Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

Hall-Driven Effects in Electron-Magnetohydrodynamic Z-Pinch–Like Implosions[1] A. S. RICHARDSON, S. B. SWANEKAMP, J. W. SCHUMER, Naval Research Laboratory, D. MOSHER, P. F. OTTINGER, Independent Consultant through Syntek Technologies, Inc. — In previous work,[2] it has been shown that density gradients give rise to Hall-driven magnetic field penetration in electron-magnetohydrodynamics (EMHD). Here, we examine the effect of geometry on this Hall-driven penetration. It is found that in z-pinch–like geometries, the implosion velocity of a Hall-driven magnetic pinch depends on its distance from the axis, moving faster as it approaches the axis. We compare analytical and numerical results for the z-pinch geometry to previous results for a rectangular slab geometry. Similar effects are found in both geometries, including electron-inertia driven nonlinearities, a Kelvin-Helmoltz like instability, and the generation of vortices. The electric field in the vortices is also examined, to determine how much charge separation occurs. If the electric field becomes large enough, it could accelerate the background ions to very high energies.

[1]This work was supported by the Naval Research Laboratory Base Program.
[2]A. S. Richardson, et al., Physics of Plasmas, 23(5), 2016

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Date submitted: 10 Jul 2017 Electronic form version 1.4