Abstract Submitted
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Analytic Closure Relations in M1 Neutrino Radiation Transport in Core-Collapse Supernovae[1] ELENA MURCHIKOVA, CHRISTIAN D. OTT, California Institute of Technology, ERNAZAR ABDIKAMALOV, Nazarbayev University, Kazakhstan, EVAN O'CONNOR, North Carolina State University, JOHN WENDELL, None, TODD URBATSCH, Los Alamos National Laboratory — Neutrinos play a crucial role in core-collapse supernova explosions. They deposit energy in the region behind the stalled shock and aid its revival. Moreover, together with gravitational waves, they are the only messengers that provide us with information from the supernova core. Full neutrino transport is a 6+1 dimensional problem and efficient yet accurate approximations are necessary to include neutrino transport in simulations. One approximation that has recently become popular is the M1 radiation transport scheme, which solves equations for the first two angular moments of the transport equation and closes the expansion with an analytic closure based on values of the first two moments. The quality of the M1 approximation depends on the quality of the chosen closure relation and it is not a priori clear, which closure to chose under which circumstances. We carry out an extensive study of closure relations available in the literature and compare M1 results to full Monte Carlo transport solutions in the context of spherically-symmetric core-collapse supernovae. We consider post-core-bounce configurations at multiple different times and study the dependence of the physical closure relation (obtained with Monte Carlo) on neutrino energy, species, and the background matter.

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