Kinetic Aspects of Guide-Field Magnetic Reconnection

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The addition of a uniform out-of-plane component of the magnetic field (hereafter the "guide" field) has no effect on the standard Harris kinetic current sheet equilibrium. However, even a very small guide field will magnetize the electrons, and this introduces a number of significant changes compared to the usual anti-parallel reconnection dynamics. This talk will review these effects as they have been revealed in 2D and 3D particle-in-cell simulations of ion-scale current sheets. Among these features are the generation of low-density cavities along two of the separatrices, formation of cold electron beams travelling at the order of the electron Alfvén speed, excitation of Buneman modes and other wave turbulence, distortion of the familiar quadrupole B_y pattern, and the formation of intense localized perpendicular electric fields at sub-electron-inertial-length scales. Particular attention will be paid to the generation of $\sim$ few hundred keV electrons. It appears that the dominant process for this energization is acceleration by the parallel electric field near the X line.