Abstract Submitted
for the DPP08 Meeting of
The American Physical Society

Ideal MHD simulations of laboratory and astrophysical magnetic bubble expansion as a model for extragalactic radio lobes. WEI LIU, SCOTT HSU, HUI LI, SHENGTAI LI, LANL, ALAN LYNN, University of New Mexico — Nonlinear ideal magnetohydrodynamic (MHD) simulations of the propagation and expansion of a magnetic "bubble" plasma into a lower density, weakly-magnetized background plasma are presented. These simulations mimic the geometry and parameters of the Plasma Bubble Expansion Experiment (PBEX), which is studying magnetic bubble expansion as a model for extra-galactic radio lobes. The simulations predict several key features of the bubble evolution. First, the direction of bubble expansion depends on the ratio of the bubble toroidal to poloidal magnetic field, with a higher ratio leading to expansion predominantly in the direction of propagation and a lower ratio leading to expansion predominantly normal to the direction of propagation. Second, an MHD shock and a trailing slow-mode compressible MHD wavefront are formed ahead of the bubble as it propagates into the background plasma. Third, the bubble expansion and propagation develop asymmetries about its propagation axis due to reconnection facilitated by numerical resistivity and to inhomogeneous angular momentum transport mainly due to the background magnetic field. These results will help guide the initial experiments and diagnostic measurements on PBEX.

Wei Liu
LANL

Date submitted: 15 Jul 2008 Electronic form version 1.4