SIGNATURES OF NON-ADIABATIC ION ACCELERATION IN THE VICINITY OF THE MAGNETIC SEPARATRIX IN THE MAGNETOSPHERIC TAIL: CLUSTER OBSERVATIONS

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According to the theory ion acceleration near the magnetic separatrix should have non-adiabatic and resonant character and occur at the spatially localized resonant sites in the CS. As a consequence the signatures of such processes are observed at the Plasma Sheet Boundary Layer as a set of accelerated ion beams with a rather narrow field-aligned velocity distribution functions with a typical life-time about 5-20 minutes. For the velocity of subsequent resonant structures the theory provides an universal scaling law: $V_N \sim N^{2/3}$, where V_N is a field-aligned velocity of a beam accelerated at the N-th resonance (N=1,2,3). Cluster-2 observations in PSBL provide experimental evidences of the existence of such resonant structures in ion velocity space, and demonstrates the first statistically proven identification of such a scaling law for quiet and moderately disturbed periods. The similar plasma manifestations are observed in the high-latitude auroral region as a small-scale fragmentation of velocity-dispersed ion structures. We analyzed the velocity scaling and equatorial mapping of these substructures and discuss the interplay of temporal and spatial effects responsible for their formation.