

Spacecraft in-situ observations of the terrestrial foreshock: Cluster results

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The Cluster multi-spacecraft mission provides a unique insight into the physical processes that take place at the terrestrial foreshock, which is the region in front of the Earth's quasi-parallel bow shock. This extended, turbulent region is the only natural collisionless plasma laboratory, where the wave-particle interaction and the particle acceleration can be studied in detail. In our presentation we will focus on the diffusive shock acceleration (DSA) mechanism, or the first-order Fermi acceleration by using in-situ ion and magnetic field data recorded by Cluster spacecraft. The CIS-HIA instrument onboard Cluster provides partial energetic ion densities in 4 energy channels between 10 and 32 keV, while the FGM instrument records high resolution magnetic field data.

The first-order Fermi acceleration to work efficiently there are certain conditions that need to be satisfied. These conditions are the injection, the pitch-angle scattering and the so-called free escape boundary. In our presentation we present individual foreshock events, when the Cluster spacecraft were in an optimal position to observe the various aspects of the acceleration mechanism.