ENVIRONMENTAL INFLUENCE ON STELLAR EVOLUTION: THE HORIZONTAL BRANCH OF NGC 1851

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The bimodal nature of the horizontal branch (HB) of NGC 1851 is known since Stetson (1981). In order to better understand the properties of its HB, we collected a set of data at the ESO-NTT telescope, which provides a full coverage of the cluster area. Additional archive images from the HST-WFPC camera have been used in order to study the central region. The resulting c–m diagram (CMD) for 20500 stars is presented in Fig. 1 (*left*). Despite its metallicity ([Fe/H]=–1.3), NGC 1851 presents a well defined blue HB tail, besides the expected red clump. The observed CMD has been compared with the synthetic ones. The bimodal HB can be reproduced assuming that there are two stellar populations in the cluster, with an age difference of $\sim$ 4 Gyr, hypothesis not supported by other properties of the CMD. On the other side, if we assume that the stars in NGC 1851 are 15 Gyr old (as suggested by the difference between the HB and the TO luminosities), only a bimodal mass loss can reproduce the HB morphology: only stars with higher than standard mass loss rate are able to populate the blue-HB (BHB) tail (Fig. 1,*left*). There are no observational evidences for a bimodal distribution of other parameters (He, CNO, *etc.*).

There is another observational evidence which might shed some light on the nature of the peculiar morphology of the NGC 1851 HB: the radial distribution of the HB stars. Fig. 1 (*right*) displays the ratio blue- over red-HB stars at four different radial positions. The ratio is clearly increasing towards the center of the cluster as consistently shown by three independent data sets. The blue HB stars are more centrally concentrated than the red ones, as furtherly confirmed by the fact that the ratio N_{BHB}/N_{SGB} increases towards the cluster center, while the ratio N_{RHB}/N_{SGB} is constant. NGC 1851 is a high concentration cluster. Color and population gradients

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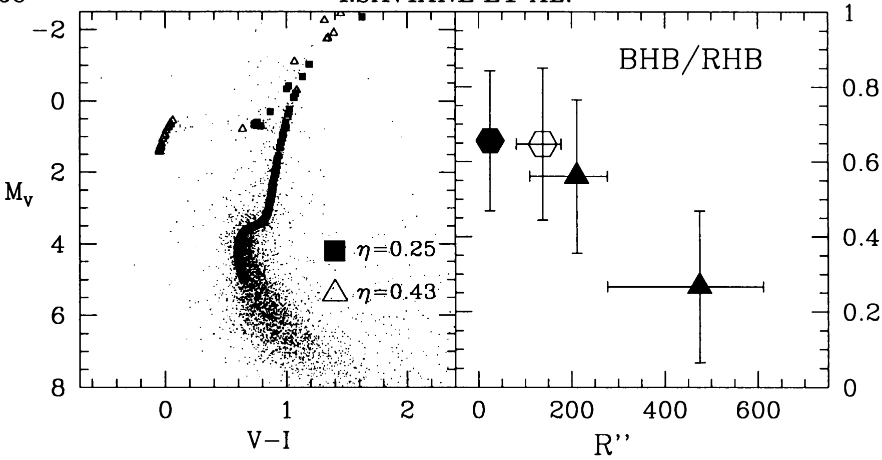

Figure 1. **Left panel**. Synthetic CMDs are compared with the observed CMD of NGC 1851. The simulations are obtained adopting the isochrones by Bertelli et al. (1994). Assuming an age of 15 Gyr, the RHB can be reproduced by a mass loss efficiency of $\eta = 0.25$ while the BHB by $\eta = 0.43$. **Right panel**. The ratio of BHB over RHB stars from the NTT (triangles), Walker (1992) (open circle) and HST/WFPC (filled circle) data. The ratio BHB/RHB increases towards the center of the cluster.

(in the sense of bluer centers) in most of the post–core–collapse have already been found (Djorgovski and Piotto 1993, and references therein). Stars in the core of high concentration clusters are likely to live in an environment where stellar encounters are common; encounters can lead to stripping, particularly of the outer expanded envelope of a red giant (Castellani 1994), which could lead to a population of very blue HB stars. An interesting working hypothesis is that the mass loss in the evolving stars in NGC 1851 could be influenced by its high central concentration. The idea that the HB morphology might be related to the cluster concentration has been developed also in Fusi Pecci *et al.* (1993), where observational evidences of bluer and extended BHB tails in high concentration clusters are presented. Here, for the first time, we show that the environment could be responsible also of the bimodality in the HB of a few clusters. The statistical significance of the gradients is not high, as usual for the GC population gradients, due to the small number of evolved stars. For this reason, our hypothesis needs to be tested on the other bimodal HB GCs.

References

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