Abstract Submitted
for the DPP08 Meeting of
The American Physical Society

Influence of Coulomb Collisions on Undriven Magnetic Reconnection in Large-Scale Systems W. DAUGHTON, B.J. ALBRIGHT, V. ROYTERSHTEYN, K.J. BOWERS, L. YIN, LANL, H. KARIMABADI, UCSD — The influence of Coulomb collisions on magnetic reconnection is studied in neutral sheet geometry using fully kinetic particle-in-cell (PIC) simulations in which binary collisions are modeled by a Monte-Carlo technique.[1] This approach describes a full Fokker-Planck collision operator and thus permits a first-principles study of the transition between collisionless and collisional reconnection. For sufficiently collisional regimes, this approach recovers the well-known Sweet-Parker scaling from resistive MHD. As the collisionality is reduced, a transition to faster reconnection rates is observed and the structure of the layer is dramatically altered. Although certain aspects of this transition are consistent with expectations from two-fluid theory, there are significant differences in the structure and time dependence within the weakly collisional regime. In particular, there is a basic tendency for the diffusion region to form an elongated current sheet for all collisionality regimes. For large-scale systems, these elongated current layers are unstable to secondary-island formation leading to a time-dependent reconnection process for both collisional and collisionless regimes. Results are presented to illustrate how the structure of the diffusion region is modified by Coulomb collisions and how the reconnection dynamics scales with system size in the various regimes.

[1]T. Takizuka and H. Abe, J. Comput. Phys., v. **25**, p. 205, 1977

William Daughton
Los Alamos National Laboratory

Date submitted: 16 Jul 2008 Electronic form version 1.4