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Photometric Standards For The
Southern Hemisphere

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About ten years ago, the authors published a paper (Bok and Bok, 1960) with several standard sequences for southern hemisphere work. Additional photo-electric measurements have been made since then, first from Australia (Mount Stromlo and Siding Spring Observatories), more recently from Chile (Cerro Tololo Interamerican Observatory). Since so much effort is now being expended on research of the Southern Milky Way and of the Magellanic Clouds, it may be helpful to bring some of the results together in one place.

1. Axis of the Large Magellanic Cloud

During his stay in Australia, Dr. W. G. Tifft determined a standard sequence in the range $9.4 < V < 18.2$ for a region centered near $\alpha = 5^{\text{h}}09^{\text{m}}$, $\delta = -69^{\circ}$. The results obtained by Tifft include only V and B magnitudes. Since the region in question is located in the rather crowded western section of the Axis of the Large Magellanic Cloud (between the clusters NGC 1850 and NGC 1856), the photometry was difficult and it seemed desirable to check the zero point in particular. It also seemed advisable to include ultraviolet measures, U, principally to check on the absorption in the region.

Star Tifft 1 was taken as the standard reference star in the sequence. It was compared with Star 1 of the van Wijk sequence (Bok and Bok, 1960) at Cerro Tololo on four nights, using the 60-inch Reflector, and on two nights, with the 36-inch Reflector.

Additional comparisons with Star No. 875 of Kapteyn Selected Area 193 were obtained on two nights with the 60-inch Reflector and on two nights with the 36-inch Reflector.

Assuming the following standard values (Bok and Bok, 1960)
for Star van Wijk 1:

$$V = 10.24, B-V = + 0.22, U-B = + 0.02$$

and for Star No. 875 S. A. 193:

$$V = 9.89, B-V = + 0.03, U-B = - 0.34,$$

we derive the following mean value for Star Tifft 1:

$$V = 9.38, B-V = + 0.20, U-B = + 0.03$$

Most weight was assigned to observations at nearly the same altitude. Hence corrections for differential extinction were generally small. Whenever the need arose the following average values for the coefficients of extinction were used:

$$A_V = + 0.17; A_B = + 0.27; A_U = + 0.60.$$

Tifft's original photometry had yielded the following standard values for Star Tifft 1:

$$V = 9.37, B-V = + 0.20.$$

The close agreement between our values and Tifft's is very satisfactory, especially since different basic standard stars were used by Tifft and by Bok and Bok.

The results of our measurements are shown in Table I. The stars in the sequence are identified by number in Plate I.

We shall leave it to Dr. Tifft to describe elsewhere the procedure used by him in selecting his sequence stars, his techniques used for zero point calibration and his derived sequence of V and B-V magnitudes and colors. We note that Tifft's sequence reaches two magnitudes fainter than ours.

A comparison between Tifft's values for V and ours shows a slight systematic trend. For the range $9.4 < V < 14.0$, the two sets of values agree to within 0.01 mag. For the stars in the range $14.0 < V < 15.0$ our values of V are fainter than Tifft's by 0.07 mag. Tifft suggests that this could be a systematic deviation caused by different techniques of measurement for sky corrections. We used the mean of four sky readings in star-free positions directly N, E, S and W of the star. Tifft selected most of the sequence stars and sky regions from Stromlo 74-inch Reflector plates reaching to 21st magnitude and claims that our average sky readings may be too great since our sky readings must include more faint stars than would occur in diaphragms of the same size centered on the specially selected sequence stars. We doubt that this explains the systematic effect and we prefer to let our values stand as they are. The differences in V do not exceed 0.10 mag. even for the faintest star, $V = 16.44$.

A comparison of our B-V values and Tifft's does not indicate the presence of any systematic effects. The mean difference for 13 stars with $(B-V) < +1.00$ is $\Delta(B-V) = 0.00$ mag., the average residual amounting to ± 0.03 mag. Hence our B-V values have indicated accidental probable errors of the order of ± 0.01 to ± 0.02 mag.

2. Standard Sequences in Carina-Centaurus.

We now have available four standard UBV sequences for one of the key sections of the Southern Milky Way. Their positions and ranges of V are shown in Table II.

The sequence and chart for Kapteyn Selected Area 193 were published long ago (Bok and Bok, 1960) and need not be reproduced again. Plate II and Table III give our sequence for a field centered near the star GL Carinae. Plate III and Table IV give comparable information for the field near the 09.5 star H. D. 101545 and Plate IV and Table V for a sequence in and near the OB cluster IC 2944.

The following comments are in order:

1. In each field one star was used as a basic reference star. These standard stars were compared to Star 875 in Kapteyn Selected Area 193 on several nights. Stars 1 and 2 in the GL Carinae Field (Table III) were compared with Star 875, both at Mount Stromlo and at Siding Spring Observatory, on at least 25 nights. Star 3 in the HD 101545 Field (Table IV) was inter-compared with Star 875 on 7 nights (Cerro Tololo). Star 2 in the IC 2944 Field was inter-compared

with Star 875 on 6 nights (Cerro Tololo). The internal consistency between the assumed values for the sub-standard stars was regularly checked as well and the data should be homogeneous.

2. All observations for Tables III and IV were made by B. J. Bok, but in Table V we have also included some results derived from measurements (at Cerro Tololo) made by Dr. R. E. White. The latter were referred to standard bright stars, rather than to our sub-standards, and are therefore on a system not as immediately related to our primary standards and sub-standards. Measurements of some stars in common indicate that the White data are very nearly on our color-magnitude system.

3. UBV Magnitudes and Colors for OB Stars in Carina-Centaurus.

Over the past decade we have accumulated considerable information on UBV colors and magnitudes of OB stars - and of some stars as late as A type - first from observations made at Mount Stromlo Observatory and at Siding Spring Observatory, more recently from observations made at Cerro Tololo Interamerican Observatory. The Australian observations were all made by B. J. Bok, those in Chile mostly by Dr. John A. Graham and some by Dr. R. E. White and by B. J. Bok. The data are assembled in Table VI. The standard stars used in this work are the same as those to which we referred in Section 2 of the present paper. The observations by Bok are generally the mean of three separate observations made on different nights, whereas the Graham and White data refer to only a single observation.

The stars in Table VI are all near one of the four centers listed in Table II. They serve to give a first indication of the interstellar reddening for a larger area of the sky than that covered by the standard UBV sequence and its immediate surroundings.

The spectral types in the second column are those of the Henry Draper Catalogue or the Henry Draper Extension unless a spectral-luminosity class for the star was listed by Jaschek et al (1964).

Close to thirty of the stars in Table VI were observed independently by Feinstein (1969). These stars have been identified with F in the Remarks Column of Table VI. For the 28 stars for which we have UBV measurements in common, we find the following average differences, Bok and Bok minus Feinstein:

$$\overline{\Delta V} = - 0.02 \pm 0.02 \text{ (p.e.)}$$

$$\overline{\Delta(B-V)} = 0.00 \pm 0.02 \text{ (p.e.)}$$

$$\overline{\Delta(U-B)} = + 0.04 \pm 0.03 \text{ (p.e.)}$$

The listed probable errors are for a single difference between the tabulated values of our Table VI and the comparable figures given by Feinstein. In the Feinstein paper, the UBV values were presumably derived with reference to the MK standards accessible from southern latitudes. The close agreement between our data and Feinstein's is satisfactory especially in view of the fact that our measurements were largely referred to the secondary standards listed earlier in the present paper. The only systematic difference that causes some

concern is $\overline{\Delta(U-B)}$; 23 of the 28 stars we have in common show positive values for the difference $\Delta(U-B)$. The accidental errors derived from the differences are as small as one might expect from the internal agreement of our observations.

We note that 21 of the stars in our Table VI are listed in the Graham-Lyngå Catalog (1965) of OB stars. Apparent magnitudes and color indices (on the Walraven System) have been determined by Graham (1968). These stars are identified with the symbol GL in the Remarks Column of Table VI.

4. Four Sequences for Centaurus and Norma Fields. Table VII contains the basic information for four standard sequences in low latitude fields of interest, one in Centaurus, three in Norma.

The standard sequence in Centaurus is given in Table VIII and the stars are identified on Plate V.

The three standard sequences in Norma are given in Table IX and the identifications are shown on Plates VI a, b and c.

For each of the four fields numerous comparisons at comparable altitudes were made with our fundamental standard Star 875 in Kapteyn Selected Area 193 and with the sub-standards in the field of GL Carinae. The number of zeropoint comparisons was at least three in number, sometimes as great as eleven. All observations reported in the present Section were made in Australia either from Mount Stromlo or from Siding Spring Observatory.

APPENDIX

Two Kapteyn Selected Areas were chosen with galactic latitudes close to that of the Large Magellanic Cloud. Standard sequences were developed in both Selected Areas to permit the photographic measurements of U, B, V magnitudes and color indices for the purpose of determining the magnitude and color distribution for the stars in these fields. These areas serve then as fields for fixing the magnitude and color distribution of the foreground stars in the Large Magellanic Cloud. The two areas are: Kapteyn Selected Areas 169 ($\alpha = 5^{\text{h}}41^{\text{m}}$, $\delta = -45^{\circ}.2$, $b^{\text{II}} = -23^{\circ}.5$) and 205 ($\alpha = 20^{\text{h}}10^{\text{m}}$, $\delta = -74^{\circ}.9$, $b^{\text{II}} = -31^{\circ}.6$).

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Table I

A Standard Photoelectric Sequence for Area in the Axis of the
Large Magellanic Cloud Centered near $\alpha = 5^{\text{h}}09^{\text{m}}$, $\delta = -69^{\circ}$

Star	No. of Observations	V	B-V	U-B
1	standard	9.38	+0.20	+0.03
2	3	10.08	+0.86	+0.31
3	1	11.07	+0.96	+0.72
4	1	12.34	+0.73	+0.35
5	1	12.67	+0.77	+0.26
6	1	13.14	+1.10	+0.95
7	4	14.15	+0.10	+0.01
8	5	14.19	+1.19	+1.3
9	5	14.29	+0.10	-0.03
10	7	14.52	+0.07	-0.33
11	5	14.56	+0.79	+0.22
12	5	14.91	-0.12	-0.81
13	2	15.20	+1.45	+1.28
14	5	15.32	-0.16	-0.99
15	2	15.38	+1.32	+0.30
16	6	16.44	-0.12	-0.54

Table II

Four Standard Sequences
in Carina-Centaurus

Sequence	α (1975)	δ (1975)	l^{II}	b^{II}	No. of Stars	Range in V
Selected Area 193	$11^h 28^m$	$-60^\circ.5$	293°	$+1^\circ$	18	7.9 to 13.2
G L Carinae Field	$11^h 13^m$	$-60^\circ.3$	291°	0°	14	10.7 to 14.9
H D 101545	$11^h 40^m$	$-60^\circ.2$	295°	-1°	19	9.5 to 15.3
I C 2944	$11^h 34^m$	$-62^\circ.8$	294°	-2°	12	9.8 to 15.4

Table III

Standard Sequence for a Field near G L Carinae

Number of Star	V	B-V	U-B
1	10.68	+0.20	-0.26
2	11.23	+0.39	+0.01
3	11.94	+0.32	-0.42
4	12.52	+1.14	+0.61
5	13.09	+0.27	-0.03
6	13.18	+0.28	-0.19
7	13.53	+0.36	+0.22
8	13.56	+0.32	+0.02
9	14.00	+0.31	0.00
10	14.11	+0.37	+0.17
11	14.35	+1.47	+1.2:
12	14.46	+0.42	+0.28
13	14.65	+0.38	+0.26
14	14.88	+0.52	+0.23

Note: Sequence Star 1 is HDE 306162; standard.
Sequence Star 2 is HDE 306163; standard.

The G L Carinae field was originally centered
on the variable star G L Carinae (HDE 306168).
The position of the sequence is somewhat different
from that of G L Carinae.

Table IV

Standard Sequence for a Field near H D 101545

Number of Star	No. of Observations	V	B-V	U-B
1	6	9.49	+1.75	+1.9:
2	3	9.57	+1.06	+0.68
3	standard	9.97	+0.04	-0.56
4	2	10.56	+0.06	-0.40
5	3	10.83	+0.07	-0.21
6	3	11.23	+0.14	-0.23
7	3	11.50	+0.22	+0.06:
8	2	11.70	+0.10	-0.46
9	3	12.05	+0.51	+0.14
10	3	12.37	+0.16	-0.42
11	3	12.57	+0.29	+0.16
12	4	12.77	+0.37	+0.26
13	3	13.35	+0.26	-0.07:
14	4	13.44	+0.52	-0.28
15	4	13.79	+0.40	+0.39
16	7	14.45	+0.31	+0.23
17	6	14.61	+0.69	+0.23
18	6	14.90	+0.73	+0.30
19	8	15.33	+0.55	+0.24

Note: Sequence Star 4 is HDE308775
Sequence Star 3 is HDE308873
Sequence Star 5 is HDE308874
Sequence Star 7 is HDE308885
Sequence Star 1 is HDE308893
Sequence Star 6 is HDE308896

Table V

Standard Sequence for a Field near I C 2944

Number of Star	No. of Observations	Observer	V	B-V	U-B
1	1	Bok	9.76	+0.02	-0.78
2	standard	Bok	10.72	+0.69	+0.45
3	1	Bok	11.17	+0.09	-0.51
4	3	Bok	12.33	+0.27	+0.20
5	1	White	12.40	+0.20	+0.23
6	1	White	13.07	+0.32	+0.27
7	1	White	13.64	+0.18	-0.05
8	2	Bok	13.76	+0.44	-0.26
9	1	White	13.90	+0.52	+0.29
10	7	Bok	14.45	+0.45	+0.42
11	1	White	15.24	+0.76	----
12	1	Bok	15.43	+1.02	+1.28:

Note: Sequence Star 1 is HD100879

Sequence Star 2 is HDE308685

Sequence Star 3 is HDE308692

The bright star in the upper right hand corner is α Centauri

Table VI

UBV Measurements for Selected Henry Draper
Catalog Stars and Henry Draper Extension Stars

Observers: B-Bok; G-Graham; W-White

Star (HD or HDE)	HDE Sp. or JASCHEK (MK Sp.)	Observer	V	B-V	U-B	Remarks
96899	B8	B	9.16	.05	-.70	GL
96946	B5	B	8.43	.20	-.69	GL
96970	A0	B	8.17	.17	.09	
97001	A0	B	9.24	.18	.10	
97151	B2e	B	7.72	-.11	-.78	
97152	(WC6+BOV)	B	8.11	-.13	-.54	
97166	(08)	B	7.87	.05	-.77	F
97206	B	B	9.62	.10	-.64	
97207	B	B	9.54	.11	-.62	
97222	(B 0 II)	B	8.75	.19	-.66	F
97223	B8	B	8.71	.04	-.45	
97253	(06)	B	7.12	.15	-.72	F
97284	B3	B	8.83	.13	-.72	GL
97319	(09.5Ib)	B	8.51	.20	-.63	F
97399	B	B	8.42	.03	-.75	
97400	B	B	7.78	.09	-.57	
97434	(08)	B,G	8.07	.16	-.76	F
97581	(B1 III)	B	8.85	.23	-.56	F, GL
97629	B5	B	9.52	.08	-.62	
97707	(B2 Ia)	B	8.06	.47	-.35	F, GL
97968	A0	B	9.36	.04	-.12	
97969	(B1:Vn)	B	7.70	-.02	-.72	F
98210	(B0.5 III)	B	8.79	.02	-.72	GL
98733	(B1 Ib)	W	7.93	.12	-.66	F
98927	(B1.5 Ve)	W	9.23	.05	-.73	F

Star (HD or HDE)	HDE Sp. or JASCHEK (MK Sp.)	Observer	V	B-V	U-B	Remarks
99160	(09 II)	B,W	9.14	.23	-.69	F
99278	B5	B	9.78	.02	-.34	
99354	(B1 IIIIne)	B,W	8.94	.11	-.69	F
99416	(B0.5 V)	B	8.88	.08	-.60	F
99469	B8	B	9.72	.08	-.44	
99547	B	G	10.50	.11	-.54	
99556	(B5 IV)	B	5.30	-.07	-.52	F
99758	A0	B	9.75	.03	.03	
99824	A0	B	8.98	-.03	-.38	
99855	A0	B	9.38	.13	-.74	
99894	A0	B	10.01	.08	-.10	
99897	(06)	B,G	8.38	.16	-.79	F
99940	A0	B	9.99	.28	.17	
100025	B3	B	9.78	.02	-.64	
100065	A2	B	8.66	.21	.04	R
100123	A0	B	8.48	.18	.06	
100135	B9	B	7.27	.01	-.36	
100198	(A0 Ia)	B	6.37	.51	-.12	
100199	(B1 Ibp)	B,G	8.21	-.01	-.84	F
100242	(B0 IV)	B,G	8.39	.18	-.75	F
100243	B9	W	9.93	.08	-.69	
100276	(B1 Ib)	B	7.26	.04	-.80	F
100277	A0	B	7.93	.04	-.03	R
100335	(B6 III)	B	7.87	-.06	-.46	F
100354	B8	B	9.78	.01	-.45	
100355	B8	W	9.23	.00	-.65	
100381	(B2 V)	B	8.73	.01	-.62	F
100840	B	G	8.14	.17	-.92	
100856	B	G	8.16	-.02	-.85	
100879	B9	B	9.76	.02	-.78	R

Star (HD or HDE)	HDE Sp. or JASCHEK (MK Sp.)	Observer	V	B-V	U-B	Remarks
101008	(Oa V)	B,G	9.15	.02	-.92	F
101190	(07)	B	7.31	.09	-.88	F
101191	(08)	B,G	8.49	.08	-.87	
101205	(08)	B,G	6.43	.08	-.88	F
101223	B8	W	8.68	.14	-.73	
101298	B3	W	8.07	.05	-.80	
101332	(B0.5 II)	B,G	7.63	.09	-.77	F
101413	B3	W	8.34	.07	-.78	
101436	B3	W	7.59	.04	-.81	
101545	(09.5 Ib)	G	6.33	.04	-.84	
101794	(B1.5 V)	G	8.64	.13	-.73	F
101838	(B1. III)	G	8.42	.05	-.80	F
101850	B5	W	9.24	-.02	-.63	
101964	(B0.5 III)	G	8.34	.01	-.80	F
102248	B	G	7.92	.03	-.42	
102368	B2	G	7.60	.03	-.88	
102415	B5	W	9.13	.11	-.76	
102475	(B0.5 II)	G	8.52	.01	-.89	F
102878	(A2 Ia)	W	5.68	.24	.01	
306050	B5	B	9.65	.08	-.57	
306053	B	B	10.25	.28	-.42	GL
306054	B9	B	10.72	.16	-.56	
306056	B5	B	10.05	.08	-.70	GL
306058	B3	B	9.94	.21	-.63	GL
306060	A0	B	10.08	.11	.07	
306068	B5	B	10.80	.11	-.53	GL
306070	B8	B	10.29	.40	-.25	
306072	B9	B	9.84	.08	-.05	
306075	A0	B	10.70	.13	-.19	
306080	B9	B	10.35	.25	-.58	GL

Star (HD or HDE)	HDE Sp. or JASCHEK (MK Sp.)	Observer	V	B-V	U-B	Remarks
306082	B5	B	10.07	.24	-.44	
306086	B5	B	9.48	.26	-.53	
306096	B5	B	9.28	.19	-.64	GL
306097	(O9 III)	B	8.91	.63	-.24	F, GL
306099	B3	B	8.72	.17	-.68	
306111	B0	B	10.10	.17	-.75	GL
306112	B3	B	9.70	.14	-.66	GL
306153	B5	B	10.23	.16	-.47	
306157	(B1 V)	B	10.29	.45	-.32	F, GL
306158	B9	B	10.74	.06	-.17	
306162	B5	B	10.68	.20	-.26	R
306163	A0	B, G	11.23	.40	.07	R
306165	B3	B	9.82	.07	-.62	GL
306171	B5	B	9.64	.14	-.66	GL
306175	A0	B	9.92	.30	.10	
306177	B9	B	10.78	.08	-.40	
306179	B	B	10.38	.21	-.60	
306180	B VAR	B	10.30	.28	-.49	
306181	B	B	9.57	.10	-.65	GL
306182	B	B	11.92	.48	.08	
306187	B	B	10.20	.31	-.42	
306190	B3	B	9.68	.16	-.63	
306196	(B0: Vn)	B	9.65	.29	-.37	F
306248	B9	B	10.63	.14	-.09	
306249	B8	B	10.10	.02	-.63	GL
306258	B5	B	11.24	.13	-.24	
306269	B5	B	10.19	.04	-.70	GL
306462	A0	B	11.43	.14	-.30	
306485	B3	B	9.84	.10	-.62	
306493	B2	B	10.60	.12	-.53	

Star (HD or HDE)	HDE Sp. or JASCHEK (MK Sp.)	Observer	V	B-V	U-B	Remarks
306495	B5	B	10.06	.08	-.48	
306523	B5	B	10.28	.15	-.60	
306545	B5	B	10.54	.10	-.48	
306571	A	B	11.30	.18	-.13	
306582	B9	B	9.88	.09	-.08	
306592	B9	B	11.59	.25	.17	
306593	B5	B	9.92	.09	-.58	
306604	B9	B	9.60	.00	-.23	R
306608	B8	B	9.88	.02	-.34	R
306619	B9	B	10.36	.03	-.51	R
306620	A0	B	9.94	-.01	-.15	R
306622	A0	B	10.80	.04	-.12	R
306645	B5	B	10.35	.05	-.40	
306654	A2	B	11.09	.35	.13	
306705	A0	B	11.76	.21	.18	
306742	A0	B	10.50	.07	-.01	
306791	B	G	8.52	.06	-.55	
306794	B	G	8.63	.02	-.62	
306797	B	G	9.64	.05	-.50	
306798	B	G	9.43	.03	-.62	
308570	B2	G	10.02	.64	-.41	
308648	B	G	11.35	.15	-.27	
308685	A2	B	10.72	.69	-.45	R
308692	A0	B	11.17	.09	-.51	R
308775	B8	B	10.56	.06	-.40	R
308873	A0	B	9.97	.04	-.56	R
308874	B9	B	10.83	.07	-.21	R
308885	A0	B	11.50	.22	.06	R
308896	A2	B	11.23	.14	-.23	R
308935	B0	B,G	9.89	.13	-.69	
309065	B	G	8.82	.07	-.72	

Table VI (Con't)

Star (HD or HDE)	Remarks
100065	S.A. 193 Sequence star 313 (Bok and Bok, 1960).
100242	S.A. 193 Sequence star 2509 (Bok and Bok, 1960); new values are means of published values and more recent observations by Graham.
100277	S.A. 193 Sequence star 2622 (Bok and Bok, 1960).
100879	I C 2944 Sequence star 1 (Table V).
306162	G L Carinae Sequence star 1 (Table III).
306163	G L Carinae Sequence star 2 (Table III).
306604	S.A. 193 Sequence star 940 (Bok and Bok, 1960).
306608	S.A. 193 Sequence star 875 (Bok and Bok, 1960).
306619	S.A. 193 Sequence star 4082 (Bok and Bok, 1960).
306620	S.A. 193 Sequence star 4584 (Bok and Bok, 1960).
306622	S.A. 193 Sequence star 4879 (Bok and Bok, 1960).
308685	I C 2944 Sequence star 2 (Table V).
308692	I C 2944 Sequence star 3 (Table V).
308775	H D 101545 Sequence star 4 (Table IV).
308873	H D 101545 Sequence star 3 (Table IV).
308874	H D 101545 Sequence star 5 (Table IV).
308885	H D 101545 Sequence star 7 (Table IV).
308896	H D 101545 Sequence star 6 (Table IV).

Notes: All stars in common with the list of Feinstein (1969)
have been marked "F" in the remarks column.

All stars in common with the list of Graham and
Lyngø (1965) have been marked "GL" in the remarks
column.

Table VII

Fields in Centaurus and Norma

Field	α (1975)	δ (1975)	l^{II}	b^{II}	No. of Stars	Range in V
Centaurus	$14^h 19^m$	$-60^\circ.8$	313°	-1	7	8.3 to 14.4
Norma I	$15^h 55^m$	$-58^\circ.8$	325°	-4	13	7.8 to 14.5
Norma II	$15^h 48^m$	$-56^\circ.1$	326°	-2	5	9.2 to 14.1
Norma III	$15^h 52^m$	$-54^\circ.4$	327°	-1	4	9.2 to 11.8

Table VIII

The Standard Sequence in Centaurus

Star	V	B-V	U-B
1	8.29	+0.51	+0.56
2	10.60	+0.14	-0.15 standard
3	11.83	+0.41	+0.24
4	11.97	+0.29	-0.06
5	13.22	-0.05	-0.72
6	13.47	+0.63	+0.10
7	14.44	+0.63	+0.39

Table IX

Three Standard Sequences in Norma

Star	Number of Observations	V	B-V	U-B
<u>NORMA I</u>				
1	6 standard	7.84	+0.55	-0.40.
2	2	8.90	+0.42	-0.46
3	11 standard	9.20	+0.41	+0.32
4	4	10.25	+0.71	+0.23
5	6	11.48	+1.30	+1.11
6	4	11.95	+0.57	-0.04
7	5	12.00	+0.32	+0.24
8	2	12.38	+0.70	+0.34
9	5	12.75	+0.58	-0.04
10	2	13.36	+0.64	+0.09
11	4	13.70	+0.66	+0.09
12	2	14.22	+0.76	+0.16
13	2	14.54	+0.88	+0.18
<u>NORMA II</u>				
1	6 standard	9.16	+0.09	+0.08
2	3	10.78	+0.67	+0.19
3	2	11.46	+0.46	+0.12
4	2	12.45	+0.54	+0.05
5	2	14.12	+0.65	+0.19
<u>NORMA III</u>				
1	3 standard	9.24	+0.11	-0.15
2	1	9.98	+0.14	-0.10
3	3	11.08	+0.51	-0.01
4	2	11.80	+0.92	+0.02

Note: Sequence Star 1 is H D 142468 (Norma I)

Table X

The Standard Sequence for SA 169

Star	HA 103	V	B-V	U-B
1	806	10.82	+0.45	-0.08
2	796	11.36	+0.44	-0.08
3	795	12.31	+0.50	-0.09
4	635	12.45	+0.65	0.00
5	482	13.06	+0.59	-0.06
6	479	13.40	+0.51	-0.06
7	806	13.44	+0.54	-0.02
8	669	13.82	+0.52	-0.12
9	663	14.28	+0.55	-0.12
10	522	14.93	+0.62	-0.14

Note: The numbers in the second column are those of
Harvard Obs. Annals 103.

Table XI

The Standard Sequence for S.A. 205

Star	HA 103	V	B-V	V-B
1	433	9.11	+0.47	-0.04
2	580	10.58	+1.22	+1.14
3	830	10.85	+0.70	+0.14
4	651	11.89	+1.35	+1.50
5	636	11.90	+0.49	+0.01
6	570	12.20	+0.48	+0.07
7	579	13.08	+0.61	+0.08
8	586	13.22	+1.04	+0.73
9	594	14.50	+0.74	+0.26
10	603	14.68	+0.78	+0.32
11	270	15.06	+0.76	+0.16
12	265	15.16	+0.46	+0.01
13	466	15.48	+0.82	+0.06
14	607	15.62	+1.09	+0.63

Note: The numbers in the second column are those of
Harvard Obs. Annals 103.

Table XII - List of Plates and Sequence Tables

Plate Number	Table Number	Field	Print Center		Emulsion	Filter	Exposure	Observer	Telescope
			R.A. 1975	Dec. 1975					
I	I	Axis of Large Magellanic Cloud	$5^h 09^m$	$-68^{\circ}9$	103aD	Chance Oy4	60 min	Tifft	Mount Stromlo 74"
II	III	G L Carinae	$11^h 13^m$	$-60^{\circ}3$	103aD	GG 14	5 min	Bok	Siding Spring 40"
III	IV	H D 101545	$11^h 40^m$	$-62^{\circ}2$	103aD	GG 14	2 min	Westerlund	Uppsala Schmidt 26"
IV	V	I C 2944	$11^h 34^m$	$-62^{\circ}8$	103aD	GG 14	5 min	Bok	Siding Spring 40"
V	VIII	Centaurus	$14^h 19^m$	$-60^{\circ}8$	103aD	GG 14	30 min	Bok	Siding Spring 40"
VI	IX	Norma I	$15^h 55^m$	$-58^{\circ}8$	103aD	GG 14	30 min	Bok	Siding Spring 40"
VII	IX	Norma II	$15^h 48^m$	$-56^{\circ}1$	103aD	GG 14	30 min	Bok	Siding Spring 40"
VIII	IX	Norma III	$15^h 52^m$	$-54^{\circ}4$	103aD	GG 14	30 min	Bok	Siding Spring 40"
IX	X	S A 169	$5^h 4^m$	$-45^{\circ}2$	103aD	GG 14	15 min	Bok	Siding Spring 40"
X	XI	S A 205	$20^h 10^m$	$-74^{\circ}9$	103aD	GG 14	30 min	Bok	Siding Spring 40"

N

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PLATE I

PLATE I

PLATE II

N

PLATE III

PLATE IV

PLATE V

PLATE VI

PLATE VII

PLATE VIII

PLATE IX

PLATE X