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A NEW OPEN CLUSTER BINARY SYSTEM IN THE MILKY WAY

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We have obtained CCD $UBVI_{KC}$ photometry for the open clusters (OCs) Hogg 12 and NGC 3590. Based on photometric and morphological criteria, as well as on the stellar density in the region, our evidence is sufficient to consider them a new open cluster binary system candidate.

$UBVI_{KC}$ images for Hogg 12 were obtained with a 2048 × 2048 pixel CCD attached to the CTIO 0.9 m telescope. The proximity of the well-known OC NGC 3590 in the same field allowed us to use it as a control cluster. By applying a method described in Piatti et al. (2010a), we found that our photometry does not permit us to distinguish cluster stars from field stars for $V \gtrsim 16$. Pavani & Bica (2007) defined the R^2 statistics, which compares the distribution of field fluctuations and density contrast in the Colour Magnitude Diagram (CMD) of the clusters to those in the star field. Thus, we built 70 different CMDs for boxes of 250 × 250 pixels distributed throughout the field, as well as the CMDs for NGC 3590 and Hogg 12. Then, we built the histogram of the R^2 distributions and performed a Gaussian fit. We found that the R^2 values for both NGC 3590 and Hogg 12 exceed by more than 10σ the mean value derived for the field. Since NGC 3590 is a well-known real OC, this result implies that Hogg 12 also constitutes a genuine physical system.

Despite the presence of some unavoidable interlopers, most of the stars observed in the field of NGC 3590 appear to trace the cluster fiducial main sequence. Thus, we adopted the $E(B-V)$ colour excess and apparent distance modulus from Clariá (1976) and overplotted the ZAMS of Lejeune & Schaerer (2001) to the (V, $B-V$), (V, $U-B$) and ($U-B$, $B-V$) diagrams. We also fitted the (V, $B-V$) and ($U-B$, $V-I$) diagrams by using a $E(V-I)$ colour excess of 0.60 mag. The Geneva isochrone of log $t = 7.50 \pm 0.20$ and solar metal content turned out to be the one which most accurately reproduces the cluster features in the three CMDs.

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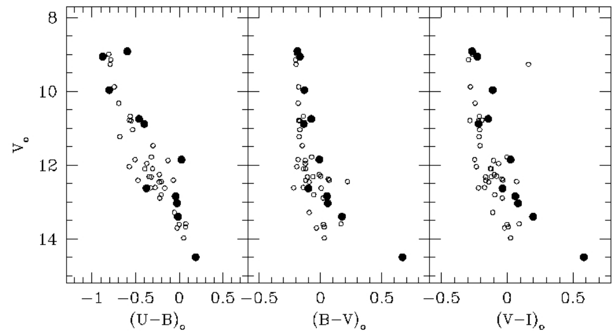

Fig. 1. (V, $U-B$), (V, $B-V$) and (V, $V-I$) diagrams for the probable members of Hogg 12 (filled circles), superimposed on those of NGC 3590 (open circles).

Once we checked that the filtering procedures of both CMDs and colour-colour diagrams, as well as the isochrone fitting method, reproduced the fundamental parameter values of NGC 3590 derived by Clariá (1976), we applied the same methods to Hogg 12. Surprisingly, most of the stars in the ($U-B$, $B-V$) diagram can be matched by a ZAMS of solar metal content reddened by $E(B-V) = 0.40 \pm 0.05$, while the ZAMS reddened by $E(V-I) = 0.50 \pm 0.05$ corresponding to $V - M_V = 12.75 \pm 0.25$ matches well the star distributions in the ($U-B$, $V-I$) diagram as well as in the three CMDs. As shown in Figure 1, both clusters seem to be nearly the same age. We derived for Hogg 12 a distance of 2.0 ± 0.5 kpc. These objects present an angular separation of 5.8′. Therefore, they are physically separated 3.6 ± 0.2 pc, which makes one of the closest pairs of OCs studied up to now. The spatial separation of these two almost coeval OCs, compared to their large heliocentric distances, suggests that they were very probably formed together. A detailed version of this study may be seen in Piatti et al. (2010b).

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