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Onset of Plasmoid Instability in an Evolving Current Sheet[1] YI-MIN HUANG, LUCA COMISSO, A. BHATTACHARJEE, Princeton University — Abstract The scaling of plasmoid instability linear growth rate with respect to Lundquist number S in a Sweet-Parker current sheet, $\gamma \sim S^{1/4}$, indicates that at high S, the current sheet will break apart before it approaches the Sweet-Parker width. Therefore, a proper description for the onset of the plasmoid instability must incorporate the thinning process of the current sheet. We carry out a series of 2D simulations and develop diagnostics to separate fluctuations from an evolving background. It is found that the fluctuation amplitude starts to grow only when the linear growth rate is sufficiently large ($\gamma\tau_A sim1$) to overcome convective losses. The linear growth rate continues to rise until the sizes of plasmoids become comparable to the inner layer width of the tearing mode. At this point the current sheet is disrupted and the instability enters the early nonlinear regime. The growth rate suddenly decreases, but the fluctuation amplitude continues to grow until it reaches nonlinear saturation. We identify important time scales of the instability development, as well as scalings for linear growth rate, current sheet width, and dominant wavenumber at current sheet disruption. A phenomenological model that reproduces simulation results is proposed.

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