Abstract Submitted
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**Kinetic simulations for laboratory astrophysics with laser-produced plasmas**[1] W. FOX, PPPL, J. MATTEUCCI, K. LEZHNIN, D.B. SCHAEFFER, A. BHATTACHARJEE, Princeton University, K. GERMASCHEWSKI, University of New Hampshire — Recent laboratory experiments with laser-produced plasmas have opened new opportunities for studying a number of fundamental physical processes relevant to magnetized astrophysical plasmas, including magnetic reconnection, collisionless shocks, and magnetic field generation by Weibel instability and Biermann battery. We develop a fully-kinetic simulation model for first-principles simulation of these systems. Leadership scale kinetic simulations in 2-D and 3-D are conducted on Titan and Summit at OLCF using the particle-in-cell code PSC. Key dimensionless parameters describing the system are derived for scaling between kinetic simulation, recent experiments, and astrophysical plasmas. First, simulations are presented which model Biermann battery magnetic field generation in plasmas expanding from a thin target. Ablation of two neighboring plumes leads to the formation of a current sheet as the opposing Biermann-generated fields collide, leading to a strongly-driven magnetic reconnection at plasma $\beta \sim 10$. Second, we model recent experiments on collisionless magnetized shocks, generated by expanding a piston plasma into a pre-magnetized ambient plasma, and discuss opportunities and predictions for collisionless shock physics available from such experiments.

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