A Discontinuous Galerkin Method for Spectral Neutrino Transport

EIRIK ENDEVE, Oak Ridge National Lab, RAN CHU, University of Tennessee, Knoxville, CORY HAUCK, Oak Ridge National Lab, ANTHONY MEZZACAPPA, University of Tennessee, Knoxville — We are developing methods for simulation of multi-dimensional neutrino transport in nuclear astrophysics applications (e.g., core-collapse supernovae and binary neutron star mergers). We aim to develop methods that are accurate and robust. Here we consider a multi-group two-moment model, where the spectral particle density $N$ and flux $F$ — angular moments of a phase space distribution function $f$ — approximates the radiation field in a computationally tractable manner. Our approach is based on the Runge-Kutta discontinuous Galerkin method. Building on our previous work, we are developing a method that maintains realizable solutions in the sense that $N$ and $F$ remains consistent with moments of an underlying Fermi-Dirac distribution (satisfying $0 \leq f \leq 1$). We present details of the physical model, the numerical method, and show preliminary numerical results.

1US Department of Energy and National Science Foundation
3Endeve et al. 2015, JCP, 287, 151-183

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Eirik Endeve
Oak Ridge National Lab

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