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Neutrino-Process for Core Collapse Supernova Explosion

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We investigate the neutrino oscillation effects by the neutrino self-interaction near to the neutrino sphere and the MSW effect far from the sphere on the element abundances. The representative synthesized elements by neutrino from supernova explosion are known as 7Li, 11B, 92Nb, 98Tc, 138La, and 180Ta. Near to the neutrino sphere, the neutrino density is about 1032 / cm3, whose number is high enough to consider the neutrino self-interaction.

Their effects on the neutrino flux are estimated in the Boltzmann equation with a collision term for the neutrino density under the mean field approximation. Due to the propagation of the shock wave we also have to take the neutrino propagation in matter, i.e. MSW effects. One of the important MSW regions is the O/Ne/Mg layer given by the progenitor and the hydrodynamics models.

In this work, we discuss how the neutrino self-interaction and the MSW effects influence on the element production by using the modified neutrino spectra and the neutrino-nucleus interactions calculated by QRPA. Our results show that the neutrino-process element abundances are increased by the self-interaction rather than the MSW effect. 11B/138La ratio is shown to be sensitive on the self-interaction. Dependence on the mass hierarchy is also discussed.

Recent calculations about the non-adiabatic shock effects on the neutrino propagation and the effects by sterile neutrinos will also be discussed with the nuclear abundances by the neutrino process.

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