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CCD PHOTOMETRY OF M15

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We present CCD observations of the galactic globular cluster M15, in the B and V filters. The cluster was reasonably covered, except in its northern region where our observations present a gap. We obtained a Hertszprung-Russell (HR) diagram for each region observed, and later we produced a combined HR diagram containing more than 3000 stars. We generate a clean Colour Magnitude Diagram (CMD) and a Super Fiducial Line (SFL). Application of several methods and isochrone fitting leads us to obtain values for the metallicity $[\mathrm{Fe/H}]_{\mathrm{M15}} \sim -2.16 \pm 0.10$, the reddening $E(B-V)_{\mathrm{M15}} \sim 0.11 \pm 0.03$, and a distance modulus of $[(m-M)_0]_{\mathrm{M15}} \sim 15.03$.

We obtained the observations at the Observatorio Astronómico Nacional in San Pedro Mártir (OAN-SPM), Baja California. We utilised a CCD camera attached to the 1.5 m telescope. The size of the images is 1024×1024 pixels which, at the resulting plate scale, of $\sim 0.24''$/pixel gives a total field size of $\sim 4' \times 4'$ per side.

We observed this cluster in the Johnson filters B, and V and took shorter (60 sec) and longer (300 sec) exposures in order to get unburnt exposures towards the centre of the cluster, as well as being able to detect fainter stars towards its outskirts.

We reduced the data using DAOPHOT. We obtained a clean colour-magnitude diagram (see Figure 1). Our diagram has the classical shape for the metal-poor globular clusters, that is, a very well populated RGB (Sandage et al. 1968), and a relatively large number of blue and RR-Lyrae stars in the HB with respect to the total number of stars in this branch. For comparison purposes we also present in Figure 1 our clean HR diagram and superimposed on it we show the Stetson (2005) data for M15. We see that on the whole the behaviour of our points and those of Stetson's is similar, although his data keep a number of stars to the red of the Main Sequence (MS). These stars have been eliminated by our cleaning procedure.

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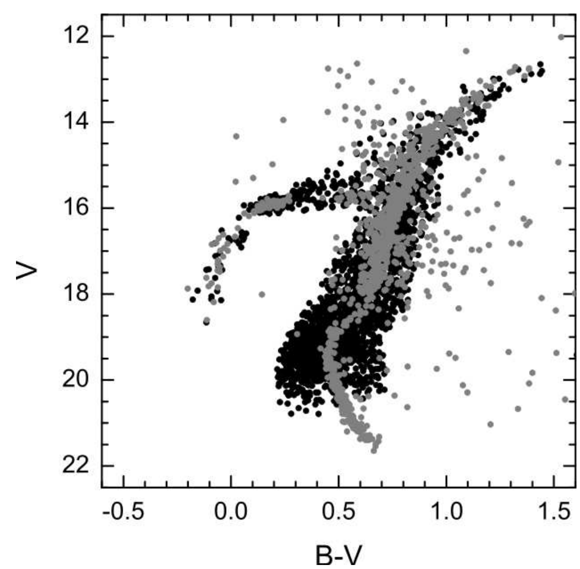

Fig. 1. Stetson (2005) data (grey dots) superimposed on our clean HR diagram (black dots). The general behaviour of his points and ours is similar.

From the data given in M. Salaris (2009, private communication) we obtain a calibration for the He abundance (Y in the Carretta & Gratton (1997) scale) in terms of the values of the R population and the $\mathrm{HB}_{\mathrm{type}}$ parameters. The calibration plane is represented by the following equation:

$$\mathrm{Y} = (0.100 \pm 0.017)\mathrm{R} + (0.015 \pm 0.004)\mathrm{HB_t} + (0.098 \pm 0.005)\,.$$

We determine a value for $[\mathrm{Fe/H}]_{\mathrm{M15}} = -2.16 \pm 0.10$ and $E(B-V)_{\mathrm{M15}} = 0.11 \pm 0.03$, an average distance modulus of $\langle (m - M_0) \rangle_{\mathrm{M15}} = 15.03 \pm 0.35$, a He abundance of $\mathrm{Y}_{\mathrm{M15}} = 0.23 \pm 0.05$.

The SFL is not parallel to the theoretical isochrone lines. It overlaps several isochrones. We **speculate** that this could be due to the fact that there might be a stellar age spread of a few Gigayears.

REFERENCES

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