Contribution ID: **20** Type: **Poster Presentation**

ASTROPHYSICAL NEUTRINOS FLAVOR EVOLUTION WITH SELF INTERACTION

Wednesday, 15 June 2016 16:30 (1h 30m)

The neutrinos that emerge in the core collapse supernovas play an important role in the cooling mechanism of the proto-neutron star (PNS). The luminosity of the neutrinos that emerge in the explosion is estimated to be 10^{52} erg/s [1]. Although the neutrinos'interaction cross-section is relatively very small, such a dense medium makes it possible for the neutrinos to engage in self-interaction [2]. In this study interactions of neutrino-matter are added to the calculations indirectly [3]. Neutrino-neutrino interactions are described by two kinds of scattering diagrams: the forward scattering diagram and the scattering diagram with exchanged momentum. When the self-interacting neutrinos are emitted from the PNS and traverse approximately 300km of range, they undergo a spectral split in their energy spectrums [4]. The spectral split which is dependent on the initial conditions such as the variety of distributions and temperature is important because it can give us important clues in evaluating or interpreting a neutrino signal of a supernova explosion that is anticipated to be observed in the near future. In this study, spectral splits for various energy spectrums, mixing angles and temperatures that are employed in the supernova models in the literature are obtained. Thus when the neutrinos, which are assessed to be coming from a supernova explosion, are detected, we can understand that which supernova model is more realistic and compatible with the experimental data.

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Session Classification: Posters