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On transport mechanisms through the cusp outer boundaries

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We compare different mechanisms of solar plasma penetration into magnetosphere in the cusp vicinity, where the magnitude of magnetic field (|B|) has local minimum. We recall 'secondary' local reconnection along with other mechanisms, which operate most effectively at the sites of low |B|: finite-gyroradius effects, impulsive penetration, diffusion and percolation, nonlinear transport due to correlated perturbations of electric-field and density or magnetic-field and current. The direct penetration of ions across charged current sheets of finite-gyroradius scale provide the mass, magnetic flux and momentum transfer at outer cusp boundaries. The ions acquire the cross-sheet potential, which affects the ion penetration and represents a kind of wave-particle interaction. The magnetic stress is often negligible in the high-beta near-cusp plasma, when both AC and DC electric fields dominate in the interaction of the incident and stagnant-cusp plasmas. The AC field of a gyroradius scale provide effective collisions for the larger-energy ions, that in turn let them aquire a part of the DC potential drop at MHD scales, enforcing charge separation and neutralizing parallel electron currents. The plasma transport is modulated by resonances of magnetosheath (MSH) cavity and cusp throat, along with strong impulsive plasma jets, accelerated in MSH by inertial drift in non-uniform electric fields. We proceed case and statistical study of the jets, trying to distinguish the flows, driven by a 'primary' reconnection (with the energy, stored in the deformed magnetic field), and the directly structured MSH jets, forcing the secondary reconnection or skewering a boundary due to their high dynamic pressure. At the outer cusp boundaries with low |B| both percolation and diffusion due to kinetic Alfven waves provide diffusion coefficients up to 5 109 m2/s, that is enough for populating of the dayside boundary layers. Another mechanism with comparable effectiveness is electrostatic ion-cyclotron resonance with a moderate amplitude of

several mV/m, measured over cusps on Prognoz-8, 10, Interball-1 and Cluster. As for the percolation, the sharp dependence of the diffusion on |B| provides the comparable transport. As MHD predicts minimum |B| at its antiparallel sites, e.g. for the northward Interplanetary Magnetic Field (IMF) it tends to locate at the tailward cusp erge along with those at the lobe flield lines further tailward. The former minimum should enlarge the discussed penetrations onto the field lines, constituting tail part of the low latitude boundary layer (LLBL), that accounts for the outlined enlargement of the cold MSH plasma penetration into the tail at the northward IMF. The cusp moving we relay with that of minimum |B|. The larger-scale 'primary' reconnection also operates, generally apart from cusp; but a source, which strongly depends on IMF, can hardly account alone for practically permanent presence of cusp and LLBL. Work was supported by INTAS grant 03-50-4872 and ISSI.