CONVECTIVE OVERSHOOTING: NEW INTEGRATED COLOURS VS AGE RELATIONS FOR STAR CLUSTERS

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If the integrated colours of a star cluster mainly depend on chemical composition and age, then theoretical calibrations of colours as function of age for different chemical compositions are very useful to obtain quantitative determinations of the age and composition of individual clusters, and thus to trace the chemical history of nearby galaxies. Several calibration curves exist in the literature which rest on the standard theory of stellar evolution. However, a growing amount of observational evidence seems to indicate that overshooting from convective cores may be an important phenomenon in stellar evolution. In fact models computed with overshooting are significantly different from the standard ones. The aim of this preliminary investigation is to study the effects of convective overshooting on the integrated colours of clusters whose turnoff mass is in that range in which convective overshooting is effective.

The Results

We have computed (B-V):(U-B) colours as a function of age adopting the following theoretical background:
a)Evolutionary tracks with overshooting parameter $\lambda=1$ and chemical composition X=0.700 and Z=0.02 (Bertelli et al 1985)
b)Relation between Mbol, LogTeff and BC, (B-V), (U-B) from model atmospheres collected from many sources and amalgamated in homogeneous manner
c)The mass loss rate during the AGB phases as in Reimers (1975) with $\eta=1$.
The separate contributions of main sequence, main sequence + red giant, main sequence + red giant + AGB phases are shown in fig 1 for (B-V) only. In the same figure the new relations are compared with those derived from classical models. Two points are evident: a)the small effect on the colour by including the AGB phase, while the contribution of the red gi[illegible] e is dominant , b)the sudden change in (B-V) slope at age $\simeq 10^9$ yr, which does not occur with other relationships. The calibration curves of fig 1 rest on the hypothesis that the clusters possess an infinite number of stars. On the other hand it is easy to understand that stochastic fluctuations in the populations of rare but luminous stars may determine a dispersion in the colours of real clusters, and that the amplitude of the dispersion depends on the total number of evolved stars. To test the point

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and to ascertain the amount of dispersion, a large number of Montecarlo simulations of real clusters have been performed. The dispersion in (B-V) as a function of different number of evolved stars is shown by the vertical bars along which are annotated the numbers of evolved stars per cluster. In order to test the reliability of the new calibration we have also plotted several LMC clusters, whose colours are from van den Bergh (1981) and ages from Chiosi et al (1985) (with overshooting). The points populate in a satisfactory way the dispersion band predicted by a finite number of stars. If the old calibration curve and the ages from Hodge (1983) are used (no overshooting) the agreement is not as good as in the previous case. New calibration curves with different chemical composition (Z=0.001 and X=0.700) are in progress on the aim of exploring if the sudden change in the slope of (B-V)-age relation at $t \cong 10^9$ yr, together with dispersion effects due to the finite number of evolved stars, and differences in chemical composition might be responsible of the discontinuity shown by LMC clusters in the relation (B-V) versus cluster type of the Searle et al (1980) classification.

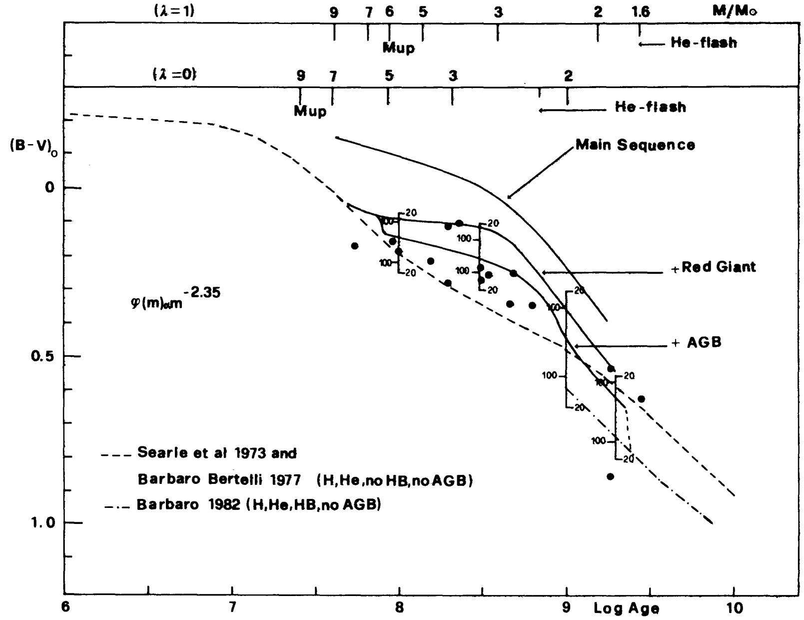

Fig. 1

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