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Global Two-Fluid Simulations of Magnetic Reconnection
NICHOLAS MURPHY, CARL SOVINEC, University of Wisconsin and the Center for Magnetic Self-Organization in Laboratory and Astrophysical Plasmas — Two-fluid effects are known to influence the magnetic reconnection process through non-MHD communication between the reconnection layer and surrounding magnetic field topology[1]. To examine the interrelationship between the local reconnection physics and the global magnetic field geometry, we perform two-fluid simulations of the Magnetic Reconnection Experiment (MRX) and the Swarthmore Spheromak Experiment (SSX) using the NIMROD extended MHD code. For MRX, we discuss the effects of toroidicity, the shape of the electron outflow region, and the effect of downstream pressure on the reconnection process. We find that much of the communication between local and global scales is due to the pressure gradients that result from the reconnection outflow. During counter-helicity push reconnection, we observe a radial shift in position of the current sheet and an asymmetric outflow, as seen in experiment[2]. This asymmetric outflow is examined in terms of separate force-density contributions. For SSX, we present simulations of counter-helicity spheromak merging in both prolate and oblate flux conservers, and discuss the impact of geometry as well as two-fluid effects on the reconnection process.
[1]D. Biskamp *et al.*, Phys. Plasmas 4, 1002, (1997).
[2]M. Inomoto *et al.*, Phys. Rev. Lett. 97, 135002 (2006).

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