THE INFLUENCE OF ROTATION ON HORIZONTAL BRANCH STARS AND ON RR LYRAE PULSATIONAL PROPERTIES.

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The occurrence of rotation in Globular Cluster stars has been suggested (see e.g. Renzini 1977) as a mechanism producing the observed colour spread in actual Horizontal Branches. If this is the case, canonical results on evolutionary properties of HB stars have to be revisited in order to account for rotation-driven structural variations: faster Main Sequence rotators delay the He flash increasing the mass-size M_c of the He core at the flash and loosing a greater amount of mass during the Red Giant stage.
Both these effects act in the sense of increasing the surface temperature of HB stars: the increase in M_c also drives an increase in the luminosity of the Zero Age HB locus. As a consequence canonical results are relased as for as the close correlation between the original helium content Y and the luminosity of HB stars is concerned. It follows that the mean period of RR Lyrae pulsators is no more a "bona fide" function of Y, neither the ratio R between the number of HB and RG stars (Iben, 1968) will remain a completely reliable Y indicator (Castellani et al 1980).
By constructing "sinthetic" Horizontal Branches under wide assumptions on the original chemical composition, we find (Castellani and Tornambè 1980) that observations can be watched with theory if galactic HB_s are populated by stars evolving along typical low-He ($Y \sim 0.22$) evolutionary tracks but overluminous will respect to the expectation from the canonical evolutionary frame.
If MS rotation is causing the quoted HB morphology, one can derive that galactic globular clusters are fitted by the values $Y \sim 0.22$, $t \sim 12 \cdot 10^9$ yrs, $\omega_o = 3.6 \cdot 10^{-4}$ provided that the efficiency of mass loss is supposed to sensitively increase in increasing the metal content Z.

References

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