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Scaling of Reconnection and Formation of Extended Current Sheets in Large Collisionless Systems B. SULLIVAN, A. BHATTACHARJEE, Q. XIN, H. YANG, Center for Integrated Computation and Analysis of Reconnection and Turbulence (CICART), University of New Hampshire — Recently, particle-in-cell simulations have shown the formation of extended current sheets in large collisionless systems. In order to determine whether such current sheets are realizable in Hall MHD models, we have carried out a sequence of simulations using the same initial conditions for large systems using a generalized Ohm's law that includes resistivity, hyperresistivity, and electron inertia as mechanisms that break field lines. In the resistive MHD model, the long thin current sheet spanning Y-points become near-explosively unstable to secondary tearing, producing plasmoids copiously. In resistive Hall MHD, the nonlinear dynamics changes qualitatively, as the Y-points contract spontaneously to form X-points thwarting the secondary tearing instabilities seen in the resistive MHD study. A steady state is then realized due to a balance between the spatial gradients of the current density and the velocity shear. Hyperresistive Hall MHD does not appear to produce extended current sheets, contrary to the suggestion in a recent theoretical study. However, in the presence of electron inertia, extended current sheets appear to form transiently before breaking up into secondary islands. Scaling studies that appear to account for simulation results under quasi-steady conditions are presented.

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