

Abstract Submitted  
for the DPP08 Meeting of  
The American Physical Society

**Three-dimensional Resistive Magnetohydrodynamics in Hydra<sup>1</sup>**

JOSEPH KONING, GARY KERBEL, MICHAEL MARINAK, Lawrence Livermore National Laboratory — The Magnetohydrodynamics package in the ALE radiation-hydrodynamics code Hydra implements the three-dimensional resistive magnetic diffusion equations in the small Hall limit. The diffusion equations are discretized, on semi-structured grids, using a vector finite element method with  $H(\text{curl})$ ,  $H(\text{div})$  and  $H(\text{grad})$  conforming spaces, resulting in a method that is second order accurate in space and fully implicit in time. Coupling of the MHD forces and Joule heating to the hydrodynamics package is accomplished through a split scheme. The package includes a second-order accurate advection method utilizing an exact DeRham complex to preserve the divergence free magnetic induction. Several improvements to the package have been applied, including matrix monotonicity constraints, a scalable iterative solution method and an arbitrary linear circuit source. This work is proceeding to create an MHD package that incorporates the full Ohm's law.

<sup>1</sup>This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA2734. LLNL-ABS-405408.

Joseph Koning  
Lawrence Livermore National Laboratory

Date submitted: 14 Aug 2008

Electronic form version 1.4