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FIRST PHOTOMETRIC ANALYSIS OF SIX OPEN CLUSTER CANDIDATES

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In this study we try to clarify the nature of six catalogued open cluster (OC) candidates using CCD $UBVI_{\mathrm{KC}}$ photometry down to $V = 22$. The objects are Haffner 3, Haffner 5, NGC 2368, Haffner 25, Hogg 3 and Hogg 4. None of them was found to be a real OC.

We obtained images of the suspected OCs using the CTIO (Chile) 0.9 m telescope. None of them has been previously observed photometrically. We analysed the possible existence of genuine OCs in the studied fields following two different approaches. On the one hand, we examined the distribution of stars in the Colour-Magnitude diagrams (CMDs) and Colour-Colour Diagrams (CCDs) and, on the other hand, we compared the number of stars counted within and outside the fields of the cluster candidates. A complementary analysis of both approaches will allow us to confirm or deny, on sounder bases, the physical reality of these objects.

To estimate a magnitude from which the characteristics of the different observed main sequences (MSs) are undistinguishable in terms of spatial density, magnitude and colour distributions, we applied a statistical method described in Piatti et al. (2010). We thus found that our photometry does not permit to distinguish different MSs for V magnitudes fainter than $\sim$16. Bearing in mind this result, the criteria adopted for evaluating the membership status of the measured stars are those defined by Clariá & Lapasset (1983). To identify what stars fulfill these criteria, we superimposed the ZAMS of Lejeune & Schaerer (2001) to the observed $(U-B, B-V)$ diagram by adopting a colour excess $E(B-V) = E_0$, which corresponds to the bluest envelope of the observed sequence. To superimpose the ZAMS, we used $E(U-B)/E(B-V) = 0.72$. Furthermore, if we adopt $E(V-I)/E(B-V) = 1.25$, this value implies $E(U-B)/E(V-I) = 0.58$. By carefully inspecting the three CMDs and the two CCDs, we could distinguish the possible cluster stars. We repeated this procedure for different $E(B-V)$ that we increased in steps of 0.05 mag each time. Although some star sequences seem to delineate a cluster MS in both CCDs, they are composed of field stars more or less aligned along the sight of view, since none of them have their counterpart MS in the three CMDs. These results allow us to conclude that the six studied objects would not be genuine OCs. Using the reddening maps of Schlegel et al. (1998), we checked for possible differential reddening across the studied fields that could be hiding the characteristics of real OCs. However, the dust in the directions of these objects appear to be uniformly distributed.

At first, we estimated the mean stellar density representative of each observed field by fitting Gaussian distributions to the star counts in 100 non-overlapped boxes of 200 pixels a side. Since the numbers of stars in a box of 200×200 pixels centred on the suspected OCs lie within 1.2σ of the mean values, they do not favour the possibility that the studied objects are real physical aggregates. On the other hand, when comparing observed and cleaned CMDs and CCDs, the differences in stellar composition did not become evident. Keeping in mind that field stars may give rise to well defined sequences in the CMDs, the presence of such sequences must not be considered in itself a proof of the existence of an OC. Finally, we built $\sim$100 CMDs for different boxes of 200×200 pixels distributed throughout the field, in addition to the CMDs for the catalogued objects. We applied the method of Pavani & Bica (2007) and found that the R^2 values for the catalogued objects do not exceed in more than 1σ the mean value derived for their respective fields, except in the case of Haffner 5 whose value is 1.3σ. These results imply that none of the six objects constitute genuine physical systems or OC remnants but should be considered random fluctuations of the field star density. The detailed version of this study can be seen in Piatti et al. (2011)

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