Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Entrainment and acceleration of ambient plasma in a magnetized, laser-produced plasma[1] JEFFREY BONDE, STEPHEN VINCENA, WALTER GEKELMAN, University of California, Los Angeles — Collisionless momentum coupling of a high energy density plasma expansion to a magnetized, ambient plasma is studied with a laser produced plasma expanding at speeds comparable to the background Alfvén speed, $v_{\rm exp} = 1.2 \times 10^7$cm/s $\approx v_A$. These expansions form diamagnetic cavities in which the background field is fully expelled. A moving Rosenbluth sheath forms at the boundary carrying a charge layer electrostatic sheath and inductive electric field. The total field in the lab frame was derived from emissive probe and magnetic probe measurements in the azimuthally symmetric experiment. Particle orbit tracing of an initially cold, stationary plasma tracked the evolution of the distribution of particles in these fields. A laser-induced fluorescence (LIF) diagnostic captured the resultant flows in the ambient argon plasma. The bulk flow fields from the orbit solvers and LIF are compared and found to agree $v_{orbit} \approx v_{LIF} \approx 3 \times 10^5$ cm/s while the distributions are highly non-Maxwellian. The orientation and magnitude of the flows show that the electrostatic sheath of the rapidly expanding plasma mostly entrains a tenuous background plasma, accelerating ions against the expansion. Orbit solvers show the effect has a significant dependence an ambient ion mass.

[1]This experiment was conducted in the Large Plasma Device at the Basic Plasma Science Facility and funded by grants from the US Department of Energy and the National Science Foundation.

Jeffrey Bonde
University of California, Los Angeles

Date submitted: 24 Jul 2015 Electronic form version 1.4