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The Neutrino Opacities in Core-collapse supernovae: a Systematic Way to Describe Neutrino Interactions for a Wide Range of Densities at Finite Temperature ZIDU LIN, ANDREW STEINER, University of Tennessee — We derived both neutrino neutral current and charged current interactions based on random phase approximation (RPA). The RPA is treated as an extendable platform where other many body effect modules, such as nucleon potential mean field corrections and collisional broadening, can be easily added. Furthermore, the RPA consistently relates the neutrino response with an equation of state (EoS). In this work, we employed density-dependent nucleon effective mass, Landau Fermi liquid parameters and nucleon potential, which are all derived from a Skyrme type EoS (NRAPR), in the RPA approximation. We further discuss the possibilities of estimating the uncertainties of neutrino response coming from the Skyrme EoS parameters. Finally, we discuss approximations beyond RPA at low densities to find an appropriate method to describe the dynamic neutrino response that is consistent with the model-independent virial approximation of neutrino static response.

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