

Abstract Submitted
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Spheromak Simulation in 3+1 Dimensions Using Multiscale Space/Time Spectral Elements¹ CHARLES WEATHERFORD, Florida A&M University — The NIMROD code is the standard simulation tool for modeling spheromaks. The current implementation of NIMROD is a two-fluid code, parallelized for high performance computers and uses direct solution methods for the matrix equations. The present work involves an investigation of various possible improvements to the NIMROD code. In particular, an iterative solver will replace the direct solver in present use. The iterative solver will employ Jacobian-free Newton-Krylov Methods. A procedure composed of four pieces is used: (1) An iterative correction is accomplished with each step. Optimal polynomials lead to various preconditioned Krylov methods; (2) Each error component is treated in an optimal subspace; (3) The Jacobian is avoided. In the Jacobian-Free Newton-Krylov method, a Krylov method solves the linear Newton correction equation, which requires Jacobian-vector products. These are approximated by the Frechet derivatives so that the actual Jacobian elements are never explicitly needed; (4) The solver is used as a preconditioner. This defines a weakly converging nonlinear method. Next, a new method for time-advance will be employed which involves the use of spectral-elements in space and time.

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