

PIC Simulations of Overstretched Ion-Scale Current Sheets in the Magnetotail



Fig. 1: Thin current sheet (TCS) Equilibrium with particle distribution function and orbits



Fig. 2: TCS force balance provided by off diagonal pressure over a time scale of 10 ion gyroperiods A sheet of electrical current flows in Earth's magnetotail where the magnetic field reverses sign. At scales comparable to the ion gyroradius, current sheets forming sufficiently far from Earth are necessary to explain its stretched magnetic field reconfiguration on the night side. However, isotropic plasmas form magnetic fields that inflate with distance from Earth and cannot reproduce the observed stretched geometry.

- Two-dimensional ion-scale current sheets stretched way beyond the isotropic limit are reproduced in particle-in-cell simulations
- Weak ion anisotropy and agyrotropy substantially modify the current density and the isotropic force balance
- Charged particles that follow spiral, figure-eight shaped, orbits (also called Speiser orbits) provide new term to force balance ($\partial_z P_{i,xz}$) contributing up to 40% of JxB force

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