Magnetic reconnection in the Jovian tail: X-line evolution and consequent plasma sheet structures

Satoshi Kasahara[1]; Tomoki Kimura[2]; Chihiro Tao[1]; Sarah Badman[1]; Masaki Fujimoto[3]
[1] ISAS/JAXA; [2] JAXA/ISAS; [3] ISAS, JAXA

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. In this paper we report observations of a reconnection event in the Jovian magnetotail by the Galileo spacecraft on 17 June 1997. In addition to the tailward retreat of a main X-line, signatures of recurrent X-line formations are found by close examination of energetic particle anisotropies. Furthermore, detailed analyses of multi-instrumental data for this period provide various spatio-temporal features in the plasma sheet. A significant density decrease was detected in the central plasma sheet, indicative of the transition to lobe (open field line) reconnection from plasma sheet (closed field line) reconnection. When Galileo vertically swept through the plasma sheet, a velocity layer structure was observed. We also analyze a strong southward magnetic field which is similar to dipolarization fronts observed in the terrestrial magnetotail: the ion flow (450 km/s) was observed behind the magnetic front, whose thickness of 10000-20000 km was of the order of ion inertial length. The electron anisotropy in this period suggests an anomalously high-speed electron jet, implying ion-electron decoupling behind the magnetic front. Particle energization was also seen associated with these structures. These observations show that X-line evolution and consequent plasma sheet structures in the Jovian magnetosphere are similar to those in the terrestrial magnetosphere, whereas their impact on the planetary scale dynamics need to be further investigated.