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Plasma structures during Jovian tail reconnection observed by Galileo

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Abstract

Magnetic reconnection in planetary magnetospheres plays important roles in energy and mass transfer in the steady state, and also possibly in transient large-scale disturbances. Our detailed case study has shown that a reconnection jet front in Jovian magnetotail was associated with the front thickness of the order of ion inertial length, sub-Alfvenic ion flow, density depletion, and particle energisation. Although these characteristics are similar to the terrestrial jet fronts, their generality in the Jovian magnetosphere has not been clarified, since the above result was based on a single event study. Therefore we examined strong north-south magnetic field events in the Jovian nightside magnetosphere. Through the analyses with plasma velocity and density data, we found the clear dawn-dusk asymmetry; both northward and southward magnetic events on the dawnside show reconnection jet front signatures (tailward- and sunward-propagating, respectively), whereas duskside events do not. Such a significant dawn-dusk asymmetry of reconnection jets would be unique to rotation-dominant magnetospheres including that of Saturn. The observed plasma structures are consistent with significant field-aligned currents which would generate localised aurora.