Abstract Submitted
for the DPP10 Meeting of
The American Physical Society

Current sheet break-up via fast plasmoid formation in the island coalescence problem the ultra-high Lundquist number regime ($S \sim 10^9$)

J.N. SHADID, R.P. PAWLOWSKI, SNL, L. CHACÓN, ORNL, D.A. KNOLL, LANL — The break-up of Sweet-Parker current sheets into smaller plasmoids has been recently the subject of attention as a possible mechanism for fast reconnection in resistive MHD. Various studies, both theoretical[1] and numerical,[2] have shown that the fast formation of small structures is not only possible, but in fact unavoidable for large enough Lundquist numbers. In this study, we have used state-of-the-art computational capabilities to perform simulations of the Fadeev island coalescence problem in the ultra-high Lundquist number regime ($S \sim 10^9$) to investigate if thin current sheets dynamically formed in this strongly driven problem are prone to break-up by fast plasmoid instabilities. Our computational capabilities are unique in that we employ massively parallel implicit solvers in combination with static spatial adaptivity to resolve evolving layers, thus guaranteeing numerical accuracy in such challenging regimes. The numerical simulations confirm that plasmoid break-up of dynamically formed current sheets occur for $S > 10^6$.

[1]N. Loureiro et al., *Phys. Plasmas*, **14** (2007)
[2]G. Lapenta, *Phys. Rev. Lett.*, **100** (2008)

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Date submitted: 26 Jul 2010 Electronic form version 1.4