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General-relativistic neutron star evolutions with the discontinuous Galerkin method FRANCOIS HEBERT, Caltech, LAWRENCE KIDDER, SAUL TEUKOLSKY, Cornell University — Simulations of relativistic hydrodynamics often need both high accuracy and robust shock-handling properties. The discontinuous Galerkin (DG) method combines these features — a high order of convergence in regions where the solution is smooth, and shock-capturing properties for regions where it is not — with geometric flexibility, and is therefore well-suited to solve the PDEs describing astrophysical scenarios. We present here evolutions of a general-relativistic neutron star with the DG method. We simultaneously evolve the spacetime geometry and the neutron star matter on the same computational grid, which we conform to the spherical geometry of the problem. The evolutions show long-term stability, good accuracy, and improved rate of convergence versus a comparable-resolution finite volume method.

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