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THE ROLE OF LOW METALLICITY AGB STARS IN GLOBULAR CLUSTER EVOLUTION

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Abstract. We compute models of intermediate mass stars at low metallicity from the pre-main sequence up to the end of the thermal pulse phase on the asymptotic giant branch (AGB) with the code STAREVOL. We focus on the nucleosynthesis that occurs in these objects and on the corresponding stellar yields. We also discuss the effects of rotation in these stars. Our goals are: to test whether such objects can build up the O-Na anticorrelation observed in all galactic globular clusters; to estimate their contribution to primary nitrogen at low metallicity.

1 Stellar models with STAREVOL

The stellar models presented here are computed with the stellar evolution code STAREVOL (Siess et al. 2000). We present models of 7 $M_\odot$ with and without rotation at $Z = 10^{-5}$. The rotating models stop after the second dredge-up. These models include the most up-to-date input physics. Diffusive overshoot (Herwig 2000) is included during the AGB phase below the convective envelope. The mass loss rate follows the prescription by Reimers (1975) during the pre-AGB phase and the prescription by Blöcker (1995) during the AGB phase. In all cases, the mass loss is scaled on metallicity by a factor of $\sqrt{Z}$. Rotation is modeled following Zahn (1992) and Maeder & Zahn (1998) and implemented in STAREVOL as described in Palacios et al. (2003). We take into account the effect of meridional circulation and shear turbulence in the transport of angular momentum and chemical.

2 Main results

We compute both standard and rotating models. We show in Fig. 1 that standard AGB models produce an appropriate increase of sodium during the second dredge-up, which correlates with an increase (instead of a decrease) of oxygen during the

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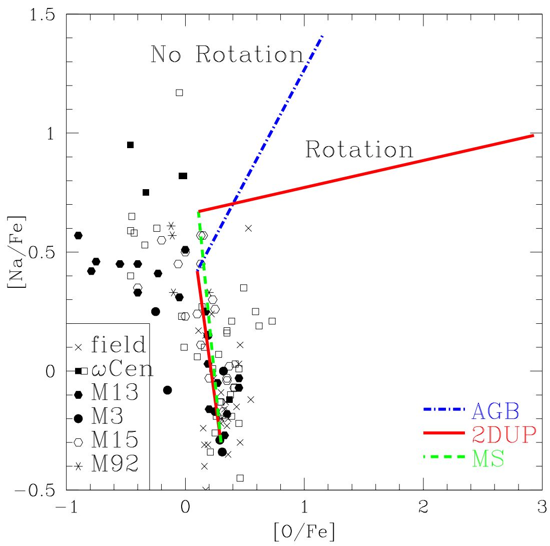

Fig. 1. O-Na anti-correlation in several globular clusters (data from Weiss et al. 2000). We also show the main evolution of the surface abundances for our rotating and non-rotating models

thermal pulses phase. Moreover, rotation increases the surface oxygen abundance during the second dredge-up. Thus, massive AGB stars at low metallicity create a correlation between sodium and oxygen abundances instead of the anti-correlation that we would expect if they were responsible for the anomalies observed in GCs. This points towards other sources to build such an anti-correlation.

As shown by Meynet & Maeder (2002), low metallicity rotating AGB stars can bring an important quantity of primary ^{14}N at the surface during the second dredge-up. We confirm this fact: rotating models at very low metallicity produce a huge quantity of primary nitrogen contrary to standard models.

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