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Thin charged current sheets as a separator between magnetosheath and cusp

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A study of nonlinear dynamics of the plasma flow interaction with the magnetosphere highlights the fundamental role of the finite-gyroradius effects, surface charges and accelerated plasma jets. In the magnetopause (MP) boundary layers the accelerated jets provide non-local flow balance via the 'active' electric field, supported at the moving and indented MP by parallel electron currents, and via the respective rotation of magnetic field. The complicated MP shape suggests its systematic velocity departure from the local normal towards the average one. The electric fields in the magnetosheath (MSH) frame accelerate the MSH plasma along MP downstream so that the plasma excess is removed close to the moving MP. The electric bursts provide effective collisions for ceasing of the MSH normal flows just in front of MP, the collisions result in the ion heating. We present Cluster data over outer cusp, where MSH flows interact with a high-beta boundary layer through reflected waves, visible as sunward bursts in Poynting flux. The waves have 3- wave phase coupling with both enhanced MSH waves and local Alfvenic fluctuations. The most prominent local impulsive momentum loss via accelerated plasma jets qualitatively differs from bow shock or reconnection processes. We discuss its input into the total MSH mass balance. Kinetic energy of the jets can substantially exceed the magnetic energy at the high-latitude MP, which should result in the MP deformation and driven reconnection. A kind of wave-particle interaction is operating at transient small-scale current sheets with surface charges. At scales of ion gyroradius it infers Hall dynamics, so that electric fields of the surface charges serve as a mechanism for momentum coupling through the current sheets and lead to acceleration/deceleration of ions with large (relative to the sheet width) gyroradius. Work was supported by INTAS grant 03-50-4872.