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Evolution of ^{6}LiBeB in Inhomogeneous Early Galaxy

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Abstract. Results of evolution of light elements (^{6}LiBeB) based on supernova (SN)-induced chemical evolution model are presented. We point out an important property of light elements as a cosmic clock in metal-poor stars.

Recent observations of old population II stars (Mcwilliam et al. 1995, Ryan et al. 1996) reveals that the their chemical compositions seem to reflect nearby SN events in the regions in which the stars were formed (Audouze, & Silk 1995). As a result, metallicity cannot be used as a reliable age indicator for the most metal-poor stars. Tsujimoto, Shigeyama, & Yoshii (1999) presented a SN-induced chemical evolution model based on these views. In their model all the stars at early epochs are born from SNR shells, as a result of their relatively high density. Their model accounts very well for the large observed scatter in the abundances of (some) heavy elements in PopII stars. Suzuki, Yoshii, & Kajino (1999) extended this model to investigate Be and B, which are mainly produced by spallation reactions involving Galactic cosmic rays (GCRs). The great advantage of this model is that it can treat the evolution of elements in an inhomogeneous, evolving, Galactic Halo in a self-consistent manner, without the need to set model parameters in an ad-hoc fashion.

Fig.1 shows our results for the SN-induced chemical evolution model of the expected frequency distributions of ^{6}LiBeB (vertical axis) and Fe (transverse axis) in the long-lived stars ($m < M_{\odot}$) with the available observations superposed. An important prediction for ^{6}LiBeB, according to this model, is that the abundances of these light elements in metal-deficient stars are expected to be better correlated with the time of formation of the stars than the abundance of heavy elements (a detailed discussion given by Suzuki et al. 2000; see also Beers et al. this volume). This is because these elements are synthesized by reactions involving GCRs which propagate rapidaly throughout the entire Halo.

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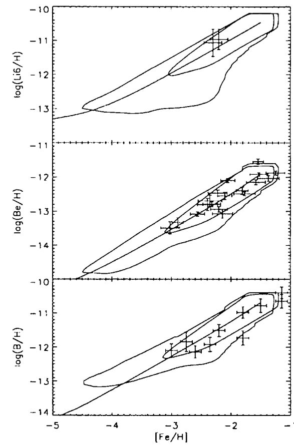

Figure 1. Predicted frequency distributions of long-lived stars in the [Fe/H]-log(L/H) planes, convolved with Gaussians having $\sigma = 0.15$ dex for Be, B, and Fe and $\sigma = 0.3$ dex for ^{6}Li, for comparison with the observations. The two contour lines, from the inside to the outside, correspond to those of constant probability density 10^{-3}, and 10^{-5} in unit area of Δ[Fe/H]=0.1$\times\Delta$log(L/H)=0.1. The solid line shows the [Fe/H]-log(L.E./H) relation in the gas. The crosses represent the data, with observational errors, taken from Smith et al. (1998; ^{6}Li), Boesgaard et al. (1999; Be), and Primas et al. (1999; B) and Duncan et al. (1997; B).

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