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Table 1. *Adopted* $(B-V)_0$ *colours*

	V	IV-V	IV	III-IV	III	II-III	II	Ib	Iab	Ia
O5	−0.32									
O6	−0.32									
O7	−0.32									
O7.5	−0.31									
O8	−0.31				−0.31				−0.29	
O9	−0.31	−0.31	−0.31	−0.31	−0.31	−0.31	−0.31	−0.28	−0.28	−0.28
O9.5	−0.30	−0.30	−0.30	−0.30	−0.30	−0.30	−0.30	−0.27	−0.27	−0.27
B0	−0.30	−0.30	−0.30	−0.30	−0.30	−0.30	−0.29	−0.24	−0.24	−0.24
B0.5	−0.28	−0.28	−0.28	−0.28	−0.28	−0.30	−0.28	−0.22	−0.22	−0.22
B1	−0.26	−0.26	−0.26	−0.26	−0.26	−0.28	−0.24	−0.19	−0.19	−0.19
B1.5	−0.25	−0.25	−0.25	−0.25	−0.25	−0.27	−0.22	−0.17	−0.18	−0.18
B2	−0.24	−0.24	−0.24	−0.24	−0.24	−0.22	−0.21	−0.16	−0.17	−0.17
B2.5	−0.22	−0.22	−0.22	−0.22	−0.22	−0.20	−0.19	−0.15	−0.15	−0.15
B3	−0.20	−0.20	−0.20	−0.20	−0.20	−0.18	−0.17	−0.13	−0.13	−0.13
B4	−0.18	−0.18	−0.18	−0.18	−0.18					−0.11
B5	−0.16	−0.16	−0.16	−0.16	−0.16	−0.15	−0.14	−0.09	−0.09	−0.09
B6	−0.14	−0.14	−0.14	−0.14	−0.14	−0.13	−0.12	−0.07	−0.07	−0.07
B7	−0.13	−0.13	−0.13	−0.12	−0.12	−0.12	−0.12	−0.04	−0.04	−0.04
B8	−0.11	−0.10	−0.10	−0.10	−0.10	−0.10	−0.10	−0.02	−0.02	−0.01
B9	−0.07	−0.07	−0.07	−0.08	−0.08	−0.08	−0.06	−0.02	0.00	0.00
B9.5	−0.04	−0.04	−0.04	−0.05	−0.05	−0.04	−0.03	−0.01	0.00	0.01
A0	−0.01	−0.02	−0.02	−0.03	−0.03	−0.01	0.00	0.00	0.01	0.02
A1	0.02	0.01	0.00	0.01	0.01			0.02	0.03	0.03
A2	0.05	0.06	0.06	0.05	0.05			0.05	0.05	0.05
A3	0.08	0.09	0.09	0.09	0.09				0.06	0.06
A4	0.12	0.12	0.12	0.12	0.12				0.08	0.08
A5	0.15	0.15	0.15	0.15	0.15	0.13	0.10	0.10	0.10	0.10
A7	0.20	0.22	0.22	0.22	0.24		0.14	0.13	0.13	0.13
A8	0.27	0.27	0.26	0.26	0.26			0.14	0.14	0.14
A9	0.30	0.30	0.29	0.29	0.28		0.18	0.14	0.14	0.14
F0	0.32	0.30	0.30	0.30	0.32			0.15	0.15	0.15
F1	0.34	0.34	0.33	0.33	0.33			0.16	0.16	0.16
F2	0.35	0.38	0.37	0.37	0.36			0.18	0.18	0.18
F3	0.41	0.39	0.39	0.39	0.39					
F4	0.42	0.40	0.42	0.42	0.42					
F5	0.45	0.42	0.44	0.43	0.43		0.38	0.26	0.26	0.26
F6	0.48	0.48	0.46	0.46	0.46					
F7	0.50	0.49	0.50	0.49	0.48					
F8	0.53	0.51	0.53	0.52	0.52			0.55	0.55	0.55
F9	0.56	0.56	0.57							
G0	0.60	0.60	0.63	0.62	0.64		0.73	0.82	0.82	0.82
G1	0.62	0.60	0.63		0.69		0.80	0.85	0.85	0.85
G2	0.63	0.60	0.64		0.77		0.87	0.88	0.88	0.88
G3	0.65	0.60	0.66		0.85	0.86	0.87	0.92	0.92	0.92
G4	0.66	0.64	0.68		0.88	0.87	0.87			
G5	0.68	0.68	0.70	0.85	0.90	0.88	0.87	1.00	1.00	1.00
G6	0.72	0.73			0.92	0.92	0.91	1.04	1.04	1.04
G7	0.73	0.76			0.94	0.94	0.95	1.10	1.10	1.10
G8	0.74	0.80	0.82	0.89	0.95	0.96	0.99	1.14	1.14	1.14
G9	0.76	0.83	0.90	0.95	0.98	1.00	1.02	1.16	1.16	1.16

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Table 1 (continued)

	V	IV-V	IV	III-IV	III	II-III	II	Ib	Iab	Ia
K0	0.81	0.86	0.91	1.01	1.01	1.05	1.06	1.18	1.18	1.18
K1	0.86	0.93	0.99	1.09	1.09	1.10	1.14	1.20	1.20	1.20
K2	0.92				1.16	1.13	1.29	1.23	1.23	1.23
K3	0.95				1.26	1.30	1.40	1.42	1.42	1.42
K4	1.00				1.43	1.50	1.42	1.50	1.50	1.50
K5	1.15				1.51	1.57	1.45	1.60	1.60	1.60
K7	1.33				1.53	1.57		1.62	1.62	1.62
K9	1.37				1.55	1.58	1.58	1.64	1.64	1.64
M0	1.37				1.57	1.58	1.58	1.65	1.65	1.65
M0.5	1.47									
M1	1.47				1.60	1.60	1.59	1.65	1.65	1.65
M2	1.47				1.60	1.60	1.59	1.65	1.65	1.65
M3	1.47				1.60	1.60	1.60	1.67	1.67	1.67
M3.5	1.47									
M4	1.52				1.63			1.75	1.75	1.75
M4.5	1.52									
M5	1.61				1.65					
M6	1.64				1.49					
M7	1.68				1.50					
M8	1.77				1.50					

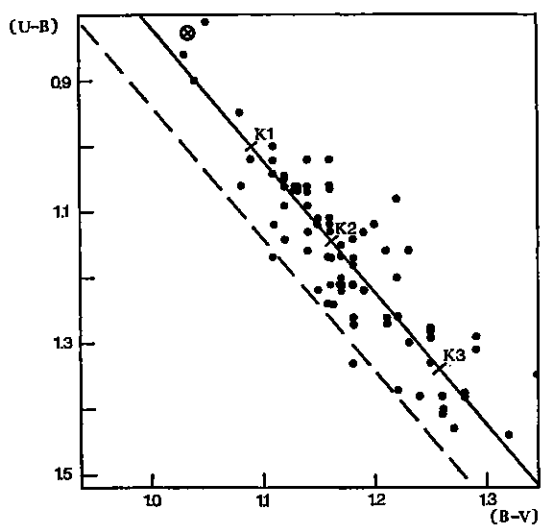

Fig. 2. Two-colour diagram for K2 III stars. The solid line represents the locus of intrinsic colours of class III stars, determined from stars within 50 parsecs. The mean colours of K1, K2, and K3 stars are marked on this line. The dashed line represents the blue-most envelope in the two-colour diagram. The point ⊗ indicates the position of the bluest colour index, such as would be found from spectral-colour plots

stars, spectral colour diagrams must be used because of the non-unique intersection of the reddening line with the intrinsic two-colour relation.

Three groupings of luminosity class are used; (i) II–III; (ii) II; and (iii) Ia, Iab, Ib, and Mt. Wilson designation c (included to increase the rather sparse data). No difference in location of the blue-most envelopes is found for luminosity classes in the last group when treated separately. Mean intrinsic colours, for individual MK classes later than G5, are obtained by averaging the colours, corrected for reddening, of the least reddened stars in that class. Mean intrinsic colours for A to G5 type stars come directly from the spectral-colour plots. The resulting colours are then plotted in two-colour diagrams and smoothed. Estimations of the accuracy with which an intrinsic colour of a bright giant or supergiant can be estimated from a MK class indicate a standard deviation of $\pm 0^{m}.1$ in $(B-V)_0$. The results given here agree reasonably well with those of other authors (Feinstein, 1959; Kraft and Hiltner, 1961; Johnson, 1964; Schmidt-Kaler, 1961), but most closely with those of Kraft and Hiltner.

The Intrinsic Colours and Reddening Lines of O and B Stars

The intrinsic colours of O and B stars are generally obtained from cluster members whose reddening is known from the reddening of fainter members of the cluster (Johnson, 1963). They may also be

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Table 2. *Adopted* $(U-B)_0$ *colours*

	V	IV-V	IV	III-IV	III	II-III	II	Ib	Iab	Ia
O5	−1.19									
O6	−1.18									
O7	−1.17									
O7.5	−1.16									
O8	−1.14									
O9	−1.13	−1.13	−1.13	−1.13	−1.13	−1.13	−1.13	−1.14	−1.14	−1.14
O9.5	−1.10	−1.10	−1.10	−1.10	−1.09	−1.11	−1.12	−1.08	−1.08	−1.07
B0	−1.08	−1.08	−1.08	−1.08	−1.08	−1.06	−1.06	−1.05	−1.05	−1.01
B0.5	−1.00	−1.02	−1.04	−1.04	−1.05	−1.08	−1.07	−1.03	−1.04	−1.01
B1	−0.95	−0.96	−0.97	−0.97	−0.96		−0.99	−0.99	−1.00	−1.01
B1.5	−0.88	−0.91	−0.93	−0.94	−0.94		−0.95	−0.94	−0.96	−1.00
B2	−0.81	−0.84	−0.86		−0.93		−0.91	−0.89	−0.93	−1.00
B2.5	−0.72	−0.74	−0.75		−0.85					
B3	−0.68	−0.68	−0.69		−0.73	−0.75	−0.80	−0.81	−0.82	−0.83
B4	−0.63	−0.64	−0.64		−0.59					−0.78
B5	−0.58	−0.55	−0.55		−0.50		−0.67	−0.69	−0.70	−0.70
B6	−0.49	−0.47	−0.47	−0.46	−0.46			−0.65	−0.69	−0.69
B7	−0.43	−0.45	−0.45	−0.44	−0.44				−0.69	−0.69
B8	−0.36	−0.40	−0.41	−0.41	−0.41		−0.46	−0.48	−0.53	−0.64
B9	−0.18	−0.19	−0.19	−0.18	−0.17	−0.46	−0.36	−0.41	−0.48	−0.60
B9.5	−0.10	−0.11	−0.11	−0.10	−0.10					
A0	−0.02	−0.03	−0.04	−0.06	−0.07		−0.25	−0.28	−0.44	−0.56
A1	0.01	0.00	−0.01	−0.01	0.00			−0.24	−0.30	−0.40
A2	0.05	0.06	0.06	0.07	0.07			−0.21	−0.26	−0.33
A3	0.08	0.07	0.07	0.09	0.11				−0.12	
A4	0.09	0.08	0.08	0.11	0.12				−0.10	
A5	0.09	0.09	0.10	0.11	0.11		0.08		−0.09	
A7	0.10	0.09	0.09	0.10	0.10				−0.09	
A8	0.09	0.08	0.08	0.08	0.09					
A9	0.08	0.07	0.07	0.07	0.08		0.12			
F0	0.03	0.06	0.06	0.06	0.07			0.06	0.06	0.06
F1	0.00	0.03	0.05	0.05	0.08			0.09	0.09	0.09
F2	0.00	0.00	0.04	0.05	0.09			0.12	0.12	0.12
F3	−0.01	0.00	0.03	0.07	0.10					
F4	−0.01	0.00	0.02		0.10					
F5	−0.02	0.00	0.02		0.10		0.08	0.24	0.24	0.24
F6	−0.01	0.00	0.02		0.09					
F7	0.00	0.01	0.02		0.07					
F8	0.02	0.04	0.04		0.03			0.40	0.40	0.40
F9	0.04	0.07	0.08							
G0	0.06	0.13	0.13		0.13		0.28	0.50	0.50	0.50
G1	0.08	0.13	0.13					0.55	0.55	0.55
G2	0.09	0.13	0.14		0.41		0.60			
G3	0.12	0.14	0.16		0.54					
G4	0.17	0.17	0.19		0.58					
G5	0.20	0.20	0.21	0.46	0.62	0.61	0.60	0.81	0.81	0.81
G6	0.27	0.29			0.65	0.65	0.66	0.88	0.88	0.88
G7	0.29	0.37			0.67	0.68	0.73	0.98	0.98	0.98
G8	0.30	0.47	0.47	0.55	0.68	0.70	0.80	1.05	1.05	1.05
G9	0.33	0.50	0.62		0.76		0.86	1.08	1.08	1.08

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Table 2 (continued)

	V	IV-V	IV	III-IV	III	II-III	II	Ib	Iab	Ia
K0	0.44	0.54	0.65	0.84	0.84	0.91	0.92	1.12	1.12	1.12
K1	0.48	0.93	0.95	1.00	1.00	1.03	1.00	1.15	1.15	1.15
K2	0.67				1.14	1.20	1.35	1.21	1.21	1.21
K3	0.73				1.33	1.42	1.62	1.54	1.54	1.54
K4	1.00				1.69	1.80	1.66	1.68	1.68	1.68
K5	1.06				1.83	1.90	1.71	1.86	1.86	1.86
K7	1.21									
K9	1.23									
M0	1.23				1.92	1.93	1.94	1.94	1.94	1.94
M0.5	1.24									
M1	1.18				1.92	1.92	1.96	1.94	1.94	1.94
M2	1.15				1.92	1.95	1.97	1.96	1.96	1.96
M3	1.17				1.90		1.77	1.98	1.98	1.98
M3.5	1.10									
M4	1.07				1.75			2.12	2.12	2.12
M4.5	1.06									
M5	1.23				1.69					
M6	1.28				1.17					
M7	1.37									
M8										

obtained from blue-most envelopes in two-colour diagrams. In this study we compare colours obtained from the blue-most envelopes in two-colour diagrams with the intrinsic colours given by Johnson and find them to be in agreement, with the exception of a few of the later B sub-classes. We have therefore adopted Johnson's $(B-V)_0$ colours except for the latter classes for which corrections of $-0^{m}.01$ to $-0^{m}.02$ have been applied to Johnson's values. The resulting $(B-V)_0$ colours, which are given in Table 1, are used in the following part of this study.

As mentioned earlier, the determination of intrinsic colours from clusters or blue-most envelopes ignores the majority of O and B type stars, that is, the reddened stars of the general field. For these stars we may obtain a two-colour reddening line in the UBV system, from which we may directly obtain the $(U-B)_0$ colour, using the $(B-V)_0$ established above. If we assume that, for a given MK class, the intrinsic $(B-V)_0$ is error-free, we may write

$$E_u = \delta_u + \alpha E_y + \beta E_y^2 \qquad (1)$$

where δ_u, α, and β are parameters to be evaluated; E_u and E_y are, respectively $(U-B) - (U-B)_0$, and $(B-V) - (B-V)_0$. Here α and β are the *slope* and *curvature*, respectively, of the two colour reddening relation; δ_u is a *correction* to the $(U-B)_0$ adopted. Even if the assumption of an error-free $(B-V)_0$ is not strictly true, the solution of Eq. (1) by least squares will yield parameters which do not differ much from the more exact values because β is generally small (Serkowski, 1963).

To obtain a crude idea of the dependence of the parameters on direction in the galaxy and on MK class the 2520 stars available in the spectral range O to A5 were divided into 198 divisions, chosen so as to be most likely to reveal differences in δ_u, α, and β. For each of six galactic zones in longitude ranges 0°–72°, 72°–90°, 90°–170°, 170°–270°, 270–320°, and 320°–360°, the MK classes were divided into the spectral ranges of, O5–O7, O8, O9–O9.5, B0–B0.5, B1–B1.5, B2, B3–B4, B5–B6, B7–B8, B9–B9.5, A0–A1, and A2–A5. Each of the spectral ranges between O9 and A5 was subdivided into three ranges of luminosity class: Ia–II, III–IV, and V.

For each of these 198 divisions the two-colour reddening line parameters were found by the method of least squares. Weights were assigned to the observed values of E_u and E_y of 0.8 and 1.2 respectively. Although a small variation in α with galactic longitude was observed (similar to that found by Wampler, 1961) the parameters of the reddening line were significantly different from each other only in the Cygnus zone. Consequently the sky was redivided

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