Photo-electric colours of B- and A-type stars in a number of Selected Areas

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COMMUNICATION FROM THE OBSERVATORY AT LEIDEN

PHOTO-ELECTRIC COLOURS OF B- AND A-TYPE STARS IN A NUMBER OF SELECTED AREAS

BY TH. WALRAVEN AND A. D. FOKKER

Results are given of a programme of photo-electric colours of 462 stars in 54 Selected Areas, and of a number of relatively bright stars at high galactic latitudes. The observations were made with the 45-inch reflecting telescope of the observatory at St Michel, Haute Provence, France. The observations were made at the approximate effective wavelengths 369 mμ (v), 390 mμ (b), 526 mμ (y) and 552 mμ (dy). The internal mean error of a single measurement of colour is about $\pm$ $^{m}.030$, that of a single magnitude about $\pm$ $^{m}.035$. Normal colours were determined from the observations of a number of relatively bright stars in galactic latitudes exceeding 45°. Colour excesses E_1 (of $b-v$) and E_2 (of $y-b$) are given in Table 4. A close correlation exists between the (yellow − blue) colour excesses and the (dark yellow − blue) ones; the colour excesses E_1 however present a bad correlation with E_2, presumably as a consequence of differences in the value of the Balmer discontinuity between stars of the same spectral type. A number of B-type stars at galactic latitudes exceeding 14° appear to have uncommonly large colour indices. No correlation is found between the colour excesses of stars in the same Selected Area and their distance moduli (corrected for interstellar absorption). This is probably the consequence of a selection effect caused by the irregular distribution of the absorbing material.

The observations and their reduction.

The observations contained in the present article have been made by the first author with the assistance of Mrs WALRAVEN at the Observatory at St Michel, Haute Provence, France. They have been secured during the summer of 1949 and the winter season 1949/1950. The programme consisted of photo-electric measures in four colours of B- and A-type stars in a number of Selected Areas, with the main purpose of obtaining colour excesses. The four colours are indicated here by v (violet), b (blue), y (yellow) and dy (dark yellow). Publication of the results of these measures has suffered some delay as a consequence of WALRAVEN's departure from Leiden to South Africa; the reductions have been completed and prepared for publication by the second author. The first author wants to make use of the opportunity to express in this place his deep gratitude towards the Director of the Observatory of the Haute Provence and to other French colleagues for their hospitability and the friendliness he has experienced.

The observations were made with the 45-inch St Michel telescope. Use was made of an RCA photomultiplier of type 931A. The voltage of 90 volts per stage was supplied from hearing-gear batteries. During the summer season cooling with dry ice was regularly applied. This proved to be unneccessary during the winter months. The photo-electric current, after having been amplified by a direct-current amplifier, has been recorded by means of a Brown recorder. The amplification could be changed step-wise by inserting different input-resistances, the values of which could be chosen from 2, 5, 10, 20 and 50 MΩ. The 20 MΩ resistance has most frequently been used.

As a fixed point of reference for all measures use has been made of a constant light-source consisting of a small spot of radio-active paint. In the course of a night its intensity was regularly recorded. The readings of the recorded deflections were multiplied by a factor such that the deflection due to the light-source, without filter and for an input-resistance of 20 MΩ, became equal to a constant value a defined by log a = 1.544. All intensities are thus expressed in the intensity of the light-source.

The correction for atmospheric extinction has been applied in such a manner as to reduce the measures to polar height (zenith-distance z defined by sec z = 1.44). The correction consisted of two parts. The first part, taking account of the mean extinction, amounted to $(1.44 - \sec z) \times \bar{k}$, where k represents the extinction coefficient. For a number of nights the extinction coefficient has been determined from measures of a star at different zenith-distances. The mean value of these determinations has been adopted as mean extinction coefficient. During the summer season the following values have been applied:

v	b	y	dy
$^{m}.750$	$^{m}.578$	$^{m}.255$	$^{m}.238$

Those valid for the winter period are:

v	b	y	dy
.572	.420	.195	.178

The second part of the extinction correction corrects for the difference between the real extinction of a night

and the mean extinction. With the purpose of determining this correction, during most nights one or two "polar stars" of Selected Area 1, viz. BD +89°6 and BD +89°38 were measured one or more times. Differences of the magnitudes (corrected for mean extinction) from their mean values for the season were determined separately in the four colours. From these values the quantity $\Delta k = k - \bar{k}$, valid for one night, was determined as: $\frac{\text{observed magnitude–mean magnitude}}{1.44}$.
The correction $-\Delta k \sec z$ was thereupon applied to the other stars measured in the same night. Because the extinction often showed a variation in the course of one night, interpolation has been made between the values of Δk derived from the different observations of polar stars made in that night. For 11 nights observations of polar stars are lacking. For these nights the value of Δk has been determined by making use of those stars that have been measured also in one or more other nights together with polar stars.

The mean extinction in the winter period having been somewhat different from the summer value, systematic corrections have to be applied to the winter observations in order to reduce them to summer atmospheric conditions. This correction was determined with the aid of the polar stars as the difference between the mean value of their magnitudes in the summer and winter observational periods. This correction has the following values: v: $-^{\rm m}.335$; b: $-^{\rm m}.320$; y: $-^{\rm m}.123$; dy: $-^{\rm m}.095$. As a consequence of the difference in atmospheric extinction one would have expected a totally different set of these values, each value being equal to $[-\bar{k}(\text{winter}) + \bar{k}(\text{summer})] \times 1.44$. Consequently the following corrections should have been obtained: v: $+^{\rm m}.257$; b: $+^{\rm m}.228$; y: $+^{\rm m}.087$; dy: $+^{\rm m}.087$. The differences between these last values and the former must apparently be ascribed to a selective change of reflectivity of the mirror. During the half-year interval elapsed between the summer and winter observational periods the mirror apparently has lost a great deal of its reflectivity for blue and violet light. The mirror having been aluminized not long before the observations were started, a change of selective reflectivity had to be expected; however, that the amount of this change has been as great as indicated by the observations, is rather disappointing.

During the winter season the intensity of the light-source has gradually decreased. As a consequence of the method of reduction adopted an extra correction therefore had to be applied to the intensities. This correction was determined in such a manner that the magnitudes derived for the polar stars (still uncorrected for variation in extinction) did not show any systematic change in the course of the winter observational period.

Apart from these instrumental complications, the foregoing discussion clearly shows that the ever changing atmospheric conditions also form a serious handicap for photo-electric observations of this type, where the measures of stars all over the sky must be intercompared.

The internal accuracy of the colour determinations and the magnitudes has been determined from stars that have been measured on more than one night. The mean errors of one single observation are as follows (n = number of differences used in the determination):

	colour-index	m.e. (m)	n		m.e. (m)	n
summer:	C $(b-v)$	±.025	168	winter:	±.022	38
	C' $(y-b)$	±.033	243		±.020	43
	C'' $(dy-b)$	±.037	168		±.022	38
	m (y)	±.038	243		±.030	43

The effective wave-lengths.

The measures have been made in four different spectral regions by means of the filters Corning 9863 (v), Schott BG2, 1 mm (b), Corning 3385 (y) and Corning 3486 (dy). The effective wavelengths were determined with the aid of colour curves, account being taken of the sensitivity of the multiplier [1]) (as given by the RCA-pamphlet), the transmission coefficients of the colour-filters (taken from Corning's catalogue), the atmospheric selective extinction and the selective reflection coefficient of the mirror. As no data for the selective reflectivity of the St Michel mirror were available, a

[1]) It was well realized, of course, that the sensitivities of individual multipliers differ widely.

FIGURE 1

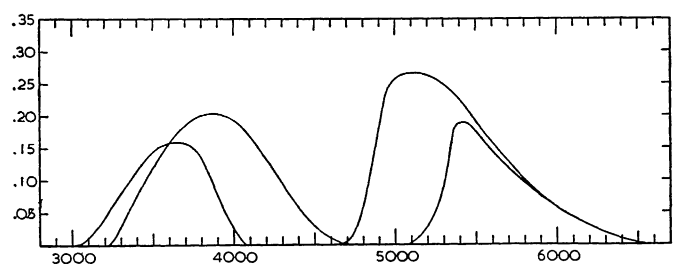
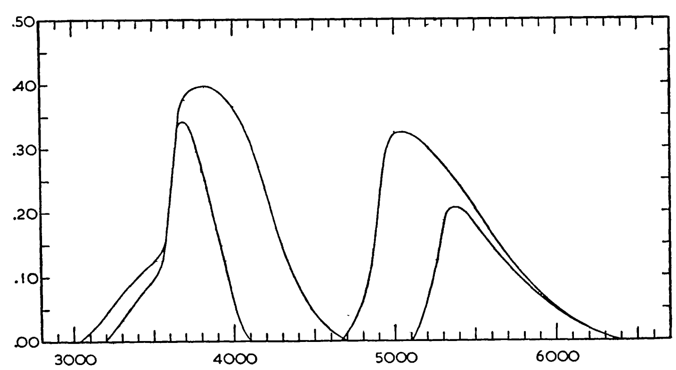


FIGURE 2



generally current value for this quantity has been adopted. In Figure 1 the resulting colour sensitivity is represented. Figure 2 shows the colour curves which are obtained by multiplication by the radiation curve of a black body with a temperature of 10 000°, with a Balmer discontinuity $\log I(3650+) - \log I(3650-)$ equal to .40 and with an intensity at λ 5600 equal to unity. The equivalent wavelengths derived from Figure 1 are:

λ 3600, λ 3870, λ 5300 and λ 5590 A.U.

The effective wavelengths, corresponding to Figure 2, are

λ 3690, λ 3900, λ 5260 and λ 5520 A.U.

From the integrated surfaces of the curves in Figure 2 theoretical colour indices may be computed. The following values have been obtained (the mean observed colour index of a number of bright A0 stars at high galactic latitude is given for comparison):

	C	C'	C''	C''' $(dy-y)$
	m	m	m	m
computed:	+.73	−.09	−.94	−.85
observed:	+.65	−.04	−.97	−.93

The agreement between the computed and the observed values is rather satisfactory, taking into consideration the following sources of uncertainty: 1. the colour sensitivities of the multiplier used and the transmission coefficients of the colour filters may differ from the values given in the catalogues; 2. the violet and blue effective wavelengths are situated in a spectral region where the energy curve of the star light deviates considerably from black-body radiation; 3. as regards the reflectivity of the mirror on the violet side of the spectrum, considerable uncertainty exists.

Considering the selective interstellar absorption to be proportional to $1/\lambda^{.56}$ [1]) one may derive from the effective wavelengths, determined above from Figure 2, a theoretical value for the proportion between the $(dy-b)$ and the $(y-b)$ colour excesses (to be denoted by E'' and E'). A value $E''/E' = 1.141$ is obtained in this manner. The observations yield for this quantity a value equal to $1.204 \pm .013$ (m.e.). The difference between the computed and the observed proportion would be removed by adopting effective wavelengths 4000, 5230 and 5560 A for instance. Especially the determination of the blue effective wavelength must be considered to be rather uncertain; so there is no reason to be surprised at the difference found.

Determination of the normal colours.

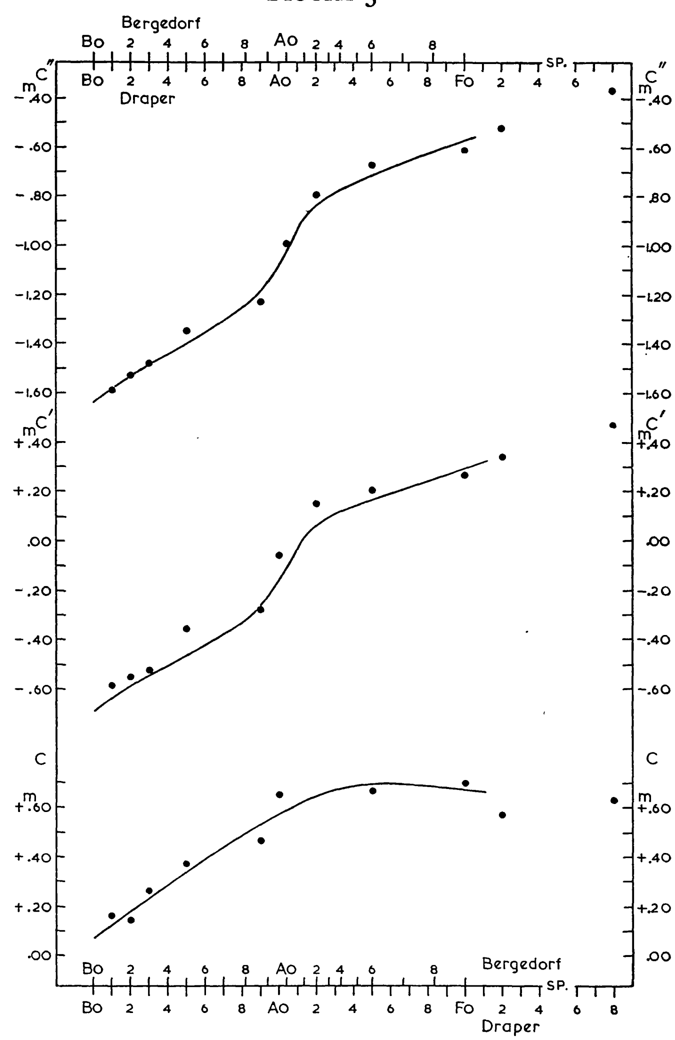
Normal colours have been derived from 43 stars brighter than $m_{pg} = 9$ and with galactic latitudes exceeding 40°. Their distribution over the spectral types and the dispersion around the mean value of their colour indices are given in Table 1. The greatest

1) Cf. *Aph. J.* **104**, p. 403 (GREENSTEIN), 1946.

TABLE 1

Sp (HD)	n	dispersion $y-b$	$dy-b$	$b-v$
B1	1			
B2	1	m	m	m
B3	2	±.066	±.090	±.107
B5	6	.081	.071	.069
B9	7	.103	.082	.073
A0	5	.063	.130	.148
A2	3	.012	.040	.053
A5	6	.036	.054	.043
F0	6	.043	.062	.085
F2	3	.029	.020	.017
F8	3	.031	.021	.028

FIGURE 3



Intrinsic colours

Dots represent means for stars of the same spectral class. The normal colours adopted are represented by the curves.

dispersion is found for the A0-type stars. The large deviations from the mean value are presumably due to the rapid change of colour index with spectral type in this region of the spectral division; as a consequence slight errors in spectral classification will change the colour appreciably. Mean colour indices for the spectral types concerned have been plotted as dots in Figure 3. In the same figure the curves connect the values that have been adopted as normal colours for the derivation of the colour excesses. Of course some arbitrariness exists in the way these curves have been drawn. Especially uncertain is the question what steepness should be given to the part of the curve between spectral types B9 and A2. Besides, it might be that one or both curves should have been displaced over a certain distance in vertical direction. In view of the possibility that the stars used in the determination of the normal colours still exhibit some amount of colour excess, the curves drawn have been kept preferentially below the observed mean values. The normal colours used in deriving the colour excesses are given by Table 2. They have been read from the

TABLE 2

Normal colours adopted

Sp (Berg. syst.)	$b-v$	$y-b$	$dy-b$
B0	+.07	−.70	−1.64
B1	+.12	−.64	−1.58
B2	+.18	−.59	−1.53
B3	+.23	−.54	−1.48
B4	+.28	−.50	−1.44
B5	+.33	−.46	−1.40
B6	+.38	−.42	−1.35
B7	+.44	−.38	−1.31
B8	+.50	−.32	−1.25
B9	+.55	−.23	−1.15
A0	+.59	−.11	−1.02
A1	+.62	.00	− .90
A2	+.65	+.06	− .83
A3	+.67	+.09	− .80
A4	+.68	+.12	− .77
A5	+.69	+.14	− .74
A6	+.70	+.17	− .71
A7	+.69	+.21	− .66
A8	+.68	+.25	− .62
A9	+.67	+.29	− .57

curves of Figure 3 for those abcissae that mark the Bergedorf spectral division. The positions of the Bergedorf spectral types with respect to the Harvard spectral division have been borrowed from the Introduction to the *Bergedorfer Spektral Durchmusterung*, Table 2, page 11; they have been plotted however by means of interpolation.

FIGURE 4

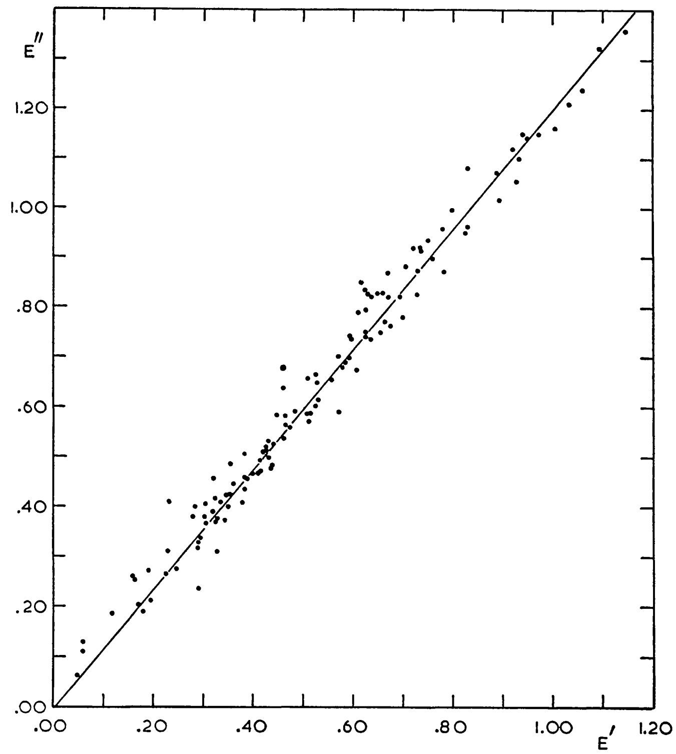
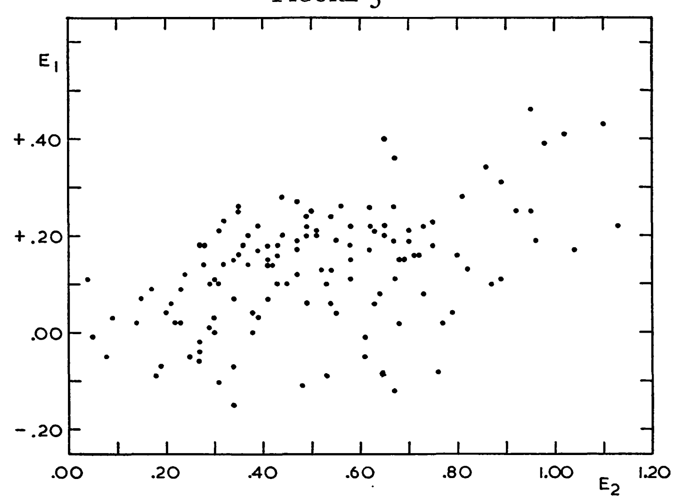


FIGURE 5



The colour excesses.

In Figure 4 the colour excesses E' $(y-b)$ and E'' $(dy-b)$ have been plotted against each other for areas with galactic latitude between $-10°$ and $+10°$. A solution from the whole material gave for the relation between E' and E'':

$$(E''-.427) = 1.204\,(E'-.359).$$
$$\pm .013 \text{ (m.e.)}$$

This line is also represented in Figure 4. From the fact that it passes very nearly through the origin, it appears that the relative position of the normal-colour curves in Figure 4 is hardly affected in a systematic way by any fault that might have arisen from the somewhat arbitrary way they have been constructed. From the scatter of the points around the central line a mean error of one colour excess equal to $\pm^{m}.043$ can be derived. This error is somewhat larger than the mean error of a single colour measurement. The difference may probably be ascribed to small accidental errors in the relative positions of the normal colours adopted.

The colour excesses E_1 $(v-b)$ and E_2 (a combination of E' and E'', which is explained in the next section) have been plotted in Figure 5. It is remarkable that the correlation in this case is considerably less close than the correlation between E' and E''. Undoubtedly, this is caused by differences in the Balmer discontinuity between stars of the same spectral type. Because for stars of spectral types B and A the value of the Balmer discontinuity is undoubtedly connected with the absolute magnitude [1]), it has been tried to find indications of an absolute-magnitude effect in the bright stars of the present material by making use of their proper motions. No conclusive evidence however as to the presence of this effect could be drawn, probably as a consequence of the limited material.

Hardly any correlation appears to exist between the colour excesses and the distances — determined as log distance = 1/5 (distance modulus + 5) — for stars of the same Selected Area. In Figure 6 some typical examples are given of diagrams where colour excesses and distances are plotted against each other. The great scatter is partly due, of course, to errors in the absolute magnitudes adopted and in the correction for interstellar absorption, which has been taken equal to $a = 3E$. Another reason why a large scatter is to be expected lies in the fact that the interstellar absorbing material may well be distributed very irregularly, even in the limited region of the sky that is covered by a Selected Area. This is made probable by the following argument. If the absorbing material were distributed homogeneously, one should expect the colour excesses to increase with distance. This not being confirmed by the observations, the conclusion may be made that, by an effect of selection, the most distant of the observed stars do not show the greatest colour excesses, because they evidently are situated in relatively transparent regions. In fact, these stars could not have been observed at all if they had been hidden behind large obscuring clouds. The lack of correlation between colour excess and distance is therefore an indication of a very irregular distribution of the interstellar material.

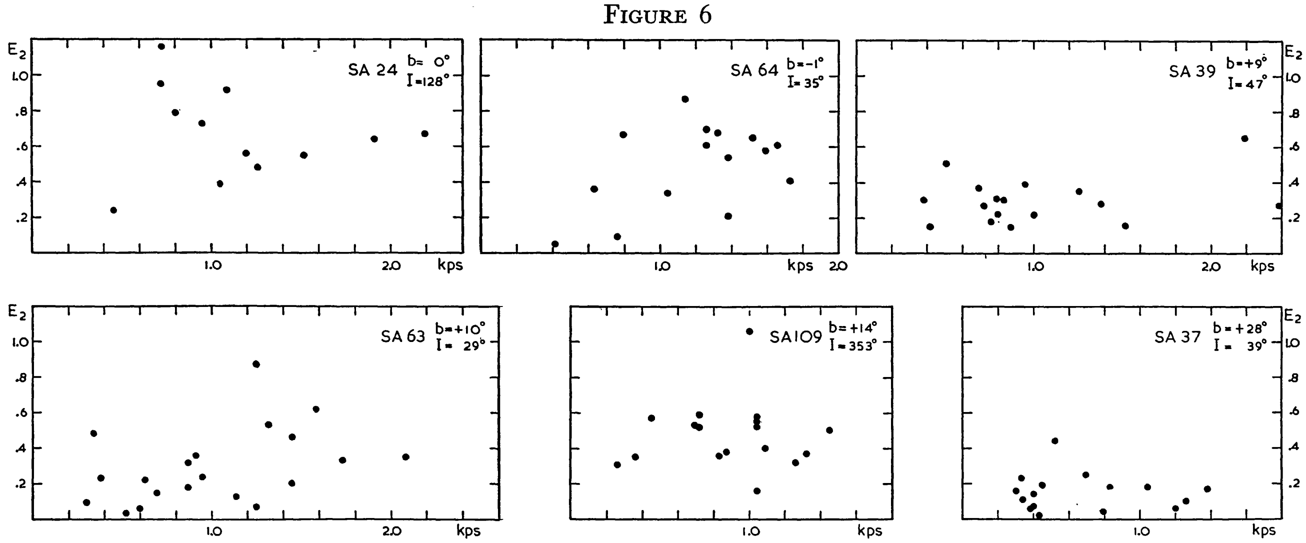
In view of these facts it is very difficult to characterise the amount of absorption in a certain Selected Area. Nevertheless some data concerning the mean colour excesses have been collected in Table 7, where the Selected Areas have been entered in the order of increasing galactic latitudes. The stars of each Selected Area have been divided according to their distances in three groups; for each group the mean colour excess has been given if at least four stars were available. Up to 1200 ps one may perhaps consider the figures given as a fairly representative measure of the amount of absorption. For greater distances however the selection effect mentioned above probably seriously affects the results, yielding values for the mean colour excess that are too small; this will be especially the case for areas at low galactic latitude.

Explanation to the main lists of measures.

In Table 4 the stars have been grouped according to

[1]) BARBIER and CHALONGE, *Annales d'Astrophysique*, tome **2**, p. 254, 1939.

FIGURE 6



the Selected Area to which they belong; they are indicated as follows:
for the Selected Areas 1—96: by their numbers in the *Bergedorfer Spektral-Durchmusterung*;
for the Selected Areas 97—112: by their co-ordinates (equinox 1900); for the Selected Areas 132—135: by their numbers in the *Potsdam Spektral-Durchmusterung* (*Publ. Potsdam* Bd 28). In Table 5, containing the bright stars used for the determination of normal colours, the stars are indicated by means of their HD numbers. An asterisk refers to a note at the end of the table.

The second column of both tables gives the photo-electric yellow magnitudes. The zeropoint of the magnitude scale has been fixed with the aid of stars of Area 1. These stars were partly compared with data concerning stars of the Polar Sequence collected in the Draft Report of the sub-Commission on sequences of magnitudes for the I.A.U. congress 1952 by REDMAN, partly with the magnitudes given by SEARES, ROSS and JOYNER in "Magnitudes and Colors of stars north of +80°". The zeropoint has been chosen in such a way as to make the mean photo-electric magnitudes of this investigation agree with the visual ones given by the authors mentioned. The stars concerned are enumerated in Table 3.

TABLE 3

Stars used for the determination of the zeropoint of the magnitudes

Berg. Nr Area 1	Polar Sequence	BD	obs.	Draft Rep.	SEARES	difference
			m	m		m
466	10		9.02	9.05		−.03
503	12		9.80	9.79		+.01
714	13		10.32	10.32		.00
435		+89°6	10.34		10.31	+.03
441		+89°7	9.99		9.99	.00
651		+89°38	9.75		9.75	.00
706		+89°33	10.38		10.42	−.04

In a few cases the magnitudes must be considered as somewhat uncertain because the sky at the moment of observation was very hazy, while no observations of polar stars had been made shortly before or after that. These magnitudes have been indicated by an asterisk. The corresponding colours on the other hand can still be considered as fairly reliable.

The third column contains the spectral type as given by the *Bergedorfer Spektral-Durchmusterung*.

The fourth, fifth and sixth columns give respectively the colour indices: blue—violet (C_1), yellow—blue (C_2) and dark yellow—blue (C_3).

The seventh column contains the colour excesses E_1 of C_1.

The eighth column contains a mean value of the colour excesses of C_2 and C_3. The excess E'' of C_3 has been reduced to a corresponding excess (E') of C_2 by multiplication by .83. The resulting value was thereupon combined with E' into a mean value E_2. As relative weights the expressions $2\alpha - 1$ and $\frac{2}{\alpha} - 1$ for E' and (E') respectively were used, where α is the scale ratio between E' and E''. For $\alpha = .83$ these weights are .32 and .68.

The eighth column contains the distance modulus, computed according to the formula $m_0 - M = m - 3E - M$, where m and $E = E_2$ have been taken as they stand in Tables 4 and 5. The values of M have been taken from Table 4 of STEBBINS, HUFFER and WHITFORD's article on the colours of 1332 B-stars [1]) as concerns the stars earlier than A0. The series of the values given by these authors has been extended to later types by making use of luminosity curve V given by MORGAN in the Introduction of his *Atlas of Stellar Spectra*. The adopted absolute magnitudes have the following values:

B0	−3.9	B5	−1.6	A0	− .1	A5	+1.6
B1	−3.6	B6	−1.4	A1	+ .4	A6	+1.8
B2	−3.0	B7	−1.1	A2	+ .8	A7	+2.0
B3	−2.2	B8	− .8	A3	+1.1	A8	+2.15
B4	−1.9	B9	− .4	A4	+1.4	A9	+2.3

The ninth column contains the number of different nights the star has been observed. In Table 5 this column has been omitted, all stars of this table having been measured on one night only. No photo-electric magnitudes have been given for the brightest stars of Table 5, for the measurement of which a diaphragm has been in use that reduced the intensity by a factor that is not exactly known. Instead, the magnitude from the *Henry Draper Catalogue* is given between parentheses.

In Table 6 measures of a number of stars with abnormal colour excesses are given. Seven of these stars have remarkably small colour excesses. These are situated in areas at relatively low galactic latitude. Except one of them, which is of spectral type B5p, all are of spectral types A0 or later. Ten stars, situated outside the immediate neighbourhood of the Milky Way, show exceptionally large colour excesses. Except one of these stars, which is an A0-type star, they are all of spectral type B8 or earlier.

For the explanation of these abnormal colour excesses one may of course consider errors of the spectral classification as a possible cause. Especially as concerns the B-type stars this may be the case. As for example HUMASON [2]) has pointed out, it is often difficult to distinguish between faint B- and early F-type stars. For both these spectral classes the intensities of

[1]) *Mt Wilson Contr.* No. 621; *Aph. J.* **91**, p. 20, 1940.
[2]) *Mt Wilson Contr.* No. 560; *Aph. J.* **85**, p. 14, 1937.

TABLE 4

		m	Sp	C_1	C_2	C_3	E_1	E_2	$m_o - M$	n
				m	m	m				
1 $l = 91°$ $b = +28°$	435	10.34	A8	.77	.50	− .30	+.09	+ .27	7.4	34
	441	9.99	F5	.54	.38	− .47				1
	466	9.02	A5p	.64	.23	− .62	−.05	+ .10	7.1	2
	503	9.80	A3	.71	.34	− .46	+.04	+ .27	7.9	1
	651	9.75	A0	.76	.23	− .63	+.17	+ .32	8.9	41
	706	10.38	A9		.30	− .51		+ .03	8.0	1
	714	10.32	A3	.74	.33	− .49	+.07	+ .25	8.5	9
8 $l = 92°$ $b = -3°$	508	12.89	B6	.74	.19	− .50	+.36	+ .67	12.3	1
	519	12.09	A0	.78	.51	− .19	+.19	+ .67	10.2	1
	521	10.04	B7	.44	.00	− .85	.00	+ .38	10.0	4
	533*	11.27	Ob	.21	.01	− .83				3
	544	10.54	B9	.83	.20	− .62	+.28	+ .44	9.6	1
	556	12.32	B4	.49	.23	− .61	+.21	+ .70	12.1	1
	559	10.79	B5p	.39	.19	− .65	+.06	+ .63	10.5	2
	1018	10.41	B6	.45	.00	− .86	+.07	+ .41	10.6	1
	1045	12.43	A0	.75	.71	− .07	+.16	+ .80	10.1	1
	1105	11.03	B0	.41	.22	− .62	+.34	+ .86	12.4	1
	1120	11.92	B5	.63	.47	− .35	+.31	+ .89	10.8	1
	1128	10.18	B1	.31	−.06	− .93	+.19	+ .55	12.1	1
	1162	9.22	B0	.25	.05	− .79	+.18	+ .72	11.0	2
9 $l = 106°$ $b = +2°$	448	11.60	B8p	.69	.65	− .10	+.19	+ .96	9.5	1
	468	9.21	A1	.69	.33	− .49	+.07	+ .34	7.8	4
	499	12.23	A2	.88	.39	− .45	+.23	+ .32	10.5	1
	512	10.56	B8	.65	.11	− .77	+.15	+ .41	10.1	1
	535	11.13	B9	.73	.21	− .67	+.18	+ .41	10.3	1
	539	11.84	A2	.83	.35	− .49	+.18	+ .28	10.2	1
	1035	9.35	B9	.57	.01	− .87	+.02	+ .23	9.1	1
	1042	11.11	B9	.77	.28	− .56	+.22	+ .49	10.0	1
	1043	12.14	A2	.91	.44	− .42	+.26	+ .35	10.3	1
	1044	11.99	A1	.79	.47	− .33	+.17	+ .47	10.2	1
	1102	11.55	B9	.73	.35	− .46	+.18	+ .58	10.2	1
	1115	12.13	A2	.79	.48	− .32	+.14	+ .42	10.1	1
	1124	12.30	A5	.90	.44	− .36	+.21	+ .31	9.8	1
	1137	12.51	A0	.84	.24	− .59	+.25	+ .35	11.6	1
	1161	10.54	B2	.41	.57	− .17	+.23	+1.14	10.1	1
	1174	11.28	B9	.74	.24	− .59	+.19	+ .47	10.3	1
10 $l = 118°$ $b = +13°$	263	10.80	A3	.79	.36	− .54	+.12	+ .23	9.0	1
	293	11.83	A0	1.09	.77	− .11	+.50	+ .80	9.5	1
	313	11.46	A4	.74	.57	− .24	+.06	+ .44	8.7	1
	547	10.88	A2	1.01	.74	− .14	+.36	+ .61	8.2	1
	555	12.64	A8	.92	.76	− .10	+.24	+ .46	9.1	1
	564	10.68	A1	.93	.51	− .36	+.31	+ .47	8.9	1
	633	9.13	A0	.82	.33	− .55	+.23	+ .40	8.0	1
	651	10.02	A1	.77	.25	− .65	+.15	+ .23	8.9	1
14 $l = 80°$ $b = +57°$	102	12.23	A8		.35			+ .10	9.8	1
	218	10.85	A9		.29			.00	8.5	1
	234	10.80	A8p		.34			+ .09	8.4	1
	241	11.91	A8p		.25			.00	9.8	1
	383	11.94	A0		.09			+ .20	11.4	1
	399	11.39	A8		.25			.00	9.2	1
	425	11.28	A7	.63	.21	− .61	−.06	+ .03	9.2	4
	511	11.93	A5		.07			− .07	10.5	1
	513	11.50	A0		.23			+ .34	10.6	1
	568	9.55	A9	.55	.29	− .56	−.12	+ .01	7.2	2
15 $l = 62°$ $b = +48°$	530	9.56	A8	.60	.27	− .56	−.08	+ .05	7.3	1

TABLE 4 (*continued*)

		m	Sp	C_1	C_2	C_3	E_1	E_2	m_0-M	n
17 $l=59°$ $b=+19°$	635	10.69	A5p	m .66	m .33	m −.54	−.03	+.17	8.6	1
20 $l=89°$ $b=-17°$	584	11.99	A5	.73	.25	−.62	+.04	+.10	10.1	1
	701	12.21	A5	.74	.29	−.61	+.05	+.12	10.2	1
	718	9.63	A6	.70	.26	−.61	.00	+.08	7.6	2
	1197	13.15	A5	.83	.34	−.42	+.14	+.25	10.8	1
	1216	12.66	A3	.65	.38	−.59	−.02	+.21	10.9	1
	1280	12.00	A3	.78	.21	−.66	+.11	+.12	10.5	1
	1307	11.09	B9	.76	.09	−.79	+.21	+.31	10.6	1
	1337	11.20	A1	.70	.15	−.76	+.08	+.13	10.4	1
	1469	11.42	A2	.68	.32	−.52	+.03	+.26	9.8	1
21 $l=99°$ $b=-17°$	1331	10.21	B9	.66	.01	−.87	+.11	+.24	9.9	1
22 $l=111°$ $b=-13°$	1360*	9.28	B5p	.20	−.44	−1.38	−.13	+.02	10.8	1
	2202	9.11	B9	.73	.15	−.76	+.18	+.34	8.5	1
	2225*	12.64	A0	.43	−.20	−1.13	−.16	−.09	13.0	1
	2237	12.18	A1	.78	.41	−.45	+.16	+.38	10.6	1
	2357	10.23	A2	.63	.05	−.83	−.02	−.01	9.5	2
	2397*	12.81	A8		.47			+.22	10.0	1
	2412*	12.26	A2	.69	.45	−.40	+.04	+.37	10.3	1
	2417	12.56	A0	.69	.11	−.78	+.10	+.20	12.1	1
	2471	12.18	A3	.68	.40	−.43	+.01	+.31	10.1	1
	2576	12.16	A2	.75	.38	−.47	+.10	+.31	10.4	1
	2587	11.13	B8	.67	.15	−.73	+.17	+.44	10.6	1
23 $l=120°$ $b=-7°$	565	9.52	B6	.49	.00	−.78	+.11	+.04	10.8	1
	626	11.75	B8	.77	.14	−.67	+.27	+.47	11.1	1
	657	11.58	A0	.79	.33	−.49	+.20	+.44	10.4	1
	668	11.28	A0	.83	.37	−.43	+.24	+.49	9.9	1
	702	11.71	A0	.76	.51	−.28	+.17	+.62	9.9	1
	1196	11.47	B9	.81	.39	−.40	+.26	+.62	10.0	1
	1234	9.85	B5p	.37	−.07	−.94	+.04	+.38	10.3	3
	1239	12.36	A2	.79	.34	−.43	+.14	+.32	10.6	1
	1248*	10.65	A4	.86	.55	−.25	+.18	+.43	8.0	1
	1287	11.93	A0	.71	.34	−.43	+.12	+.47	10.6	1
	1289	11.33	A0	.75	.25	−.57	+.16	+.43	10.1	1
	1341	11.61	A1	.73	.31	−.53	+.11	+.30	10.3	1
	1351	11.89	B8	.75	.19	−.66	+.25	+.50	11.2	1
	1451	10.49	B8	.44	−.03	−.92	−.06	+.27	10.5	1
24 $l=128°$ $b=0°$	505	12.11	B9	.80	.71	.00	+.25	+.95	9.3	1
	507	11.26	B8	.59	.60	−.13	+.09	+.92	10.2	1
	531	11.98	A0	.81	.62	−.14	+.22	+.73	9.9	1
	536	11.61	B7	.52	.23	−.52	+.08	+.64	11.4	1
	540	12.47	A0	.68	.41	−.33	+.09	+.55	10.9	1
	551	11.80	A1	.79	.40	−.43	+.17	+.39	10.2	1
	568	11.95	A0	.82	.47	−.35	+.23	+.56	10.4	1
	586	11.83	A0	.48	.33	−.41	−.11	+.48	10.5	1
	599	12.26	B6	.49	.28	−.57	+.11	+.67	11.7	1
	823	11.30	B8	.93	.63	−.11	+.43	+.95	9.3	1
	851	10.57	B8	.54	.46	−.29	+.04	+.79	9.0	1
	885	9.45	A1	.74	.24	−.61	+.12	+.24	8.3	2
25 $l=133°$ $b=+9°$	628	11.75	A0	.73	.21	−.63	+.14	+.32	10.9	1
	630	10.35	B8	.70	.18	−.67	+.20	+.49	9.7	1
	643	12.81	A3	.77	.37	−.48	+.10	+.29	10.8	1
	654	11.97	A3	.76	.27	−.61	+.09	+.17	10.4	1

TABLE 4 (*continued*)

		m	Sp	C_1	C_2	C_3	E_1	E_2	m_0-M	n
25 (*cont.*)				m	m	m				
	661	12.77	A2p	.74	.35	− .59	+.09	+ .23	11.3	1
	672	11.26	B8	.67	.11	− .73	+.17	+ .43	10.8	1
	681	11.41	A1	.77	.35	− .50	+.15	+ .34	10.0	1
	687	9.40	B9	.69	.14	− .70	+.14	+ .37	8.7	2
	718	10.68	B7p	.51	.05	− .81	+.07	+ .42	10.5	2
	737	11.44	B3	.33	−.08	− .94	+.10	+ .45	12.3	1
	1043	11.64	B9	.81	.44	− .33	+.26	+ .67	10.0	1
	1102	11.91	A4	.83	.71	− .07	+.15	+ .58	8.8	1
	1140	10.82	B8p	.68	.16	− .68	+.47	+ .18	10.2	1
26										
$l=138°$ $b=+18°$	186	10.53	B8	.64	−.04	− .95	+.14	+ .26	10.5	1
	272	11.00	A0	.71	.30	− .55	+.12	+ .40	9.9	1
	943	12.68	B9	.69	−.01	− .97	+.14	+ .17	12.6	1
	1008	12.27	B9	.73	.12	− .76	+.18	+ .34	11.6	1
	1092	9.49	B9	.76	.08	− .80	+.21	+ .30	9.0	4
	1130	9.61	A1	.70	.23	− .64	+.08	+ .22	8.5	2
	1260	11.46	A4	.65	.35	− .50	−.03	+ .23	9.4	1
	1775	9.82	B8	.70	.01	− .88	+.20	+ .32	9.7	1
	1776	12.66	B9	.78	.06	− .89	+.23	+ .27	12.3	1
	1957	11.96	A0	.76	.24	− .70	+.17	+ .35	11.0	1
	1976	11.68	B8p	.79	.29	− .56	+.29	+ .59	10.9	1
27										
$l=141°$ $b=+29°$	983	10.32	A0p	.66	.16	− .73	+.07	+ .25	9.7	1
	1068	9.80	A3	.66	.17	− .73	−.01	+ .07	8.5	1
28										
$l=143°$ $b=+39°$	946	10.23	A8	.70	.31	− .52	+.02	+ .08	7.8	1
30										
$l=135°$ $b=+60°$	519	10.05	A0	.68	−.07	−1.00	+.09	+ .03	10.1	3
33										
$l=57°$ $b=+67°$	110	11.26	B5	.30	−.42	−1.34	−.03	+ .05	12.7	2
	331	11.81	A2	.51	.25	− .53	−.14	+ .23	10.3	2
	342	12.19	A5		.28			+ .14	10.2	1
	449	11.21	A2		.35			+ .29	9.5	1
	559	9.88	B9	.70	.07	− .83	+.15	+ .28	9.4	6
	585	11.45	A5		.41			+ .27	9.0	1
35										
$l=39°$ $b=+49°$	21	12.45	A8		.35			+ .10	10.0	1
	160	11.07	A2		.18			+ .12	9.9	1
	456	10.76	B9	.56	−.17	−1.09	+.01	+ .05	11.0	4
	718	9.25	A2	.70	.15	− .68	+.05	+ .11	8.1	2
	802	10.49	A8		.26			+ .01	8.3	1
	951	12.59	A0		.04			+ .15	12.2	1
37										
$l=39°$ $b=+28°$	40	9.88	A0	.69	.16	− .73	+.10	+ .25	9.2	1
	41	10.41	A8		.32			+ .07	8.0	1
	60	10.93	A2		.24			+ .18	9.6	1
	96	10.19	A8	.61	.38	− .50	−.07	+ .11	7.7	1
	240	10.91	A7p		.40			+ .19	8.3	1
	263	9.69	A4	.65	.36	− .51	−.03	+ .23	7.6	1
	274	10.43	A8	.72	.29	− .61	+.04	+ .02	8.2	1
	303	12.44	A0		.28			+ .39	11.4	1
	552	11.81	A8		.29			+ .04	9.5	1
	617	9.90	A7		.37			+ .16	7.4	1
	721	10.62	A8	.67	.37	− .44	−.01	+ .14	8.0	5
	1010	12.40	A5		.24			+ .10	10.5	1
	1013	12.72	A8		.31			+ .06	10.4	1
	1036*	9.49	B9p	.71	.21	− .62	+.16	+ .44	8.6	2

TABLE 4 (*continued*)

		m	Sp	C_1	C_2	C_3	E_1	E_2	m_0-M	n
37 (*cont.*)				m	m	m				
	1096	12.00	A2		.23			+ .17	10.7	1
	1097	10.28	A8		.31			+ .06	7.9	1
	1182	11.73	A3		.27			+ .18	10.1	1
38										
$l=42°$ $b=+18°$	609	11.49	A3	.73	.22	− .69	+.06	+ .10	10.1	1
	662	12.86	A8		.50			+ .25	10.0	1
	694	12.89	A0	.76	.23	− .65	+.17	+ .32	12.0	2
	700	11.15	A6		.47			+ .30	8.5	1
	1294	11.56	A8		.35			+ .10	9.1	1
	1305	12.21	A8		.41			+ .16	9.6	1
	1314	10.98	A5		.29			+ .15	8.9	1
	1320	11.99	A0	.71	.34	− .53	+.12	+ .42	10.8	2
	1344	9.97	A8	.64	.25	− .57	−.04	+ .03	7.7	3
	1385	10.77	A5		.37			+ .23	8.5	1
	1404	10.91	A5		.31			+ .17	8.8	1
	1474	11.95	A8		.47			+ .22	9.1	1
	1484*	12.58	A5	.65	.31	− .58	−.04	+ .14	10.6	2
	1496	11.93	A3	.67	.24	− .67	.00	+ .12	10.5	2
39										
$l=47°$ $b=+9°$	1074	11.53	A5	.60	.33	− .53	−.09	+ .18	9.4	1
	1075	10.70	A8p	.75	.40	− .44	+.07	+ .15	8.1	1
	1095	11.27	A3		.24			+ .15	9.7	1
	1111	9.50	B8	.70	.06	− .81	+.20	+ .37	9.2	5
	1125	13.01	A5		.30			+ .16	10.9	1
	1142	11.29	A2		.36			+ .30	9.6	1
	1167	10.90	A8	.71	.57	− .27	+.03	+ .30	7.9	1
	1172	12.69	B5	.43	.00	− .72	+.10	+ .53	12.7	2
	1186	12.05	B5	.73	.20	− .63	+.40	+ .65	11.7	2
	1190	10.33	A0	.69	.21	− .65	+.10	+ .31	9.5	1
	1192	10.87	A2		.33			+ .27	9.3	1
	1195	12.36	A2		.39			+ .28	10.7	2
	1206	11.72	A5		.36			+ .22	9.5	1
	1237	10.63	B9	.77	.18	− .68	+.22	+ .39	9.9	1
	1276	11.18	B9	.71	.11	− .73	+.16	+ .35	10.5	1
	1308	9.18	B8	.71	.21	− .65	+.21	+ .51	8.5	1
	1956	12.27	A5	.71	.37	− .47	+.02	+ .22	10.0	1
	2032	12.62	A0	.77	.17	− .70	+.18	+ .27	11.9	1
40										
$l=53°$ $b=0°$	650	11.17	B9	.77	.41	− .41	+.22	+ .62	9.7	1
	684	10.71	B5	.74	.58	− .19	+.41	+1.02	9.3	1
	1619	12.70	B8	.69	.34	− .38	+.19	+ .70	11.4	1
	1647	9.56	B3	.45	.07	− .81	+.22	+ .58	10.0	1
	1659	11.01	B3	.45	.13	− .71	+.22	+ .65	11.3	2
	1727	12.51	A5	.69	.42	− .36	.00	+ .30	10.0	1
	1737*	12.29	A0	.82	.62	− .10	+.23	+ .75	10.1	1
	1759	9.91	B3	.34	.35	− .41	+.11	+ .89	9.4	4
	1865	12.08	A2	.85	.52	− .19	+.20	+ .51	9.7	1
46										
$l=117°$ $b=-27°$	267	10.54	B9	.57	−.11	−1.01	+.02	+ .12	10.6	1
	337	11.42	A1	.73	.35	− .48	+.11	+ .35	10.0	1
	373*	12.40	A8p	.74	.51	− .34	+.06	+ .24	9.5	1
	839	10.37	A8	.65	.56	− .27	−.03	+ .29	7.3	1
	1123	11.09	A3	.73	.36	− .47	+.06	+ .27	9.2	1
47										
$l=127°$ $b=-21°$	291	11.64	A2	.92	.72	− .01	+.27	+ .67	8.8	1
	305	9.68	B9	.73	.28	− .55	+.18	+ .50	8.6	2
	306	9.26	A8	.74	.57	− .23	+.06	+ .32	6.1	2
	331	11.45	A2	.84	.55	− .26	+.19	+ .48	9.2	1
	401	12.09	B9	.40	−.17	−1.04	−.15	+ .08	12.3	1
	483	9.25	B9	.65	.23	− .59	+.10	+ .47	8.2	1

Table 4 (*continued*)

		m	Sp	C_1	C_2	C_3	E_1	E_2	m_0-M	n
47 (*cont.*)				m	m	m				
	513	11.19	A1p	.95	.73	− .03	+.33	+ .73	8.6	1
	521	12.08	A8p	.88	.82	.07	+.20	+ .57	8.2	1
	674	11.77	B9	.86	.61	− .17	+.31	+ .82	9.7	1
48 $l=136°$ $b=-12°$	591	11.91	A2	.89	.57	− .15	+.24	+ .55	9.5	1
	640	11.40	B9	.83	.41	− .36	+.28	+ .65	9.9	1
	677	11.18	B9	.80	.55	− .25	+.25	+ .76	9.3	1
	688	10.25	B8	.79	.31	− .51	+.29	+ .62	9.2	2
	705	11.73	A3	.88	.89	.09	+.21	+ .76	8.3	1
	721	10.19	B8p	.76	.25	− .60	+.26	+ .55	9.3	1
	742	11.71	A0	.95	.98	.23	+.36	+1.05	8.7	1
	743	10.92	B9p	.79	.54	− .41	+.24	+ .67	9.3	1
	758	11.38	A0	.85	.41	− .51	+.26	+ .45	10.1	1
	761	10.82	B8	.77	.23	− .63	+.27	+ .53	10.0	1
49 $l=145°$ $b=-2°$	1228	9.81	B5	.29	−.19	−1.07	−.04	+ .27	10.6	1
	1253	10.76	B5	.31	−.18	−1.07	−.02	+ .27	11.5	1
50 $l=151°$ $b=+10°$	1074	12.06	A3	.81	.20	− .65	+.14	+ .12	10.6	1
	1088	11.42	A2	.70	.42	− .39	+.05	+ .36	9.5	1
	1093	11.39	A0	.74	.21	− .70	+.15	+ .28	10.7	1
	1094	9.48	B7	.49	−.18	−1.11	+.05	+ .18	10.0	1
	1101	11.34	A5	.73	.32	− .53	+.04	+ .18	9.2	1
	1113	12.43	A8	.71	.35	− .51	+.03	+ .09	10.0	1
	1136	11.27	A0	.75	.19	− .68	+.16	+ .29	10.5	1
	1990	10.45	A0	.73	.03	− .87	+.14	+ .13	10.2	1
51 $l=156°$ $b=+22°$	659	11.17	B9	.49	−.20	−1.13	−.06	+ .02	11.5	1
	1104	11.83	A0	.78	.23	− .67	+.19	+ .30	11.0	1
	1144	9.75	B8	.61	−.09	−1.00	+.11	+ .21	9.9	1
	1176	11.27	B9	.59	−.15	−1.07	+.04	+ .07	11.5	1
57 $l=30°$ $b=+84°$	444	10.58	B6	.59	−.18	−1.08	+.21	+ .23	11.3	3
	741	10.50	A3	.67	.18	− .67	.00	+ .10	9.1	1
59 $l=13°$ $b=+59°$	656	10.19	A5	.63	.30	− .55	−.06	+ .16	8.1	1
62 $l=24°$ $b=+23°$	754	10.11	A9	.69	.25	− .61	+.02	− .04	7.9	4
	767	10.40	A5		.23			+ .09	8.5	1
	769	10.12	A9		.29			.00	7.8	1
	822	9.64	A9		.16			− .13	7.7	1
	1300	10.23	A1	.72	.25	− .56	+.10	+ .28	9.0	2
	1347	10.64	A6	.66	.35	− .45	−.04	+ .20	8.2	1
	1358	11.35	B7	.41	−.27	−1.16	−.03	+ .12	12.1	1
63 $l=29°$ $b=+10°$	993	12.02	B8	.65	.29	− .49	+.15	+ .62	11.0	1
	1035	12.04	A0	.64	.35	− .47	+.05	+ .46	10.8	1
	1060*	10.91	A8		.28			+ .03	8.7	1
	1090	12.33	A5	.77	.24	− .57	+.08	+ .13	10.3	1
	1129	11.39	A3		.27			+ .18	9.7	1
	1131	11.27	A5	.69	.27	− .54	.00	+ .15	9.2	1
	1188	11.22	A8		.31			+ .06	8.9	1
	1235	12.23	A5	.63	.40	− .46	−.06	+ .24	9.9	1
	1252	11.55	B5	.53	.42	− .35	+.20	+ .87	10.5	2
	1254	9.81	A8	.65	.32	− .51	−.03	+ .09	7.4	1
	1858	12.10	A0	.67	.23	− .63	+.08	+ .33	11.2	1
	1870	12.47	A3	.61	.25	− .54	−.06	+ .20	10.8	1
	1895	10.23	B9	.64	.09	− .77	+.09	+ .32	9.7	5

TABLE 4 (*continued*)

		m	Sp	C_1	C_2	C_3	E_1	E_2	m_0-M	n
63 (*cont.*)				m	m	m				
	1937	12.08	A0	.67	.41	−.37	+.08	+.53	10.6	1
	1976	12.55	A0	.69	.23	−.63	+.10	+.35	11.6	1
	1990	9.22	B9	.62	−.04	−.91	+.07	+.20	9.0	1
	1991	10.21	A5	.72	.35	−.45	+.03	+.23	7.9	1
	2002	10.13	A8	.64	.33	−.51	−.04	+.09	7.7	1
	2036	11.69	A3	.64	.33	−.52	−.03	+.23	9.9	1
	2065	11.15	A1		.07			+.07	10.5	1
	2087	10.09	B8	.70	.03	−.81	+.20	+.36	9.8	2
	2147	9.69	B9	.59	.25	−.56	+.04	+.48	8.7	1
64										
$l=35°$ $b=-1°$	1343	10.49	B3	.38	.12	−.65	+.15	+.68	10.6	1
	1412	12.07	B8	.70	.31	−.45	+.20	+.65	10.9	1
	1566	10.30	B8	.43	.00	−.83	−.07	+.34	10.1	1
	1583	11.28	A5	.72	.20	−.61	+.03	+.09	9.4	1
	1597	10.27	A7	.68	.26	−.60	−.01	+.05	8.1	4
	1607	11.52	B8	.74	.21	−.60	+.24	+.54	10.7	1
	1616*	12.60	A3	.55	.73	.02	−.12	+.67	9.5	1
	1635	11.89	A6	.88	.49	−.25	+.18	+.36	9.0	1
	1640	11.25	A0	.65	.08	−.75	+.06	+.21	10.7	1
	1679	11.22	B7	.43	.21	−.57	−.01	+.61	10.5	1
	1815	11.75*	B8	.65	.37	−.43	+.15	+.69	10.5	1
	1868	11.79	B7	.39	.21	−.57	−.05	+.61	11.1	1
	2894	12.02*	B9	.69	.15	−.65	+.14	+.41	11.2	1
	3168*	10.76	B3	.33	.29	−.40	+.10	+.87	10.3	1
	3210	11.63*	B7	.55	.19	−.61	+.11	+.58	11.0	1
65										
$l=43°$ $b=-12°$	798	9.87	A0	.65	.29	−.56	+.06	+.39	8.8	2
	824	12.70	A5	.77	.33	−.56	+.08	+.16	10.6	1
	933	11.00	A0	.84	.49	−.33	+.25	+.58	9.4	1
	942	12.90	A8	.67	.18	−.66	−.01	−.04	10.9	1
	978	9.73	B9	.74	.05	−.87	+.19	+.25	9.4	1
	984	10.18	B8	.53	−.17	−1.11	+.03	+.13	10.6	1
	1024	13.15	A	.49	.62	−.28				1
	1669	12.39	A5	.57	.50	−.35	−.12	+.33	9.8	1
	1671	9.18	B2	.19	.27	−.22	+.01	+1.01	9.1	1
	1757	12.46	A8	.55	.43	−.45	−.15	+.14	9.9	1
	1885*	12.40	A8	.62	.43	−.43	−.06	+.16	9.8	1
	1892	10.37	A0	.68	.07	−.83	+.09	+.17	10.0	1
	1896	11.58	A0	.73	.14	−.74	+.14	+.24	11.0	1
	1923*	12.33	A0	.73	.33	−.50	+.14	+.43	11.1	1
	1927	11.34	A0	.65	.03	−.90	+.06	+.11	11.1	1
66										
$l=53°$ $b=-21°$	681*	12.48	B8	.90	.00	−.84	+.40	+.33	12.3	1
	711	11.25	A8	.68	.31	−.51	.00	+.06	8.9	1
	812	11.63	A2	.65	.29	−.61	.00	+.20	10.2	1
	946	10.29	B9	.77	.12	−.79	+.22	+.32	9.7	1
	959	12.75	A3	.73	.35	−.64	+.06	+.18	11.1	1
	1366	11.52	A5	.76	.30	−.64	+.07	+.11	9.6	1
	1380	11.26	A0	.71	.02	−.87	+.12	+.13	11.0	1
	1425	12.48	A0	.79	.26	−.79	+.20	+.25	11.8	1
	1505	10.47	B7	.73	.11	−.79	+.29	+.45	10.2	3
	1509	10.45	A0	.72	.10	−.80	+.13	+.19	10.0	1
	1527	12.60	A2	.57	.08	−.61	−.08	+.13	11.4	1
	1545	11.33	B9	.65	.05	−.83	+.10	+.27	10.9	1
67										
$l=65°$ $b=-28°$	403	11.18	A0	.77	.24	−.65	+.18	+.32	10.3	1
	680	10.24	A0	.45	−.13	−1.13	−.14	−.07	10.5	1
85										
$l=4°$ $b=+27°$	591	11.21	B9	.69	.28	−.56	+.14	+.50	10.1	1
	903*	9.36	A2	.71	.33	−.54	+.06	+.25	7.8	3

TABLE 4 (*continued*)

		m	Sp	C_1	C_2	C_3	E_1	E_2	m_0-M	n
85 (*cont.*)				m	m	m				
	1001	10.76	A0p	.67	.00	− .93	+.08	+ .09	10.6	1
	1325	12.25	B9	.71	.00	− .89	+.16	+ .22	12.0	1
86 $l=10°$ $b=+13°$	745	9.71	A0	.72	.03	− .85	+.13	+ .14	9.4	5
	763	11.18	A0	.67	.21	− .60	+.08	+ .34	10.3	2
	764	11.05	A0	.69	.09	− .76	+.10	+ .21	10.5	1
	821	12.32	A8	.63	.31	− .48	−.05	+ .06	10.0	1
	855	12.43	A0	.69	−.03	− .97	+.10	+ .08	12.3	1
	857	11.79	A8	.56	.35	− .49	−.12	+ .10	9.3	1
	867	12.88	A8	.63	.31	− .48	−.05	+ .08	10.5	2
	1007	12.43	A8	.72	.41	− .34	+.04	+ .21	9.7	1
	1477	12.04	A0	.65	.25	− .58	+.06	+ .37	11.0	1
	1539	12.86	A5	.77	.25	− .63	+.08	+ .10	11.0	1
	1634	12.49	A8	.81	.79	.03	+.13	+ .54	8.7	1
87 $l=17°$ $b=0°$	432	11.99	B8	.66	.46	− .43	+.16	+ .71	10.7	1
	481	12.67	A3	.70	.45	− .31	+.03	+ .39	10.4	1
	502	12.26	A1	.68	.53	− .23	+.06	+ .54	10.2	1
	533	11.58	B7	.52	.35	− .43	+.08	+ .73	10.5	1
	550	10.43	B2	.35	.48	− .29	+.17	+1.04	10.3	2
	934	11.73	B7	.69	.55	− .21	+.25	+ .92	10.1	1
	963	11.35	B9	.76	.40	− .39	+.21	+ .63	9.9	1
	999	10.32	B8	.63	.25	− .62	+.13	+ .54	9.5	3
	1020	10.75	B7	.56	.15	− .71	+.12	+ .51	10.3	1
	1027	11.26	B9	.61	.28	− .58	+.06	+ .49	10.2	2
	1047	11.17	B8	.89	.69	− .09	+.39	+ .98	9.0	1
88 $l=24°$ $b=-12°$	1679	11.11	A1	.71	.19	− .71	+.09	+ .17	10.2	1
	1719	12.34	A2	.79	.11	− .85	+.14	+ .01	11.5	1
	1735	10.78	A8	.50	.32	− .52	−.18	+ .08	8.4	1
	1761	11.61	A1	.71	.09	− .77	+.09	+ .10	10.9	1
	1765	12.26	A8	.74	.15	− .71	+.06	− .08	10.3	1
	1850	11.93	A5	.73	.23	− .67	+.04	+ .07	10.1	1
	1901	11.50	A3	.74	.17	− .73	+.07	+ .07	10.2	1
	1944	10.61	B8	.70	.11	− .79	+.20	+ .40	10.2	4
	1949	12.03	A1	.71	.12	− .73	+.09	+ .14	11.2	1
	1992	12.10	A2	.72	.06	− .87	+.07	+ .02	11.2	1
89 $l=33°$ $b=-23°$	438	6.92	B5p	.25	−.47	−1.43	−.08	− .02	8.6	1
	514	12.05	A8	.71	.29	− .53	+.03	+ .06	9.7	1
	572	13.35	A0	.38	−.23	− .95	−.21	− .02	13.5	1
	575	10.81	A2	.73	−.31	− .53	+.08	+ .25	9.3	1
	959	12.15	A8	.64	.23	− .59	−.04	+ .01	10.0	1
	972	11.60	A8p	.64	.33	− .54	−.04	+ .07	9.2	1
	979	9.66	B8	.46	−.25	−1.16	−.04	+ .07	10.3	3
	995	9.45	A4p	.73	.17	− .70	+.05	+ .06	7.9	1
	1012	13.05	A2p	.77	.21	− .51	+.12	+ .23	11.6	1
	1057	10.92	A2	.69	.14	− .74	+.04	+ .07	9.9	1
	1084	11.03	A2p	.72	.53	− .29	+.07	+ .45	8.9	1
97 $l=174°$ $b=-11°$	$\alpha=5^h52^m$ $\delta=0°00'$									
	+11.6′ − 5.1′	10.65	A1	.87	.48	− .29	+.25	+ .50	8.7	1
	+17.7 − 5.6	12.27	A5	.92	.84	.09	+.23	+ .69	8.6	1
	+23.2 −11.1	12.13	A5	.82	.57	− .21	+.13	+ .43	9.2	1
	+31.2 −35.2	11.93	A1	.89	.57	− .25	+.27	+ .55	9.8	1
100 $l=197°$ $b=+28°$	$\alpha=8^h49^m$ $\delta=-0°10'$									
	+27.8′ −33.4′	12.41	A2	.73	.15	− .61	+.08	+ .15	11.2	1
	+38.5 −56.2	13.21	A5	.87	.17	− .80	+.18	− .02	11.7	1

Table 4 (*continued*)

			m	Sp	C_1	C_2	C_3	E_1	E_2	m_0-M	n
100 (*cont.*)	$\alpha=8^h49^m$	$\delta=-0°10'$									
	′	′			m	m	m				
	−57.6	+17.3	11.32	A1	.72	.02	−.89	+.10	+.01	10.9	1
	−24.9	+35.6	11.52	A5	.65	.27	−.57	−.04	+.13	9.5	1
	+17.8	+0.4	12.18	A2	.82	.17	−.69	+.17	+.12	11.0	1
	+48.5	+14.6	11.93	A3	.77	.25	−.64	+.10	+.14	10.4	1
	−57.6	−2.0	10.29	B8	.75	.12	−.77	+.25	+.41	9.9	1
108 $l=343°$ $b=+28°$	$\alpha=16^h32^m$	$\delta=-0°10'$									
	′	′									
	+30.8	−67.9	12.21	A2		.48			+.42	10.1	1
	+45.8	−60.6	9.55	A8		.37			+.12	7.0	1
	+10.1	−21.2	10.67	A0	.74	.14	−.73	+.15	+.24	10.0	3
	+64.3	−51.2	9.86	A0	.56	−.02	−.87	−.03	+.11	9.6	1
	+64.8	−12.3	11.08	A8		.49			+.24	8.2	1
	−48.6	+12.3	9.47	A8		.44			+.19	6.7	1
	+1.5	+24.0	10.87	A0p		.15			+.26	10.2	1
	+61.7	+35.3	10.18	A8		.35			+.10	7.7	1
	+50.3	+27.0	11.59	B8		.01			+.33	11.4	1
109 $l=353°$ $b=+14°$	$\alpha=17^h40^m$	$\delta=-0°10'$									
	′	′									
	−50.7	−49.8	11.39	A2	.73	.19	−.63	+.08	+.16	10.1	2
	−35.9	−15.3	11.78	A0	.79	.45	−.32	+.20	+.58	10.1	1
	−32.9	−24.1	11.53	A0	.72	.43	−.40	+.13	+.52	10.1	1
	−26.2	−4.3	11.44*	A2	.82	.43	−.39	+.17	+.36	9.6	2
	−15.6	−22.4	11.57*	A0	.77	.27	−.57	+.18	+.37	10.6	1
	−12.1	−21.0	12.47*	A5	.98	.51	−.27	+.29	+.38	9.7	1
	+17.9	−16.4	9.96	A0		.46			+.57	8.3	1
	+48.4	−52.7	11.33	A0	.80	.29	−.53	+.21	+.40	10.2	1
	−45.1	+24.1	11.03	A8		.60			+.35	7.8	1
	+30.0	+39.6	10.73	A0		.41			+.52	9.3	1
	+41.9	+8.8	12.12	A3		.68			+.59	9.3	1
	+42.2	+18.3	11.68	A0		.44			+.55	10.1	1
	+47.3	+37.7	11.40	A5		.45			+.31	8.9	1
	+7.8	−50.9	9.68	B7	.59	.15	−.68	+.15	+.53	9.2	3
	+16.8	−14.8	11.09	B9p		.09			+.32	10.5	1
	−35.6	+16.9	10.37*	B4	.45	.01	−.84	+.17	+.50	10.8	2
110 $l=0°$ $b=+1°$	$\alpha=18^h37^m$	$\delta=0°00'$									
	′	′									
	−40.1	−24.3	10.61	A8p	.63	.48	−.31	−.05	+.25	7.7	1
	−1.6	−2.4	10.99	A2	.81	.76	.05	+.16	+.72	8.0	2
	−.9	−18.0	11.67	A8	.53	.55	−.21	−.15	+.34	8.5	2
	+23.9	−20.3	9.21	A9	.62	.35	−.46	−.05	+.08	6.7	1
	+35.3	−12.4	9.96	A2	.67	.18	−.65	+.02	+.14	8.7	3
	−9.6	+9.7	10.11	A5	.62	.32	−.49	−.07	+.20	7.9	1
	+4.9	+34.4	9.74	A2	.69	.22	−.57	+.04	+.20	8.3	1
	+16.4	+23.9	11.86	A0	.87	.72	−.06	+.28	+.81	9.5	1
	+25.0	+26.2	11.19	A2	.75	.49	−.31	+.10	+.43	9.1	1
	+26.2	+17.0	11.74	A−F	.99	.97	.26				1
	+29.2	+04.6	12.26	A0	1.02	.98	.30	+.43	+1.10	9.1	1
111 $l=6°$ $b=-11°$	$\alpha=19^h33^m$	$\delta=+0°10'$									
	′	′									
	+23.2	−7.7	12.34	A0	.92	.50	−.27	+.33	+.62	10.6	1
	+23.2	−17.2	9.51	A0	.78	.37	−.46	+.19	+.47	8.2	1
	+8.7	+34.9	12.25	A0	.89	.51	−.32	+.30	+.59	10.6	1
	+22.3	+45.3	12.21	A0	.79	.40	−.38	+.20	+.51	10.8	1
	+27.9	+11.0	12.41	A5	.75	.47	−.29	+.06	+.36	9.7	1
	+30.0	+38.8	12.20	A0	.79	.29	−.48	+.20	+.43	11.0	1
	−12.9	−2.6	8.88	B9	.57	.03	−.88	+.02	+.24	8.6	1
	−15.3	+24.1	9.69	B8	.43	−.09	−.97	−.07	+.23	9.8	2
	+35.1	+18.1	12.21	B9	.71	.15	−.65	+.16	+.41	11.4	1

TABLE 4 (*continued*)

			m	Sp	C_1	C_2	C_3	E_1	E_2	m_0-M	n
112	$\alpha=20^h37^m$	$\delta=+0°10'$									
$l=15°$ $b=-25°$	′	′			m	m	m				
	−8.8	−22.0	8.74	A8	.66	.39	−.47	−.02	+.13	6.2	1
	+1.8	−12.6	11.51	A5	.57	.40	−.48	−.12	+.23	9.2	1
	+9.9	−5.6	12.11	A0	.73	.12	−.72	+.14	+.24	11.5	1
	+35.9	−16.7	12.74	A3	.76	.17	−.72	+.09	+.07	11.4	1
	−58.8	+35.3	9.53	A0	.69	−.03	−.95	+.10	+.07	9.4	5
	−30.6	+57.0	9.16	A0	.69	.12	−.77	+.10	+.22	8.6	1
	−17.9	+36.9	11.20	A8	.58	.28	−.55	−.10	+.05	8.9	1
	+0.6	+2.1	12.16	A5	.63	.35	−.47	−.06	+.22	9.9	1
	+11.9	+12.8	13.19	A8	.59	.38	−.43	−.09	+.15	10.6	1
	−5.1	+69.2	12.49	A8	.55	.38	−.41	−.13	+.15	9.9	1
	−54.0	+62.1	10.49	B9	.48	−.03	−.87	−.07	+.22	10.2	1
132											
$l=327°$ $b=+23°$	103		10.71	A5	.70	.47	−.33	+.01	+.34	8.1	1
	122		9.73	A3	.71	.35	−.46	+.04	+.28	7.8	1
	188		10.83	A1	.73	.43	−.39	+.11	+.43	9.1	1
	283		9.63	A4	.63	.42	−.40	−.05	+.31	7.3	3
	373		11.74	A1	.83	.23	−.61	+.21	+.24	10.6	1
133											
$l=336°$ $b=+11°$	177		9.55	A3		.34			+.25	7.7	1
	223		10.11	A8		.43			+.18	7.4	1
	251		11.37	A4		.39			+.27	9.2	1
	292		10.08	A0		.33			+.44	8.9	1
	303		9.88	A5		.50			+.36	7.2	1
	305		9.72	A2	.83	.38	−.42	+.18	+.34	7.9	2
	404		10.34	A0		.52			+.63	8.5	1
	418		9.44	A5		.26			+.12	7.5	1
134											
$l=343°$ $b=-1°$	616*		10.54*	B7	.36	.35	−.39	−.08	+.76	9.4	1
	765		10.37	B5	.35	.19	−.57	+.02	+.68	9.9	1
	851		12.10	A8	.69	.47	−.21	+.01	+.29	9.1	1
	1140		9.88	B6	.29	.09	−.69	−.09	+.53	9.7	1
	1217		9.36	B5	.35	.29	−.47	+.02	+.77	8.7	2
	1269		10.01	B2	.31	.22	−.53	+.13	+.82	10.5	1
135											
$l=350°$ $b=-13°$	452		11.35	A0	.73	.16	−.72	+.14	+.26	10.7	1
	494		11.59	A5	.77	.19	−.71	+.08	+.03	9.9	1
	554		10.69	A0	.70	.28	−.56	+.11	+.39	9.6	1
	581		10.66	A8	.67	.31	−.47	−.01	+.10	8.2	1
	600		11.67	A3	.66	.28	−.64	−.01	+.15	10.1	1
	617		10.82	A0	.51	.46	−.38	−.08	+.54	9.3	1
	628		9.46	B9	.47	−.17	−1.06	−.08	+.07	9.7	3
	629		11.20	A1	.59	−.02	−.85	−.03	+.02	10.7	1
	686		9.87	A0	.47	−.14	−1.03	−.12	−.02	10.0	1
	695		10.91	A0	.73	.26	−.57	+.14	+.39	9.8	1
	759		9.88	A0	.62	.33	−.48	+.03	+.44	8.7	1
136											
$l=357°$ $b=-27°$	298		10.09	A5	.67	.24	−.60	−.02	+.11	8.2	1

Notes to Table 4 (these notes have been taken from the Bergedorf and Potsdam Catalogues).

S.A.	No.	
8	533	double star
22	1360	double star
	2225	double star, spectrum uncertain
	2397	spectrum uncertain
	2412	double star
23	1248	double star
37	1036	spectrum variable?
38	1484	variable star?
40	1737	spectrum uncertain
46	373	composite spectrum?
63	1060	double star
64	1616	spectrum uncertain
	3168	spectrum uncertain
65	1885	spectrum uncertain
	1923	spectrum uncertain
66	681	spectrum uncertain
85	903	double star
134	616	spectrum uncertain

the hydrogen lines are about the same, whereas the H and K lines of calcium are not yet strong enough in the early F-type stars to serve as a criterion. Colour measurements can give a clue as to the real spectral type much easier at high galactic latitudes, where the observed colours deviate only little from the intrinsic colours, than at low latitudes. When considering the B-type stars as early F-type ones the colour excesses are reduced to about zero. Thus the suggested misidentification of these stars does not lead to large negative colour excesses, which would have been an argument against this explanation. Besides considering errors in the spectral classification as a possible cause for the large apparent colour excesses, one must not exclude beforehand the possibility that the intrinsic colour of some of these stars really is redder than the colour of an ordinary star of the same spectral type.

TABLE 5

HD	m	Sp	C_1	C_2	C_3	E_1	E_2	m_0-M
10547	8.35	B9	.35	−.36	−1.30	−.24	−.24	9.2
77691	7.75	F0	.63	.25	− .58	−.08	−.02	6.4
77770	7.50	B5	.20	−.50	−1.45	−.13	−.04	9.2
78792	6.73	A0	.65	−.04	− .96	+.08	+.10	6.5
80608	7.14	B9	.57	−.21	−1.17	+.04	+.01	7.5
89688	6.65	B3	.32	−.43	−1.37	+.09	+.09	8.6
97991	7.39	B3	.19	−.61	−1.60	−.04	−.09	9.8
115750	9.21	A2	.70	.13	− .77	+.05	+.05	8.0
116246	8.65	A0	.60	−.21	−1.16	+.03	−.06	8.9
116405	8.27	A0	.57	−.21	−1.17	.00	−.08	8.6
116798	7.54	A5	.63	.21	− .68	−.06	+.03	5.9
117815	7.06	A5	.67	.15	− .72	−.02	−.02	5.5
118954	7.65	A5	.70	.22	− .65	+.01	+.05	5.9
120405	7.55	A5	.71	.15	− .73	+.02	−.02	6.0
120817	7.68	A2	.68	.14	− .75	+.04	+.07	6.7
123691	6.90	F2	.54	.31	− .54		−.02	
124568	7.53	A0	.69	.09	− .81	+.12	+.22	6.7
125162	(4.26)	A0	.74	.07	− .87	+.17	+.19	
125273	7.84	A5	.68	.26	− .62	−.01	+.08	6.0
125558	7.09	A5	.61	.23	− .63	−.08	+.06	5.3
126080	9.00	A2	.67	.21	− .65	−.03	+.15	7.7
126138	7.49	B9	.35	−.36	−1.32	−.18	−.11	8.2
126660	(4.06)	F8	.61	.47	− .39			
127762	(3.00)	F0	.74	.18	− .75		+.14	
131495	6.98	F2	.56	.35	− .51		+.01	
132736	6.80	F2	.61	.35	− .51		+.02	
134225	7.78	B9	.49	−.25	−1.17	−.04	.00	8.2
138003	7.80	B9	.35	−.37	−1.33	−.18	−.12	8.6
138749	6.51	B5	.43	−.33	−1.31	+.10	+.09	7.8
147394	6.25	B5	.39	−.37	−1.35	+.06	+.06	7.7
209409	(4.66)	B5p	.44	.32	−1.29	+.11	+.10	
209582	7.79	F0	.73	.34	− .53		+.04	5.2
209697	8.46	F8	.67	.50	− .33			
209905	8.84	B9	.56	−.21	−1.20	+.03	+.02	8.2
210686	7.11	F0	.73	.20	− .70		−.10	5.0
210719	7.79	F0	.65	.33	− .54		+.03	5.3
211924	(5.35)	B5	.41	−.27	−1.23	+.08	+.16	
212571	(4.64)	B1p	.16	−.59	−1.59	+.04	+.01	
213425	7.55	F0	.71	.29	− .57		.00	5.1
213998	(4.13)	B8	.55	−.24	−1.21	+.07	+.05	
215707	8.87	F8	.61	.45	− .37			
217891	6.84	B5p	.39	−.36	−1.37	+.06	+.05	8.3
219188	(6.93)	B2	.14	−.55	−1.53	−.04	+.03	
224103	(6.12)	B9	.59	−.18	−1.15	+.04	+.02	

For the stars with large negative colour excesses a straightforward explanation seems not to be possible. Besides the possibility of errors in the spectral classification or peculiarities of the stars themselves a slight chance exists that a misidentification has occurred. This might be especially the case for the two very faint stars of Area 65. In general the chance of misidentifications during the observation is small. Misidentifications are discovered almost without exception by comparing the observed magnitudes with those given by the *Bergedorfer Spektral-Durchmusterung*. Three stars have thus been rejected as probably misidentified, because their magnitudes did not agree with those contained in the Bergedorfer catalogue. Only in cases where a star of about equal brightness is in the immediate neighbourhood of the star observed, the possibility remains that measures of a misidentified star are contained in the present list of measures.

Comparison with other observers.

Comparison with observations of others of an accuracy comparable with that of the present material has been possible for 9 stars of STEBBINS, HUFFER and WHITFORD's list of 1332 B-type stars [1]), for 6 stars that are in common with stars measured by ELVIUS [2]), for 7 stars near the pole, for which standard colour indices are available, and for 4 stars in common with STEBBINS and WHITFORD's six-colour photometry [3]). The following relations between the colour indices C of these other publications with the colours C_2 and C_3 of the present publication have been derived:

from stars in common with STEBBINS, HUFFER and WHITFORD:

$$C + .16 = .39\,(C_2 + .44) \quad (n = 9)$$
$$\pm .08 \text{ (m.e.)}$$
$$C + .16 = .35\,(C_3 + 1.42) \quad (n = 9);$$
$$\pm .08 \text{ (m.e.)}$$

from stars in common with ELVIUS:

$$C - .28 = 1.04\,(C_2 - .33)$$
$$\pm .09 \text{ (m.e.)}$$
$$C - .28 = .76\,(C_3 + .47) \quad (n = 6);$$
$$\pm .10 \text{ (m.e.)}$$

[1]) *L. c.*
[2]) *Stockholms Obs. Ann.* **16**, No. 4, 1951.
[3]) *Mount Wilson Contr.* No. 712; *Aph. J.* **102**, p. 318, 1945.

TABLE 6

Stars with abnormal colour excesses

	m	Sp	C_1	C_2	C_3	E_1	E_2	m_0-M	n
Colour excesses exceptionally small:									
21 $l=99°$ $b=-17°$									
703	8.35	A0	.35	−.36	−1.30	−.24	−.24	9.2	1
64 $l=35°$ $b=-1°$									
1583	11.28	A5	.72	.20	− .61	+.03	+.09	9.4	1
1597	10.27	A7	.68	.26	− .60	−.01	+.05	8.1	4
65 $l=43°$ $b=-12°$									
942	12.90	A8	.67	.18	− .66	−.01	−.04	10.9	1
1798	12.90	B5p	.07	−.71	−1.71	−.26	−.25	15.3	1
88 $l=24°$ $b=-12°$									
1040	12.50	A4	.43	−.24	−1.09	−.25	−.30	12.0	1
132 $l=327°$ $b=+23°$									
170	10.19	A5	.25	−.25	−1.11	−.44	−.33	9.6	1
Colour excesses exceptionally large:									
14 $l=80°$ $b=+57°$									
42	12.09	B2	.55	.31	− .48	+.37	+.88	12.5	1
20 $l=89°$ $b=-17°$									
1194	12.45	B8	.64	.39	− .41	+.14	+.70	12.1	1
35 $l=80°$ $b=+49°$									
983	12.52	A0		.27			+.38	11.5	1
51 $l=156°$ $b=+22°$									
1129	12.37	B8	.79	.30	− .51	+.29	+.63	11.3	1
1181	11.94	B7	.63	.32	− .54	+.19	+.66	11.1	1
62 $l=24°$ $b=+23°$									
649	10.61	B8	.70	.36	− .46	+.20	+.66	9.4	1
108 $l=343°$ $b=+28°$									
$16^h33^m.9+0°27'.5$	11.06	B8		.36			+.68	9.8	1
109 $l=353°$ $b=+14°$									
$17^h37^m.4+0°25'.9$	11.57	B5	.71	.60	− .18	+.38	+1.06	10.0	2
112 $l=15°$ $b=-25°$									
$20^h35^m.8+0°18'.4$	11.99	B8	.53	.29	− .55	+.03	+.59	11.0	1
$20^h37^m.2+0°21'.1$	12.64	B5	.63	.36	− .50	+.30	+.77	11.9	1

from stars in common with the North Polar Sequence or with SEARES' measures of stars in the polar cap:

$$C-.22 = .95\,(C_2-.33)$$
$$\pm .05 \text{ (m.e.)}$$
$$C-.22 = .79\,(C_3+.50) \quad (n=7).$$
$$\pm .05 \text{ (m.e.)}$$

The coefficients of these relations have to be considered as rather uncertain in view of the limited number of stars used in their determination and the small range covered by the colour indices. The root mean square deviations of the individual stars from these relations have the following values:

from the comparison with C_2:

STEBBINS c.s.	ELVIUS	Polar stars
$\pm^m.043$	$\pm^m.057$	$\pm^m.022$;

from the comparison with C_3:

STEBBINS c.s.	ELVIUS	Polar stars
$\pm^m.042$	$\pm^m.083$	$\pm^m.024$.

The figures relating to STEBBINS' and ELVIUS' observa-

TABLE 7
Mean colour excesses

S.A.	l	b	$d < 800$ ps $\bar{E}$	$\bar{d}$ (kps)	n	800 ps $< d < 1200$ ps $\bar{E}$	$\bar{d}$ (kps)	n	$d > 1200$ ps $\bar{E}$	$\bar{d}$ (kps)	n
87	17°	0°				.69	1.08	6			
40	53	0				.55	.96	5			
24	128	0	.77	.63	4				.58	1.61	5
110	0	+ 1	.43	.52	10						
64	35	− 1							.55	1.45	9
9	106	+ 2				.48	1.07	11			
8	92	− 3				.57	.99	4	.68	2.10	8
23	120	− 7				.47	1.03	6	.36	1.42	7
39	47	+ 9	.29	.65	8	.27	.91	4	.37	2.02	6
25	133	+ 9				.49	.99	4	.33	1.65	7
63	29	+10	.17	.50	8	.24	.95	6	.43	1.52	8
111	6	−11							.51	1.53	5
133	336	+11	.33	.42	8						
88	24	−12				.12	1.09	6			
65	43	−12	.56	.69	4	.20	.94	4	.21	1.52	5
48	136	−12	.71	.64	7						
135	350	−13				.17	.94	6			
22	111	−13							.21	1.95	6
109	353	+13	.48	.58	6						
86	10	+13							.17	1.71	5
10	118	+13	.45	.58	8						
20	89	−17							.20	1.36	5
38	42	+18	.17	.55	7				.25	1.63	4
26	138	+18							.33	2.10	6
66	53	−21				.27	.95	4	.22	1.97	6
47	127	−21	.53	.48	7						
132	327	+23	.34	.43	4						
62	24	+23	.07	.46	6						
89	33	−23	.16	.59	5	.05	.99	4			
112	15	−25	.14	.55	5						
108	343	+28	.17	.31	4	.26	.99	4			
37	39	+28	.15	.48	11						
1	91	+28	.21	.41	6						
100	197	+28							.07	1.74	4
14	80	+57	.03	.52	5						

tions are somewhat larger than could have been expected from the mean errors of their observations and from the accuracy of the present measures. However, because of the small number of stars used for the comparison, not too much value can be attached to these results. The root mean square deviation resulting from the comparison with polar stars on the other hand appears to be small as compared with the value that could be expected.

The four stars in common with STEBBINS and WHITFORD's six-colour photometry have yielded the following relation between their (yellow—ultraviolet)-colour index (denoted by C) and the (yellow—violet)-index of the present publication (C'):

$$C + .45 = 1.15\,(C' - .95).$$
$$\pm .01 \text{ (m.e.)}$$

The scale of the photo-electric magnitudes resulting from the present material has been compared with the scale of the photographic magnitudes m, given in the *Bergedorfer Spektral-Durchmusterung*. In order to verify the correspondence between the two scales, for each Selected Area containing at least twelve stars of the present programme, a least-squares solution of the following equation has been made:

$$m = A\,\{m(\text{yellow}) + m(\text{blue})\} + B\,(C'),$$

where the magnitudes and colour indices have been reckoned from their respective mean values; m(blue) is defined as: $m(\text{blue}) = m(\text{yellow}) + C'$.

As a weighted average of thirteen individual scale factors A derived in this manner the value $\bar{A} = .4967 \pm .0053$ (m.e.) has been obtained. The agreement between the scales of the Bergedorfer magnitudes and the photo-electric ones thus appears to be quite satisfactory.

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