Fine structure of PSBL ion beams. Effects of nonlinearity and magnetic field topology.

L.M. Zelenyi (1), M.S. Dolgonosov (1), M. Ashour-Abdalla (2), V. Peroomian (2)

(1) Space Research Institute of RAS, Moscow, Russia (lzelenyi@iki.rssi.ru), (2) University of California, Los Angeles, USA

Experimentally dynamical plasma processes occurring in this region have very complicated spatial/temporal manifestations. Multipoint CLUSTER measurements provided important information about fine structure of powerful acceleration processes operating in the magnetotail. Trajectories of solar wind ions interacting with magnetotail current sheet as a rule are non-integrable and one may expect that non-adiabatic CS interactions should be accompanied by strong stochastic scattering and could produce only the energized quasi-isotropic thermal population of the plasma sheet. However detailed analysis reveals the existence of so called CS resonances producing islands of regular motion in otherwise chaotic phase space. If the formation of high velocity almost field aligned PSBL ion beams could be attributed to the non-adiabatic (Speiser) acceleration mechanism then their fragmentation on a finite number of substructures is an intrinsic result of a discreet nature (N=1, 2, 3, ...) of such resonances. Quantitatively the values of ion fluxes in PSBL are very high and their generation in the current sheet should be accompanied by strong nonlinear modifications of the cross-tail current. Non-linearity competes with standard velocity filter and time of flight dispersion effects and produces well-defined features in the ion precipitation (VDIS) patterns which could be seen in Cluster data. Microdispersions within the global dispersion profile are very sensitive to the fine structure of the current sheet, proximity to the X-line and symmetry/nonsymmetry of particle sources populating plasma sheet. We speculate on the relative importance of all these effects on the resulting plasma filamentation.