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Numerical simulations with a First order BSSN formulation of Einstein's field equations DAVID BROWN, North Carolina State University, PETER DIENER, Louisiana State University, SCOTT FIELD, University of Maryland, JAN HESTHAVEN, Brown University, FRANK HERRMANN, University of Maryland, ABDUL MROUE, Canadian Institute for Theoretical Astrophysics, Cornell University, OLIVIER SARBACH, Universidad Michoacana de San Nicolas de Hidalgo, ERIK SCHNETTER, Perimeter Institute, University of Guelph, Louisana State University, MANUEL TIGLIO, University of Maryland, MICHAEL WAGMAN, Brown University — We present a new fully first order strongly hyperbolic representation of the BSSN formulation of Einstein's equations with optional constraint damping terms. In particular, we describe the characteristic fields of the system, discuss its hyperbolicity properties, and present two numerical implementations and simulations: one using finite differences, adaptive mesh refinement and in particular binary black holes, and another one using the discontinuous Galerkin method in spherical symmetry. These results constitute a first step in an effort to combine the robustness of BSSN evolutions with very high accuracy numerical techniques, such as spectral collocation multi-domain or discontinuous Galerkin methods.

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