

A photometric study of the open cluster King 7

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1. Introduction

The UBVRI CCD photometric observations of stars in the field of King 7 have been used to study the fundamental parameters such as interstellar extinction, age, distance and mass function of the cluster. To obtain these parameters we use colour - colour and colour - magnitude diagrams of the star cluster.

2. Observations and reductions

The observations of the cluster King 7 (C0355 + 514, $l = 149^{\circ}.76$, $b = -1^{\circ}04$) were carried out in the UBVRI passbands using the Photometrics CCD system at $f/13$ Cassegrain focus of the 104-cm reflector of the Uttar Pradesh State observatory (UPSO), Naini Tal during October - November, 1993. In this setup, each pixel of 1024×1024 size CCD corresponds to 24μ and the entire chip covers a field of 6.0×6.0 arcmin. In order to improve the S/N ratio, the observations were taken in binning mode of 2×2 pixels. Multiple exposures were taken with exposure time ranging from 5 sec to 2000 sec depending upon the presence of bright stars and filter used and the frames were coadded in order to achieve a total integration time of 100 minutes in U, 45 minutes in B, 30 minutes in V, 15 minutes in R and I filters. Two field regions located at $\sim 30'$ towards north and south of the cluster region were also observed to estimate the field star contamination in the cluster region.

The observations have been reduced using the facilities (Vax stations 3100, 4000 and ALPHA) available at the UPSO. Clean images have been obtained using the ESO MIDAS software package. The photometric reductions were made using DAOPHOT profile fitting software (Stetson 1987). The stellar point spread function (PSF) was evaluated from several uncontaminated stars present in each frame. Landolt (1983) standard stars were observed for calibration purposes.

3. Results

To estimate the interstellar extinction, we have used (U-B, B-V) diagram. The intrinsic zero-age main sequence (ZAMS) given by Schmidt - Kaler (1982) has been used and the slope of $E(U-B) / E(B-V)$ was taken to be equal to 0.72 (Johnson & Morgan, 1953). The reddening $E(B-V)$ comes out to be ~ 1.37 (figure 1).

The CMDs for the cluster region are shown in figure 2. the broadness of the main sequence is due to various causes, among which are the photometric errors, the presence of unresolved binary stars, a possible internal reddening the field star contamination.

Age and distance of the cluster has been obtained by fitting theoretical isochrones incorporating convective overshoot (Bertelli *et al.* 1994) to the CMDs. The major problem in determining the age and distance modulus by comparing the theoretical isochrones with the observed CMDs, is the absence of data about the metal abundance (Fe/H). Therefore, we have used isochrones of different metallicity and tried to find out which provides the best global fit. The best comparison with the model shown in figure 2, yields an age $\sim 6 \times 10^8$ years and $(m-M) = 15.6$ for $Z = 0.008$. The obtained distance modulus corresponds to a distance of 1.9 Kpc.

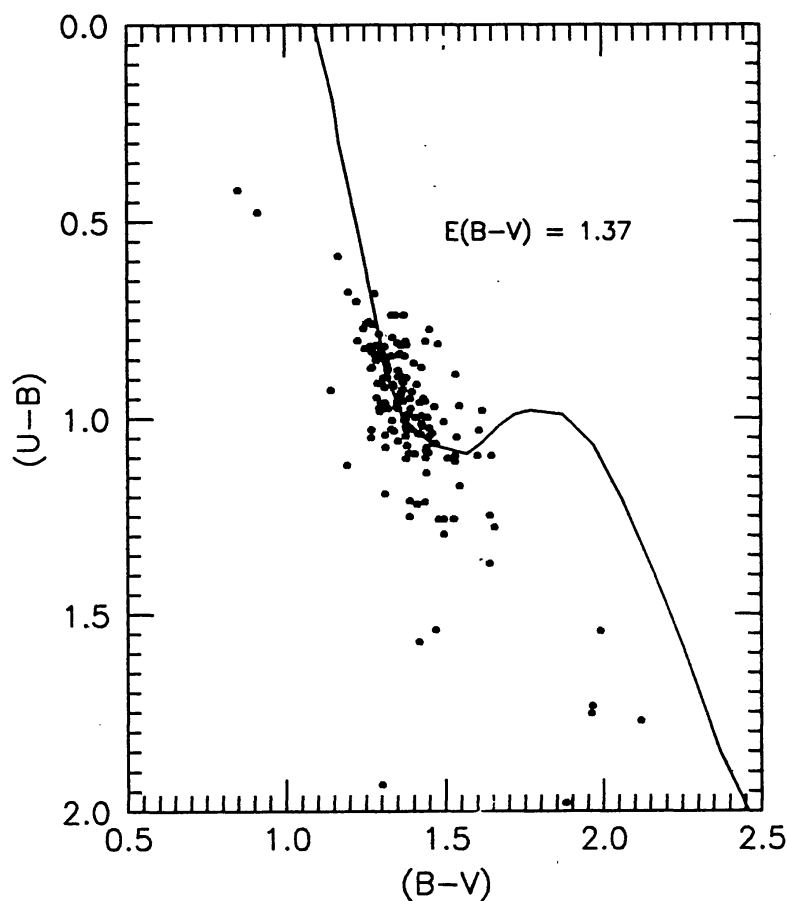


Figure 1. The colour-colour diagram for the stars in cluster region.

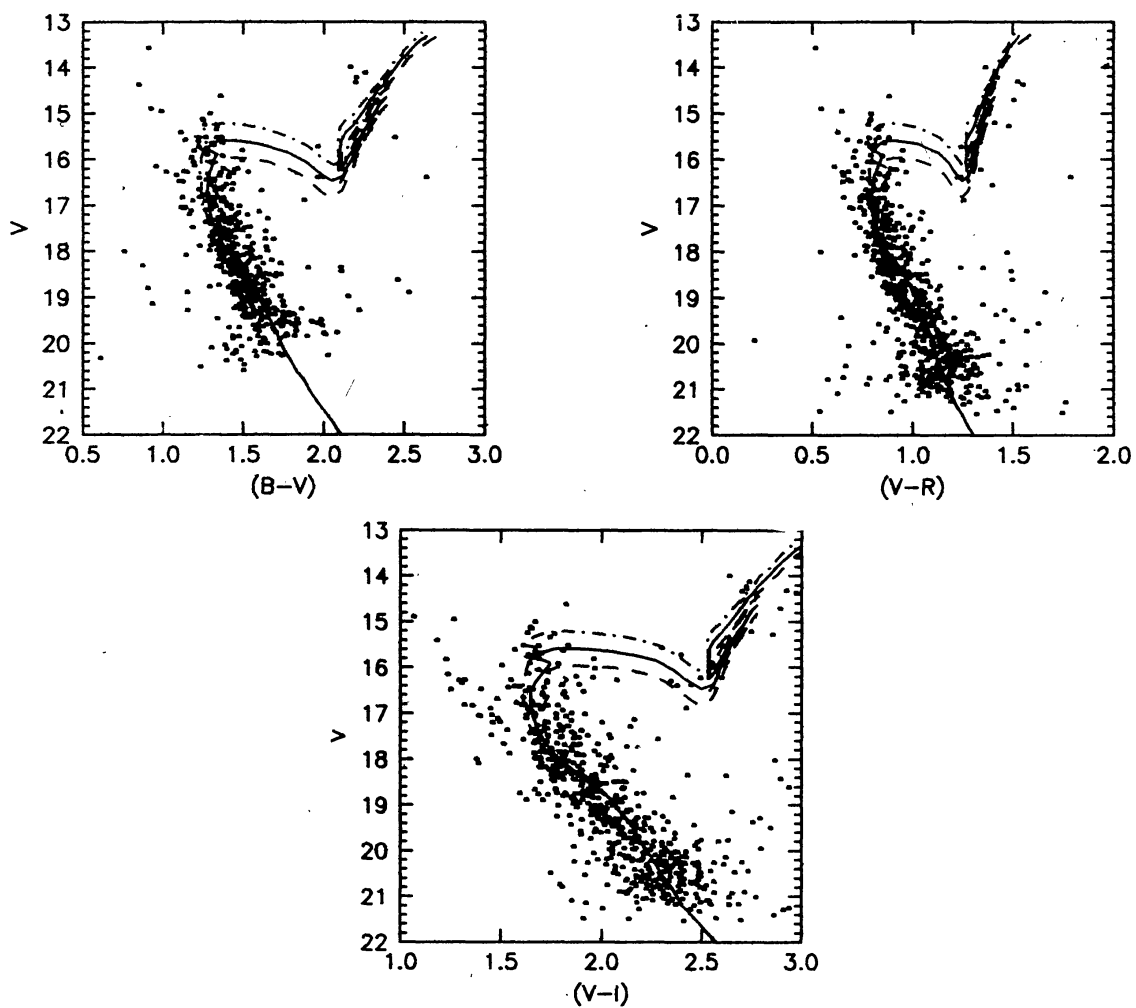


Figure 2. The V , $(B-V)$, V , $(V-R)$ and V , $(V-I)$ diagrams for stars in the cluster region. Isochrones fitted to the cluster sequence are taken from Bertelli *et al.* (1994). The dot-dash, solid and dashed curves represent isochrones for age $\log t = 8.7, 8.8$ and 8.9 respectively.

4. Mass Function

Two field regions located at $\sim 30'$ towards north and south of the cluster region have been used to estimate the approximate number of field stars present in the cluster region. It is assumed that the distribution of the field stars in the nearby regions is same as the distribution of field stars in the cluster region. The MS luminosity function is obtained by subtracting the contribution of field stars in each magnitude bin. The luminosity function is converted into mass function using the mass - luminosity relation. The slope of the mass function $x = -1.57 \pm 0.29$ is in agreement with Salpeter value ($x = -1.35$). The mass function has also been obtained to ascertain whether there is any change in the value of the mass function by changing the bins and also the broadness of the MS. It is found that the value of (x) comes out to be same within the errors.

Acknowledgements

This work is partly supported by the Department of Science and Technology (India) under the grant SP / S2 / O -07/93.

References

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