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Neutrino emission and equation of state in core collapse supernovae

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I would like to report the recent progress on microphysics and supernova neutrinos utilizing our numerical simulations based on Boltzmann equation. As recent progress of core-collapse supernova simulations is rapid toward the first principle type calculations, remaining uncertainties of the microphysics are becoming important.

We have been developing the data table of equation of state (EOS) based on the nuclear many body theories both in non-relativistic and relativistic approaches including detailed information of mixture of nuclei (Togashi, Furusawa 2017, 2019). Revision of Shen EOS table is on going with improvement of isovector interactions for neutron matter, keeping good properties of nuclei and nuclear matter with TM1 (Hu, Sumiyoshi et al., 2019). Our group is running 2D core-collapse supernovae by neutrino-radiation hydrodynamics with 6D Boltzmann solver using some of these microphysics and I would like to touch upon their effects.

I would like to also report the prediction of neutrino detection at Superkamiokande based on supernova neutrino database and a series of simulations. Long term behavior of event number of neutrino detection over 100 sec is studied by proto-neutron cooling simulations to determine the last event and burst duration. We propose the backward time plot to extract the properties of proto-neutron star (Suwa et al. 2019). 1D simulations with Boltzmann equation have been also applied to predictions of diffuse supernova neutrino background in order to assess the fraction of black hole formation from massive stars (Horiuchi et al. 2018).

Keywords

Core-Collapse Supernovae

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