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Effects of magnetosheath plasma jets in the magnetosphere and radiation belts

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Abstract

Magnetosheath plasma jets are dense and fast plasma streams, whose energy density in the magnetosheath is higher than the energy of the incident solar wind. Jets can be generated in interaction of interplanetary discontinuities with the bow shock or as a result of foreshock disturbances in the subsolar region. They can move across the streamlines and, thus, interact with the magnetopause. The interaction results in large-scale local magnetopause distortions of ~10 min duration that corresponds to spatial scales of ~10 Re. The magnetopause distortions are translated inside the magnetosphere in the form of geomagnetic pulses, which can be observed globally while a jet is travelling along the magnetopause. It was found that jets with sufficiently high speed and high kinetic β can pierce through the magnetopause resulting in a direct transport of the magnetosheath plasma inside the dayside magnetosphere. The average transport rate was estimated to be ~10^{29} particles/day and sometimes can achieve values of 1.5 x 10^{29} particles/hour that is comparable with estimates of the total amount of plasma entering the dayside magnetosphere. In the magnetosphere, the magnetosheath plasma precipitates to the high-latitude ionosphere and produces throat aurora. An increase of conductivity in the dayside ionosphere results in induction of electric field on the nightside where the conductivity is weak. This electric field can penetrate to low latitudes and produce anomalous ExB transport of energetic particles in the inner radiation belt. This scenario allows connecting of interplanetary intermittency in the form of discontinuities to the dynamics of particles in the inner magnetosphere.

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