

High order well-balanced finite volume and discontinuous Galerkin schemes for a first order hyperbolic reformulation of the coupled Einstein-Euler system in 3+1 general relativity

Michael Dumbser

University of Trento, Via Mesiano 77, 38123 Trento, Italy

We present new well-balanced discontinuous Galerkin finite element schemes with subcell finite volume limiting for the solution of a new first order strongly hyperbolic Z_4 formulation of the Einstein-Euler system of general relativity. Nonlinear involutions are accounted for via a covariant GLM cleaning technique. In this talk we introduce a new, simple and efficient type of well-balancing that automatically applies to any numerical discretization and arbitrary equilibria in multiple space dimensions. We show numerical results for stable long-time evolution of vacuum spacetimes, including black-hole spacetimes and for a stable TOV star. We also show preliminary results for a head-on collision of two puncture black holes.