BVRI PHTOMETRY OF STAR CLUSTERS IN THE BOK REGION OF THE LARGE MAGELLANIC CLOUD

William Liller and Gonzalo Alcaino

Institute Isaac Newton

It is at present difficult from the literature to intercompare ages of clusters in the Magellanic Clouds owing to the variety of ways in which authors have interpreted the observational data and the several theoretical models used. With these considerations in mind we have embarked on a homogeneous investigation of clusters within a sky area of about 1 square degree. Because of its large concentration of clusters, we have chosen for study the so-called Bok region (Bok and Bok 1969) located in the northwestern part of the LMC bar. Photographic BVRI color-magnitude and color-color diagrams are provided for the 14 clusters listed in Table 1. None of these clusters have had previous stellar photometry in R, I and only four of them in the BV passbands.

The photographic plates have been obtained with the 1.5 m telescope at Tololo, the 2.5 m telescope at Las Campanas and the 3.6 m telescope at La Silla, and they have been calibrated with a BVRI photoelectric sequence of 15 stars in the magnitude range $9.4<V<15.3$ (Alcaino and Liller 1982). This sequence has been extended using a Pickering-Racine wedge in the last two mentioned telescopes. Four global features are recognizable in the V vs (B-V) and V vs (B-R) CMDs: (1) the cluster main sequence population; (2) bright blue stars, probably evolved blue giants and supergiants, at $V\sim14$, $(B-V\sim0.0)$, $(B-R\sim0.0)$; (3) evolved luminous red giants to $(B-V\sim2.0)$, and $(B-R\sim3.0)$; (4) fainter cool giant branch stars extending from an upper red tip of $V\sim16.5$, $(B-V\sim2.0)$, $(B-R\sim3.0)$ to $V\sim19.0$, $(B-V\sim1.0)$, $(B-R\sim1.3)$. These last stars are known to belong to the field consisting of the older population abundantly present in this part of the LMC. Obviously the cluster features stand out much more clearly in well-populated clusters such as NGC 1850 and NGC 1854; they can hardly be discriminated in the stellar defficient clusters and NGC 1834, NGC 1860, SL 234 and SL 237.

In what follows, we have used the corrected distance modulus to the LMC of $(m-M)_o = 18.59$ which implies a distance of 52.2 kpc (Sandage and Tammann 1974). A value of $E(B-V)=0.06\pm0.02$ is generally adopted towards the LMC and the old and intermediate age star clusters, but the objects with ages $\lesssim 3\times10^8$ years are expected to be embedded in absorbing matter which should strongly increase the internal reddening. As our clusters are blue, and therefore young, individual reddening should be derived

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for each object. We have estimated the reddening by fitting the main sequence of our CMDs to an unreddened zero-age main sequence (Mermilliod 1981). The reddening derived in this way is listed in Table 1. In making a first estimation of the ages, we have followed the procedure used by Hodge (1983). To homogenize the age data, he assembled the pertinent CMDs and compared them with a single set of theoretical predictions. In order to age-date the younger clusters, Hodge used two indices, the magnitude of the MS turnoff and that of the brightest blue (B-V<0.4) evolved star. The mean values obtained by these two methods calibrated from Figure 1 in Hodge's paper are listed in Column 4 of Table 1. Another approach used to estimate the age has been fitting of the CMDs to the isochrones of Maeder and Mermilliod (1981). These isochrones are calculated with X=0.70, Z=0.03 and given in the M_V vs $(B-V)_o$ plane with ages ranging from 2.5×10^7y to 6.3×10^9y for models with $\alpha_c=0$. The isochrones have been superimposed in the V vs B-V diagrams, with the apparent distance modulus for each cluster listed in Table 1, Column 3. The weighted mean age for each object is listed in Table 1. It is seen from our samples that all the clusters are young with ages ranging from $15\pm5 \times 10^6$y for NGC 1858 (B-V=-0.20) to $138\pm25 \times 10^6$y for NGC 1860. They lie symetrically in the center of the age histogram of 245 galactic clusters (Lyngå 1982). Both distributions peak close to $\log_t \sim 7.5$.

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TABLE I.

REDDENING AND AGES FOR THE CLUSTERS STUDIED

Cluster (NGC)	E(B-V)	$(m-M)_V$	MST+BBS 10^6y	Isoch. 10^6y	Weighted Mean Age 10^6y
1834	0.10:	18.89	52:	43±7	47±8
1836	0.20:	19.19	31±5	37±8	34±8
1839	0.27	19.40	22±4	27±8	24±5
1847	0.25	19.34	18±4	18±4	18±4
1850	0.18	19.13	19±2	24±4	21±4
1854	0.20	19.19	20±1	25±5	22±4
1856	0.26	19.37	66±9	60±12	63±8
1858	0.15	19.04	10±3	19±6	15±5
1860	0.18:	19.13	115±28	160±25	138±25
1863	0.20	19.19	57:	55±10	56±10
1870	0.14	19.01	55±21	60±20	58±18
SL234	0.15:	19.04	57±11	40±15	48±12
SL237	0.17:	19.10	20±2	19±6	20±5
SL304	0.20	19.19	36±8	50±8	43±10

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