ENERGETIC ELECTRON ACCELERATION WITHIN THE FLOW BRAKING REGION IN THE NEAR-EARTH MAGNETOTAIL: CLUSTER SPACECRAFT MULTI-SCALE OBSERVATIONS

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The flow braking region in the near-Earth magnetotail is a key region during substorms where the interaction of fast reconnection flows with the dipolar magnetic field triggers important plasma processes such as magnetic field reconfiguration, electromagnetic energy conversion and energetic particle acceleration. Here we focus on the acceleration of energetic electrons. We show observations during one substorm event on October 27, 2007 when two Cluster spacecraft were separated by ~ 30 km while being located at ~10000 km from the others, corresponding respectively to a few electron scales and to MHD scales. The braking of fast flows occurs at MHD scales however it is associated with strong magnetic field fluctuations that are comprised of non-MHD structures (size ~ few ion scales). Such structures are edged by current layers with thickness ~ few electron scales where strong electric fields and waves are observed and electrons are accelerated up to ~400 keV. Acceleration is mainly consistent with betatron mechanism however in a few cases even stronger acceleration is produced by non-adiabatic mechanisms. We discuss the possible role of non-MHD acceleration processes in the flow braking region for large-scale processes such as the injection of energetic electrons in the inner magnetosphere.

Substorms, particle acceleration

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