Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

Velocity-Shear Driven Magnetic Reconnection in Particle-In-Cell Simulations CARRIE BLACK, SPIRO ANTIOCHOS, NASA/GSFC, RICK DEVORE, NRL, JUDY KARPEN, NASA/GSFC, KAI GERMASCHEWSKI, UNH —
In the standard model for coronal mass ejections (CME) and/or solar flares, the free energy for the event resides in the strongly sheared magnetic field of a filament channel. The pre-eruption force balance consists of an upward force due to the magnetic pressure of the sheared field balanced by a downward tension due to overlying un-sheared field. Magnetic reconnection is widely believed to be the mechanism that disrupts this force balance, leading to explosive eruption. For understanding CME/flare initiation, therefore, it is critical to model the onset of reconnection that is driven by the buildup of magnetic shear. In MHD simulations, the application of a magnetic field shear is a trivial matter. However, kinetic effects are important in the diffusion region and thus, it is important to examine this process with PIC simulations as well. The implementation of such a driver in PIC methods is non-trivial: it must be done in a self-consistent manner that avoids the generation of waves that destroy the applied shear. In this work, we discuss methods for applying a velocity shear perpendicular to the plane of reconnection within a 2.5D, aperiodic, PIC system. We also discuss the implementation of boundary conditions that allow a net electric current to flow through the walls.

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Date submitted: 16 Aug 2012 Electronic form version 1.4