	M2	III	2	+ 17	0.7	
61787. .	35.9	+18 17	8.1	F5	G4	IV	2	− 1	1.3	
62094. .	37.2	+78 28	8.0	F8	F6	V	2	− 4	2.9	
62549. .	39.4	− 4 49	7.9	G0	G1	V	2	+ 85	1.5	
63210. .	42.6	+18 36	7.7	G5	G8	III	2	+ 13	2.5	
63348. .	43.4	+55 00	7.4	K5	M0	III	2	− 5	2.2	
63653. .	44.9	− 8 04	8.0	F8	F5	IV	2	+ 35	0.7	
64207. .	47.7	+26 49	8.0	F8	F9	V	3	+ 25	1.6	
64291. .	48.1	+10 57	7.7	G5	G6	III	2	+ 67	5.5	
64372. .	48.5	+30 37	7.8	G5	G7	III	2	+ 82	0.9	
64493. .	49.1	+18 21	7.4	K2	K4	III	3	− 12	2.0	
64512. .	49.2	+18 13	7.5	K0	G6	III	3	+ 5	2.5	

‡ 57267. On first two plates, spectrum G5 + A, av. vel. = +24; and on third plate, G5, vel. = 0.

TABLE 1—*Continued*

HD (1)	α (1900) (2)	δ (1900) (3)	Vis. Mag. (4)	Spec. Cl. HD (5)	Spec. Cl. LO (6)	Lum. Class (7)	No. Obs. (8)	V (Km/Sec) (9)	p.e. (Km/Sec) (10)	Remarks (11)
65174..	$7^h52^m.4$	+2°55′	8.1	F8	F5	V	2	+28	±2.7	
65477..	53.8	+6 36	8.3	F0	F0	IV	2	+1	2.8	
66633..	59.4	+74 39	8.2	F0	....	....	2	+6	0.3	MW* +2±3 (3)
66686..	59.6	+10 47	7.7	G5	G5	III	2	+17	0.2	
66823..	8 00.2	+65 57	7.3	K5	K5	III	2	−10	1.6	
67141..	01.5	−20 39	8.2	G5	G1	IV	2	+58	0.1	
67517..	03.3	+54 32	8.0	F8	F8	V	3	−23	3.4	
68706..	08.5	+2 19	8.0	F8	F7	V	2	−29	2.3	
68793..	08.9	−4 21	8.2	F5	F4	V	2	−6	2.1	
69229..	10.9	−13 19	7.2	Ma	M2	III	2	−4	2.9	
69285..	11.2	+67 51	7.2	Ma	M3	III	2	+10	0.9	
69287..	11.2	+38 11	8.2	F2	F2	III	3	+24	6.7	Var (+9 to +42)
69438..	11.9	−16 01	7.6	K0	G9	III	2	+26	1.7	
71053..	20.2	+18 10	7.9	G0	F9	V	2	+28	1.1	
71228..	21.1	+2 48	7.6	K0	K1	III	2	+2	1.1	
71495..	22.7	+34 04	8.1	F5	F4	V	4	+9	2.8	
71659..	23.5	+50 37	8.0	F8	F8	V	2	−50	6.4	Var?
72052..	25.7	+30 03	8.2	F2	F3	V	3	−26	3.8	MW −22.8±1.9 (3)
72132..	26.1	+42 28	7.7	G5	G5	III	2	−28	0.5	
72528..	28.3	−4 59	8.0	F8	F7	V	3	+16	2.7	
72854..	30.0	−20 51	7.9	F2	F0	IV	3	+21	1.4	
73039..	31.0	−20 00	8.4	F2	F3	V	2	+20	4.5	
73668..	34.4	+6 08	7.8	G5	G1	V	2	−20	2.1	MW −17.1±0.6 (3)§
74225..	37.7	+78 33	7.3	Mb	M5	III	2	−43	1.1	
74360..	38.5	+46 33	8.2	F5	F4	V	2	−24	1.8	
74492..	39.2	−16 39	8.0	F8	F7	V	3	−13	2.7	
75107..	42.9	+66 49	7.8	G5	G8	III	2	−57	0.1	
75646..	46.1	+26 05	7.5	K0	G9	III	2	−8	0.2	
75775..	46.8	−20 09	8.0	F8	F7	IV	2	+19	4.0	
75786..	46.9	−8 45	8.2	F5	F3	V	3	+30	3.6	
75994..	48.3	+18 37	7.8	G5	G5	IV	2	−34	3.6	
76122..	49.1	−16 50	8.2	F0	F3	IV	2	+26	0.7	
76318..	50.3	+26 45	8.2	F2	F2	V	3	+27	1.5	
76646..	52.4	−0 16	8.2	F0	F3	V	2	+34	0.9	
77015..	54.6	−16 06	7.6	K0	K1	III	3	+56	4.6	
77024..	54.7	+22 52	8.1	F8	F7	V	2	−14	1.4	
77098..	55.2	−20 25	8.4	F8	F6	V	2	−19	3.2	
77173..	55.8	+26 47	8.3	F0	F0	IV	2	+21	13.1	V. br. lines
77189..	55.9	+39 03	7.3	K5	K5	III	3	+8	4.8	
77378..	57.0	+18 10	8.2	F0	F3	V	3	+25	7.6	Var?
77391..	57.1	+22 40	7.8	G5	G6	IV	2	+43	1.3	
77572..	58.3	+10 17	8.2	F2	F4	V	2	+14	1.7	
77772..	59.5	+38 50	8.1	F5	F6	V	2	−12	2.2	
77930..	9 00.3	+38 28	8.1	F5	F6	V	2	+47	7.4	Var?
78195..	01.8	+10 03	7.5	K0	G9	III	2	+3	3.2	
78670..	04.4	−16 22	8.1	F8	F9	V	2	+71	2.7	
80388..	14.4	+78 51	8.0	G	G1	V	4	−12	4.0	Var (+1 to −33)‖
80547..	15.4	+26 26	8.1	F5	F4	IV	3	+16	1.6	
80731..	16.3	+62 12	8.3	F0	F0	V	2	+4	1.7	
80743..	16.4	+42 38	8.1	F8	F5	V	3	−23	2.8	
81028..	18.1	+8 09	7.2	Ma	M4	III	2	+58	0.1	MW* +57.8±1.7 (2)
81069..	18.4	+2 50	7.5	K0	K0	III	3	−16	1.6	DAO −28 (1)
81109..	18.6	−20 36	7.1	Ma	M3	III	2	+17	0.2	MW* +11 (1)
81265..	19.5	+30 56	7.8	G5	G7	IV	2	0	3.1	MW* −1.0±0.8 (3)
81373..	20.1	+6 41	7.5	K0	G9	III	3	−2	1.7	
81548..	21.2	+2 57	8.1	F5	F7	V	4	+21	1.7	
81704..	22.2	+46 02	8.1	F8	F9	IV	2	+8	0.5	MW* +8.6±0.3 (2)
82333..	26.2	+2 43	7.7	G5	G5	III	3	+13	3.9	

§ 73668. Brighter component of Σ 1255.

‖ 80388. Brighter component of β 5017, $d = 29''$.

TABLE 1—*Continued*

HD (1)	α (1900) (2)	δ (1900) (3)	Vis. Mag. (4)	Spec. Cl. HD (5)	Spec. Cl. LO (6)	Lum. Class (7)	No. Obs. (8)	V (Km/Sec) (9)	p.e. (Km/Sec) (10)	Remarks (11)
82394..	9h26m6	+22° 18′	7.5	K0	G7	II	3	− 4	± 3.9	
82957..	30.1	− 4 27	7.4	K2	G8	III	2	0	4.3	
83140..	31.3	+78 00	8.3	F2	F3	IV	2	− 7	1.5	
83395..	33.0	+30 36	8.0	G0	G6	III	2	+ 13	1.1	
83423..	33.2	+42 44	8.0	F8	F8	V	2	− 6	1.3	
83839..	36.0	+51 44	7.3	Ma	M2	III	2	− 11	1.2	
84165..	38.1	+66 05	7.2	Ma	M1	III	3	− 32	1.6	MW* −26 (1)
84606..	41.3	+18 36	7.9	G0	G0	IV	2	+ 19	2.0	
84660..	41.7	+42 54	8.1	F5	F1	III	2	+ 9	3.8	
85162..	44.9	+31 52	7.3	Ma	M2	III	2	− 34	0.6	MW* −33.4±0.2 (2)
85198..	45.2	+18 12	7.9	G0	F6	V	2	+ 24	3.7	
85431..	46.6	−16 05	8.2	F5	F6	V	3	+ 20	0.9	
85958..	50.3	+30 15	8.1	F8	F5	V	3	− 14	2.7	
86391..	53.1	−20 42	7.8	G5	G7	III	2	0	0.5	
86476..	53.7	+ 5 16	7.3	Ma	M2	III	2	− 32	0.3	
86871..	56.3	+50 21	7.5	K0	G5	III	2	− 11	2.1	
87161..	58.1	− 8 24	8.0	G0	G2	IV	2	+ 1	1.0	
87209..	58.4	+42 52	8.1	F8	F6	V	2	+ 24	0.4	
87386..	59.6	+82 53	7.6	K0	K0	III	3	− 35	2.7	
87481..	10 00.2	+61 24	7.4	K5	K5	III	3	+ 33	1.3	
87621..	01.0	+38 31	8.2	F2	F3	V	2	− 26	2.7	
87646..	01.2	+18 23	7.9	G0	G1	IV	3	+ 21	2.4	
88108..	04.5	−12 52	7.3	Ma	M2	III	3	− 13	1.5	MW* −10.6±1.7 (2)
88513..	07.4	+42 23	8.2	F2	F3	IV	3	+ 8	2.1	
88785..	09.4	+42 22	8.2	F2	F3	III	2	+ 23	2.1	
88865..	09.9	+70 30	8.3	F2	F6	IV	3	+ 6	4.2	Var?
89276..	12.9	+30 20	8.2	F0	F0	V	2	− 13	13.6	Var?
89312..	13.1	−20 31	7.4	K5	K5	II–III	4	− 4	3.4	Var (+9 to −16)
89885..	17.2	−20 04	7.2	K0	K1	III	3	+ 19	1.8	
89945..	17.7	− 8 54	7.2	Ma	M3	III	3	0	1.5	
90068..	18.6	+34 41	7.3	Ma	M6	III	3	+ 1	0.5	MW* 0 (1)
90164..	19.4	+30 52	7.8	G5	F8	V	1	− 28	....	
92547..	36.0	−12 37	8.1	F8	F8	V	2	− 9	1.5	
92855..	38.2	+46 44	8.1	F8	F9	V	2	− 2	9.6	Var? MW* +13 var (9)
93238..	40.9	+66 08	7.2	Ma	M4	III	2	− 18	1.4	
93391..	41.9	+27 26	7.3	K5	K5	III	3	+ 9	1.3	
93542..	42.8	+14 45	8.2	F2	F5	V	3	− 2	2.6	
93552..	42.9	+22 38	8.3	F2	F2	V	2	+ 9	2.2	
94270..	47.7	−16 29	7.9	G0	G0	V	2	+ 21	3.2	
94336..	48.2	+26 44	7.3	Ma	M3	III	2	0	2.9	MW* −5.8±0.6 (3)
94467..	49.2	+66 16	8.1	F8	F9	V	2	− 61	5.5	
94500..	49.4	− 0 59	8.3	F2	F4	IV	2	+ 16	0.9	
94574..	50.0	+70 34	8.1	F5	F4	V	2	− 11	1.5	
94794..	51.5	+14 07	8.1	F8	F8	V	3	+ 11	1.5	
94937..	52.5	+78 13	8.1	F8	F7	V	2	− 7	2.7	
94978..	52.8	+66 50	8.3	F2	F0	IV	6	− 4	2.7	Var (+13 to −17)
95532..	56.5	−16 24	7.9	G0	F7	IV	2	− 25	5.4	
95660..	57.4	+30 58	8.2	F2	F3	V	2	+ 5	0.5	V. br. lines
95680..	57.5	−20 52	7.4	K0	G6	III	2	+ 8	4.0	
96161..	11 00.3	+38 56	7.5	K2	G5	III	1	+ 13	....	
96294..	01.0	+54 14	8.2	F0	F2	III	2	0	0.5	
96497..	02.1	+22 35	7.9	G0	G1	V	2	+ 3	0.1	
96696..	03.2	−20 59	7.7	K0	G7	III	2	+ 5	5.0	
97406..	07.5	+46 45	8.2	F2	F1	V	2	− 2	2.5	
97486..	08.0	+62 48	7.8	G5	G5	III	2	− 30	0.7	
97658..	09.2	+26 16	7.6	K0	G7	V	2	+ 2	3.3	
97876..	10.4	−11 02	7.3	Ma	M4	III	3	− 27	2.8	

TABLE 1—*Continued*

HD (1)	α (1900) (2)	δ (1900) (3)	Vis. Mag. (4)	Spec. Cl. HD (5)	Spec. Cl. LO (6)	Lum. Class (7)	No. Obs. (8)	V (Km/Sec) (9)	p.e. (Km/Sec) (10)	Remarks (11)
97904..	11h10m6	+74° 53′	7.6	K0	G7	III	2	− 23	± 0.7	
98019..	11.3	−20 09	7.8	K0	G7	III	3	+ 33	0.9	
98487..	14.7	+62 54	8.2	F2	F1	V	2	− 4	2.3	
98500..	14.8	+30 40	7.4	K5	M0	III	4	+ 31	0.6	
98932..	18.0	−16 04	8.1	F5	F5	III	2	+ 8	2.4	
99058..	18.9	−20 43	8.1	G0	F6	V	3	+ 16	2.0	
99331..	20.7	−13 59	7.4	K5	K5	III	2	+ 25	1.9	
99873..	24.3	− 0 18	7.4	K2	K4	III	1	− 15	......	
100551..	29.2	−12 19	8.1	F8	F5	V	2	− 6	1.3	
100738..	30.5	+66 54	8.1	F5	F5	IV	2	− 30	0.4	
101025..	32.5	+22 15	8.2	F5	F2	IV	3	− 6	1.2	
101178..	33.5	+39 45	7.4	K5	M1	III	2	− 36	1.5	
101642..	36.7	+26 29	8.0	F8	F8	V	2	− 23	1.0	
101828..	38.1	+82 53	7.8	G5	G5	II	2	− 16	1.0	
101969..	39.0	− 4 15	8.1	F5	F4	V	2	+ 19	1.7	
102159..	40.4	+36 26	7.2	Mb	M6	III	2	+ 58	0.7	MW* +63 (1)
102165..	40.4	−20 55	7.6	F5	F7	IV	2	+ 19	1.9	
102570..	43.3	+46 41	8.2	F0	F3	V	2	+ 5	0.0	
102651..	44.0	− 8 34	7.5	K0	G6	III	2	+ 14	0.9	
102652..	44.0	−12 04	8.3	F2	F2	IV	2	+ 16	5.7	Var?
102686..	44.3	+30 03	7.6	K0	G6p	III#	3	0	1.4	
102885..	45.6	−12 18	7.3	K5	K5	III	4	− 25	1.9	
103628..	50.9	+22 34	8.0	F8	F7	IV	2	+ 23	3.3	
104415..	56.3	−20 58	8.3	F8	F6	V	3	+ 61	3.4	
104986..	12 00.2	+74 00	7.6	K0	G9	III	3	− 54	3.3	
105187..	01.6	− 8 51	8.1	F5	F7	V	2	− 6	2.7	
105548..	04.1	+17 45	7.4	K5	M1	III	3	+ 36	1.7	
105679..	04.9	+42 51	8.0	F8	F7	V	2	+ 4	3.8	
105730..	05.1	−19 13	7.7	K5	K5	III	3	− 6	1.5	
106127..	07.6	− 1 55	7.4	K5	K5	III	3	+ 8	4.4	
106348..	09.0	+42 43	8.1	F5	F4	V	2	− 15	3.4	
106691..	11.1	+26 19	8.1	F5	F5	IV	2	+ 8	6.2	Trumpler +0.7±1.5 (4)
107582..	16.8	+62 19	8.0	G0	G1	V	2	− 82	0.5	
108203..	20.7	− 4 18	8.1	F8	F6	V	2	− 15	1.1	
108468..	22.6	+18 24	7.5	K0	G5	III	4	− 24	0.7	
108649..	23.8	+66 02	8.1	F2	F3	V	2	− 6	4.0	
108832..	25.2	+82 33	8.2	F5	F3	IV	3	− 8	0.8	
109031..	26.6	+22 08	8.2	F2	F0	IV	2	+ 3	2.0	
109035..	26.6	−20 25	7.3	K2	K0	III	2	+ 4	0.5	
109497..	30.0	+30 45	8.2	F5	F6	IV	1	− 6	......	
109695..	31.5	−20 45	7.9	K2	G9	III	5	+ 9	2.2	
110194..	35.3	+34 42	7.5	K2	K3	III	2	− 44	0.7	
110375..	36.6	+38 56	8.1	F5	F2	IV	2	− 23	5.2	
110950..	40.6	+30 19	8.0	G0	G2	V	3	+ 8	4.6	
111384..	43.8	− 8 40	7.6	K0	K2	III	3	+ 16	1.0	
111420..	44.1	+71 29	7.3	K5	K3	II–III	2	− 39	0.4	
111603..	45.4	+42 46	8.2	F5	F6	IV	3	+ 11	6.2	Var (−3 to +28)
111957..	47.9	+50 49	8.2	F5	F4	V	2	+ 4	1.5	
112311..	50.7	+58 41	8.2	F0	F0	IV	2	− 12	2.7	
112574..	52.6	−12 36	8.1	F8	F7	V	3	− 10	5.4	Var?
113036..	55.8	+42 28	8.2	F0	F0	V	2	− 1	0.4	
113284..	57.6	+30 53	8.2	F0	F1	IV	2	+ 7	4.4	
113406..	58.4	+24 21	7.2	Ma	M1	III	4	+ 1	2.4	MW* +3.5±3.1 (3)
113449..	58.7	− 4 37	7.5	K0	G5	V	2	0	6.9	Var?
113516..	59.2	+22 25	7.8	G5	F7	V	2	− 10	6.7	Var?
113577..	59.6	+46 59	8.2	F5	F4	IV	2	+ 6	1.9	
113621..	59.9	+50 36	8.0	G0	F9	V	2	− 5	1.3	

102686. λ 4077 gives III; λ 4215 gives IV.

TABLE 1—*Continued*

HD (1)	α (1900) (2)	δ (1900) (3)	Vis. Mag. (4)	Spec. Cl. HD (5)	Spec. Cl. LO (6)	Lum. Class (7)	No. Obs. (8)	V (Km/Sec) (9)	p.e. (Km/Sec) (10)	Remarks (11)
113637..	13h00m0	+54° 29′	7.5	K2	K3	III	2	− 32	± 0.5	
113892..	01.7	+41 27	7.4	K5	M1	III	4	− 33	3.2	
114217..	04.1	+42 41	8.2	F2	F4	IV	1	− 20	....	
114494..	05.8	+ 2 16	8.1	F8	F6	III	3	− 5	6.7	Var (−16 to +14)**
114662..	06.8	−20 20	8.0	K2	K0	II	3	+ 4	1.7	
114913..	08.6	+58 59	8.0	G0	F7	V	2	− 12	3.1	
115322..	11.4	+ 7 02	7.2	Mb	M6	III	3	− 24	1.0	MW* −22 (1)
115427..	12.0	−12 00	8.1	F5	F4	IV	3	− 14	7.6	Var (−1 to −36)
115832..	14.6	+ 6 00	8.1	F5	F5	III	3	− 11	1.2	
116961..	22.0	−12 47	7.7	G5	G5	III	3	+ 2	1.4	
117125..	23.2	+ 2 45	7.6	K0	G8	III	3	− 1	1.6	
117403..	25.0	+46 54	8.0	F8	F4	III	2	0	0.4	
118186..	30.1	−16 25	8.1	F8	F8	V	2	− 16	3.3	
118643..	33.1	+34 15	7.5	K2	K3	II	2	− 4	1.9	
118942..	35.1	−16 50	8.1	F5	F3	IV	3	+ 4	1.9	
118957..	35.2	− 4 45	8.1	F5	F5	IV	2	− 10	4.5	
119272..	37.2	+78 24	8.2	F5	F4	V	3	− 17	2.0	
120335..	43.7	+18 44	8.1	F5	F3	IV	2	+ 5	7.5	Var?
120893..	47.2	+38 13	8.2	F5	F6	V	2	− 8	3.1	
120980..	47.7	+66 29	8.2	F0	F1	III	2	− 10	2.5	
121766..	52.4	− 4 59	8.1	F5	F4	IV	2	− 9	2.1	
121785..	52.5	−20 09	8.6	F0	A	....	6	+ 50	12.0	Var? v. br. lines
121829..	52.8	+18 44	7.7	G5	G6	III–IV	3	− 5	2.1	
122132..	54.8	+47 06	7.2	Ma	M2	III	3	− 60	1.7	MW* −57.9±2.0 (3)
122149..	54.9	+54 04	7.9	G0	G2	IV	2	− 2	2.3	
122694..	58.3	+22 33	8.2	F2	F6	V	2	− 45	2.2	
122751..	58.6	−20 50	8.2	F8	F2	V	3	− 29	2.9	
122967..	59.9	+62 46	8.2	F0	F3	V	2	− 7	1.0	
123011..	14 00.1	+70 49	7.6	K0	G8	III	2	− 38	2.1	
123280..	01.6	+42 51	8.0	F8	F6	V	2	+ 7	11.7	Var (+25 to −10)
123413..	02.4	−20 43	8.1	K0	G5	III	3	+ 28	4.2	
123598..	03.5	−18 46	7.2	Ma	M3	III	2	+ 65	3.5	MW* +50 (1)
123673..	04.0	+18 06	7.8	G5	G6	III	3	− 8	1.1	
123760..	04.5	+10 44	7.9	G0	G5	V	2	+ 2	1.1	MW* −3.5±2.7 (5)
124304..	07.7	−13 23	7.2	Mb	M5	II	3	− 46	1.5	MW* −43 (1)
124330..	07.9	+54 53	7.8	G5	G4	IV	3	− 30	1.4	
124370..	08.1	+62 59	8.2	F5	F2	IV	2	+ 4	1.3	
124575..	09.3	−20 36	7.7	K0	K5	II–III	2	− 21	5.1	
125272..	13.3	+58 32	8.0	G0	F9	V	2	− 22	0.4	
125455..	14.4	− 4 42	7.6	K0	K0	V	2	− 1	3.6	MW −13.0±1.6 (3)
126101..	18.4	−12 28	8.1	F8	F5	V	2	+ 2	1.3	
126140..	18.6	+38 57	8.3	F0	F0	IV	3	− 4	2.5	
126381..	20.0	+ 6 04	7.6	K0	G4	III	2	+ 7	2.1	
126516..	20.9	− 0 15	8.2	F2	F3	V	3	− 37	4.2	
126898..	23.2	−16 31	8.3	F0	F4	V	3	+ 11	12.4	Var?
127007..	23.9	− 4 29	8.1	F5	F2	III	3	+ 9	1.4	
127227..	25.1	+16 40	7.4	K5	K5	III	3	− 41	1.0	
127824..	28.4	+50 02	8.2	F0	F4	IV	2	+ 24	1.6	
127825..	28.4	+ 6 44	8.1	F5	F7	V	2	+ 1	1.6	
128164..	30.3	+70 41	8.2	F2	F2	IV	2	− 8	0.5	
128200..	30.5	− 4 50	7.5	K0	K0	III	2	+ 2	1.9	
128684..	33.2	− 3 11	7.4	Ma	M2	III	3	− 11	2.7	MW* −2.0±1.6 (3)
129209..	36.2	+30 57	7.9	G0	G2	IV	2	− 7	4.8	
129391..	37.2	+18 55	7.6	K0	G7	III	3	− 15	1.0	
130155..	41.5	+14 56	7.3	Ma	M1	III	3	+ 6	3.9	
130342..	42.5	+18 45	8.0	G0	F4	V	2	+ 4	8.3	Var?
130768..	44.9	+10 37	7.5	K0	G9	III	2	+ 16	3.5	
130893..	45.6	+58 29	8.2	F5	F3	IV	2	− 16	2.4	

** 114494. λ 4077 strong.

TABLE 1—*Continued*

HD (1)	α (1900) (2)	δ (1900) (3)	Vis. Mag. (4)	Spec. Cl. HD (5)	Spec. Cl. LO (6)	Lum. Class (7)	No. Obs. (8)	V (Km/Sec) (9)	p.e. (Km/Sec) (10)	Remarks (11)
130991..	14h46m0	−20° 12′	7.5	K0	G7	III	3	∸ 2	±. 3.5	MW −7.1±1.1 (3)
131271..	47.5	− 8 17	8.1	F8	F6	V	2	+ 12	5.0	
131958..	51.5	−16 07	8.3	F2	F1	V	2	+ 34	6.4	Var?
133460..	59.5	+26 25	7.9	G0	F7	V	3	− 9	5.5	Var (−22 to +6)
133644..	15 00.5	− 0 55	8.1	F8	F7	V	3	+ 6	1.0	
134063..	02.8	+22 57	7.7	G5	G4	III	2	−108	1.1	
134228..	03.6	+10 30	7.9	G0	F8	V	2	+ 7	0.3	
134630..	05.8	−12 41	7.5	K0	G7	III	2	− 37	0.7	
135633..	11.1	+22 55	8.1	F8	G0	V	3	− 29	4.3	Var (−19 to −41)††
136010..	13.2	− 8 02	7.6	K0	K1	II–III	2	+ 1	0.7	
136711..	17.1	+18 48	7.6	K0	K3	II–III	3	− 76	0.1	
136866..	17.9	−16 13	7.6	K0	K4	II–III	3	+ 35	2.9	
136927..	18.2	+ 6 24	8.1	F5	F6	IV	3	− 48	0.6	
137719..	22.5	+44 39	7.4	K5	K5	III	2	− 14	2.2	
137945..	23.9	+22 49	8.3	F2	F3	V	2	− 48	2.0	
139784..	35.0	−16 25	8.3	F2	F1	IV	3	+ 22	2.8	
140489..	38.8	+ 2 44	7.6	K0	G8	III	2	− 12	2.5	
140514..	38.9	+22 01	7.9	G0	G2	IV	2	+ 14	1.9	
140700..	40.0	+16 50	7.4	K5	K5	II–III	2	− 26	2.4	
141247..	43.0	− 4 29	7.9	G0	F9	V	3	− 68	4.0	
142176..	48.0	+30 11	7.4	K5	K5	III	2	− 53	2.2	
143840..	57.6	− 4 32	8.2	F5	F1	V	3	− 29	1.7	
144492..	16 01.1	− 4 30	8.0	F8	F4	V	3	− 14	5.4	Var?
144639..	01.8	−12 52	8.2	F2	F3	III	3	+ 10	3.7	
144955..	03.4	+58 26	8.2	F2	F1	IV	3	− 4	0.3	
145059..	03.8	−16 55	8.0	G0	G1	V	2	+ 45	0.5	
145153..	04.3	−12 37	7.6	K0	G8	III	3	− 15	1.7	
145404..	05.7	+26 16	7.7	G5	G0	V	2	− 8	3.2	
145710..	07.3	+62 45	8.2	F2	F0	V	2	− 20	3.6	
145748..	07.5	−14 51	7.4	K5	M0	III	3	− 34	2.3	
146264..	10.3	+18 28	7.5	K0	G8	III	3	− 21	1.7	
146815..	13.1	+ 6 19	7.6	K0	G7	II	2	+ 31	0.4	
146929..	13.7	+34 31	8.3	F2	F2	IV	2	− 27	0.3	
147144..	15.0	+42 52	8.3	F2	F4	IV	2	− 18	5.5	
147644..	18.0	− 0 29	7.9	G0	F9	V	2	+ 10	2.1	
148180..	21.2	− 8 30	8.2	F0	F0	IV	2	− 8	3.1	
148365..	22.4	+50 41	7.8	G5	G6	III	2	− 43	2.1	
150415..	35.8	−16 45	8.2	F5	F5	V	2	+ 10	3.6	
150466..	36.1	− 4 02	8.2	F0	F5	V	3	− 10	5.3	Var (+4 to −22)
150553..	36.7	+22 57	8.3	F0	F0	V	2	− 11	7.7	Var?
150826..	38.4	+58 19	8.2	F5	F6	IV	2	− 24	3.4	
151061..	39.9	− 2 54	7.2	Mb	M6	III	3	− 6	1.9	MW* −10.6±1.1 (3)
151120..	40.3	+42 48	8.2	F0	F2	IV	2	− 13	0.8	
151445..	42.3	+42 37	8.0	F8	F5	IV	2	+ 2	4.7	
151451..	42.3	−20 46	8.7	F8	F5	III	4	+ 46	1.2	
152112..	46.3	+10 03	7.3	Ma	M3	III	4	− 45	1.9	
152484..	48.5	− 4 09	7.7	G5	G9	III	2	+ 45	6.3	Var?
152794..	50.4	+30 36	8.2	F2	F0	IV	2	− 15	0.8	
153033..	52.0	+ 6 39	7.5	K0	K5	III	3	− 42	0.5	
153240..	53.1	− 4 11	8.0	F8	F6	V	2	− 22	1.4	
153540..	55.1	+11 05	7.3	K5	K4	III	3	− 18	1.0	
153698..	55.9	+27 29	7.3	Mb	M4	III	3	− 20	3.7	MW* −24.2±0.8 (3)
153741..	56.1	−20 26	7.6	K0	G6	II	2	− 27	0.3	
153777..	56.3	+38 00	8.1	F5	F2	IV	2	− 12	7.7	Var?
154578..	17 01.2	+46 14	8.0	F8	F7	V	2	+ 28	0.3	
154617..	01.5	+26 36	8.1	F5	F5	IV	2	− 24	0.2	
155105..	04.5	− 8 24	8.0	G0	G3	V	2	− 33	0.1	
155467..	06.7	− 0 52	8.1	F5	F7	V	2	− 11	1.3	

†† Brighter component of ADS 9555 (7.5–11.0 mag.); separation 10″8.

TABLE 1—*Continued*

HD (1)	α (1900) (2)	δ (1900) (3)	Vis. Mag. (4)	Spec. Cl. HD (5)	Spec. Cl. LO (6)	Lum. Class (7)	No. Obs. (8)	V (Km/Sec) (9)	p.e. (Km/Sec) (10)	Remarks (11)
155581..	17h07m4	+14° 38′	7.4	K5	K5	III	3	+ 13	± 1.0	
155967..	09.7	+14 42	8.1	F5	F6	V	3	− 15	1.7	MW −16.7±1.9 (3)
156282..	11.6	+42 21	7.9	G0	F8	V	1	− 1	....	
156392..	12.2	−12 12	8.2	F5	F3	V	4	− 32	1.5	
156536..	13.0	+26 49	8.1	F5	F3	IV	2	− 38	1.1	
156649..	13.7	+63 28	7.4	K5	K5	III	3	+ 16	2.4	
157031..	15.8	−20 08	8.5	G0	G0	V	2	− 10	3.5	
157072..	16.0	−20 28	7.1	K2	K4	IV	3	+ 1	1.5	
157463..	18.3	+42 19	7.6	K0	G5	III	2	+ 8	0.3	
157606..	19.1	+13 30	7.4	K5	K4	III	2	− 8	2.8	
157683..	19.6	+22 00	8.2	F5	F1	V	2	− 25	0.8	
157925..	21.1	+22 31	8.3	F2	F0	III	2	− 25	4.3	
158211..	22.9	+18 00	7.5	K0	G9	III	2	− 1	3.2	
158671..	25.5	+46 09	8.2	F2	F2	V	2	− 22	3.9	
159119..	27.8	+14 28	7.4	K5	K5	III	2	− 20	0.4	
159410..	29.5	+46 24	7.5	K2	K3	III	2	− 52	3.6	
159714..	31.1	+24 25	7.4	K5	K4	III	4	− 20	4.9	Var (−8 to −36)
159754..	31.3	+74 34	8.2	F2	F2	V	2	− 5	0.7	
159972..	32.4	+ 6 30	8.1	F8	F6	V	2	0	0.7	
161227..	39.2	−16 44	8.2	F0	F0	II	2	+ 4	1.7	
162262..	45.1	+ 2 16	8.1	F5	F5	V	5	− 1	0.9	Var (+32 to −44)
162949..	48.6	+34 13	7.9	G0	F3	V	3	− 11	2.3	
163418..	51.0	+42 41	7.6	K0	G6	III	2	− 1	1.1	MW −0.7±0.6 (3)
163572..	51.7	−20 37	8.8	F0	F2	II	2	+ 24	2.9	
164809..	57.8	+22 28	7.5	K2	K0	II–III	2	− 51	1.7	
165042..	59.0	+19 33	7.2	Ma	M5	II–III	2	− 23	3.6	MW* −20.0±0.2 (2)
165073..	59.1	+30 21	8.1	F8	F7	V	2	− 35	1.1	
165374..	18 00.6	+16 55	7.2	Ma	M2	III	2	− 17	11.3	Var (0 to −34) MW* −11 var (+50 to −41) (4)
166091..	04.0	+63 47	7.4	K5	K5	II–III	2	− 69	3.5	
166408..	05.4	+50 52	8.3	F0	A8	....	2	− 40	1.3	
166601..	06.3	+30 49	8.0	F8	F5	V	2	− 67	0.1	
166780..	07.1	+57 57	7.4	K5	K5	III	2	− 43	2.8	
166781..	07.1	+26 38	7.7	G5	G3	II	2	− 39	1.9	
167225..	09.1	−20 54	8.9	K0	G7	III	3	− 13	2.5	
167391..	09.9	+26 44	8.1	F5	F5	IV	2	− 15	10.0	Var (−1 to −29)
168245..	13.7	− 4 09	7.6	K0	G7	II	3	+ 41	11.0	Var (+25 to +73)
168451..	14.6	−20 15	8.1	F5	F6	IV	4	− 30	0.5	
168621..	15.6	+34 05	8.1	F8	F4	V	2	− 20	1.0	
170002..	22.2	+46 12	8.1	F5	F5	IV	2	− 11	1.6	
170053..	22.4	+ 6 56	7.6	K0	K2	II	3	− 30	0.5	
170456..	24.4	−16 16	8.3	F0	F1	V	3	− 7	9.1	Var (−22 to +19)
170698..	25.7	+18 32	7.6	K0	G6	III	2	0	0.8	
171662..	31.0	−16 01	7.4	K5	K5	III	3	− 18	0.8	
171706..	31.2	− 4 38	8.0	G0	F9	V	2	+ 20	4.2	
172237..	34.0	−20 46	8.8	F5	F6	IV	2	− 20	2.7	
172381..	34.8	+30 22	7.3	Ma	M2	III	2	− 61	2.7	
172508..	35.5	− 4 36	7.5	K0	K0	II–III	4	− 11	1.8	DAO −14 (1)
172669..	36.4	+66 49	7.6	K0	G3	V	2	− 6	0.6	MW −5.8±1.5 (3)
173051..	38.3	+58 08	8.3	F0	F2	IV	2	− 20	0.3	
173189..	39.0	+54 49	8.1	F5	F5	V	2	+ 11	1.8	
173297..	39.4	−20 45	8.1	F5	G0	I*b*	2	+ 19	13.3	Var (−1 to +39) V 350 Sgr
173435..	40.2	+26 08	7.7	G5	G7	III	2	− 12	1.8	
173511..	40.6	+61 27	7.4	K5	K5	III	2	− 8	0.8	
173526..	40.7	+22 27	7.5	K0	G4	II	2	+ 10	0.2	DAO +14 (1)
173651..	41.3	+ 2 52	8.1	F5	F7	V	2	− 1	3.4	

TABLE 1—*Continued*

HD (1)	α (1900) (2)	δ (1900) (3)	Vis. Mag. (4)	Spec. Cl. HD (5)	Spec. Cl. LO (6)	Lum. Class (7)	No. Obs. (8)	V (Km/Sec) (9)	p.e. (Km/Sec) (10)	Remarks (11)
173741..	18h41m8	+38° 13′	7.6	K0	K5	III	3	− 6	± 2.8	
173854..	42.4	−19 19	7.0	K5	K5	III	3	+ 7	3.0	
173883..	42.6	− 0 21	7.9	G0	F9	V	2	− 82	1.4	
174349..	45.0	+10 25	7.5	K2	K4	II–III	2	− 21	2.2	
174719..	46.8	+ 2 55	7.7	G5	G6	V	3	− 18	2.9	
175036..	48.4	+26 24	7.9	G0	F8	V	2	− 51	0.5	
175545..	50.7	− 0 52	7.5	K0	K2	III	2	− 14	1.7	DAO −30 (1)
175905..	52.5	− 0 39	7.5	K0	K1	III	2	+ 24	2.3	DAO +18 (1)
176391..	55.0	+42 32	8.2	F2	F5	III	2	− 18	0.4	
176886..	57.2	−20 52	8.5	F5	F5	IV	2	0	0.5	
177433..	59.6	+14 57	7.6	K0	K0	II–III	2	− 31	2.4	
178011..	19 01.9	+ 5 05	8.3	F0	F3	IV	1	+ 1	....	
178165..	02.4	+ 5 04	7.6	K0	K3	III–IV	2	− 2	2.5	
178612..	04.2	+48 46	7.3	K5	K4	III	2	− 9	0.5	
179070..	06.0	+38 33	8.0	G0	F6	IV	2	− 28	2.2	
179177..	06.4	−16 36	8.1	F5	F5	III	2	− 33	1.8	
179757..	08.7	+18 58	8.3	F0	F0	V	3	+ 21	12.4	Var (−1 to +57) broad lines
179785..	08.8	+14 46	7.4	K2	K4	III	2	− 26	3.6	MW −32.1±1.1 (3) DAO −29 (1)
179869..	09.1	+41 04	7.3	Ma	M3	III	2	− 11	0.8	
179985..	09.6	+34 19	8.0	G0	F7	III	2	− 25	0.1	
180015..	09.7	−16 17	7.5	K0	G8	III	2	+ 41	1.1	
180714..	12.5	+18 39	8.3	F0	F0	IV	2	− 18	3.8	
180867..	13.1	+46 53	8.1	F8	F6	V	2	− 14	0.1	
180940..	13.4	+18 40	7.6	K0	G2	III–IV	2	+ 4	2.1	
181312..	14.9	−10 44	7.3	Ma	M5	III	3	− 68	3.4	
181358..	15.1	+54 07	8.1	F8	F6	IV	2	− 54	3.0	
181475..	15.5	− 4 41	7.4	K5	K5	II	3	+ 3	1.6	DAO +1 (1)
181604..	16.0	+10 28	7.9	G0	F7	IV	2	− 20	4.7	
181681..	16.3	+40 05	7.4	K5	K4	III	2	− 21	0.1	
182549..	20.1	+46 06	7.8	G5	G6	II	2	− 25	1.9	
183127..	22.9	− 0 37	8.1	F5	F6	IV	2	− 10	0.9	
183681..	25.6	+22 30	7.5	K2	M0	III	5	− 8	2.0	DAO −21 (1)
183791..	26.1	+ 6 10	7.8	G5	G2	II	2	+ 15	2.6	
184025..	27.3	+ 6 27	8.1	F5	F2	IV	3	− 23	4.9	Var (−11 to −36)
184590..	30.1	+25 08	7.2	Ma	M1	II–III	2	+ 15	0.7	MW* +24.0±1.0 (2)
184881..	31.4	+18 21	7.8	G5	G5	III–IV	2	+ 3	0.1	
184909..	31.5	+14 18	7.5	K2	K3	III	3	− 20	1.9	
185115..	32.5	+46 22	8.2	F0	F1	IV	3	− 15	1.2	
186176..	37.8	+46 09	7.8	G5	G6	III	2	− 1	0.6	
185497..	39.6	− 8 53	8.3	F0	F0	V	5	− 3	4.8	Var (+20 to −22)
186752..	41.2	−20 08	8.5	G0	F8	V	3	− 15	1.4	
186962..	42.3	+18 34	7.6	K0	K0	II–III	3	− 18	2.8	
186981..	42.4	+18 38	8.1	F8	F4	III	3	− 21	2.1	
187317..	44.3	+58 08	7.9	G0	F6	III	2	− 21	0.3	
187401..	44.7	+14 58	7.7	G5	G5	II	3	− 16	1.3	
187663..	46.0	−12 52	7.5	K0	G9	III	2	− 11	1.3	
188169..	48.8	+50 24	8.0	F8	F4	V	2	− 10	0.1	
188398..	49.9	+50 46	8.2	F5	F4	III	1	+ 34	....	
189063..	53.1	+60 33	7.3	K5	M0	III	2	− 22	0.1	MW −23.0±1.6 (4)
189084..	53.2	+60 21	7.4	K5	M0	III	3	− 6	2.6	
189148..	53.5	+34 45	8.2	F5	F6	V	3	− 9	0.9	
189578..	55.6	+14 37	8.1	F8	F5	V	2	+ 12	7.9	Var (−22 to +46)
190149..	58.5	+43 50	7.3	Ma	G9	III	2	− 61	1.4	
190315..	59.3	+75 27	7.3	K5	K4	III	2	− 27	1.0	
190464..	20 00.0	+54 23	8.3	F0	F2	III	2	+ 6	2.8	
191373..	04.5	+54 22	8.1	F5	F3	V	2	− 9	1.1	

TABLE 1—*Continued*

HD (1)	α (1900) (2)	δ (1900) (3)	Vis. Mag. (4)	Spec. Cl. HD (5)	Spec. Cl. LO (6)	Lum. Class (7)	No. Obs. (8)	V (Km/Sec) (9)	p.e. (Km/Sec) (10)	Remarks (11)
191737..	20h06m4	+58° 30′	7.8	G5	G3	III	2	− 5	± 0.2	
191878..	07.0	+18 12	8.1	F8	F7	IV	2	− 23	1.0	
192020..	07.7	+38 06	7.8	G5	G8	V	2	− 6	1.8	
192260..	08.9	+34 53	7.6	K0	K0	IV	2	− 26	1.2	
192343..	09.3	+ 6 18	8.0	G	G4	V	5	− 2	2.0‡‡	
192344..	09.3	+ 6 18	7.8	G5	G4	IV	5	− 1	1.3‡‡	
192635..	10.8	+74 08	8.1	F5	F4	IV	3	− 35	1.4	
192804..	11.7	+30 56	7.7	G5	F8	V	2	− 25	0.1	
192867..	12.1	+43 50	7.4	K5	M1	III	2	− 5	6.8	Var? DAO −18 (1)
192869..	12.1	+42 03	7.9	G0	F6	IV	2	− 28	1.5	
193054..	13.1	+52 12	7.3	K5	K5	III	2	− 57	0.5	DAO −54 (1)
193533..	15.6	+72 16	7.3	Ma	M3	III	2	− 25	0.8	
193799..	17.1	+ 6 51	7.6	K0	G9	III	2	− 2	0.5	
194299..	19.8	+63 07	7.3	K5	M0	III	2	+ 21	1.4	
194595..	21.4	+26 23	8.2	F5	F2	IV	2	− 18	4.2	
194737..	22.2	+54 41	7.5	K2	K0	II–III	2	− 47	2.5	
194917..	23.1	−12 07	7.4	K5	M0	III	4	+ 17	1.4	
195075..	24.0	−12 55	7.5	K0	G7	III	2	+ 28	0.3	
195100..	24.2	+42 44	7.5	K0	G6	III	2	+ 2	1.7	
195534..	26.8	− 0 29	7.6	K0	G8	III	2	− 49	0.7	
195668..	27.6	+18 17	7.2	Mb	M4	II–III	3	− 3	0.5	
195767..	28.1	− 6 33	7.3	Ma	M3	III	2	− 21	1.9	
195807..	28.4	+54 15	8.2	F0	F2	III	2	+ 7	3.3	
195850..	28.7	+82 02	8.1	F5	F5	IV	2	+ 4	20.9	Var (−27 to +36)
195993..	29.4	+17 51	7.3	K5	K5	III	2	− 3	4.7	
196090..	30.0	+46 49	7.8	G5	G7	III	2	− 42	1.6	
196245..	31.0	+ 6 44	8.1	F5	F4	IV	2	− 6	5.8	
196282..	31.2	+49 25	7.3	K5	K4	III	2	− 26	1.0	DAO −26 (1)
196346..	31.7	+ 2 08	7.6	K0	G9	III	3	− 49	1.8	
196643..	33.6	+37 45	7.4	K5	K5	III	2	− 11	0.1	DAO −20 (1)
196674..	33.8	+26 43	8.0	F8	F7	IV	2	− 56	1.5	
196972..	35.6	+30 28	7.5	K2	K0	II	2	+ 15	1.3	DAO +14 (1)
197206..	37.2	+30 54	7.4	K2	K1	IV	2	− 26	1.0	
197315..	37.8	+ 2 38	8.3	F2	F4	V	2	− 21	0.1	
197577..	39.5	− 8 21	8.0	K0	G2	III	2	+ 6	5.6	
197976..	42.1	+18 25	8.3	F0	F0	III	1	− 24	....	
198025..	42.5	+ 1 29	7.3	K5	K4	III	2	+ 19	4.5	
198075..	42.8	−12 49	8.0	G0	G3	V	2	− 16	1.3	
198188..	43.5	−20 59	8.0	G5	G0	V	2	− 90	3.6	MW* −82.6±2.6 (3)
198330..	44.5	+30 25	7.4	K5	K4	III	2	− 4	5.8	DAO +4 (1)
198861..	48.2	+10 36	8.1	F8	F7	IV	3	− 34	1.2	
199120..	50.0	+58 16	7.6	K0	G7	II–III	2	− 6	3.7	
199378 } 199379 }.	51.7	−14 27	7.5	K0 +A2	G0§§	IVp§§	2	− 15	1.8	
199523..	52.6	−12 21	7.5	K0	G7	III	2	+ 13	2.0	
199761..	54.1	+46 48	8.1	F8	F4	III	2	− 16	4.3	
200043..	55.9	+32 06	7.2	Mb	M3	III	3	− 16	0.7	
200451..	58.4	+26 06	7.4	K5	M0	III	2	− 25	3.7	
200531..	58.9	+34 38	8.2	F2	F3	V	2	+ 11	1.6	
200580..	59.2	+ 2 36	8.1	F8	F8	V	3	− 4	4.2	Var? MW −9.3±1.5 (3)
200925..	21 01.4	+50 24	8.2	F5	F5	III	2	+ 15	2.4	
201525..	05.1	+22 32	8.0	F8	F7	IV	2	− 31	1.6	
202712..	12.6	+22 05	8.2	F2	F4	IV	2	+ 3	7.1	Var?
202783..	13.1	−12 41	8.0	F8	F7	V	3	− 18	1.2	
203135..	15.3	+53 45	7.4	K5	K3	II–III	2	− 45	2.1	DAO −37 (1)
203140..	15.3	+12 33	7.3	K5	M0	III	3	− 16	0.6	
203378..	16.7	+55 01	7.2	Mb	M6	III	2	− 27	9.0	Var (−1 to −41)

‡‡ 192343. Precedes 192344 0s0 and is south 0°6.

§§ 199378. Spectrum suspected to be composite (G5 III +A).

TABLE 1—*Continued*

HD (1)	α (1900) (2)	δ (1900) (3)	Vis. Mag. (4)	Spec. Cl. HD (5)	Spec. Cl. LO (6)	Lum. Class (7)	No. Obs. (8)	V (Km/Sec) (9)	p.e. (Km/Sec) (10)	Remarks (11)
203600..	21h18m2	+62°06′	8.0	F8	F5	IV	2	− 17	± 0.9	
203712..	18.9	+40 30	7.3	Mb	M7	III	2	− 53	1.4	MW* −50 (1)
203844..	19.6	− 8 37	8.0	G0	G1	V	2	− 18	0.6	
205025..	27.4	+34 06	8.2	F2	F3	IV	3	− 17	0.8	
205837..	32.9	+14 46	7.5	K0	G4	III	2	− 29	3.7	
205966..	33.8	+50 37	7.4	K5	M0	III	2	− 24	1.7	DAO −23 (1)
205998..	34.0	+40 38	7.4	K5	K5	III	2	− 39	1.7	DAO −35 (1)
206146..	35.0	−19 21	7.4	K5	M0	III	3	− 2	1.7	
206311..	36.2	+63 56	7.4	K5	K5	III	5	− 7	1.0	DAO −14 (1)
206367..	36.5	+21 46	7.4	K5	M2	III	2	− 17	3.2	
206469..	37.2	− 8 55	8.2	F5	F4	V	2	+ 18	2.5	
206485..	37.3	+18 30	7.6	K0	G7	III	2	− 10	2.5	
206507..	37.4	+70 00	8.0	F8	F5	V	2	+ 8	1.1	
207076..	41.4	− 2 40	7.2	Mb	M8	III	3	− 37	1.2	
207583..	44.9	−16 40	7.8	G5	G5	V	2	+ 24	0.6	
207858..	47.0	+26 16	8.0	F8	F6	V	2	− 20	2.7	
208609..	52.3	+17 13	7.3	K5	K4	III	2	− 28	2.6	
208745..	53.3	+58 09	8.3	F0	F0	V	2	− 8	9.0	Var?
208785..	53.6	+50 01	7.6	K0	K3	II–III	2	− 17	2.4	
209394..	58.0	+36 29	7.2	Mb	M2	III	2	− 60	3.2	
209712..	22 00.3	− 8 11	8.1	F8	F6	V	2	− 17	2.5	
209977..	02.1	+11 17	7.3	Ma	M1	III	2	− 68	2.9	MW* −64 (3)
210266..	04.1	+ 6 59	8.0	F8	F7	V	3	− 3	1.2	
210342..	04.7	+22 03	8.1	F5	F4	III	3	− 28	1.9	
210483..	05.6	+18 18	7.8	G0	G1	V	2	− 72	1.2	
210514..	05.8	+31 48	7.3	Mb	M4	III	3	− 25	1.4	
210698..	07.1	+39 13	7.4	K5	K5	III	2	− 15	0.1	
210891..	08.4	+10 22	8.2	F0	F0	IV	3	− 3	12.9	Var (+24 to −39)
210922..	08.6	+54 36	7.4	K2	K1	III	2	− 12	0.3	DAO −15 (1)
210957..	08.8	+18 25	8.2	F0	A9	IV	2	+ 5	5.7	
211244..	10.7	+18 07	8.1	F5	F3	IV	2	+ 47	23.6	Var (+12 to +82)
211362..	11.4	−16 53	8.1	F8	F6	IV	2	− 12	1.4	
211472..	12.2	+54 10	7.8	G5	K1	V	2	− 7	1.0	
211489..	12.3	+54 20	8.2	F0	F1	V	2	− 12	3.0	
211645..	13.4	+38 31	7.5	K2	G9	III	2	− 25	2.8	
212882..	22.4	+62 49	7.2	Mb	M4	III	2	+ 8	2.6	
213199..	24.6	−16 58	8.1	F8	G0	V	2	+ 4	1.5	
213758..	28.7	+58 31	8.0	F8	F3	V	2	+ 8	1.2	
213863..	29.3	−20 22	8.7	F0	F1	V	2	− 38	5.2	
213890..	29.5	+14 31	8.0	F8	F4	IV	2	+ 12	5.5	
214245..	31.8	+12 39	7.3	K5	K5	III	3	− 30	3.1	
214422..	32.9	+26 54	8.1	F8	F6	V	3	+ 2	1.7	
215166..	38.2	−16 40	8.1	F8	F7	V	2	− 18	3.2	
215290..	39.0	+32 19	7.3	K5	M0	III	2	− 23	1.0	
215399..	39.8	+46 06	8.2	F0	F1	V	2	+ 13	6.3	
215763..	42.4	+ 2 22	8.0	G0	F9	V	3	− 22	1.3	
215772..	42.5	+46 39	8.2	F5	F5	V	3	− 2	5.8	Var (−15 to +14)
215953..	43.8	+49 03	7.2	Ma	M3	III	2	− 52	2.5	MW* −50 (1)
216085..	44.8	−16 50	8.3	F2	F3	IV	4	+ 14	1.2	
217276..	54.5	−16 56	8.0	G0	G0	V	2	+ 52	1.8	
217577..	56.6	+18 44	8.0	G0	G2	V	2	− 2	0.5	
217580..	56.6	− 4 23	7.6	K0	K4	V	2	− 39	1.6	MW −50.7±0.5 (3)
217694..	57.4	+50 18	7.4	K5	K4	III	2	− 81	2.5	DAO −83 (1)
217786..	58.0	− 0 58	7.7	G5	F9	V	2	+ 7	2.0	
218081..	23 00.1	− 8 18	7.6	K0	G8	III	3	− 25	1.1	MW* −23 var? (4)
218159..	00.6	−16 00	8.1	F5	F3	V	2	+ 8	0.3	
218170..	00.7	+28 29	7.4	K5	M2	III	3	− 54	3.5	Var?
218234..	01.3	+18 27	7.6	K0	G8	III	2	+ 14	1.9	

TABLE 1—*Continued*

HD (1)	α (1900) (2)	δ (1900) (3)	Vis. Mag. (4)	Spec. Cl. HD (5)	Spec. Cl. LO (6)	Lum. Class (7)	No. Obs. (8)	V (Km/Sec) (9)	p.e. (Km/Sec) (10)	Remarks (11)
218852..	23h06m2	+30°37′	7.6	K0	G8	III	2	+ 5	± 2.1	
219066..	07.9	− 0 30	7.7	G5	G6	III	2	0	4.3	
210497..	11.1	+34 09	8.0	G0	F6	IV	2	+ 56	3.1	
219828..	13.8	+18 06	8.0	G0	G0	IV	3	− 23	2.7	
220008..	15.3	+ 6 19	7.8	G5	G4	V	3	− 15	1.0	
220140..	16.3	+78 27	7.7	G5	G9	V	2	− 19	0.9	MW* −15.1±1.3 (3)
221247..	25.3	+30 49	8.2	F2	F2	V	2	− 3	2.6	
221477..	27.4	+34 47	8.1	F8	F8	V	2	+ 13	2.8	
221584..	28.2	+62 44	8.0	G0	F7	V	2	− 27	1.5	
221777..	29.9	− 8 14	7.4	K5	K4	III	2	+ 9	0.4	
221913..	31.0	+50 43	7.2	Ma	M1	III	2	− 19	1.3	
222928..	39.9	− 1 13	7.3	K5	K5	III	2	+ 8	0.4	
223110..	41.7	+54 36	8.1	F5	F5	V	3	− 13	4.1	Var?
223835..	47.9	+40 47	7.2	Ma	M2	III	3	− 12	3.2	MW* −11 (1)
223847..	48.0	+58 52	7.8	G5	G7	III	2	− 15	1.4	
223963..	48.9	− 9 51	7.4	K5	M1	III	2	− 34	2.1	
224060..	49.7	+18 12	7.6	K0	K3	III	2	− 11	3.4	
224839..	56.0	− 0 37	8.0	G0	F8	V	2	0	0.8	
224882..	56.4	+30 11	8.0	G0	G2	IV	2	− 6	1.6	
225191..	59.2	+42 02	8.2	F5	F7	IV	3	+ 21	1.3	

III. THE SPECTRAL AND LUMINOSITY CLASSES

All the estimates of spectral and luminosity class were made by Miss Emilia Pisani according to the Yerkes two-dimensional system[2] that includes the spectral class and Roman numerals indicative of luminosity. A total of 32 stars was selected from the *Atlas*, and, with their spectra as standards, spectral- and luminosity-class estimates were made of (*a*) all but nine of the 820 stars in Table 1 and (*b*) the 260 brighter stars used to bring the system of one-prism velocities into agreement with the three-prism Mills system. This latter group served to give some notion of the consistency of the spectral- and luminosity-class estimates, because for most of these brighter stars Mount Wilson, Victoria, and HD spectral class were available, while, for 41 of them, spectral and luminosity classes were contained in the *Atlas*.

The detailed results of the comparison of spectral classes are not given here because it was found that most of the estimates were in good agreement. The only differences of statistical significance are in the early F's, where the Lick estimates are appreciably later than the HD and Mount Wilson classes but agree well with those in the *Atlas*.

Since a comparison of the luminosity classes is relatively more important, the individual estimates for the 41 stars mentioned above are included in Table 2. An inspection of this table shows that the luminosity classes estimated for these brighter stars are in satisfactory agreement with the *Atlas* assignments. In most cases the estimates differ by less than one luminosity class, and there is only one instance (ξ Peg) in which the difference exceeds one luminosity class.

Because of the basis for selection of these stars—only those within a narrow range of apparent magnitude (HD m_{pg} 8.5–8.6)—the frequencies in Table 3 have only limited usefulness. Thus there are so few stars of the higher luminosity classes I and II and such

[2] Morgan, Keenan, and Kellman, *An Atlas of Stellar Spectra* (Chicago: University of Chicago Press, 1943).

TABLE 2

COMPARISON OF LUMINOSITY CLASSES

Star	MKK *Atlas*	Lick Obs.	Star	MKK *Atlas*	Lick Obs.
χ Peg........	M2 III	M1 III	β Boo........	G8 III	G7 II
α Cas........	K0 II–III	G7 II–III	δ Boo........	G8 III	G5 IV
η Cas A......	G0 V	G0 V	α Ser.........	K2 III–IV	K2 III
τ Cet.........	G8 V	G6 V	λ Ser.........	G2 V	G0 V
ι Per.........	G0 V	G2 V	γ Ser........	F6 IV	F7 V
δ Eri.........	K0 IV	K1 IV	ϵ CrB........	K3 III	K3 III
π^3 Ori........	F6 V	F6 V	ϵ Oph........	G8 III	G9 III
χ^1 Ori........	G0 V	F8 V	η Dra........	G8 III	G7 III
κ Gem........	G8 III	G9 III	κ Oph........	K2 III	G9 III
β Cnc........	K5 III	K4 III	λ Her........	K3 III	K4 III
σ^2 UMa......	F6 IV	F5 V	β Oph........	K2 III–IV	K3 III
α Hya........	K3 III	K4 II–III	ξ Her........	G5 III	G6 III
ϵ Leo.........	G0 I–II	G0 I*b*	η Ser.........	K0 III–IV	K0 IV
36 UMa......	F8 V	F6 V	κ Lyr........	K2 III	K2 II
ν Hya........	K2 III	K3 III–IV	109 Her......	K2 III	K2 IV
46 LMi.......	K0 III–IV	K0 III	α Sct.........	K3 III	K3 III
ψ UMa.......	K2 III	K1 II	ϵ Aql.........	K2 III	K2 II
ϵ Crv.........	K2 III	K2 II–III	δ Dra........	G8 III	G7 III
ϵ Vir.........	G8 III	G6 III	γ Aql........	K3 I–II	K4 II
70 Vir........	G5 IV–V	G6 IV–V	52 Cyg.......	K0 III	K1 III
τ Boo........	F6 IV	F6 IV	1 Lac........	K3 III	K3 II
α Boo........	K2 pec	K0 III	ξ Peg........	F6 III–IV	F7 V
ρ Boo........	K3 III	K3 III			

TABLE 3

FREQUENCIES OF SPECTRAL AND LUMINOSITY CLASSES

LUMINOSITY CLASS	SPECTRAL CLASS																																			TOTALS
	F										G										K						M									
	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	0	1	2	3	4	5	6	7	8	
I*b*......	..	..	..	..	1	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3
II......	1	..	1	..	..	..	1	..	..	..	..	1	1	1	1	3	3	3	1	1	3	3	3	2	..	3	1	1	..	1	..	2	..	..	..	37
II–III.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	..	1	7	1	..	4	2	3	..	1	..	1	2	1	..	..	..	25
III.....	5	2	6	7	9	9	4	1	..	..	1	..	2	2	11	17	21	24	19	18	6	7	3	6	24	41	18	13	19	15	9	3	7	1	1	331
III–IV.	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	2	2	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	6
IV.....	12	4	15	20	19	22	17	12	..	2	4	4	6	3	3	3	1	3	2	1	2	1	1	..	1	..	..	..	..	..	..	..	..	..	..	158
V......	11	9	9	22	26	27	32	34	21	17	9	11	3	5	3	5	1	1	1	1	1	1	..	..	1	..	..	..	..	..	..	..	..	..	..	251
Un-class.*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	9
9......	29	15	31	49	55	58	54	47	21	19	15	16	13	11	18	30	29	32	23	22	20	13	7	13	28	47	19	15	19	17	11	6	7	1	1	820
Subtotals..	179					199					73					136					128						81					15				....

* HD 24694 (F0), 47194 (A8), 54983 (A9), 55760 (A9), 56819 (A9:), 60265, 66633, 121785 (A), 166408 (A8).

a marked absence of main-sequence dwarfs of class V from about G5 through M that the tabulated data contribute little to a knowledge of the luminosity function for high and low luminosities. On the other hand, for giants, class III, and for the subgiants, class IV, the frequency distributions may be indicative of the true character of the luminosity function for these classes. For example, Morgan, Keenan, and Kellman,[2] Keenan,[3] and McCuskey[4] give evidence that subgiants later than K1 or K2 may not occur. The frequencies of the spectral and luminosity classes are given in Table 3 for all the stars listed in Table 1.

Quite recently Eggen,[5] has shown by precise photoelectric photometry that, among the nearer stars, those of class IV have very nearly the same photographic absolute magnitude, $M = +3.6$, with a very small dispersion, in the range F2–K1. The class IV stars in this material are therefore all at nearly the same distance, approximately 100 parsecs. Consequently, the frequency distribution for class IV in Table 3 may be typical for the volume of space concerned—a relatively thick shell of radius 100 parsecs. Within this shell there appears to be a maximum frequency of subgiants at F4–F5, with a fairly definite drop to zero frequency at K5. At the present time, however, no similar statement appears appropriate for class III stars because correspondingly precise information regarding their absolute magnitudes has not yet been published.

IV. SOLAR MOTION

Solar-motion solutions were made for three groupings according to luminosity class: (1) giants, classes II and III (including II–III and III–IV); (2) subgiants, class IV; and (3) main-sequence dwarfs, class V. Before the solutions were made, however, it was decided to reject certain stars, namely, a few of high velocity (>80 km/sec) and a number of variable or probably variable velocity. The latter are listed in Table 4.

The numbers of stars of constant velocity available for the solar-motion solutions for the several luminosity classes are indicated in Table 5. In the case of stars of luminosity class V, only those stars in the spectral range from F5 to G4, inclusive, were used in the solution.[6] The results from the solar-motion solutions are collected in Table 6.

The results from the solar-motion solutions indicate that there probably are no significant differences between the several luminosity groups, since the differences are of the order of the sums of the probable errors. Certainly, the co-ordinates of the apex agree well within their probable errors, and for this reason rounded mean values, $\bar{\alpha}_0 = 280°$ and $\bar{\delta}_0 = +44\frac{1}{2}°$, were used to compute the mean residual radial velocities from the appropriate values of the solar motions, V_0, for giants, subgiants, and dwarfs. Table 7 gives the mean residual velocities computed in this manner; quantities in parentheses are the numbers of stars in the means. Stars with residual velocities greater than 60 km/sec are individually listed in Table 8.

Comparison of the solar-motion results in Table 6 with those for other groups of stars, such as those included in the extensive computations of Nordström,[7] does not reveal outstanding differences. For the group of fainter stars included in Table 1 the galactic

[3] *Ap. J.*, **91**, 518, 1940.

[4] *Ap. J.*, **109**, 426, 1949.

[5] A.A.S. meeting, Ottawa, June 18–21, 1949.

[6] [Dr. Moore left no manuscript notes giving a reason for omitting the fairly large group of 62 F0–F4 stars and the small group of 12 G5–K4 stars from the solar-motion solution. Among the early F stars, however, it probably was difficult to separate those of luminosity class IV from class V. Thus within the spectral-class range from F0 to F4, inclusive, the class V assignments may include a number of class IV stars. Most of the class IV assignments in the same spectral range, on the other hand, probably are correct, since such assignments presumably would not have been made unless the luminosity criteria were fairly evident.—N. U. MAYALL.]

[7] *Lund Obs. Medd.*, Ser. II, No. 79, 1936.

TABLE 4

STARS OF VARIABLE OR PROBABLY VARIABLE VELOCITY

Lum. Class	Var HD	Var Sp. Cl.	Var? HD	Var? Sp. Cl.
Ib........	173297 (V350 Sgr)	G0	....	......
II........	168245	G7	....	......
II–III....	89312	K5	....	......
III.......	56418	....	2624	G6
	59076/77	G7+A	23962	K5
	69287	F2	57267	G5
	114494	F6	152484	G9
	159714	K4	192867	M1
	165374	M2	218170	M2
	203378	M6	....	......
IV.......	94978	F0	4270	F3
	111603	F6	19808	F5
	115427	F4	39967	F6
	167391	F5	55438	F0
	184025	F2	58477	F2
	195850	F5	88865	F6
	210891	F0	102652	F2
	211244	F3	120335	F3
			153777	F2
			202712	F4

Lum. Class	Var HD	Var Sp. Cl.	Var? HD	Var? Sp. Cl.
V........	80388	G1	9956	F6
	123280	F6	26395	F4
	133460	F7	29936	F9
	135633	G0	71659	F8
	150466	F5	77378	F3
	162262	F5	77930	F6
	170456	F1	89276	F0
	179757	F0	92855	F9
	186497	F0	112574	F7
	189578	F5	113449	F5
	215772	F5	113516	F7
			126898	F4
			130342	F4
			131958	F1
			144492	F4
			150553	F0
			200580	F8
			208745	F0
			223110	F5
Unclass...	56819	A9	24694	F0
			60265	......
			121785	A

TABLE 5

NUMBERS OF STARS OMITTED AND USED IN SOLAR-MOTION SOLUTIONS

Lum. Class	No. of Stars	Omitted: Var Vel.	Omitted: Var? Vel.	Constant Vel.	Used in Sol.
II..............	37	1	0	36	
II–III..........	25	1	0	24	
III.............	331	7	6	318	
III–IV..........	6	0	0	6	
	399	9	6	384	
		V>80		−3*	381
IV.............	158	8	10	140	
		V>80		−1†	139
V..............	251	11	19	221	
		F0–F4		−62	
		G5–K4		−12	
		V>80		− 1‡	146

* HD 19258, 27598, 134063. † HD 21910. ‡ HD 198188.

1950ApJ...112...48M

TABLE 6

SOLAR-MOTION SOLUTIONS, WITH PROBABLE ERRORS

LUM. CLASS	NO. OF STARS	V_0 (KM/SEC)	K (KM/SEC)	EQUATORIAL		GALACTIC	
				α_0	δ_0	l	b
II, II–III / III, III–IV	381	24.2±1.8	+1.5±1.1	282°2±5°2	+46°7±2°3	43°7±4°0	+18°6±4°0
IV	139	23.0±2.3	+3.0±1.5	275.7±6.4	+43.6±3.0	38.9±4.7	+22.5±3.4
V*	146	18.7±3.1	−2.0±1.7	285.0±9.5	+43.0±5.0	40.9±7.7	+15.3±4.2

* Only spectral classes F5–G4 (inclusive).

TABLE 7

MEAN RESIDUAL VELOCITIES (KM/SEC)
(Co-ordinates of Apex: $\bar{a}_0$=280°, δ_0= +44 1/2°)

LUM. CLASS	V_0 (KM/SEC)	F		G		K	M		ALL SP. CL.
		0–4	5–9	0–4	5–9	0–5	0–4	5–8	
II, II–III / III, III–IV	24	19.3 (30)	15.4 (14)	18.7 (20)	17.3 (112)	17.8 (112)	20.4 (79)	25.9 (14)	18.6 (381)
III	24	19.0 (28)	15.1 (13)	15.9 (14)	17.6 (96)	17.8 (81)	20.1 (72)	25.8 (12)	18.6 (316)
IV	23	11.2 (59)	15.0 (47)	17.4 (20)	23.5 (8)	13.0 (5)	....	....	14.1 (139)
V	19	16.3 (62)	17.2 (115)	24.1 (30)	12.1 (8)	15.0 (3)	....	....	17.7 (218)

TABLE 8

STARS WITH RESIDUAL RADIAL VELOCITIES >60 KM/SEC*

STAR HD	CLASS		OBS. VEL.	SUN CORR.	RES. VEL.	STAR HD	CLASS		OBS. VEL.	SUN CORR.	RES. VEL.
	Sp.	Lum.					Sp.	Lum.			
19258	M1	III	− 74	− 7	−81	102159	M6	III	+ 58	+ 6	+64
19286	F2	V	+ 52	+10	+62	107582	G1	V	− 82	+11	−71
21910	G9	IV	−104	+13	−91	123598	M3	III	+ 65	0	+65
27498	M4	III	+ 86	−15	+71	134063	G4	III	−108	+16	−92
27598	M5	II	+ 99	−18	+81	136711	K3	II–III	− 76	+15	−61
43856	F6	V	− 58	−12	−70	173883	F9	V	− 82	+13	−69
50060	F9	V	+ 71	−10	+61	198188	G0	V	− 90	+ 6	−84
62549	G1	V	+ 85	−14	+71	217694	K4	III	− 81	+18	−63
64372	G7	III	+ 82	− 6	+76	219497	F6	IV	+ 56	+14	+70

* Var and var? velocities omitted.

longitude of the apex is somewhat greater, by 15°–20°; but the latitude of the apex is about the same as for the stars represented, for example, in Nordström's Table 29. The apparently systematically lower latitude for Nordström's group of 500 dwarf G–M stars fainter than sixth magnitude, included in his Table 19, is not obtained from the luminosity class V stars in this material. Also, the solar motion for the luminosity class III stars appears to be a little larger, by 4–5 km/sec, than for the giants included in Nordström's investigation.

As regards the mean residual motions, Table 7 shows the usual tendency for them to increase with advancing spectral type, for the several luminosity classes. While there is an apparent exception in the case of the early F III stars, it probably cannot be regarded as significant, for the late F III stars do not show the same effect.

V. GALACTIC ROTATION

To investigate the possibility that differential galactic rotation may be represented in the radial velocities of some of these stars, several solutions that included a rotational term were made for the giants. This group was selected, of course, because its greater average distance would be expected to lead to a larger rotational term.

Since the direction to the center of the galaxy is now known to be toward $L_0 = 325°$, with an uncertainty of only a few degrees, this value was assumed in the first solution, which included 348 stars, mainly of luminosity class III (318 III, 24 II–III, 6 III–IV). Also, since the K-term for these stars was found to be $+1.5 \pm 1.1$ km/sec (Table 6), it was assumed to be zero, and the following results were obtained:

$$V_0 = 24.7 \pm 3.3 \text{ km/sec} ;$$

$$\alpha_0 = 281\overset{\circ}{.}9 \pm 1\overset{\circ}{.}5 , \quad \text{or} \quad l = 38\overset{\circ}{.}4 \pm 1\overset{\circ}{.}4 ;$$

$$\delta_0 = +41.3 \pm 0.9 , \quad \text{or} \quad b = +16.7 \pm 1.0 ;$$

$$\bar{r}A = 4.2 \pm 1.9 \text{ km/sec} .$$

The solar motion is essentially the same as before, and there appears to be a significant rotational term, although the latter is only a little more than twice as large as its probable error. Since the stars included in the solution are distributed fairly uniformly over the sky, it is possible that those in higher galactic latitudes, for example, those with $|b| > 20°$, might tend to reduce the value of $\bar{r}A$ and to increase its probable error. To check this possibility, a second solution was made for $\bar{r}A$ and L_0, the longitude of the galactic center, from the residual radial velocities (computed as indicated in Table 7) for 147 giants having $|b| < 20°$, with the following results:

$$\bar{r}A = 6.7 \pm 1.5 \text{ km/sec} ;$$

$$L_0 = 309\overset{\circ}{.}2 \pm 7\overset{\circ}{.}0 .$$

In this case the rotational term is four and a half times as large as its probable error, and it may therefore be concluded that the normal giants included in this material participate in the differential galactic rotation characteristic of the region around the sun. This conclusion supports Nordström's extensive computations for stars brighter and fainter than $m = 6.0$[8] and his analysis[9] of the radial velocities of a group of nearly 400 faint K stars observed by Redman, who had previously found little evidence for galactic rotation in his material.[10]

[8] *Ibid.*, Table 34.

[9] *Arkiv för Mat., Astr. och Fysik*, **23A**, No. 14, 1933; *Lund Obs. Medd.*, Ser. I, No. 131.

[10] *M.N.*, **92**, 107, 1931.

That a value for $\bar{r}A$ of the order of 5 km/sec is approximately correct for the luminosity class III stars in this material may be shown from the data in Table 9, which gives the mean distances for the stars concerned.

TABLE 9

MEAN DISTANCES OF 348 LUMINOSITY-CLASS III STARS*

Sp. Cl.	No. of Stars	Mean Sp. Cl.	Mean m_{vis}	Mean M_{vis}†	Mean Distance (Pcs)	Wt.
F	41	F4	8.2	+1.4	230	4
G	119	G6	7.7	+0.4	288	12
K	101	K4	7.4	−0.1	316	10
M	87	M2	7.3	−0.3	331	9

* Including 24 II–III and 6 III–IV stars.

† *An Atlas of Stellar Spectra*, Fig. 2, p. 34.

The weighted average of the mean distances in Table 9 is $\bar{r} = 300$ parsecs, which, with a generally accepted value of $A = 0.017$ km/sec/parsec, gives $\bar{r}A = 5.1$ km/sec for these stars. Thus the observed and expected galactic-rotational terms agree as well as may be expected.