P053-027 Room: C401 Time: May 30 13:30-13:45

Carbon and Nitrogen isotopic ratios in suernova ejecta of low metallicity stars and presolar grains from supernovae

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It is considered that SiC type X grains and some of graphite grains originate from type II supernovae. These grains are identified as supernova origin based on the qualitative and quantitative comparison between their isotopic ratios and those evaluated by supernova explosion models. Travaglio et al, (1999) performed mixing calculations of different layers in supernova explosions and compared the resulting isotopic ratios with the isotopic ratios of graphite grains previously measured. As a result, the excesses of 28Si and the wide range of 12C/13C ratios measured in the graphite grains were reproduced by the mixtures between the deep layer and the He/C-layer in the supernova ejecta. On the other hand, the excesses of 15N combined with 13C excesses were not reproduced even if the mixing in the supernova explosion is considered. Travaglio et al, (1999) performed the mixing calculations using supernova models by Woosley and Weaver (1995) and the initial composition of the model they used is the solar-system composition. However, the material in the solar-system consists of the ejecta from stars which have been evolved before the solar-system formation and the initial metallicity of the stars would be less than the solar metallicity. In this study, we set the initial metallicity of massive star as 1/10 of the solar metallicity and perform the mixing calculations of different layers in supernova explosions. Using the obtained results, we investigate the range of the isotopic ratios of 12C/13C-14N/15N in the mixture of the different layers of the low metallicity supernovae.

First, we carried out the stellar evolution of 4 solar mass and 1/10 solar metallicity He star from the core He burning to the onset of the core collapse using the He star model in Nomoto and Hashimoto (1988), Hashimoto (1995). The He star with 4 solar mass corresponds to 15 solar mass main sequence star. We follow the calculation of the supernova explosion using the explosion model in Shigeyama et al, (1987), Hashimoto (1995). From the calculations of the stellar evolution and the supernova explosion, the time variation of the temperature, the density and the radius distributions of the He star is obtained. Secondly, using the temperature, the density, and the radius profiles we calculate the nucleosynthesis with a nuclear reaction network which consist of 675 species of nuclei up to Pr. From the obtained composition distribution of the supernova explosion model, we evaluate the range of 12C/13C-14N/15N ratios in the supernova ejecta of 4 solar mass and 1/10 solar metallicity He star. For comparison, we also evaluated the range of 12C/13C-14N/15N ratios in the case of 4 solar mass and the solar metallicity He star.

We evaluated the ranges of the 12C/13C-14N/15N ratio of the 4 solar mass He stars with different metallicity taking account of the mixing process during the supernova explosions and the condition necessary to the carbide grain formation that C/O ratio is grater than unity. The range of the 12C/13C ratio under the condition of the 14N/15N lower than the corresponding solar-system ratio is 70-600000 and 70-3000000 in the cases of solar metallicity He star and the 1/10 solar metallicity He star, respectively. The minimum ratio of 12C/13C under the condition of the excess of 15N hardly depends on the metallicity. The small 12C/13C ratios with 15N excess is not reproduced by the mixing calculation of the supernova model of the 1/10 solar metallicity He star. In the meeting we will talk about production process during the supernova explosions and composition distribution of the supernova ejecta.