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Photometry of open cluster Stock 17

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Abstract. Photoelectric magnitudes of 10 stars in the field of Stock 17 have been obtained. The reddening is uniform across the cluster. A distance of 2.12 kpc has been estimated for the cluster. It is concluded that the age of the cluster lies between that of the NGC 6231 and NGC 2362 groups.

Key words : open cluster—photometry—reddening

1. Introduction

The open cluster Stock 17 (OC1 268) ($\alpha_{1950} = 23^{\text{h}}43^{\text{m}}.6$, $\delta_{1950} = +61^{\circ}54'$) has been assigned class I3 p by Ruprecht (1966). The cluster was put on our observing program during the year 1983. The identification chart of the cluster field obtained by enlargement of a photograph taken with the 104-cm reflector of the observatory is shown in figure 1. The plate scale of the star field shown in figure 1 is $\approx 2''.5/\text{mm}$.

2. Observations

The observations of Stock 17 were carried out during 1983 October on the 104-cm reflector of the observatory using a thermoelectrically cooled (-20°C), EMI 6094S photomultiplier and standard UBV filters. Each star was observed at least on two different nights. Star no. 4 was taken as the comparison star. The differential instrumental magnitudes were determined using nightly extinction coefficients and these were subsequently standardized in the UBV system. The magnitudes and colours of the stars thus obtained are listed in table 1. The accuracy of the observations is $\pm 0^{\text{m}}.02$ in V and B and $\pm 0^{\text{m}}.025$ in U for stars of $V \approx 13^{\text{m}}$.

3. Discussion

Reddening across the cluster has been determined using the colour-colour diagram of the cluster shown in figure 2. The slope of the reddening line has been taken

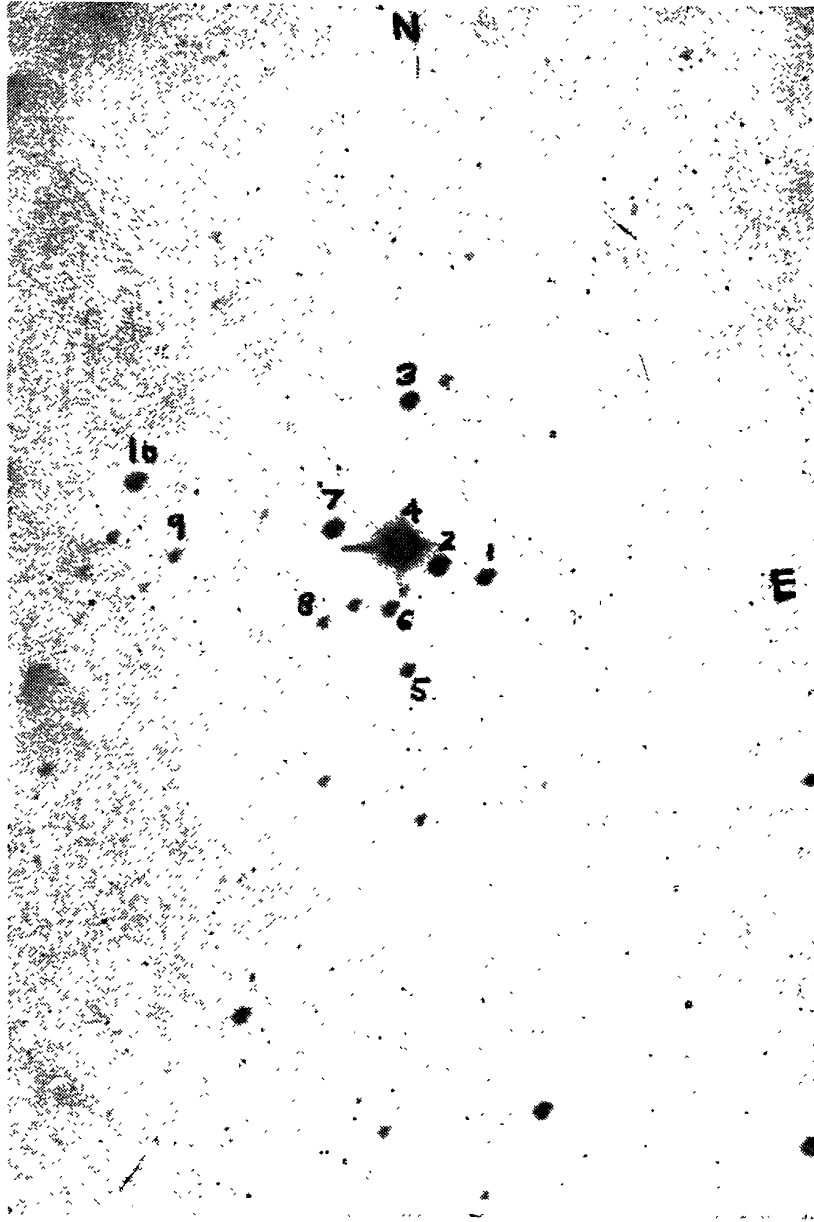


Figure 1. Identification chart for Stock 17. The scale of the star field is $\approx 2''.5/\text{mm}$.

Table 1. Photoelectric magnitudes and colours of stars in Stock 17

Star No.	V	$B - V$	$U - B$	$E(B - V)$
1	13 ^m .22	0 ^m .57	-0 ^m .18	0 ^m .76
2	12.51	0.73	-0.44	1.04
3	13.09	0.59	-0.25	0.81
4	8.39	0.47	-0.54	0.75
5	13.73	0.89	0.56	0.90
6	13.75	0.57	-0.11	0.73
7	12.76	0.52	-0.30	0.74
8	14.27	1.08	0.32	1.23
9	14.94	0.66	0.22	0.74
10	12.64	0.90	0.41	0.97

to be 0.72 (Johnson & Morgan 1953) and the intrinsic main sequence has been taken from Mermilliod (1981). Colour excesses derived from colour-colour diagram are $E(B - V) = 0^m.76$ and $E(U - B) = 0^m.55$.

For all stars in the cluster field, Q method (Johnson & Morgan 1953) has also been used for estimating the reddening. The values of reddening for individual stars thus estimated are given in column 5 of table 1 and have been used in subsequent discussions. Unreddened colour-colour diagram thus obtained for stars in the cluster field is shown in figure 3. The relation $A_v = 3.25E(B - V)$ (Moffat & Schmidt-Kaler 1976) has been used to compute the unreddened magnitudes V_0 of the cluster stars.

The kinematical data are not available for the cluster. Therefore, on the basis of the $[V_0, (B - V)_0]$ and $[V_0, (U - B)_0]$ diagrams the following conclusion are drawn :

(i) The stars numbered 5, 8 and 10 lie considerably above the main sequence in the $[V_0, (B - V)_0]$ and $[V_0, (U - B)_0]$ diagrams. Therefore, these stars are foreground stars.

(ii) The position of star no. 2 in $[V_0, (B - V)_0]$ and $[V_0, (U - B)_0]$ diagram shows that it is a background star.

(iii) On the basis of the colour indices and absolute magnitude, the star no. 4 is the earliest spectral type of BOIa (FitzGerald 1970; Allen 1976) which could be a cluster member in its evolved stage of evolution.

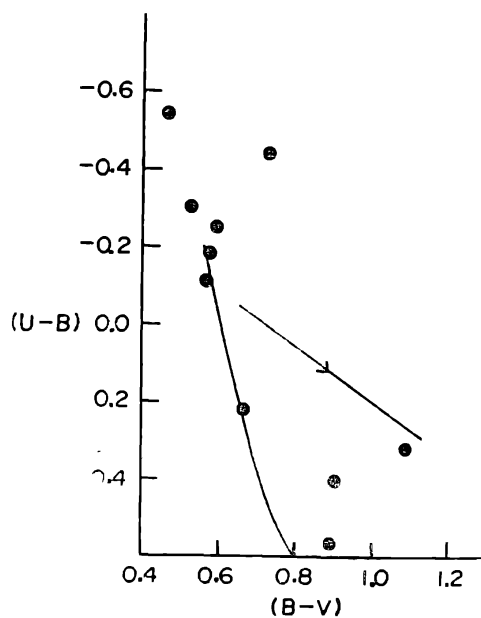


Figure 2. Colour-colour diagram of Stock 17. The arrow indicates the direction of reddening.

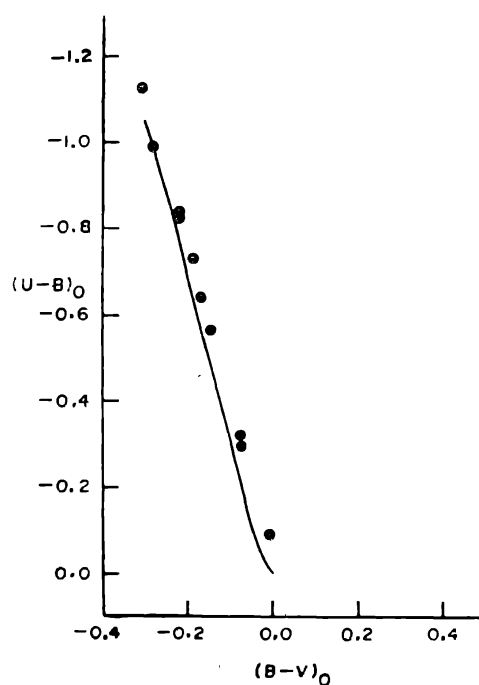


Figure 3. Unreddened colour-colour diagram of Stock 17. The solid line curve has been taken from Mermilliod (1981).

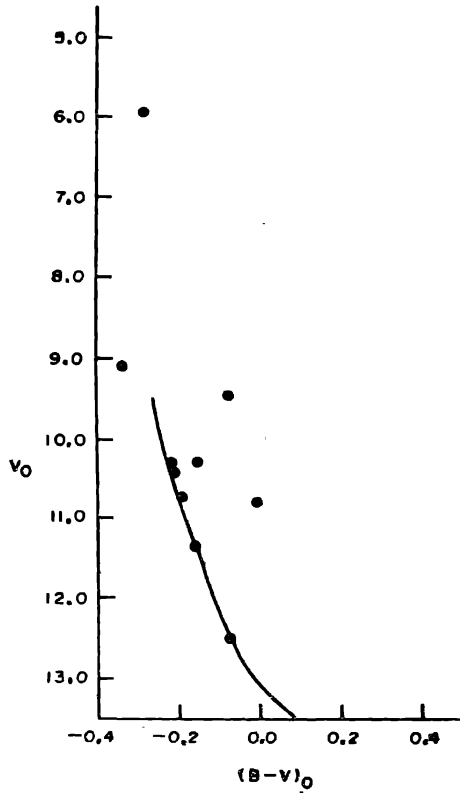


Figure 4. $[V_0, (B - V)_0]$ diagram of Stock 17. Solid line represents the ZAMS.

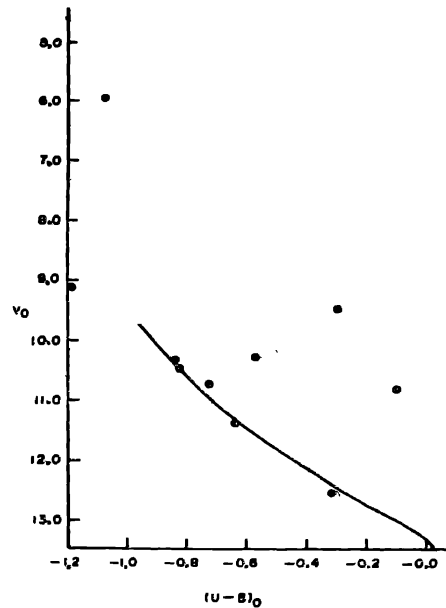


Figure 5. $[V_0, (U - B)_0]$ diagram of Stock 17. Solid line represents the ZAMS.

Since the value of $\Delta E(B - V)$ for the cluster members is less than $0^m.11$, therefore, using the criteria given by Burki (1975), we infer that the reddening across the cluster is uniform.

The distance modulus obtained by fitting the ZAMS given by Mermilliod (1981) to the lower portions of the $[V_0, (B - V)_0]$ and $[V_0, (U - B)_0]$ colour-magnitude diagrams shown in figures 4 and 5, comes out to be $11^m.50$ and $11^m.75$ respectively. Thus, the mean value of the distance modulus for the cluster is estimated to be $11^m.63$, which corresponds to a distance of 2.12 kpc.

$[M_v, (B - V)_0]$ diagram for the cluster members is shown in figure 6. The age of the post main sequence stars has been estimated using the composite isochrones given by Mermilliod (1981). From the $[M_v, (B - V)_0]$ diagram the age of the cluster is found to be in between the ages of the NGC 6231 and NGC 2362 groups (Mermilliod 1981). The ages of the NGC 6231 and NGC 2362 are 3.2×10^6 yr and 2.5×10^7 yr respectively (Lynga 1983).

The galactic longitude and distance of cluster show that the cluster lies in the Perseus arm.

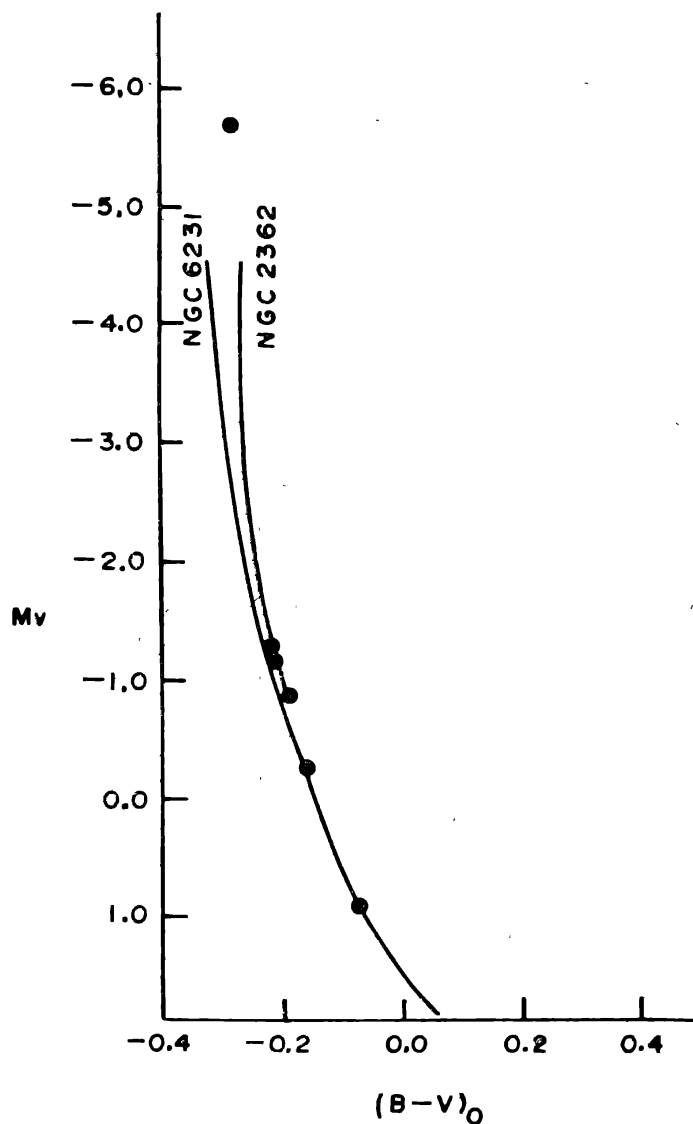


Figure 6. $[M_v, (B - V)_0]$ diagram of Stock 17. Colour-magnitude sequences of the NGC 6231 and NGC 2362 groups are shown by solid lines in the diagram.

Acknowledgements

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