



Magnetospheric MultiScale observations of ion acceleration at jet fronts

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Plasma jet fronts in the Earth's magnetotail are kinetic-scale boundaries separating hot fast plasma jets, generally attributed to reconnection outflows, from colder ambient plasma. Jet fronts are typically associated with a sharp increase of the vertical component of the magnetic field B_z , an increase of the plasma temperature and a drop of plasma density. Spacecraft observations and numerical simulations indicate that jet fronts are sites of major ion acceleration. Yet the exact acceleration mechanisms as well as the dependence of such mechanisms on ion composition are not fully understood. Recent Magnetospheric MultiScale (MMS) spacecraft high-resolution measurements of ion distribution functions in the magnetotail allow for the first time to study the acceleration mechanisms in detail. Here, we show an example of two jet fronts propagating earthward with different velocities. The faster jet is following the slower jet and observations of electric and magnetic fields in the region between the two jets are consistent with the formation of a magnetic island, in agreement with Particle-In-Cell numerical simulations. Observations are consistent with ions trapped in the island and accelerated in a magnetic bottle. We also discuss the acceleration mechanisms of different ion species (H^+ , He^{++} , O^+) ahead of the first, slower jet and we discuss how such mechanisms depend on the ion species.