Contribution ID: **52** Type: **oral contribution**

Neutrino self-interaction and MSW effect on the neutrino-process in core-collapse supernovae

Thursday, 23 August 2018 16:25 (15 minutes)

We investigate the nuclear abundances uniquely produced from the neutrino-process in supernova (SN) explosion. We calculate the neutrino flux propagation and its modification by neutrino self-interactions near the neutrino-sphere along with the Mikheyev-Smirnov-Wolfenstein (MSW) mixing in the outer envelopes. We compute the neutrino-induced nucleosynthesis of ^{7}Li, ^{11}B, ^{92}Nb, ^{98}Tc, ^{138}La, and ^{180}Ta. Near to the neutrino-sphere, the neutrino density is $\sim 10^{32}\mathrm{cm}^{-3}$. This number density is sufficiently large that the neutrino self-interaction becomes important. The interaction effect on the neutrino flux is calculated by solving the evolution equation for the neutrino density matrix with a collision term estimated in the mean field approximation. We discuss how the neutrino self-interaction and the MSW effect influence the nuclear production by using the modified neutrino spectra along with neutrino-nucleus interactions calculated in the Quasiparticle Random Phase Approximation (QRPA). Our results show that abundances of all nuclides considered in this work are increased by the neutrino self-interaction.

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Session Classification: YSS