SORTING CATEGORY: L1 (Simulation Methods and Implementation)
CATEGORY TYPE: Computational Physics

TITLE: A Discontinuous Galerkin Method for General Relativistic Hydrodynamics in thornado

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ABSTRACT:

Discontinuous Galerkin[1] methods have been applied to special relativistic hydrodynamics, but little is known about their application to general relativistic hydrodynamics and/or problems in curvilinear coordinates. We are developing such a solver, with an eye strongly towards core-collapse supernovae (CCSNe). We show results from three test problems: The first is a 2D, special relativistic Kelvin-Helmholtz instability problem, showing the code's ability to resolve turbulence; the second is a 2D, special relativistic Riemann problem, which demonstrates the code's ability to resolve strong shocks; and the third is the standing accretion shock instability problem, a crucial element of the neutrino-driven CCSN explosion mechanism[2], which tests the code's ability to handle curvilinear coordinates in a stationary background spacetime. These problems also test the code's use of limiters, such as the slope and positivity limiters. We are developing this code under the thornado framework, and will make use of AMReX[3] to add AMR capabilities. S.D., E.E., A.M., and J.B. acknowledge support from the NSF Gravitational Physics Program (NSF-GP 1505933 and 1906692).

[1] Cockburn, B., & Shu, C.-W. (2001), J. Sci. Comput., 16, 173
[2] Blondin, et al., (2003), ApJ, 584, 971
[3] LBNL