



A mechanism producing suprathermal populations and cross-tail current disruptions in the Earth's magnetotail

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We suggest a physical mechanism being potentially able to produce, in the Earth's plasma sheet, suprathermal populations and cross-tail current disruptions simultaneously. The mechanism is based on elementary, repetitive, almost autonomous and spatiotemporal entities that correspond each to a local thinning/dipolarization pair having duration less than ~ 1 min. We suggest that the particle energization is essentially gained by transient electrostatic fields along the magnetic field lines. Protons and electrons are separately accelerated at local thinnings and dipolarizations, respectively. In cases energetic particles are accelerated without any dB/dt variation. All our inferences are checked by the highest resolution Geotail Energetic Particles and Ion Composition (EPIC) instrument datasets. The energetic particles are used as the best diagnostics for the accelerating source. Near Earth ($X \approx 10$ Re) selected events support our basic concept, and none contradiction is traced. Moreover, the proposed acceleration mechanism seems to be tightly associated with the physical mechanism triggering cross-tail current disruption or even magnetic field line reconnection. This mechanism seems to reveal the building block in the substorm phenomenon and may be the fundamental assumption explaining longstanding problems in magnetospheric physics. The mechanism is further checked and found consistent with substorm associated observations performed ~ 30 and 60 Re away from Earth.