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Fast magnetic reconnection induced by collisionless effects and flux pile-up in laser-produced plasma bubbles W. FOX, A. BHATTACHARJEE, K. GERMASCHEWSKI, Center for Integrated Computation and Analysis of Reconnection and Turbulence, University of New Hampshire — Recent experiments have observed magnetic reconnection in high-energy-density, laser-produced plasma bubbles [1,2], with reconnection rates observed to be much higher than can be explained by classical theory. This is a novel regime for magnetic reconnection study, characterized by extremely high magnetic fields, high plasma beta and strong, supersonic plasma inflow. Furthermore, due to the high temperatures attained, this experimental technique may be the first to obtain the high-Lundquist number regimes of astrophysical relevance. Reconnection in this regime is investigated with particle-in-cell simulations. Work to-date with collisionless simulations identifies two key ingredients, simultaneously present for the first time: two-fluid reconnection mediated by collisionless effects (that is, the Hall current and electron pressure tensor), and strong flux-pileup of the inflowing magnetic field. The first is expected to be important since the ion skin-depth is of finite size in these plasmas. The latter results from the super-sonic and super-Alfvenic inflow. The combination of the two boosts the reconnection rate above the nominal 0.1 V_A to values consistent with experiment.
[1] P. M. Nilson, et al, *PRL* **97**, 255001 (2006).
[2] C. K. Li, et al, *PRL* **99**, 055001 (2007).

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