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Three-dimensional merging in a closed simply-connected volume
VYACHESLAV S. LUKIN, Naval Research Laboratory, MICHAEL R. BROWN, TIM GRAY, Swarthmore College, MARK G. LINTON, Naval Research Laboratory — This talk will describe numerical simulations of reconnection and relaxation of two magnetized plasma plumes in the Swarthmore Spheromak eXperiment (SSX). We model the dynamical evolution of global magnetic fields and show it to be closely related to the reconnection rate and dynamics of localized magnetic reconnection regions. The simulations are performed using the fully implicit 3D high-order spectral element HiFi framework and follow previous work on 3D merging of quasi-stationary spheromaks, including validation of HiFi simulations against SSX experimental data [Gray et al, PoP (2010)] and a systematic numerical study of 3D reconnection through a non-stationary reconnection region [Lukin & Linton, Nonlin. Processes Geophys. (2011)]. Recently, the SSX group has begun experiments on high-velocity plasma merging in an MHD wind-tunnel, focusing on merging of two strongly magnetized high kinetic energy plasmoids. Comparison of ongoing HiFi resistive MHD and Hall MHD simulations of the SSX wind tunnel indicate that inclusion of Hall effects is crucial to reproducing the experimental data in this geometry and plasma parameter regime. Test-particle simulations in evolving HiFi-calculated electro-magnetic fields to study ion heating for a variety of species will also be discussed.

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