Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Hyperresistive Plasmoid Instability and Onset of Fast Reconnection YI-MIN HUANG, AMITAVA BHATTACHARJEE, TERRY FORBES, BRIAN SULLIVAN, University of New Hampshire — Plasmoid instability in hyperresistive MHD models is studied. A governing parameter is the hyperresistive Lundquist number, defined as $S_H \equiv L^3 V_A/\eta_H$, where L is the current sheet length, V_A is the Alfvén speed, and η_H is the hyperresistivity. The linear instability is found to be super-Alfvénic, with a peak growth rate $\gamma \sim S_H^{1/6} V_A/L$. Nonlinearly the reconnection rate becomes weakly dependent on hyperresistivity. Scaling laws of the number of plasmoids, secondary current sheet length, width, and current density are deduced. Probability distribution of plasmoid magnetic flux ψ is found to be consistent with a power law ψ^{-2}. When Hall effect is included, it is found that the plasmoid instability may facilitate Hall reconnection, leading to an even higher reconnection rate. Similar to an earlier resistive Hall MHD study, onset of Hall reconnection does not always expel all plasmoids and result in a single X-point magnetic topology. Our findings suggest that copious plasmoid formation may be a generic feature of magnetic reconnection in large systems, regardless of the mechanism of breaking the frozen-in condition.

Yi-Min Huang
University of New Hampshire

Date submitted: 26 Jul 2011 Electronic form version 1.4