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THE COLOR-LUMINOSITY ARRAY FOR STARS NEAR THE SUN *

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Abstract. The 245 stars that (1) have a mean parallax greater than $0''.049$, as determined at two or more observatories, (2) are assigned a spectral type of K5 or earlier in the 1952 edition of the Yale parallax catalogue, and (3) are not known to be white dwarfs or binaries with a visual magnitude difference of less than three magnitudes between the components, are listed in Table I. Magnitudes and colors are available for 205, or 84 per cent, of these stars. An additional list of 32 M-type dwarfs that have a mean parallax greater than $0''.074$ is given in Table III.

There are 294 stars in the 1952 edition of the Yale parallax catalogue (Jenkins 1952) that meet the following specifications:

(1) The spectral types, given in the catalogue, are K5 or earlier. The stars of later type are omitted for two reasons: (a) the color-system used here rapidly loses resolution for the red dwarfs, and (b) most of the red dwarfs are apparently faint and not observable with the 12-inch and 9-inch refractors used in the present program.

(2) The mean parallaxes, determined at two or more observatories, are at least as large as $0''.050$. Since the parallaxes from the Dearborn, Stockholm, Uppsala, and London Observatories are few in number and have been assigned relatively low weights by Miss Jenkins, they have been eliminated from the catalogue means. In a few cases where additional parallaxes, not included in the catalogue, have become available, they have been incorporated into the means with the precepts established by Miss Jenkins.

Six of these stars, Yale Nos. 160, 1579, 1813, 3081, 4895, and 5803, are known white dwarfs and have been omitted. Also, 43 of the stars are known to be visual binaries with a difference of less than three visual magnitudes between the components. Their Yale numbers are:

97	778	2153	2924	3375	3745	4137
104	1187	2212	3006	3410	3908	4399
146	1785	2268	3035	3438	3919	4920
328	1809	2625	3153	3480	3924	5076
352	1856	2645	3309	3491	3970	5107
537	2067	2648	3360	3681	3975	5421
						5657

Since the presence of companions will affect the observed magnitudes and colors, these stars have been omitted.

The remaining 245 stars are listed in Table I. Magnitudes and colors are available for 205, or 84 per cent, of the objects in the table. These magnitudes and colors are on the $(P, V)_E$ -system, described previously (Eggen 1955, referred to here as Paper A). The observations, made with the 9-inch Oddie refractor of the Australian Commonwealth Observatory and with the Lick 12-inch refractor, were published in Paper A; previously unpublished results for Yale Nos. 350, 1002, 1173, 1222, 1224, 1314, 1543, 1606, 1831, 1889, 2117, 2304, 2429, 2824, and 5258 are included in Table I. Some of the stars have also been observed at the McDonald Observatory by Johnson and Morgan (1953), and by observers at the Royal Observatory, Cape of Good Hope (1953). All these latter magnitudes and colors have been reduced to the $(P, V)_E$ -system, as described in Paper A, where they were referred to as $(P, V)_{E,J}$ and $(P, V)_{E,C}$, respectively. When Cape or McDonald results have been used alone or in combination with the magnitudes and colors given in Paper A, that fact is indicated by a dagger in Table I. The magnitudes and colors of 9 stars determined by Yates (1954) with the Huggins refractor of the Cambridge Observatory, have been reduced to the $(P, V)_E$ -system and are given in parentheses in Table I. The

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Table I. 245 Stars within 20 parsecs of the sun

Yale	V_E	$(P-V)_E$	Sp	π	Wt	M_V	Yale	V_E	$(P-V)_E$	Sp	π	Wt	M_V
3	8.51	+0.94	K0	0.072	14	+7.80	1002	8.32	+0.805	dK4	0.056	18	+7.06
9	(6.13)	(+0.61)	dG8	0.069	33	+5.32	1070	5.26	+0.54	dG1	0.073	24	+4.58
16†	2.26	+0.23	F2 IV	0.072	23	+1.55	1077†	3.16	+0.34	F6 V	0.125	39	+3.64
54†	4.20	+0.47	G0 V	0.134	15	+4.83	1129*	6.20	+0.97	dK5	0.106	79	+6.33
69†	2.75	+0.52	G1 IV	0.153	18	+3.68	1164†	4.74	+0.40	F8	0.078	17	+4.20
110†	5.85	+0.77	K0 V	0.100	26	+5.85	1173	5.02	+0.36	F6 V	0.053	38	+3.64
116	(7.35)	(+0.90)	dK5	0.071	22	+6.61	1199	4.68	+0.505	G0 V	0.066	29	+3.78
120	5.89	+0.435	G0	0.052	18	+4.47	1121	7.80	+0.94	dK5	0.071	40	+7.06
134†	1.99	+0.96	K0 III	0.057	14	+0.77	1222	8.57	+1.095	dK5	0.061	37	+7.50
155†	3.49	+0.47	G0 V	0.182	40	+4.79	1224	5.01	+0.40	F8 V	0.061	37	+3.94
156	5.74	+0.795	dK4	0.145	36	+6.55	1242	7.64	+1.00	dK6	0.080	25	+7.16
162	7.11	+0.765	dG7	0.058	17	+5.93	1289	6.21	+0.75	dK2	0.095	34	+6.10
166	----	----	dF9	0.059	27	----	1314	7.26	+0.73	dK2	0.077	40	+6.69
169	----	----	dM2	0.062	14	----	1316†	3.54	+0.385	F6 V	0.119	28	+3.92
217	(9.04)	(+1.12)	dM1	0.072	29	+8.33	1339†	3.85	+0.07	A5 III	0.055	16	+2.55
219†	5.14	+0.59	G8 Vp	0.136	32	+5.81	1354	4.39	+0.485	G0 V	0.101	30	+4.41
257†	4.91	+0.46	dG0	0.064	14	+3.94	1365	6.61	+0.57	dG0	0.051	38	+5.15
322	6.91	+0.77	dG8	0.064	16	+5.94	1370†	3.65	+0.225	dF2	0.061	23	+2.58
331	4.08	+0.335	F8 V	0.062	35	+3.04	1435	6.51	+0.575	dG4	0.056	36	+5.25
350	4.94	+0.53	G2 V	0.086	26	+4.61	1468	5.08	+0.615	G9	0.109	15	+5.27
354	----	----	dM0	0.077	46	----	1543†	3.87	+1.015	K1 IV	0.052	22	+2.45
356†	5.22	+0.75	K1 V	0.133	24	+5.84	1571	5.34	+0.45	G0 V	0.068	28	+4.50
365†	3.48	+0.625	G8 Vp	0.275	34	+5.68	1573	3.42	+0.31	F5 III	0.051	24	+1.96
371†	5.62	+0.70	dK0	0.111	25	+5.85	1577†	-1.44	-0.115	A1 V	0.375	78	+1.43
390	3.44	+0.35	F6 IV	0.050	20	+1.93	1606	6.58	+0.94	dK6	0.096	28	+6.49
394*	2.66	+0.02	A5 V	0.063	35	+1.66	1647	6.00	+0.485	dG2	0.058	23	+4.82
405†	3.62	+0.765	G5 IV	0.052	17	+2.20	1718	3.58	+0.23	F2 IV	0.059	34	+2.43
445	6.10	+0.70	dG5	0.083	18	+5.70	1760†	4.19	+0.20	F0 V	0.059	24	+3.04
452	----	----	dK4	0.051	20	----	1805†	0.36	+0.305	F5 IV-V	0.284	79	+2.62
464*†	4.88	+0.50	G0 V	0.094	58	+4.75	1826†	1.16	+0.93	K0 III	0.093	34	+1.00
479	6.31	+0.615	dK0	0.088	18	+6.03	1829	----	----	dG8	0.070	40	----
488	5.15	+0.505	dG1	0.070	15	+4.38	1831	4.99	+0.68	dG4	0.050	15	+3.48
520†	5.82	+0.89	dK4	0.147	38	+6.66	1841	5.33	+0.43	dG0	0.057	18	+4.11
549	4.12	+0.375	F7 V	0.077	42	+3.55	1864†	4.98	+0.34	dF3	0.067	19	+4.11
557	5.42	+0.455	F5	0.063	24	+4.42	1889	7.01	+0.59	dG7	0.056	48	+5.75
560†	4.44	+0.365	dF5	0.067	18	+3.57	1902	----	----	dF8	0.059	18	----
588	----	----	dM0	0.063	32	----	1946†	4.70	+0.31	F5	0.050	18	+3.19
599	6.03	+0.78	dK0	0.122	25	+6.46	1977†	5.90	+0.675	dK1	0.075	35	+5.28
633†	4.02	+0.085	A0n	0.051	18	+2.56	1979	5.10	+0.35	F6 V	0.061	24	+4.03
642	----	----	dM0	0.057	30	----	1998*	----	----	dF2	0.052	45	----
647†	4.05	+0.49	G0 V	0.084	37	+3.67	2042	----	----	dG8	0.080	17	----
664†	3.82	+0.42	F6 V	0.070	29	+3.05	2082	8.53	+0.853	dK5	0.059	40	+7.38
691†	4.82	+0.58	G5 V	0.105	32	+4.93	2089	6.50	+0.805	K2	0.091	19	+6.30
703†	4.20	+0.62	G5 V	0.156	17	+5.16	2117	5.96	+0.77	dK0	0.074	23	+5.31
712	7.84	+1.055	dK6	0.061	23	+6.77	2143†	3.11	+0.07	A7 V	0.066	32	+2.21
734	----	----	K0	0.060	23	----	2174	4.78	+0.38	F7 IV	0.052	25	+3.36
740†	4.66	+0.28	dF4	0.052	18	+3.24	2193†	6.48	+0.62	dG7	0.062	34	+5.44
742†	3.68	+0.80	K2 V	0.303	81	+6.09	2255†	4.51	+0.35	F6 V	0.067	18	+3.64
753†	4.25	+0.46	F8 V	0.058	40	+3.07	2256	----	----	dK5	0.085	16	----
788†	3.48	+0.85	K0 IV	0.109	50	+3.67	2266	3.20	+0.365	F6 IV	0.052	24	+1.78
827†	4.16	+0.32	dF3	0.053	21	+2.78	2280†	5.42	+0.665	G8 IV	0.107	42	+5.57
887	----	----	dK0	0.054	36	----	2304	8.15	+1.015	dK6	0.068	34	+7.31
891	----	----	dF7	0.053	40	----	2306	----	----	dF7	0.073	14	----
900	----	----	K3	0.054	16	----	2366	5.37	+0.555	G2 V	0.053	31	+3.99
902†	(5.85)	(+0.54)	dG1	0.069	36	+5.04	2413	(5.81)	(+0.39)	dF3	0.060	35	+4.70
945†	4.38	+0.73	dK0	0.200	57	+5.89	2429	5.75	+0.42	dF6	0.059	22	+4.80
950	7.62	+0.98	K0	0.069	16	+6.81	2449	(6.61)	(+0.51)	dG2	0.051	36	+4.95
952†	4.23	+0.23	F5	0.053	17	+2.85	2457†	8.69	+1.215	K7 V	0.082	36	+8.26

Yale	V _E	(P-V) _E	Sp	π	Wt	M _V	Yale	V _E	(P-V) _E	Sp	π	Wt	M _V
2459†	4.82	+0.40	F8 V	0.082	36	+4.39	3896†	3.32	+0.275	F2 III	0.057	16	+2.10
2556†	5.16	+0.45	dG0	0.073	22	+4.48	3935†	4.33	+0.265	dF2	0.058	18	+3.15
2604	-----	-----	dM0	0.056	20	-----	3946†	5.39	+0.525	G0 V	0.072	42	+4.68
2611	(7.64)	(+0.94)	dK5	0.077	14	+7.07	3972*	6.46	+0.66	dK1	0.076	37	+5.86
2678	5.96	+0.675	dK2	0.099	18	+5.94	4000	2.09	+0.045	A5 III	0.056	35	+0.83
2701	-----	-----	K5	0.075	18	-----	4013	5.24	+0.50	G1 V	0.062	75	+4.20
2725	4.87	+0.545	dG4	0.092	17	+4.69	4016	6.51	+0.88	dK3	0.080	30	+6.03
2738†	2.13	-0.03	A3 V	0.076	43	+1.53	4027†	5.04	+0.61	dG0	0.071	19	+4.30
2739†	3.60	+0.435	F8 V	0.098	36	+3.56	4060†	3.42	+0.655	G5 IV	0.117	28	+3.76
2745†	6.47	+0.64	G8 Vp	0.112	36	+6.72	4153	5.07	+0.40	F7 V	0.058	76	+3.89
2762*	7.23	+1.045	dK6	0.096	16	+7.14	4166	8.39	+1.145	K7	0.074	46	+7.74
2767†	5.46	+0.665	dG7	0.078	23	+4.92	4171	6.43	+0.785	K2 V	0.094	34	+6.30
2824	3.27	-0.05	A3 V	0.052	33	+1.85	4215†	3.22	+0.85	K0 III-IV	0.054	42	+1.88
2889	-----	-----	G5	0.070	16	-----	4245*†	3.58	+0.40	F7 V	0.120	34	+3.98
2895†	4.27	+0.485	G0 V	0.108	27	+4.44	4254	-----	-----	dK5	0.051	38	-----
2935	5.98	+0.425	dF9	0.065	23	+5.04	4256	-----	-----	dK0	0.073	20	-----
2974	7.54	+0.705	dK1	0.061	14	+6.47	4266	-----	-----	K5	0.050	25	-----
2978	-----	-----	dM0	0.051	34	-----	4293†	0.02	-0.12	A0 V	0.123	44	+0.47
3010	8.73	+0.48	dF9	0.052	28	+7.31	4340	-----	-----	dK4	0.052	20	-----
3012	4.92	+0.37	F6 III-IV	0.059	14	+3.77	4345	9.23	+1.115	dM1	0.056	40	+7.97
3015†	4.26	+0.46	G0 V	0.120	30	+4.66	4433†	6.08	+0.61	G5	0.056	20	+4.82
3034	5.18	+0.465	G0 V	0.075	31	+4.56	4456	6.04	+0.61	dG4	0.059	24	+4.89
3039†	4.69	+0.61	G6 V	0.113	25	+4.95	4482	-----	-----	K5	0.064	20	-----
3144†	4.50	+0.37	F7 V	0.056	24	+3.24	4541	5.10	+0.665	G8 IV	0.059	38	+3.95
3154	-----	-----	dK6	0.072	17	-----	4542*	3.38	+0.195	F0 IV-V	0.062	44	+2.34
3161	-----	-----	dG5	0.056	18	-----	4607†	4.68	+0.695	K0 V	0.173	63	+5.87
3163	-----	-----	G5	0.071	19	-----	4611	4.49	+0.285	F5 IV	0.057	35	+3.27
3175*†	2.70	+0.49	G0 IV	0.120	35	+3.10	4650	(8.05)	(+0.85)	dK0	0.053	16	+6.67
3206†	2.02	+0.93	K0 III-IV	0.059	15	+0.87	4665†	0.78	+0.11	A7 IV, V	0.198	63	+2.27
3242†	-0.06	+1.155	K2 IIIp	0.090	46	-0.29	4686	-----	-----	dK5	0.067	19	-----
3243	6.63	+0.90	K3	0.098	20	+6.59	4705†	3.70	+0.76	G8 IV	0.067	57	+2.83
3255	-----	-----	dK1	0.050	44	-----	4754**†	3.54	+0.655	G5 IV	0.170	19	+4.69
3264	6.26	+0.505	dG3	0.061	32	+5.19	4760	5.76	+0.525	dG1	0.059	40	+4.61
3274†	4.04	+0.39	F7 V	0.067	24	+3.17	4762	7.27	+0.745	dK3	0.050	27	+5.76
3300	4.48	+0.235	F2 V	0.063	27	+3.48	4782	5.33	+0.755	dK4	0.171	16	+6.49
3354†	7.87	+0.905	dK5	0.064	26	+6.90	4804*	5.75	+0.795	dK5	0.116	23	+6.07
3367*	6.02	+0.74	dK1	0.084	18	+5.64	4834	(8.92)	(+1.19)	dM0	0.075	15	+8.30
3416	4.94	+0.315	F5 V	0.061	22	+3.87	4849	5.94	+0.48	dG1	0.066	45	+5.04
3462	5.63	+0.545	G0	0.059	18	+4.48	4864	6.57	+0.63	dG6	0.051	23	+5.11
3536†	4.64	+0.29	F5	0.053	18	+3.26	4911	6.36	+0.605	dG7	0.065	21	+5.42
3567	6.05	+0.615	dG6	0.069	16	+5.24	4924	-----	-----	K5	0.080	27	-----
3570†	4.41	+0.50	G0 V	0.091	34	+4.21	4937**	-----	-----	dG5	0.052	13	-----
3596†	4.60	+0.45	F9 V	0.056	38	+3.34	4966†	3.42	+0.83	K0 IV	0.071	52	+2.68
3602	-----	-----	K5	0.055	19	-----	5077A†	5.19	+1.08	K5 V	0.292	71	+7.52
3604†	3.84	+0.37	F6 V	0.069	23	+3.03	5077B†	6.02	+1.24	K7 V	0.292	71	+8.35
3650	6.67	+0.63	dG8	0.080	35	+6.19	5139†	2.44	+0.12	A7 IV, V	0.063	43	+1.44
3654	8.55	+0.875	dK5	0.056	20	+7.29	5152†	4.26	+0.35	F6 V	0.111	17	+4.49
3669	7.55	+0.685	G5	0.063	40	+6.55	5174	-----	-----	dM0	0.056	26	-----
3687	-----	-----	dG1	0.059	45	-----	5198	-----	-----	K0	0.069	18	-----
3728	-----	-----	dK2	0.056	19	-----	5258	2.86	+0.19	Am	0.065	24	+1.92
3773	5.75	+0.725	dK0	0.098	35	+5.71	5262†	5.56	+0.49	dG5	0.068	20	+4.72
3799†	2.80	+0.545	G0 IV	0.103	68	+2.87	5314†	4.71	+0.95	K3 V	0.285	23	+6.98
3803	3.45	+0.83	G8 III-IV	0.053	24	+2.07	5345*†	3.77	+0.325	F5 V	0.074	42	+3.12
3815	8.12	+1.245	K7 V	0.105	15	+8.23	5395	5.44	+0.49	G0	0.077	14	+4.87
3827	8.42	+0.725	K7 V	0.050	36	+6.91	5415†	5.39	+0.555	dG0	0.052	15	+3.97
3837	6.62	+0.655	dG9	0.065	42	+5.68	5493	-----	-----	G0	0.060	15	-----
3860*	4.85	+0.38	F6 V	0.069	31	+4.04	5562	6.49	+0.99	dK4	0.134	54	+7.12
3877	6.77	+0.625	dK0	0.063	35	+5.77	5565†	1.16	-0.015	A3 V	0.134	54	+1.79
3878†	7.76	+1.04	K5 V	0.088	76	+7.48	5568†	5.50	+0.575	dG0	0.073	28	+4.82
3884	7.46	+0.765	G5	0.079	20	+6.95	5577*	-----	-----	dK4	0.054	18	-----

Yale	V _E	(P-V) _E	Sp	π	Wt	M _V	Yale	V _E	(P-V) _E	Sp	π	Wt	M _V
5580*	---	---	A2n	0'052	20	---	5725†	^m _{3.20}	^{+0.94}	K1 IV	0'064	43	^{+3.23}
5616†	5.56	^{+0.915}	K3 V	0.152	35	^{+6.47}	5772*	6.33	^{+0.855}	dK5	0.090	54	^{+6.10}
5658	---	---	dK2	0.055	29	---	5792	---	---	dM0	0.057	21	---
5721	7.10	^{+0.865}	K3	0.090	18	^{+6.87}	5807†	5.76	^{+0.55}	G2 V	0.087	69	^{+5.46}
5724†	4.13	^{+0.385}	F7 V	0.064	18	^{+3.16}	*Sp. B.	**Mag. Var.		†Incl. obs. of others.			

Table II. 32 M-type dwarfs within 13.5 parsecs of the sun

Yale	V_E	$(P-V)_E$	Sp	π	Wt	M_V	Yale	V_E	$(P-V)_E$	Sp	π	Wt	M_V
49A†	$m_{8.04}$	$+1.39$	dM2	0'282	16	$+10.29$	3880†	$m_{10.08}$	$+1.25$	dM3	0'088	76	$+9.80$
49B†	11.04	$+1.59$	sdM4e	0.282	16	$+13.29$	3955†	7.54	$+1.22$	dK6	0.123	50	$+7.99$
520B†	11.60	$+1.44$	---	0.147	38	$+12.50$	4029†	9.13	$+1.35$	dM3	0.203	75	$+10.68$
1010	8.66	$+1.25$	dM1	0.088	14	$+8.38$	4098†	9.50	$+1.57$	sdM5	0.545	89	$+13.19$
1046	9.94	$+1.345$	dM2	0.102	22	$+9.98$	4133	9.37	$+1.37$	dM2	0.133	28	$+9.99$
1255	7.89	$+1.295$	dM3	0.163	45	$+8.95$	4330A†	8.90	$+1.37$	dM4	0.285	43	$+11.17$
2390	6.59	$+1.25$	dM0	0.222	36	$+8.32$	4330B†	9.69	$+1.415$	dM5	0.285	43	$+11.96$
2420†	9.38	$+1.35$	dM4e	0.215	42	$+11.04$	4494†	9.08	$+1.32$	dM3	0.168	63	$+10.20$
2456	9.58	$+1.37$	dM2	0.128	17	$+10.11$	5012	8.52	$+1.30$	dM2	0.138	58	$+9.22$
2576	7.48	$+1.355$	dM2	0.398	41	$+10.48$	5117	6.76	$+1.275$	dM1	0.255	15	$+8.79$
2631†	9.32	$+1.27$	dM1	0.110	18	$+9.53$	5546†	10.16	$+1.425$	dM5	0.206	29	$+11.73$
2951†	8.44	$+1.28$	dM0	0.090	25	$+8.21$	5563†	8.66	$+1.345$	dM2	0.150	34	$+9.54$
3135†	8.48	$+1.275$	dM2	0.200	58	$+9.99$	5572	7.96	$+1.205$	dM1	0.125	28	$+8.44$
3419	10.10	$+1.22$	dM0	0.075	25	$+9.48$	5584	7.43	$+1.345$	dM2	0.273	18	$+9.61$
3712A†	8.59	$+1.27$	dM0	0.088	50	$+8.31$	5763†	8.96	$+1.325$	dM2	0.160	23	$+9.98$
3712B†	10.69	$+1.35$	---	0.088	50	$+10.41$	5817	8.59	$+1.325$	dM3	0.219	16	$+10.29$

Table III. Mean relationship between M_V and $(P-V)_E$ for main sequence stars

$(P-V)_E$	M_V	$(P-V)_E$	M_V	$(P-V)_E$	M_V	$(P-V)_E$	M_V
$m_{-0.20}$	$+0.60$	$m_{+0.16}$	$+2.82$	$m_{+0.54}$	$+4.96$	$m_{+0.90}$	$+6.71$
-0.18	$+0.85$	$+0.18$	$+2.90$	$+0.56$	$+5.06$	$+0.92$	$+6.80$
-0.16	$+1.05$	$+0.20$	$+2.98$	$+0.58$	$+5.16$	$+0.94$	$+6.90$
-0.14	$+1.22$	$+0.22$	$+3.05$	$+0.60$	$+5.26$	$+0.96$	$+7.00$
-0.12	$+1.38$	$+0.24$	$+3.12$	$+0.62$	$+5.35$	$+0.98$	$+7.09$
-0.10	$+1.54$	$+0.28$	$+3.12$	$+0.64$	$+5.45$	$+1.00$	$+7.19$
-0.08	$+1.68$	$+0.30$	$+3.30$	$+0.66$	$+5.54$	$+1.02$	$+7.29$
-0.06	$+1.80$	$+0.32$	$+3.50$	$+0.68$	$+5.64$	$+1.04$	$+7.38$
-0.04	$+1.92$	$+0.34$	$+3.68$	$+0.70$	$+5.74$	$+1.06$	$+7.48$
-0.02	$+2.02$	$+0.36$	$+3.86$	$+0.72$	$+5.83$	$+1.08$	$+7.58$
0.00	$+2.12$	$+0.38$	$+4.01$	$+0.74$	$+5.93$	$+1.10$	$+7.67$
$+0.02$	$+2.24$	$+0.40$	$+4.16$	$+0.76$	$+6.03$	$+1.12$	$+7.77$
$+0.04$	$+2.34$	$+0.42$	$+4.30$	$+0.78$	$+6.13$	$+1.14$	$+7.87$
$+0.06$	$+2.42$	$+0.44$	$+4.42$	$+0.80$	$+6.22$	$+1.16$	$+7.96$
$+0.08$	$+2.50$	$+0.46$	$+4.54$	$+0.82$	$+6.32$	$+1.18$	$+8.06$
$+0.10$	$+2.58$	$+0.48$	$+4.66$	$+0.84$	$+6.41$	$+1.20$	$+8.16$
$+0.12$	$+2.66$	$+0.50$	$+4.77$	$+0.86$	$+6.51$	$+1.22$	$+8.25$
$+0.14$	$+2.74$	$+0.52$	$+4.86$	$+0.88$	$+6.61$	$+1.24$	$+8.35$

spectral types in the table are those given in Paper A; for stars not included in Paper A the spectral types from the Yerkes, Mount Wilson, or Harvard Observatories, in order of preference, are listed in the table.

All of the colors and visual absolute magnitudes in Table I are plotted in Figure 1A; known spectroscopic binaries are represented by crosses. In order to minimize parallax errors some crite-

ria is necessary for selecting the most accurately determined values. Two such criteria are (1) the probable error of the absolute magnitudes, determined from the following equation, which ignores the error in the observed magnitudes:

$$\Delta M = 2.17 \Delta \pi / \pi,$$

or (2) the sum of the weights assigned by Miss Jenkins to the individual parallax determina-

Figure 1. (A) Color-luminosity array for 245 stars with parallaxes in excess of $0''.049$.
 (B) Array for stars with a parallax weight greater than 36. The crosses represent known spectroscopic binaries.

tions. Since the latter criterion puts emphasis on the number of independent determinations of the parallax rather than on the size of the parallax itself, it will be used here. All the stars in Table I with a total weight in excess of 36 are plotted in Figure 1B. The form of the main sequence shown in Figure 1B as a continuous line was determined from the main-sequence stars in the Praesepe and Pleiades clusters; the zero point is determined from all of the dwarf stars in Figure 1B with $(P-V)_E$ greater than $+0.6$ mag. A tabular representation of the average main sequence is given in Table III.

Since a weight of 36 corresponds to a probable error of $\pm 0''.005$ in the parallax (Jenkins 1952), the probable errors of the absolute magnitudes of all the stars plotted in Figure 1B are less than ± 0.25 mag.; the diameter of their points is 0.25 mag. In Figure 1B, from about $+0.5$ to $+0.9$ mag. in color index, there may be some suggestion of another sequence branching off below the main sequence. This possibility, which is obscured by the greater absolute magnitude dispersion shown in Figure 1A, is indicated by a dashed line. The six subluminescent stars nearest this broken line are the following:

Yale	Name	$(P-V)_E$	M_V	V_r	V_T
4849	HR 7783	$+0''.48$	$+5''.04$	-5	40
5807	85 Peg	$+0.55$	$+5.46$	-36	70
1889	HD 65583	$+0.59$	$+5.75$	+12	100
3669	HD 145417	$+0.685$	$+6.55$	—	125
1314	HD 38230	$+0.73$	$+6.69$	-31	45
2082	HD 74377	$+0.835$	$+7.38$	-26	60

where V_r and V_T are the radial and tangential components, respectively, of the motion in km/sec with respect to the sun. At least half of these stars, some of which have not been previously recognized as subdwarfs, are high-velocity objects. An examination of the parallaxes of the stars that fall below the general run of the main sequence in Figure 1A shows that the subluminescent nature of many of these objects is doubtful because of the large dispersion in the parallax determinations by different observers. There are, however, a half-dozen stars in this group that appear to have quite accurately determined parallaxes, to judge from the consistency of the individual determinations. These stars are the following:

Yale	Name	$(P-V)_E$	M_V	V_r	V_T
2413	39 Leo	$+0''.39$	$+4''.70$	+38	35
2935	10 CVn	$+0.425$	$+5.04$	+81	30
3264	HR 5384	$+0.505$	$+5.19$	-18	40
219	μ Cas	$+0.59$	$+5.81$	-97	130
3650	HD 144579	$+0.63$	$+6.19$	-60	35
2745	Gr. 1830	$+0.64$	$+6.72$	-98	305

Figure 2. Color-luminosity array for 32 M-type dwarfs.

At least two stars in this group, μ Cassiopeiae and Groombridge 1830 (HR 4550), are known subdwarfs.

The parallax of HD 114606, Yale No. 3010, places this star over two magnitudes below the main sequence at $(P-V)_E = +0.48$ mag. The individual determinations at the Allegheny and McCormick Observatories, respectively, are $0''.046$, with a weight 20, and $0''.053$, weight 8. Since a parallax of $0''.015$ would be required to place the star on the main sequence, there seems to be little doubt of its abnormally subluminescent nature. Dr. Bidelman has kindly examined the spectrum of this star, which he described as follows: "The spectrum of this star resembles that of HR 483, G2 V, but the G band is somewhat stronger. This star is probably somewhat below the main sequence. It is perhaps similar to μ Cassiopeiae but earlier in type. Its spectrum, on low-dispersion spectra, is no more abnormal than that of μ Cassiopeiae."

Magnitudes and colors from the Lick (Eggen 1955) and McDonald (Johnson and Morgan 1953) Observatories are also available for 32 stars with a parallax of at least $0''.075$ and a spectral type later than K5. These stars are listed in Table II where the spectral types are from R. E. Wilson's (1953) catalogue of radial velocities. The colors and absolute magnitudes are plotted in Figure 2; the continuous line in the figure is an extension of the main sequence from Figure 1B. The most obvious feature of Figure 2 is the sudden deviation of the points from the extrapolated main sequence for stars redder than about $+1.3$ mag. Since this color corresponds to spectral type near Mo, the break in the run of the main sequence may be caused by TiO ab-

sorption bands, which are characteristic of later spectral types. The color-luminosity array is further confused at this point by the merging of the two sequences noted in Figure 1B. The four stars near $(P-V)_E = +1.25$ mag. and between $M_V = +9.5$ and $+10.0$ mag. appear to form an extension of the subdwarf sequence discussed above. Two of these subluminoous stars, Yale Nos. 2631 and 3880, like the earlier-type subdwarfs (Johnson and Morgan 1953), are brighter in the ultra-violet region of the spectrum than are the main sequence objects of the same $(P-V)_E$ color, as can be seen in the following comparison:

Yale	M_V	$(P-V)_E$	$(U-B)$	V_r	V_T
3880	+9.80	+1.25	+1.09	-30	80
2631	+9.53	+1.27	+1.08	+47	125
Means	+9.66	+1.26	+1.085		
3712A	+8.31	+1.27	+1.27	-14	30
2951	+8.21	+1.28	+1.27	-1	20
Means	+8.26	+1.275	+1.27		

The values of $(U-B)$ were determined by Johnson and Morgan (1953).

Since the ordinary blue-yellow color systems have little resolution for the red dwarfs of spectral type later than about M0, a detailed study of the position of these stars in the color-luminosity array has been made with a red-infrared color system by Kron, Gascoigne, and White (1955).

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THE COLOR-LUMINOSITY ARRAY FOR SOME GALACTIC CLUSTERS *

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Abstract. Photoelectrically-determined magnitudes and colors of stars in several galactic clusters were reduced to a common system and used to construct a composite color-luminosity array. Previously unpublished magnitudes and colors of stars in the Perseus moving cluster, obtained with the 12-inch refractor, are given in Table IV and new observations of the Coma Berenices cluster members, made with the same instrument, are in Table I. The metallic-line stars appear to occupy a well-defined region of the color-luminosity array.

Magnitudes and colors of stars in several galactic clusters have been determined photoelectrically in recent years at the Lick Observatory by the writer and at the McDonald Observatory by Johnson (1954). The latter's results, which are on his (B, V) system, can be accurately converted to the $(P, V)_E$ system, as was previously shown (Eggen 1955) by a comparison of the results for 122 field stars observed at both observatories. In this paper the observations of cluster stars were reduced to a common system that permits a composite color-luminosity array to be drawn.

Praesepe. Magnitudes and colors for 26 stars in this cluster were published by the writer four years ago (Eggen 1951). The more recent series of measures by Johnson (1952), however, is much more extensive and will be used here. The magnitudes and colors of 51 stars with converted

colors, $(P-V)_{E,J}$, between $+0.5$ and $+1.25$ mag., and which were observed by Johnson on more than one night, are plotted in Figure 1A. Three possible subdwarf members of the cluster, KW Nos. 568, 572, and 576, considered by Haffner and Heckmann (1940), have been omitted. The correlation between V_J and $(P-V)_{E,J}$ for the stars in Figure 1A is given by the linear relation

$$V_J = 4.84 (P-V)_{E,J} + 8.40. \quad (1)$$

The seven stars indicated by crosses in the figure show differences between the observed and computed values of V_J of more than 0.15 mag. Since all seven of these residuals are negative, that is, the stars are apparently too bright for their color, they may indicate undetected binaries. The largest positive residual is 0.14 mag., and

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