PRIMEVAL OXYGEN OVERABUNDANCE AND TYPE I-1/2 SUPERNOVAE

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Abstract: Models of chemical evolution of the Galaxy have been computed by taking into account the different roles played by TypeI-1/2 (single stars suffering degenerate C-ignition) and TypeII supernovae in the chemical enrichment. The overabundance of oxygen observed in the Halo stellar population has been well reproduced.

Introduction: Little attention has been devoted to the role played by TypeI-1/2 or I supernovae in the chemical history of our Galaxy.
Following some recent results and suggestions on the mass spectrum of single stars suffering Carbon-deflagration and on its behaviour versus the initial metal content of the progenitor star (Tornambé,1983),we have computed models of galactic chemical enrichment starting from a pure Hydrogen and Helium protohalo mixture.
As is well known,degenerate Carbon-ignition gives rise to a thermonuclear runaway in a core of about 1.4 $M_{\odot}$;one half of this core can reach nuclear statistical equilibrium and,if the star is finally destroyed,a large amount of Iron-peak nuclei can be ejected into the interstellar medium. The question concerning the exact amount of matter processed is still under debate,because fully hydrodynamical codes and several physical processes are required to follow correctly the last evolutionary stages of the quoted stars; current ideas suggest an estimate of 0.7 $M_{\odot}$ of Iron peak nuclei and 0.35 $M_{\odot}$ each of Carbon and Oxygen (Nomoto,1984). These amounts have been chosen as inputs for our code.
The mass spectrum of TypeI-1/2 supernovae falls between 4 and 10 $M_{\odot}$ for $Z \leq 10^{-8}$ becoming narrower as the initial metallicity of the progenitor star increases(i.e. between 8 and 9 $M_{\odot}$ for $Z=10^{-2}$),(Tornambé,1983b).

Results: We have used the chemical evolution model performed by Chiosi and Matteucci(1982),in which the basic assumptions are: i) no instantaneous approximation ; ii) detailed description of the variation over the

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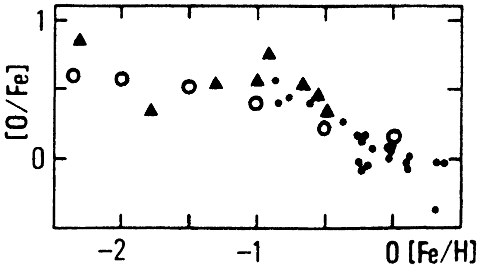
galactic lifetime of a set of elements (He,C,O,Si+Fe),due to stellar nucleosynthesis,stellar mass ejection and inflow of primordial gas.
The initial mass function is expressed as a power law($\varphi(m)\propto m^{-x}$),and two cases are considered: costant slope(x=1.35) over the galactic lifetime and a time variable slope,as suggested by Melnick and Terlevich,1983.
One of the most straightforward tests for our chemical model was to account for recent observations concerning the overabundance of Oxygen with respect to Iron in metal deficient stars(Sneden et al.1979,Clegg et al. 1981). The other properties of the solar vicinity(i.e. the G-dwarf distribution and the age-metallicity relationship) have been also fitted likewise. The model results can be summarized as follows:

i) TypeI-1/2 supernovae are required to explain the Oxygen overabundance with respect to Iron in metal poor stars.In fact,they restore to the interstellar medium a substantial fraction of Iron with a temporal delay due to their longer lifetimes.
However,the Iron ejected by TypeII supernovae($M\geq10\ M_\odot$),although it must be produced in a smaller amount(one half) with respect to the one predicted by Arnett(1978),is also required.

ii) Our best model contains both Type II and I-1/2 supernovae,no mass loss in massive stars and constant initial mass function over the galactic lifetime.



Observational data(filled points and triangles) by Clegg et al. and Sneden et al. Open circles represent our theoretical best model.

iii) The model computed with variable initial mass function well fits the overabundance of Oxygen during the Halo phase but Oxygen and Iron during the Disk phase are underestimated.

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