Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Physics-Based Preconditioning for a Radially Compressed FRC Model A.H. GLASSER, University of Washington, V.S. LUKIN, Naval Research Laboratory — SEL is a parallel code for solving initial-boundary value problems for coupled nonlinear fluid equations, using high-order spectral elements for discretization in 2 spatial dimensions, and a fully-implicit time step. Efficient parallel operation requires a scalable method for solving large, sparse matrices. In previous work, a framework for such a solver has been developed, separated into general-purpose modules for all applications and problem-specific code for each application. The heart of the method is physics-based preconditioning, which reduces the order and enhances the diagonal dominance of the linear systems to be solved. Approximations introduced at this stage are eliminated by matrix-free Newton-Krylov iteration on the full nonlinear system. The details of the approach depend on the coupling of the various physical variables. It has been successfully tested for ideal MHD waves in a doubly periodic plane. The purpose of this presentation is to describe the development and testing of physics-based preconditioning for a more interesting test case, modeling a radially compressed FRC with extend MHD.

Alan Glasser
University of Washington

Date submitted: 18 Jul 2009 Electronic form version 1.4