Geophysical Research Abstracts
Vol. 14, EGU2012-3466, 2012
EGU General Assembly 2012

Small Scale Reconnection : Structure and Electron Jet Emission

I. Roth

UC Berkeley, Space Sciences, Physics, Berkeley, United States (ilan@ssl.berkeley.edu)

The effects of small scale processes on the formation and evolution of macroscopic inhomogeneous magnetic configurations and the resulting super-Alfvenic jets have been investigated in space and lab over many years. Various satellite measurements at the magneto-sheath crossings observe features with small spatial scale of the order of electron skin depth, indicating the importance of processes dominated by electron dynamics. The data show structures which are (a) spatially non-symmetric with densities and magnetic field differing substantially on both sides of the region, while (b) the inhomogeneous magnetic and electric field structures consist of narrow, three-dimensional electron diffusion regions, with (c) bifurcated current over electron skin depth or below and (d) ejection of energetic, super-Alfvenic, non-Gaussian electrons perpendicularly to the magnetic field, away from the X-line. At small scales the main Alfven mode which describes the MHD regime is replaced by a helicon/whistler. The eMHD model, which includes the full dynamics of the electrons and stationary ions, with density gradients and asymptotically different values of the magnetic field is implemented for the experimentally observed configurations. Over the small scales the electron fluid follows the lines of the generalized vorticity (GV) as it decouples from the magnetic field. The regions of a significant deviation of the GV from the magnetic field become the potential sites for non-adiabatic electron acceleration. Effects of geometry, compressibility and thermal effects on this deviation will be discussed. The non-thermal jet distribution is conjectured to form when the standard diffusion is replaced by a non Markovian with large jumps random walk process, describing its evolution through the fractional diffusion equation and resulting in a non-Gaussian distribution.