Geophysical Research Abstracts, Vol. 7, 03734, 2005
SRef-ID: 1607-7962/gra/EGU05-A-03734

Minimum in magnetic field - a signature or the driver of transport across magnetospheric boundaries?

S. Savin (1), E. Amata (2), J. Blecki (3), J. Buechner (4), J.L. Rauch (5), L. Zelenyi (1)

(1) IKI, Moscow, Russia, (2) IFSI, Roma, Italy, (3) SRC, Warsaw, Poland, (4) MPSP, Germany, (5) LPCE, Orleans, France

A lot of studies correlate penetration of solar plasma into magnetosphere with antiparallel magnetic fields at magnetospheric boundaries, when the magnitude of magnetic field (|B|) becomes low. A mechanism, accounting for the transport in this situation, is the stationary 'primary' reconnection of antiparallel fields, which releases the energy stored in the magnetic field, deformed by the incident magnetosheath flow. The reconnection certainly looks to operate, but a source, which strongly depends on the interplanetary field direction, can hardly account for the permanent presence of cusp and low latitude boundary layer. Instead, we outline a role in the plasma transport of 'secondary' small-scale time-dependent reconnection along with other mechanisms, which also operate most effectively at the sites of low |B|. We recall theoretical and numerical predictions for minimum |B| at magnetopause and discuss finite-gyroradius effects, filamentary penetration, diffusion and percolation, all of which maximize the transport with falling |B|. Both gyro-viscosity and direct interaction of ions with charged current sheets of finite-gyroradius scale provide the momentum and magnetic flux transfer. The sheets also are transparent for higher-energy ions, accelerated by surface charges, that is a kind of wave-particle interaction and energy transfer without parallel electric fields. In the presence of nonlinear cascades the small-scale 'secondary' reconnection in such sheets represents a necessary chain element for the transport, being modulated by resonances of magnetosheath cavity and cusp throat, along with stromg plasma jets accelerated by inertial drift in non-uniform electric fields. In minimum |B| over cusps and 'sash' both percolation and diffusion due to kinetic Alfven waves provide diffusion coefficients $\sim$ 5 109 m^2/s, that is enough for populating of dayside boundary layers. Another mechanism with comparable effectiveness is

electrostatic ion-cyclotron resonance. While the cyclotron waves measured in the minimum |B| over cusps on Prognoz-8, 10 and Interball-1 have characteristic amplitude of several mV/m, the sharp dependence of the diffusion on |B| provides the transport that of the percolation. Work was supported by INTAS grant 03-50-4872.