Abstract Submitted
for the DPP14 Meeting of
The American Physical Society

Particle-In-Cell Modeling of Hall-Driven Magnetic Penetration and Species Separation in Two-Species Plasmas[1] ANDREW RICHARDSON, STEPHEN SWANEKAMP, Naval Research Laboratory, PAUL OTTINGER, Engility, JUSTIN ANGUS, IAN RITTERSDORF, JOSEPH SCHUMER, Naval Research Laboratory — Understanding the interaction of a strong magnetic field with a plasma is a key problem in plasma physics. In this poster we report on a new systematic study using two-dimensional particle-in-cell simulations designed to explore the interplay between magnetic pushing and Hall-driven magnetic field penetration. In plasma where the ions are infinitely massive and $\nabla n \times B > 0$, the magnetic field penetrates into the plasma at a specific fraction of the Hall speed, v_b. When the ions have finite mass, the penetrating magnetic field gives an impulse to the ions, accelerating them to speed v_i. In a two-species plasma, simulations show simultaneous pushing of the light-ion species and magnetic field penetration through the heavy-ion species when $v_{heavy} < v_b < v_{light}$. This leads to a separation of the two ion species. If the mass of the light ions is increased, a transition to magnetic penetration of both species is observed when $v_{heavy} < v_{light} < v_b$. Analytic estimates for both v_i and the mass at which this transition occurs agree well with simulations.

[1]This work was supported by the NRL Basic and Applied Research Program.

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Date submitted: 11 Jul 2014 Electronic form version 1.4