RADIAL VELOCITIES AND SPECTRAL TYPES OF 181 DWARF STARS*

ALFRED H. JOY
Mount Wilson Observatory
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ABSTRACT

Spectral types and radial velocities have been determined for 181 dwarf stars having for the most part proper motions greater than 0."35. The classification follows the Henry Draper system except that 21 subdwarfs have been recognized in types A, F, G, K, and M. Emission lines of *H* and *Ca* II (H and K) were observed in 41 stars, and of *Ca* II alone in 24 other stars.

The correlation between spectral type and absolute magnitude determined from trigonometric parallaxes is shown in Figure 1. If the subdwarfs are excluded, the average spread in luminosity is 1.6 mag.

Since the beginning of spectrographic work at the Mount Wilson Observatory, the observation of dwarf stars with large proper motions has been emphasized. A number of observers have taken part, and the results have been published from time to time. Dr. W. S. Adams has been largely responsible for the continued interest in this program.

The present paper gives the results of the observations of spectra of large-proper-motion stars for which one or more plates had been obtained prior to 1940, together with a few other stars of especial interest on account of their low luminosity. Except for five stars with emission lines, the proper motion of every star included is greater than 0."35. The early spectrograms were obtained by several observers (W. S. Adams, G. Strömberg, R. F. Sanford, R. E. Wilson, and A. H. Joy) and measured, for the most part, by members of the computing staff. The observations and measurements since 1940 have been made largely by the writer.

Most of the spectrograms were obtained with one-prism spectrographs at the 60- and 100-inch reflectors. Since 1940, at the 100-inch telescope, a two-prism spectrograph with a collimating mirror and a 6-inch Schmidt camera (dispersion 115 A/mm) has been used for the fainter stars.

The dispersions usually employed are:

Mag.	A/mm
8.0 or brighter	35
8.0—10.5	75
10.5—14	115

The average probable errors of the radial velocities for these three magnitude groups are 1.1, 1.7, and 2.1 km/sec, respectively.

The stars observed, with relevant data, are listed in Table 1. For stars not in the *Henry Draper Catalogue* the apparent visual magnitudes are generally Kuiper's estimates, although for some of the stars other sources have been used. The visual absolute magnitudes (M_v) of the seventh column were computed from the trigonometric parallaxes of the next column except that the absolute magnitudes of stars having no trigonometric parallaxes were read from the mean curve of the Russell diagram (Fig. 1) according to the estimated type. The parallaxes of such stars were computed from the apparent and absolute magnitudes and marked "(S)" in the eighth column. The measured radial velocities, corrected for the earth's orbital motion, are in the last column, together with their probable errors.

* *Contributions from the Mount Wilson Observatory, Carnegie Institution of Washington*, No. 726.

TABLE 1

SPECTROSCOPIC OBSERVATIONS OF DWARF STARS

STAR	α(1900)	δ(1900)	m_v	μ	SPECT.	M_v	π	VELOCITY No. of Plates	VELOCITY Km/Sec
ADS 48A.....	0^h $0^m.4$	+45° 16′	9.4*	0″.86	dK6	9.2	0″.090(10)	3	0†
20 C 16......	0 11.8	+40 24	8.7	0.55	dM0	8.3	.083(1)	3	+ 13±2.0
ADS 246A....	0 12.8	+43 28	8.5*	2.89	dM2.5	10.7	.278(6)	11	+ 15† ...
ADS 246B....	....	....	10.9	......	sdM4e	13.1	....	5	+ 22±0.8
GC 354......	0 12.8	−14 1	6.6	0.41	dG0	4.7	.042(S)	3	+ 29±0.8
ADS 433A....	0 26.3	+66 41	10.4	1.74	dM2.5	10.4	.099(3)	4	+ 18±2.6
GC 668A.....	0 28.8	−35 32	6.6	0.52	dG0	5.0	.049(1)	2	+ 28±0.2
20 C 40......	0 33.5	+30 4	11.4	1.55	dM3.5†	11.0	.084(3)	3	+ 10±1.6
GC 873......	0 38.2	+75 24	7.4	0.40	dG4	5.4	.039(2)	3	− 9±0.3
20 C 60......	0 45.4	+57 45	11.5	1.58	dM2	10.4	.060(1)	3	− 19±1.1
GC 1058	0 48.1	−30 54	7.6*	0.63	dK5	7.7	.107(1)	3	− 5† ...
GC 1186.....	0 54.1	+31 57	7.0	0.36	dF5	4.7	.035(1)	3	+ 22±0.4
20 C 66......	0 55.3	+71 9	9.9	1.78	dM3.5	10.1	.108(4)	3	+ 11±1.4
LPM 63......	1 7.5	−17 32	11.6	1.33	dM5e	13.6	.251(S)	3	+ 28±3.6
GC 1752A....	1 21.7	+44 53	5.0	0.36	F2	1.6	.021(3)	3	+ 12±0.9
GC 2050.....	1 35.7	+42 7	5.1	0.81	dG0	4.9	.091(2)	6	+ 1±0.6
GC 2280.....	1 48.0	−22 56	9.0	0.86	dM1.5	8.6	.082(2)	3	+ 25±2.6
20 C 153.....	2 7.3	+ 3 9	10.3	2.58	dM3	10.1	.088(2)	5	+ 7±1.7
ADS 2081B...	2 37.4	+48 48	10.0	0.35	dM2.5	9.6	.081(5)	4	+ 25±2.5
20 C 187.....	2 46.0	+34 0	9.6	1.37	dM0	8.8	.068(3)	3	− 45±0.8
GC 3449.....	2 47.7	−13 11	6.1	0.42	dK0	6.8	.137(2)	3	+ 19±1.7
20 C 212.....	3 7.6	+18 28	14.4*	1.74	sdM0	13.1	.054(1)	3	−102† ...
GC 3901.....	3 8.3	+71 55	9.0	0.43	dG5	5.0	.016(1)	4	+ 9±3.1
20 C 217.....	3 9.9	+37 45	10.5	1.36	sdK5	8.7	.044(2)	3	−166±1.5
20 C 235.....	3 22.3	+37 3	10.6	1.58	sdK5	8.4	.036(2)	5	−174±4.1
ADS 2894A...	3 52.4	− 1 27	8.6	0.27	dK5	8.6	.101(1)	4	+ 7±1.6
ADS 2894B...	....	....	11.3*	......	dM3e	11.3	....	6	+ 15† ...
20 C 279.....	3 59.7	+32 42	9.2	1.08	dK4	6.9	.035(2)	3	+112±1.8
20 C 280.....	4 2.2	−21 6	9.7	0.78	dM0	8.5	.057(2)	3	+ 28±2.4
ADS 3093C...	4 10.7	− 7 48	11.1	4.08	dM4.5e	12.6	.203(12)	3	− 45±1.7
20 C 303.....	4 37.0	+18 47	9.8	1.27	dM2.5	9.9	.106(3)	4	+ 33±1.9
BD+52°911..	4 55.1	+53 3	9.8	1.96	dM0.5	8.7	.059(1)	2	+ 76±1.2
GC 6144.....	4 56.5	+13 57	8.3	0.41	dG8	6.7	.049(1)	3	− 27±1.4
20 C 318.....	5 7.0	+19 37	9.2	0.75	dK3	6.9	.035(2)	3	+ 7±1.3
ADS 4099B...	5 23.3	+54 35	9.7	0.41	dK4	6.9	.028(7)	2	+ 27±0.2
CD−29°2277.	5 25.0	−29 58	11.5	0.41	sdF6	6.2	.009(S)	5	+547±1.6†
Ross 42......	5 26.7	+ 9 45	11.8*	0.30	dM4e	11.1	.073(2)	3	+ 17† ...
BD+62°780..	5 36.3	+62 13	9.2	0.82	dK5	7.6	.048(S)	4	− 13±2.9
20 C 344.....	5 36.4	+12 28	11.7	2.53	sdM4.5	12.7	.161(2)	3	+103±1.9
20 C 347.....	5 39.5	+ 9 13	11.9	0.61	sdF7	6.1	.007(3)	3	− 1±5.8
20 C 377.....	6 6.4	−21 50	8.2	0.71	dM2.5	9.4	.172(3)	3	0±1.4
20 C 390.....	6 24.3	− 2 44	11.3	0.97	dM4.5e†	13.3	.253(4)	5	+ 24±2.7
BD+47°1355.	6 44.1	+47 29	9.2	0.83	dK6	7.9	.055(S)	2	+ 28±1.4
20 C 400.....	6 48.3	+33 24	9.9	0.87	dM3.5	11.0	.162(2)	3	+ 41±2.0
20 C 402B....	6 49.5	+40 13	10.7	0.44	dM1.5	8.7	0.041(2)	3	+ 61±1.8

TABLE 1—*Continued*

STAR	α(1900)	δ(1900)	m_v	μ	SPECT.	M_v	π	VELOCITY: No. of Plates	VELOCITY: Km/Sec
Ross 986.....	7h 3m3	+38° 43′	12.4*	1″12	dM5e†	13.3	0″151(1)	5	+ 52† ...
BD+5°1668..	7 22.0	+ 5 35	10.0	3.75	dM4	12.1	.264(3)	3	+ 28±2.3
20 C 426.....	7 25.4	+36 26	11.2*	0.44	dM3.5e	10.9	.087(2)	9	+ 1† ...
Ross 989†.....	7 25.4	+36 27	12.2	0.41	dM4.5e	11.9	.087(2)	4	− 2±4.6
Ross 882.....	7 39.4	+ 3 48	11.6†	0.64	dM4.5e	12.4	.147(1)	5	+ 18±0.9
20 C 462.....	8 6.5	+ 9 9	12.5	5.40	dM5	13.4	.153(2)	2	− 35±0.1
20 C 475.....	8 27.3	+67 38	9.2	1.09	dM1	8.8	.089(3)	5	+ 18±2.1
20 C 489.....	8 43.1	+ 6 51	10.3	0.55	dM0	7.4	.026(3)	3	− 23±0.6
GC 12307....	8 49.4	− 5 4	6.0	0.43	dG3	5.0	.063(S)	4	+ 30±1.9
20 C 498.....	8 50.0	+ 1 57	9.9	1.09	dM1	9.0	.066(1)	6	+ 3±2.6
20 C 500.....	8 52.8	+20 56	8.9	0.68	dK5	7.1	.045(2)	3	− 46±1.0
20 C 501.....	8 54.1	− 3 37	9.5	0.73	sdF3	6.7	.028(1)	5	+ 20±2.5
20 C 510.....	9 1.9	+51 12	8.1	0.43	dG6	5.6	.032(S)	3	+ 22±1.0
BD+1°2341..	9 35.6	+ 1 28	11.0*	0.54	F0	2.7	.002(S)	4	− 65† ...
20 C 540.....	9 35.8	+13 40	10.6	0.77	dM2.5	9.7	.066(2)	3	+ 20±2.4
BD+75°403..	10 1.7	+75 37	9.3	0.39	dK6	8.0	.055(1)	5	− 47±2.7
20 C 580.....	10 23.8	+ 1 22	9.6	0.96	dM2.5	10.1	.128(2)	3	+ 18±2.1
L 1113-55....	10 30.9	+ 5 38	12.2	0.68	dM4e	11.4	.069(S)	3	+ 21±0.8
20 C 589.....	10 41.9	+28 57	10.3	0.83	sdF5	6.3	.016(1)	4	+ 77±1.7
20 C 591.....	10 45.7	+ 7 21	11.9*	1.23	dM5	12.6	.139(2)	3	+ 4† ...
GC 14964....	10 46.8	+76 36	9.4	0.48	dK6	7.7	.045(1)	5	− 22±2.8
20 C 598.....	10 51.0	+70 8	10.2	0.64	dM0.5	8.4	.045(2)	4	+ 7 ±2.2
20 C 600.....	10 51.6	+ 7 36	13.5	4.67	dM6e†	16.5	.406(1)	4	+ 13±2.9
20 C 606B....	11 0.5	+44 2	14.8†	4.54	dM5.5e	16.0	.176(2)	2†	....
GC 15365....	11 5.2	+66 34	9.0	0.36	dG5	6.3	.029(1)	3	+ 27±3.2
BD−17°3336.	11 10.3	−17 35	10.0	0.76	dM1	9.8	.056(3)	4	+ 5±2.4
BD−17°3337.	11 10.3	−17 35	10.4*	0.76	dM1	9.5	.065(3)	5	+ 18† ...
20 C 632.....	11 18.6	+ 9 6	11.0	1.16	dM1	7.4	.019(1)	4	+ 58±1.0
20 C 641†....	11 23.3	+ 8 6	9.7	1.21	dM0	8.0	.045(2)	3	+ 37±2.1
20 C 655.....	11 34.7	+67 52	12.3	3.20	sdM0.5	10.4	.042(2)	3	−118±1.7
GC 16044....	11 36.2	−28 39	6.9*	0.38	dG0	3.9	.025(1)	4	− 20† ...
AC+79°3888.	11 41.3	+79 14	11.0	0.87	sdM4	12.5	.198(2)	3	−115±3.1
20 C 662.....	11 42.6	+ 1 23	11.0	1.40	dM5	13.3	.292(1)	2	− 10±1.0
GC 16248....	11 47.2	+10 30	7.8	0.36	dK1	6.5	.054(1)	3	+ 11±1.1
20 C 684.....	12 3.3	+ 0 4	10.8	0.96	dM1	9.8	.063(2)	2	+ 31±1.9
20 C 703.....	12 19.6	−17 38	11.7	2.49	dM4	11.8	.103(1)	4	+ 58±1.7
BD−6°3580..	12 23.7	− 6 57	9.6	0.45	dK5	7.6	.040(S)	3	+ 27±1.7
20 C 716AB ..	12 28.4	+ 9 34	12.7	1.81	dM5.5e	14.5	.230(3)	6	− 5±3.0
20 C 717.....	12 28.8	−14 5	9.6	0.48	dK4	7.1	.032(2)	3	+ 7±1.0
20 C 726.....	12 34.0	+12 14	11.3	1.16	dM4	10.4	.065(1)	3	+ 8±0.2
GC 17308....	12 38.4	−37 9	7.5	0.71	dG5	5.8	.038(2)	4	− 30±2.7
20 C 737.....	12 43.0	+10 18	11.1	1.09	dM4	11.3	.108(1)	3	+ 5±0.7
GC 17447....	12 46.2	−12 56	8.1	0.41	dG2	5.3	.027(1)	5	+ 25±1.5
GC 17629....	12 55.2	+69 19	8.6*	0.40	dG6	6.3	.034(1)	6	+ 7† ...
20 C 754....	12 55.6	+ 6 13	13.6*	1.01	dM5e	13.6	0.100(S)	3	− 40† ...

TABLE 1—*Continued*

STAR	α(1900)	δ(1900)	m_v	μ	SPECT.	M_v	π	VELOCITY	
								No. of Plates	Km/Sec
20 C 755.....	12ʰ55ᵐ8	+12° 53′	9.9	0″.70	dM2e†	9.6	0″.087(S)	5	− 13±2.4
GC 17819....	13 4.3	−21 39	7.3	0.40	dG7	6.7	.077(1)	4	− 6±1.7
GC 17966....	13 11.6	+28 16	8.4	0.39	dG8	6.1	.035(S)	3	+ 16±0.8
ADS 8841B...	13 11.9	+17 33	10.2	0.67	dM2	9.5	.072(2)	4	+ 10±2.0
20 C 770.....	13 13.9	− 2 33	9.8	0.71	dK5	8.1	.046(2)	3	+123±1.5
GC 18040....	13 15.6	+38 41	8.3*	0.40	dG6	5.3	.025(1)	3	+ 1† ...
20 C 780A....	13 23.2	− 1 50	11.4	0.50	dM4	11.4	.098(2)	3	− 26±1.4
20 C 782.....	13 24.9	+10 55	9.2	1.49	dM1	9.7	.124(1)	7	+ 19±1.4
AC+18°1204-96A.......	13 28.1	+17 16	11.0	0.38	dM4e	11.5	.126(S)	4	0±2.4
AC+18°1204-96B.......	....	....	11.5	......	dM4.5e	12.4	.151(S)	3	+ 8±2.3
20 C 793.....	13 33.2	+75 1	9.8	0.43	dK6	8.0	.043(1)	3	− 1±1.2
GC 18520....	13 37.2	+ 8 54	6.1	0.39	F4	3.9	.037(1)	5	− 11±1.1
20 C 806.....	13 42.2	− 5 38	9.6	0.67	dK4	7.0	.030(1)	3	− 46±0.5
ADS 9090A...	13 58.5	+46 49	9.9	0.55	dM3	9.5	.085(8)	4	− 31±2.1
ADS 9090B...	....	....	9.9	......	dM3	9.5	....	4	− 28±2.4
20 C 835.....	14 5.1	−13 27	9.7	0.42	sdF7	6.1	.019(S)	4	+126±2.8
20 C 837.....	14 7.8	−11 33	13.5	0.79	dM5.5e	14.7	.174(S)	1†	....
BD+21°2649.	14 20.9	+21 3	8.0	0.64	F8	4.4	.019(S)	3	− 54±0.4
20 C 863.....	14 24.8	+15 57	10.5	1.74	dM3	9.9	.077(3)	3	+ 20±1.7
GC 19693....	14 31.7	− 3 51	7.8	0.35	dG3	4.3	.020(2)	3	− 44±1.3
20 C 901.....	14 53.6	+31 45	11.1	1.50	dM1.5	9.2	.042(S)	3	+ 24±2.0
20 C 904.....	14 57.4	+45 49	9.0	0.43	dM0	8.3	.071(1)	3	− 14±1.4
CPD−21°5912	15 7.4	−21 36	10.5	0.70	dK5	8.0	.032(1)	3	− 72±2.1
L 1130-30A...	16 1.6	+ 8 38	12.0*	0.48	dM3e	10.4	.048(S)	5	− 48† ...
L 1130-91....	16 7.3	+ 5 46	12.1	0.69	dK4	7.0	.010(S)	4	− 15±3.0
ADS 9970AB.	16 9.4	+39 36	8.7*	0.37	dG4	3.9	.011(1)	4	− 53±1.5
ADS 9982A...	16 11.1	+ 7 35	9.4*	0.50	dK6	6.9	.032(1)	8	+ 7±2.1
BD+55°1823.	16 14.9	+55 32	10.1	......	dM1.5e†	9.2	.066(S)	3	− 28±0.6
20 C 986.....	16 21.1	+48 35	10.3	1.23	dM3	10.9	.132(2)	3	− 29±0.7
20 C 995.....	16 24.7	−12 25	10.2*	1.24	dM4.5	12.5	.288(4)	3	− 18† ...
GC 22255....	16 27.9	+ 3 28	9.5*	0.40	dK0	7.6	.043(2)	5	− 58† ...
GC 22445....	16 35.9	− 2 39	7.1	0.44	dG2	5.7	.051(3)	3	− 43±0.9
GC 22636....	16 45.1	+37 12	8.2	0.38	dK0	7.1	.059(2)	4	+ 4±0.6
GC 22805AB.	16 50.1	− 8 9	9.9	1.22	dM3e	11.0	.167(7)	26	+ 19† ...
GC 22805C...	16 50.1	− 8 8	11.9*	1.22	sdM4	13.0	.162(4)	5	+ 25† ...
Ross 867.....	17 16.1	+26 36	13.4	0.47	dM5e	13.6	.110(S)	2†	....
Ross 868.....	17 16.1	+26 36	11.2	0.47	dM4e	11.4	.110(S)	4	− 28±1.9
ADS 10585AB	17 25.5	+29 29	9.9*	0.39	dM0	8.6	.055(3)	4	− 7±1.9
ADS 10786B..	17 42.5	+27 47	10.4	0.82	dM4	10.6	.111(2)	4	− 13±1.9
LPM 661.....	17 50.3	−16 23	11.0	0.60	sdF8†	6.2	.011(S)	3	−216±2.2
20 C 1069....	17 52.9	+ 4 25	9.7	10.25	sdM4.5†	13.4	.542(7)	12	−103±1.7†
BD−3°4233..	17 59.8	− 3 2	9.2	0.53	dM2	9.9	.139(3)	3	+ 34±0.5
20 C 1091....	18 27.9	−11 42	8.8	0.41	dM0	7.5	.054(3)	3	− 83±0.3
GC 25317....	18 28.6	+44 57	8.1	0.36	F8	4.8	.022(1)	3	− 4±1.6
20 C 1095....	18 32.4	+45 39	9.8	0.56	dM2	9.4	0.082(2)	3	− 23±2.9

TABLE 1—*Continued*

Star	α(1900)	δ(1900)	m_v	μ	Spect.	M_v	π	Velocity: No. of Plates	Velocity: Km/Sec
20 C 1108....	$18^h 43^m 6$	−23°57	10.5	0″74	dM4.5e	13.3	0″355(3)	4	− 4±0.9
20 C 1129....	19 2.8	+20 44	10.7	0.57	sdM2	11.1	.122(4)	3	+ 34±2.2
Ross 731.....	19 2.9	+20 43	10.7	0.57	sdM2	11.1	.122(4)	3	+ 35±2.2
ADS 12061CD	19 3.7	+32 21	11.8	1.66	dM4	12.3	.127(4)	3	− 31±2.0
20 C 1136....	19 7.1	+ 2 44	11.3	1.88	dM4	11.4	.106(2)	3	− 40±0.7
20 C 1143....	19 12.0	+ 5 1	9.2	1.44	dM3	10.4	.171(4)	3	+ 33±1.1
ADS 12882A..	19 41.0	+ 4 0	7.0	0.1†	dG0	4.7	.035(S)	4	− 8±1.4
ADS 12882B..	....	....	11.4	......	dM2e†	9.6	.044(S)	5	+ 5±2.8
20 C 1191....	20 2.7	+54 10	12.2*	1.62	dM3e	11.2	.063(3)	7	0† ...
CD −32°16135A	20 35.6	−32 47	10.9	0.45	dM4.5e†	11.1	.109(2)	5	− 4±2.4
CD −32°16135B	20 35.6	−32 47	11.1	0.45	dM4.5e	11.3	.109(2)	5	− 3±2.8
20 C 1223....	20 37.2	−19 16	10.3	1.15	dM2	9.4	.067(1)	3	+ 6±1.8
20 C 1225....	20 39.0	−31 42	8.7	0.45	dM2e	8.9	.111(1)	5	+ 5±3.0†
20 C 1227....	20 40.5	+54 57	15.3	1.87	dM5e	14.6	.072(1)	1	− 23† ...
20 C 1228....	20 41.4	+44 8	10.6	0.50	dM3	10.6	.102(1)	3	− 15±1.8
20 C 1242....	20 51.4	−10 49	11.5	1.14	dM3.5	10.2	.056(3)	3	+ 51±3.0
20 C 1253....	20 58.7	− 6 32	10.3	0.46	dK5	7.2	.024(2)	2	− 37±0.9
20 C 1263....	21 5.6	+59 21	13.4*	2.14	sdM1	11.5	.042(1)	5	−260† ...
20 C 1285....	21 24.8	+17 12	10.4	1.07	dM4	11.3	.150(1)	3	− 2±1.6
20 C 1288....	21 25.8	−10 14	11.5	1.19	dM4.5e	12.3	.147(2)	1†	....
GC 30918....	22 1.4	+ 1 22	7.5	0.37	F8	4.7	.028(2)	3	− 43±0.8
Ross 271.....	22 6.6	+17 55	10.4	0.51	dM2	9.4	.062(1)	3	− 41±2.3
20 C 1348....	22 9.1	− 9 13	11.5	0.68	dK4	7.3	.014(1)	4	− 18±4.1
GC 31109....	22 9.2	−16 18	6.6	0.36	dG8	4.3	.035(2)	3	+ 12±1.2
Wolf 1561A...	22 12.1	− 9 18	13.5	0.55	dM4.5e	13.5	.101(2)	3	+ 54±2.1
Wolf 1561B...	22 12.1	− 9 18	14.5	0.55	dM5e	14.5	.101(2)	1†	....
20 C 1363....	22 23.7	+ 5 19	14.4*	1.57	sdK6	9.8	.012(S)	2	−157† ...
ADS 15972B.	22 24.4	+57 12	11.3	0.86	dM4.5e	13.4	.258(7)	4	− 28±0.9
20 C 1368....	22 27.6	+49 11	9.3	0.41	dG8	6.1	.023(S)	3	+ 28±0.4
LPM 837.....	22 33.0	−15 53	12.3	3.27	dM5.5e	14.6	.286(2)	4	− 60±0.8
BD+9°5076..	22 33.6	+10 2	11.1*	0.57	dK0	6.8	.014(S)	3	− 70† ...
GC 31669....	22 37.5	+65 59	7.5	0.44	dG3	4.9	.030(1)	3	− 46±1.5
20 C 1382....	22 42.6	+43 49	10.2	0.84	dM4.5e	11.8	.205(4)	4	− 1±2.0
AC +31°70565†	22 47.2	+31 13	11.2	0.49	dM3.5e	9.6	.047(1)	4	0±2.0
20 C 1385....	22 47.3	+31 12	9.4	0.50	dK5	7.4	.040(2)	7	+ 3±1.5
20 C 1387....	22 47.9	−14 47	10.3	1.12	dM4.5	11.9	.212(4)	3	+ 13±1.3
GC 31978†...	22 50.8	−32 6	6.5	0.36	dK5	7.0	.128(2)	5	+ 12±1.6
20 C 1392....	22 51.7	+16 2	9.0*	1.09	dM2.5	10.1	.166(2)	6	− 19† ...
20 C 1404....	23 4.5	+ 0 12	10.2	1.29	sdG2	6.5	.018(S)	3	−112±0.7
GC 32541....	23 17.8	−11 19	8.0	0.50	dK2	6.9	.059(3)	3	+ 36±1.6
BD +19°5116A	23 26.7	+19 23	10.3	0.53	dM4e†	11.1	.146(1)	5	− 1±0.9
BD +19°5116B	....	....	12.8	......	dM5.5e	13.6	....	6	− 4±2.9
20 C 1445....	23 37.0	+43 39	12.2	1.82	dM5.5e†	14.7	.321(2)	3	− 81±2.5
GC 32998....	23 41.2	−42 7	7.5	0.88	sdA2S†	4.7	.027(2)	3	− 24±1.2
GC 33222....	23 52.4	−10 12	7.8	0.45	dG2	4.3	.020(2)	4	− 32±0.7
ADS 48F.....	23 59.9	+45 14	9.9	0.87	dM2	9.7	0.089(5)	4	+ 3±2.3

NOTES FOR TABLE 1

The magnitudes of all stars distinguished by an asterisk (*) in the fourth column have been corrected for a companion star. The correction for spectroscopic binaries is 0.4 mag.

The notes for stars marked with a dagger (†) follow:

ADS 48A	0h 0m4	Spectroscopic binary, range −16 to +11 km/sec; the distant companion F and both stars of the close pair show strong emission H and K lines.
ADS 246A	0 12.8	This value of the radial velocity based on additional plates should replace values previously published; a range of from +2 to +28 km/sec indicates that the star is a spectroscopic binary; H and K appear in emission.
20 C 40	0 33.5	Luyten's estimates of early spectral type (*Pub. A.S.P.*, **34**, 132 and 356, 1922; *Lick Obs. Bull.*, **11**, 128, 1923) are obviously the result of misidentification.
GC 1058	0 48.1	Spectroscopic binary, range −20 to +14 km/sec.
20 C 212	3 7.6	Spectroscopic binary, range −140 to −76 km/sec; the spectral lines are greatly weakened.
ADS 2894B	3 52.4	Spectroscopic binary, range −1 to +34 km/sec; the emission lines were found by F. C. Leonard (*Pub. A.S.P.*, **56**, 38, 1944); the bright star has H and K in emission.
CD−29°2277	5 25.0	The high velocity found by D. M. Popper (*Ap. J.*, **98**, 210, 1943) is confirmed; the motion in the line of sight is by far the greatest yet found; the spectrum is characteristic of F-type subdwarfs.
Ross 42	5 26.7	Spectroscopic binary, range +5 to +48 km/sec.
20 C 390	6 24.3	Unseen companion reported by D. Reuyl (*A.J.*, **45**, 133, 1936); bright *H* lines were found by A. Vyssotsky (*Harvard Ann. Card*, No. 550, 1940).
Ross 986	7 3.3	Spectroscopic binary, range +27 to +85 km/sec; the emission lines were mentioned in a letter from W. J. Luyten, dated June 21, 1945.
20 C 426	7 25.4	Spectroscopic binary, range −26 to +25 km/sec.
Ross 989	7 25.4	39″ north of 20 C 426, which has nearly the same motion.
Ross 882	7 39.4	A. van Maanen reported 1.4 mag. increase in brightness on March 11, 1943 (*Pub. A.S.P.*, **57**, 216, 1945).
BD+1°2341	9 35.6	Spectroscopic binary, range −98 to −15 km/sec; the proper-motion star is the preceding of two stars in the field; the lines are poor and on one plate are suspected of being double.
20 C 591	10 45.7	Spectroscopic binary, range −18 to +16 km/sec.
20 C 600	10 51.6	The spectrum shows the strongest titanium oxide bands yet observed among dwarf stars.
20 C 606B	11 0.5	A. van Maanen reported 1.5 mag. increase in brightness on May 11, 1939 (*Mt. W. Contr.*, No. 630; *Ap. J.*, **91**, 503, 1940); two spectrograms with dispersion 440 A/mm were obtained by M. L. Humason.
BD−17°3337	11 10.3	Spectroscopic binary, range +3 to +43 km/sec.
20 C 641	11 23.3	South following of two stars; this identification is by A. N. Vyssotsky; the results given in *Mt. W. Contr.*, No. 387; *Ap. J.*, **70**, 219, 1929; and *Mt. W. Contr.*, No. 511; *Ap. J.*, **81**, 240, 1935, apply to the north preceding star.
GC 16044	11 36.2	Spectroscopic binary, range −32 to −10 km/sec.
GC 17629	12 55.2	Spectroscopic binary, range −12 to +21 km/sec.
20 C 754	12 55.6	Spectroscopic binary, range −76 to −22 km/sec.
20 C 755	12 55.8	Emission lines found by D. M. Popper (*Ap. J.*, **98**, 210, 1943).
GC 18040	13 15.6	Spectroscopic binary, range −19 to +19 km/sec.
20 C 837	14 7.8	One low-dispersion (220 A/mm) plate only.
L 1130-30A	16 1.6	Spectrographic binary, range −69 to −33 km/sec; the spectrum of the fourteenth-magnitude companion, distant 2″, has not been observed.
BD+55°1823	16 14.9	The emission lines were found by G. Münch (*Ap. J.*, **99**, 222, 1944).
20 C 995	16 24.7	Spectroscopic binary, range −26 to −7 km/sec.
GC 22255	16 27.9	Spectroscopic binary, range −76 to −39 km/sec.
GC 22805AB	16 50.1	Spectroscopic binary, range +4 to +30 km/sec.
GC 22805 C	16 50.1	Spectroscopic binary, range +13 to +46 km/sec.
Ross 867	17 16.1	Two low-dispersion (220 A/mm) plates only.
LPM 661	17 50.3	Lines very weak.
20 C 1069	17 52.9	Barnard's star; the weakness of the metallic lines indicates that this well-known star should be classed as a subdwarf; there is some evidence of a small variation in radial velocity.
ADS 12882A	19 41.0	The proper motion is estimated from the *A.G.* catalogue.
ADS 12882B	19 41.0	The emission lines were found by F. C. Leonard (*Pub. A.S.P.*, **56**, 202, 1944).
20 C 1191	20 2.7	Spectroscopic binary, range −97 to +71 km/sec.
CD−32°16135A	20 35.6	Variable intensity of the bright lines was suspected by W. J. Luyten (*Harvard Bull.*, No. 835, 1926).

(Notes for Table 1 continued on following page)

NOTES FOR TABLE 1—*Continued*

20 C 1225	$20^h39^m.0$	The large range in the measures indicates that the star may be a spectroscopic binary.
20 C 1227	20 40.5	One low-dispersion (220 A/mm) plate only.
20 C 1263	21 5.6	Spectroscopic binary, range −292 to −242 km/sec.
20 C 1288	21 25.8	One low-dispersion (220 A/mm) plate only.
Wolf 1561B	22 12.1	One low-dispersion (220 A/mm) plate only.
20 C 1363	22 23.7	Spectroscopic binary, range −176 to −139 km/sec.
BD+9°5076	22 33.6	Spectroscopic binary, range −93 to −49 km/sec.
AC+31°70565	22 47.2	This star was found by accident near 20 C 1385 (*Pub. A.S.P.*, **55**, 242, 1943); according to McCormick observers, the two stars have about the same parallax and total proper motion, but direction of the cross-motion is quite different.
GC 31978	22 50.8	The motion is nearly the same as that of Fomalhaut.
20 C 1392	22 51.7	Spectroscopic binary, range −36 to −3 km/sec.
BD+19°5116A	23 26.7	The emission lines were found by Wirtanen (*Pub. A.S.P.*, **53**, 340, 1941).
20 C 1445	23 37.0	The absorption lines are poor and the bright *H* lines weak; probably a subdwarf.
GC 32998	23 41.2	In this subdwarf of early type the *H* absorption lines have deep cores and noticeable wings; λ 4481 *Mg* I is present but somewhat weakened.

THE RADIAL VELOCITIES

The radial velocities of 20 faint stars from Table 1 have been measured at the McDonald Observatory by D. M. Popper[1] and G. Münch.[2] A comparison of these velocities with the Mount Wilson values shows an average difference of 8.4 km/sec and a systematic difference (Mt. W. − McD.) of +3.3 km/sec.

For 7 bright stars of the list whose velocities were determined at the Lick Observatory, the systematic difference (Mt. W. − L.) is −0.2 km/sec. A comparison of Mount Wilson plates taken with different cameras and different slit-widths shows only insignificant mean differences.

Large velocities of over 75 km/sec were found for 19 stars of Table 1. As previously determined, the subdwarfs show the highest radial velocities. The average velocity for 21 subdwarfs of the list is 121 km/sec.

THE SPECTRA

The stars are classified according to the Henry Draper system. The types of the M dwarfs are based strictly upon the strength of the titanium oxide bands in the blue region of the spectrum. When obtained by this method, the types are comparable with those of the giants, supergiants, and M-type variables. The more detailed classification permitted by additional decimal half-subdivisions (M0.5, M1.5, etc.) seems justified.

Subdwarfs, formerly called "intermediate white dwarfs," have been recognized in late, as well as in early, types when the criteria are clearly marked. The spectroscopic features[3] which distinguish subdwarfs from ordinary dwarfs are: for types A–M, a general weakening of the absorption spectrum; A–G, a marked weakening and narrowing of hydrogen lines and of λ 4481 *Mg* II; F–G, a weakening of the G band; K–M, a strengthening of the Lindblad absorption band in the neighborhood of λ 4226 and a weakening of emission lines. According to Kuiper, the continuum at the head of the Balmer series is weakened in subdwarfs of early types, but this region of the spectrum has not been observed on our plates.

[1] *Ap. J.*, **95**, 308, 1942; **98**, 210, 1943.

[2] *Ap. J.*, **99**, 272, 1944.

[3] W. S. Adams, *Mt. W. Contr.*, No. 105; *Ap. J.*, **42**, 187, 1915. Adams, Joy, Humason, and Brayton, *Mt. W. Contr.*, No. 511; *Ap. J.*, **81**, 191, 1935. G. P. Kuiper, *Ap. J.*, **89**, 551, 1939; *Colloque internat. d'ap.*, III: *White Dwarfs* (Paris, 1941).

Emission lines of *Ca* II and *H* were observed in 41 stars of the list whose spectral types are M1.5 or later. Low luminosity and low temperature favor the production of emission lines in stars at the lower end of the main sequence, but emission lines are weak or absent in subdwarfs. The emergence of bright lines is rather definitely fixed at M4.5. Of the 32 stars with spectral type M4.5 or later, only 7 fail to show emission, and 3 of these are probably subdwarfs. Of 78 M-type stars with spectra earlier than M4.5, only 16 show emission *H* lines. Twenty-five additional stars (1 G0, 1 K0, 3 K5, 2 K6, and 18 M0-4), however, show bright H and K, but no blue or violet *H* lines in emission. The observations of H and K are not complete because many of the spectrograms are too weak in the violet region.

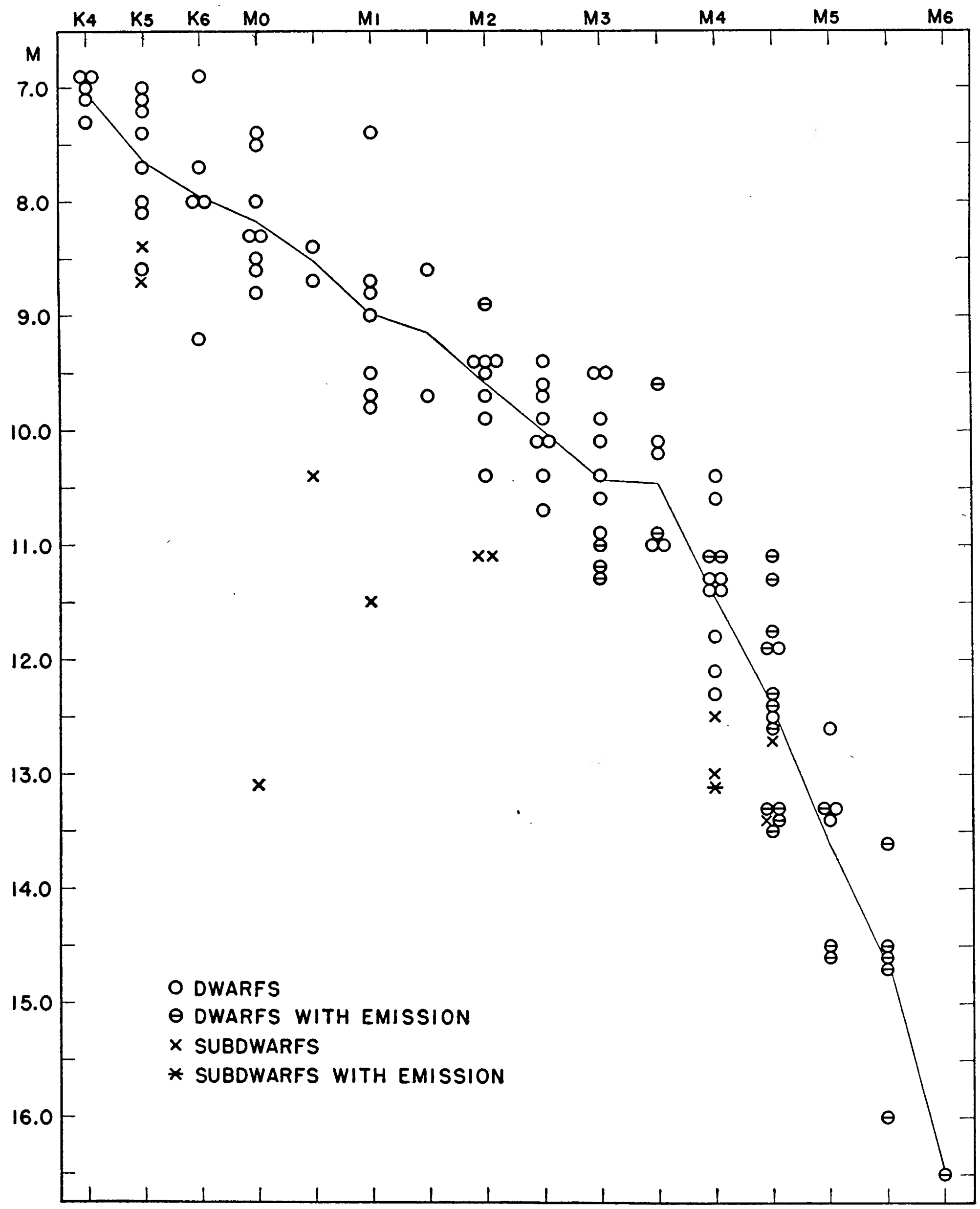

FIG. 1.—Russell diagram for late-type dwarfs with trigonometric parallaxes

Although 29 of the 66 stars showing emission are members of close pairs, the evidence seems to indicate that the bright lines result from low temperature or low luminosity rather than from duplicity.

ABSOLUTE MAGNITUDES

The absolute magnitudes determined from apparent magnitudes and trigonometric parallaxes are plotted against spectral type in Figure 1, and the mean values are given in Table 2.

TABLE 2

ABSOLUTE MAGNITUDES OF FAINT DWARF STARS

Spectral Type	M_v	Spectral Type	M_v	Spectral Type	M_v
K4	7.0	M1.0	9.0	M3.5	10.8
K5	7.6	M1.5	9.2	M4.0	11.5
K6	8.0	M2.0	9.6	M4.5	12.4
M0	8.2	M2.5	10.0	M5.0	13.6
M0.5	8.5	M3.0	10.4	M5.5	14.7

Because most of the stars were observed with low dispersion, no attempt was made to determine the spectroscopic absolute magnitude from the line intensities. If the stars recognized as subdwarfs are excluded, the average spread in luminosity is 1.6 mag. Since this value includes errors in apparent magnitude and trigonometric parallax, as well as errors in estimating spectral type, the results seem to indicate little dispersion in luminosity from the mean of the main sequence. The possibility of variations in apparent magnitude and type and the probability that some subdwarfs have been retained by mistake may account for some of the spread.

Kuiper's[4] success in classifying faint M-type spectra on panchromatic film suggests that the red region may offer possibilities of higher accuracy in estimating spectral types than the usual blue region. If the types could be estimated by employing criteria more sensitive than the blue *Ti* bands, it would be worth while to use decimals smaller than half-subdivisions in the classification, for, in the late spectral types, a difference of one subdivision in type corresponds to a difference of more than 2 mag. in the absolute magnitude.

[4] *Ap. J.*, **95**, 207, 1942.