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Stability of a resistive Sweet-Parker reconnection layer and onset of fast reconnection in Hall MHD. V.S. LUKIN, PPPL, N.F. LOUREIRO, CMPD-UMD / PPPL, S.C. JARDIN, PPPL — Evolution of a two-dimensional system from a perturbed tearing- unstable Harris equilibrium through to saturation is studied using the implicit adaptive spectral element code SEL. Within resistive MHD, a small localized perturbation to a long Harris sheet (so called, large Δ' limit) is observed to non- linearly form a long and thin Sweet-Parker resistive layer. In a quiet plasma, such layer is observed to self-similarly expand and remain stable until either the stored energy of the initial equilibrium is dissipated or the boundary of the computational domain prevents further expansion of the resistive layer. However, additional small localized perturbations of sufficient magnitude are shown to be capable of triggering secondary tearing instabilities within the expanding resistive layer before the boundary effects become important. Onset of fast reconnection is investigated within the Hall MHD model in a regime where the ion skin depth (c/ω_{pi}) is much smaller than the width of the equilibrium Harris sheet and of the order of the resistive layer width. Nonlinear formation and subsequent elongation of a quasi-resistive reconnection layer with some two-fluid characteristics is observed. It is shown that as the layer evolves, it continues to elongate until either the boundary effects with associated layer growth stagnation and secondary tearing instability take over, or the very fast current layer collapse to an X-point is triggered by an explosive onset of fast reconnection.

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