Abstract Submitted
for the DNP20 Meeting of
The American Physical Society

Spin and density response functions for hot and dense nuclear matter from chiral nuclear forces[1] EUNKYOUNG SHIN, JEREMY HOLT, Department of Physics and Astronomy, Texas AM University, College Station, Texas 77843, USA, ERMAL RRAPAJ, School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455, USA, SANJAY REDDY, Department of Physics, University of Washington, Seattle, Washington, USA — The response functions and associated dynamical structure factors of nuclear matter affect neutrino propagation in core-collapse supernovae and neutron star mergers. In this talk we will discuss new calculations of the spin and density response functions of beta equilibrium matter under a wide range of ambient conditions starting from realistic chiral nuclear forces. We include both mean field and vertex corrections at first order in many-body perturbation theory. The former have already been shown to significantly affect neutrino charged-current reactions in the neutrinosphere, and in the present work we highlight the role of vertex corrections that enter at the same order in perturbation theory. Theoretical uncertainties are estimated by varying the order in the chiral expansion and the high-momentum cutoff scale in the effective field theory expansion of the nuclear force. We expect the results of this study to provide theoretical guidance for neutrino reaction rates used in numerical simulations of supernovae and neutron star mergers.

[1]This work was supported by the National Science Foundation under Grant No. PHY1652199. Portions of this research were conducted with the advanced computing resources provided by Texas AM High Performance Research Computing.

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Date submitted: 17 Jul 2020 Electronic form version 1.4