

Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

Preconditioning of the HiFi Code by Linear Discretization on the Gauss-Lobatto-Legendre Nodes A.H. GLASSER, University of Washington, V.S. LUKIN, Naval Research Laboratory — The most challenging aspect of extended MHD simulation is the scaling of computational time as the problem size is scaled up. The use of high-order spectral elements, as in the HiFi code, is useful for handling multiple length scales and strong anisotropy, but detailed code profiling studies show that cpu time increases rapidly with increasing np, the polynomial degree of the spectral elements, due to the cost of Jacobian matrix formation and solution. We have implemented a method of matrix preconditioning based on linear discretization of the Jacobian matrix on the Gauss-Lobatto-Legendre interpolatory nodes.[J. Brown, J. Sci. Comput. 45, 48-63 (2010)] The resulting matrix has much fewer nonzero elements than the full Jacobian and shares the same vector format. The full solution is then obtained by matrix-free Newton-Krylov methods, which converges rapidly because the preconditioner provides an accurate approximation to the full problem. Scaling studies will be presented for a variety of applications.

A. H. Glasser
University of Washington

Date submitted: 11 Jul 2013

Electronic form version 1.4