EVAPORATING STARS AT GALACTIC CENTERS ?

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1. Wolf-Rayet (WR) stars in metal rich regions

The Geneva group has computed a complete grid of stellar models from 0.8 to 60 $M_\odot$ at a metallicity of Z=0.100 (*i.e.* 5 times solar, Mowlavi et al. 1997). These stellar models present interesting features such as the nearly complete evaporation of the most massive stars due to intense stellar winds. For instance, for $Z > 0.040$, final stages of massive stars (M > 60 $M_\odot$) might be white dwarfs rather than neutron stars or black holes [1].

Statistics of WR stars much depend on the mass loss rates used. Below we present results for low (or standard) and high mass loss rates (see Meynet et al. 1994, for a description of these rates). At $Z = 0.100$ and for standard $\dot{M}$, one has about one WR star for 2 O-type stars. When high $\dot{M}$ are considered, this proportion rises up to 3 WR stars for 4 O-type stars. The number ratios of WR stars of a given type to the total number of WR stars are, (under the assumption of a constant star formation rate): 0.29 for WNL, 0.24 for WNE, 0.47 for WC in the case of standard $\dot{M}$, and 0.55 for WNL, 0.26 for WNE and 0.19 for WC in the case of enhanced $\dot{M}$.

Two synthetic HR diagrams for clusters with an age of 4 Myrs and metallicities Z = 0.020 and Z = 0.100 are presented in Fig. 1. At Z=0.100,

[1]The discovery of white dwarfs in young metal rich clusters would support such a scenario.

Y. Sofue (ed.), The Central Regions of the Galaxy and Galaxies, 441-442.

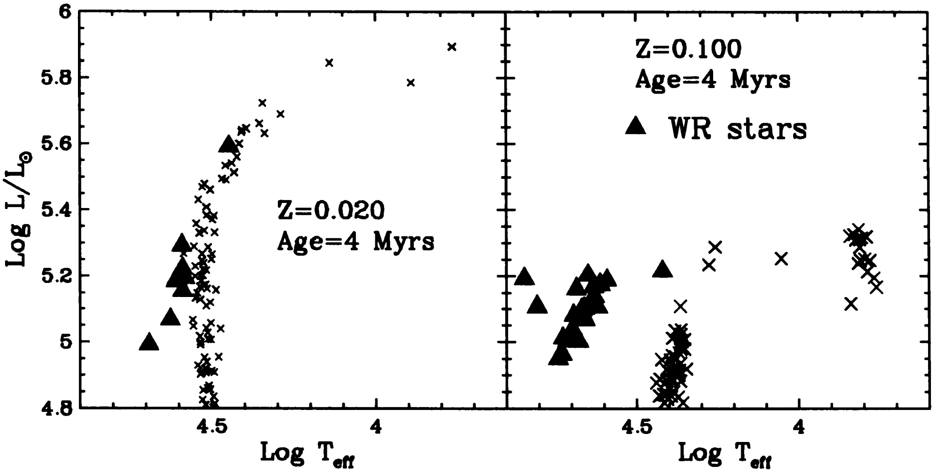

Figure 1. Synthetic clusters obtained using a Salpeter IMF ($dN/dM \propto M^{-2.35}$). The total number of stars in each cluster is fixed by imposing that the number of stars with an initial mass between 8 and 14 $M_{\odot}$ is equal to 250. Small errors on $\log T_{eff}$ and $\log L/L_{\odot}$ of at most 0.02 dex are taken into account. Only single stars have been considered. The models are those of Meynet et al. (1994, Z=0.020) and Mowlavi et al. (1997, Z=0.100).

O stars have already disappeared after only 2 Myrs, while, slightly more than two dozen of WR stars (of WN type) are present. After 4 Myrs, and in the high Z cluster, the number of WR stars remains still important. It amounts in our numerical example to 23, which corresponds to more than twice the number of WR stars expected in a similar cluster at solar metallicity. In general, at high Z, WR stars appear in greater numbers, and at a younger age than at solar metallicity. This has interesting consequences on the expected number of supernovae having a WR star as progenitor (see Mowlavi et al. 1998).

Properties of the stellar models at Z=0.04 and 0.100 might well apply to massive stars in the Galactic Centre clusters (see the discussion in Schaerer 1996 and recent observations by Najarro et al. 1997) or other similar clusters found in the central regions of galaxies.

References

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