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Horizontal Branch stars: He-enhanced stellar models

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Abstract. We present a new database of He-burning low-mass stellar models computed for a wide range of metallicity and different initial helium contents. We also briefly discuss a new approach for investigating the presence of a He-enhanced stellar population in Galactic Globular Clusters based on the comparison between predicted and empirical slope of hot portion of the Horizontal Branch (HB) in the optical-UV Color-Magnitude Diagram (CMD). We apply this procedure to the cluster NGC 2808.

Key words. CM diagram – He burning stars

1. Hot HB stars as He abundance tracers

Recently, it was suggested that some anomalous features observed in CMD of Galactic GCs such as ω Cen (Piotto et al. 2005) and NGC 2808 (D'Antona et al. 2005) could be explained by accounting for an enhancement and/or a spread in the He abundance among the GC stars.

In this preliminary investigation we discuss a new approach for investigating the presence in a GC of a He-enhanced stellar population, based on the analysis of the Horizontal Branch morphology.

Using the same evolutionary code and prescriptions adopted in Pietrinferni et al. (2004) we computed HB star models by adopting α-enhanced heavy elements mixture and a wide

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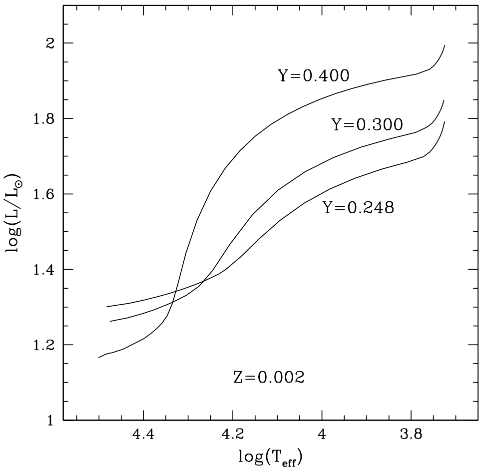

Fig. 1. Theoretical ZAHB loci computed by adopting the same metal content but the different initial He abundances (see labels).

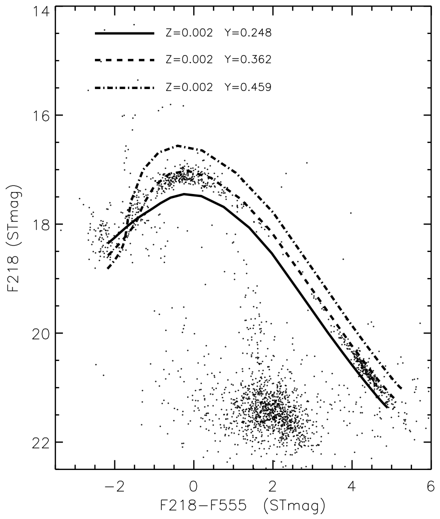

Fig. 2. Optical-UV Color Magnitude Diagram for the Galactic GC NGC 2808. Data were collected with the WFPC2 on board of HST (Castellani et al. 2005).

range of both initial He ($0.2 \leq Y \leq 0.4$) and metal contents, namely $10^{-4} \leq Z \leq 0.0198$.

Fig. 1 shows that the initial He abundance affects not only the HB luminosity level, but also its slope. Specifically, the HB slope at effective temperatures larger than $\approx$ 20000 K, strongly increases when the initial He content increases. The same trend is also present in the observational plane, and becomes more and more evident when moving from visual to UV photometric bands. Therefore, we suggest using the slope of the hot end of the HB in order to constrain the occurrence of a He-enhanced stellar component in the GC stellar population.

Fig. 2 shows the comparison between our models and the optical-UV CMD of the cluster NGC 2808. Current predictions show quite clearly that the slope of extreme HB stars ($T_{eff} \geq$ 18000K) becomes steeper and steeper when He abundance increases. On the other hand, empirical data show a flatter distribution in this HB region; evidence which does not support the presence in this cluster of a stellar population characterized by a significant increase in the initial helium content.

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