Effects of rotation on the evolution of primordial stars

S. Ekstr"om[1], G. Meynet[1], C. Chiappini[1,2], R. Hirschi[3], A. Maeder[1]

1 - Geneva Observatory, University of Geneva, Switzerland; 2 - Osservatorio Astronomico di Trieste, Italia; 3 - University of Keele, UK

(Abridged) Rotation has been shown to play a determinant role at very low metallicity, bringing heavy mass loss where almost none was expected. Is this still true when the metallicity strictly equals zero? The aim of our study is to get an answer to this question, and to determine how rotation changes the evolution and the chemical signature of the primordial stars. We have calculated 14 differentially-rotating and non-rotating stellar models at zero metallicity, with masses between 9 and 200 Msol. The evolution has been followed up to the pre-supernova stage. We find that Z=0 models rotate with an internal profile Omega(r) close to local angular momentum conservation, because of a very weak core-envelope coupling. Rotational mixing drives a H-shell boost due to a sudden onset of CNO cycle in the shell. This boost leads to a high 14N production. Generally, the rotating models produce much more metals than their non-rotating counterparts. The mass loss is very low, even for the models that reach the critical velocity during the main sequence. Due to the low mass loss and the weak coupling, the core retains a high angular momentum at the end of the evolution. The high rotation rate at death probably leads to a much stronger explosion than previously expected, changing the fate of the models. The inclusion of our yields in a chemical evolution model of the Galactic halo predicts log values of N/O, C/O and 12C/13C ratios of -2.2, -0.95 and 50 respectively at log O/H +12 = 4.2.

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Comments:

Email: sylvia.ekstrom@obs.unige.ch