 Supernova Nucleosynthesis and Extremely Metal-Poor Stars

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We present explosions and nucleosynthesis of population III supernovae (SNe) and compare the abundance patterns of the yields with those of the metal-poor stars.

Recently, very accurate observations of abundances of Extremely Metal-Poor (EMP) stars have been performed with VLT and SUBARU. They determined the abundance patterns of many EMP stars \((-4.2<[Fe/H]<-2)\). In the result, it is confirmed with small dispersions that the abundance ratios of these stars are obtained like a function of the metallicity \([Fe/H]\). For example, the smaller \([Fe/H]\) is, the larger \([Zn,Co/Fe]\) are, and the smaller \([Cr/Fe]\) is. We propose that SN models with different main-sequence masses and explosion energies can explain the observed trends.

Next, the metal-poor stars with \([Fe/H]<-4\), i.e., a ultra metal-poor (UMP) stars \((-5<[Fe/H]<-4)\) and two hyper metal-poor (HMP) stars \([Fe/H]<-5\), are carbon-enhanced. We perform two-dimensional hydrodynamical calculations of the jet-like explosions and propose that the tendency stem from the properties of the jets, especially energy deposition rates.

References