Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

Flux Rope Formation from Magnetic and Velocity Shear WILLIAM DAUGHTON, YI-HSIN LIU, TAKUMA NAKAMURA, LANL, HOMA KARIMABADI, VADIM ROYTERSHTEYN, UCSD — Spacecraft observations and simulations both suggest that magnetic islands are commonly associated with the onset and nonlinear development of reconnection. While most theoretical efforts have focused on 2D models, in real 3D systems the islands correspond to flux ropes which can form and interact in a variety of complex ways. The most common explanation is the tearing instability driven by the magnetic shear. In large 3D systems, the spectrum of unstable modes can be much richer due to multiple resonance surfaces, but the details depend strongly on the parameter regime. A distinctly different explanation for generating flux ropes is the Kelvin-Helmholtz instability driven by Alfvénic flow shear. For layers above the ion-scale, the vortex leads to wrapping of the field lines and generation of flux ropes comparable to the size of the vortex. This is in sharp contrast to flux ropes formed from the tearing instability which start on small scales and grow in time to reach larger sizes. Here, we compare and contrast these two mechanisms using 3D fully kinetic simulations for configurations involving various combinations of magnetic and velocity shear. Characteristic properties of the flux ropes, fluctuation spectra and influence on particle acceleration will be discussed.

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Date submitted: 13 Jul 2012 Electronic form version 1.4