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A Discontinuous Galerkin Method for General Relativistic Hydrodynamics[1] SAMUEL DUNHAM, Vanderbilt University, EIRIK ENDEVE, Oak Ridge National Laboratory, ANTHONY MEZZACAPPA, University of Tennessee at Knoxville — Core-collapse supernovae (CCSNe) are multi-physics phenomena; the study of which provides insight into, among other things, the origin of the elements. To simulate supernova hydrodynamics we are developing a new code for solving the general relativistic (GR) hydrodynamics equations, using the discontinuous Galerkin (DG[2]) method combined with Runge-Kutta (RK) time-stepping. The RK-DG method is high-order accurate and local in space, and can therefore achieve high spectral bandwidth in regions with unsteady smooth flows (e.g., turbulence). At the same time it can capture discontinuities, such as in the nonlinear phase of the standing accretion shock instability (SASI[3]). Many current simulations point to the crucial role played by the SASI in aiding the neutrino-driven CCSN explosion mechanism. The first scientific target of our new code is to further understand the SASI's development in compact GR environments. We present the initial conditions and show preliminary results. We also address the questions of how well the RK-DG method handles shocks and resolves the turbulent flows that develop from the SASI.

[1]NSF Gravitational Physics Theory 1505933
[2]Cockburn, B., & Shu, C.-W. (2001). J. Sci. Comput., 16, 173
[3]Blondin, J. M., Mezzacappa, A., & DeMarino, C. (2003). ApJ, 584, 971

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