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Particle simulation of high-energy-density laser-driven reconnection experiments A. BHATTACHARJEE, W. FOX, K. GERMASCHEWSKI, University of New Hampshire — Recently, reconnection between magnetic fields, self-generated through the Biermann battery effect, has been observed and studied in high-energy-density, laser-driven experiments on the Vulcan, OMEGA, and Shenguang laser facilities. This is a novel regime for magnetic reconnection study, characterized by extremely high magnetic fields, high plasma beta and strong, supersonic plasma inflow. Reconnection in this regime is investigated with particle-in-cell simulations using the PSC code. Previous 2-d particle-in-cell reconnection simulations with parameters and geometry relevant to the experiments identified key ingredients for obtaining the very fast reconnection rates, namely two-fluid reconnection mediated by collisionless effects (that is, the Hall current and electron pressure tensor), strong flux pile-up of the inflowing magnetic field [1], and secondary instabilities that lead to magnetic island formation. We present further detailed simulations of reconnection in this geometry, exploring the role of binary particle collisions and examining mechanisms for particle energization and acceleration, as has been recently observed in laser-driven reconnection experiments [2].

[1] W. Fox, et al, PRL 106, 215003 (2011).
[2] Q.L.Dong, et al., PRL 108, 215001 (2012).

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