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Numerical and Analytical Studies of Plasmoid-Dominated Reconnection NUNO LOUREIRO, IPFN/IST Lisbon, DMITRI UZDENSKY, Univ. Colorado-Boulder, ALEXANDER SCHEKOCHIHIN, Univ. Oxford, RAVI SAMTANEY, KAUST — Magnetic reconnection at large Lundquist numbers ($S > 10^4$) is studied analytically and numerically. It is found that the Sweet-Parker (SP) theory is not valid in this regime: the current sheet is violently unstable to the formation of multiple plasmoids (secondary islands) that quickly grow wider than the original SP layer and start to dominate the reconnection process. Our resistive-MHD numerical simulations are carried out for sufficiently long times to achieve a statistical steady state. The steady- state SP layer gets replaced by a much broader, turbulent-like reconnection region with a fast (independent of S) effective time-averaged reconnection rate. Secondary interplasmoid current sheets themselves become unstable to the same instability, giving rise to a truly hierarchical, multiscale (and multifrequency) structure. The plasmoid size distribution function is analyzed; in particular, we observe the occasional formation of unusually large plasmoids, which may have observational implications. A theoretical picture describing the main features of plasmoid-dominated reconnection is also presented.

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