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Turbulent Reconnection in Collisionless Mesoscale Layers
WILLIAM DAUGHTON, ADAM STANIER, ARI LE, Los Alamos National Laboratory — A great deal of progress has been made towards understanding the physics of collisionless reconnection in kinetic-scale current sheets. High-time resolution spacecraft observations in the Earth’s magnetosphere are in good agreement with fully kinetic simulations. Metaphorically, these kinetic layers are the hydrogen atom of reconnection physics, and at this scale our understanding is approaching maturity. However, the applicability to much larger systems remains highly uncertain. For example, the scale of a solar flare is 10 orders of magnitude larger than the electron inertial length, at which the frozen-flux condition is normally broken. Kinetic simulations suggest that large 3D reconnection layers may fragment into a turbulent spectrum of interacting flux ropes, leading to a vast number of kinetic-scale reconnection sites. Such simulations are typically initialized with a highly extended kinetic-scale current sheet, which is not physically realistic, and precludes the possibility of reconnection occurring in much thicker layers. In this work, we present a new approach for driving turbulent reconnection in layers much thicker than the inertial scale, and we characterize the dynamics in these regimes.

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