

A flux transfer event generated by multiple X-line reconnection at the magnetopause: THEMIS observations

Hiroshi Hasegawa^{1*}, the ISSI team², James P. McFadden³, Vassilis Angelopoulos⁴

¹ISAS/JAXA, ²International Space Science Institute, ³University of California, Berkeley, ⁴IGPP, UCLA

A flux transfer event (FTE) [Russell and Elphic, 1978] is characterized by a bipolar oscillation in the magnetic field component normal to the magnetopause and an enhancement in the field intensity, and is often encountered by spacecraft at or near the boundary. Its formation process is directly linked to the manner the solar wind energy is transferred to the magnetosphere, but is not fully understood. This presentation reports observations by the THEMIS spacecraft near the postnoon magnetopause of an FTE generated by magnetic reconnection at multiple sites. The event occurred on 14 June 2007 (near solstice) when the geomagnetic dipole axis was tilted sunward in the northern hemisphere and the IMF was dominantly duskward. The FTE was sandwiched by two oppositely directed (subsolar-ward and tailward) Alfvénic ion jets, and bidirectional field-aligned fluxes of heated electrons were observed on the immediate magnetosheath side of the FTE (magnetosheath electron boundary layer); reconnection occurred on both subsolar-ward and tailward sides of the FTE. The cross-section of the associated flux rope, recovered by Grad-Shafranov reconstruction technique [Hasegawa et al., 2005], had a size of order 0.5 R_E and was elongated in the normal (rather than tangential) direction, consistent with the two jets squeezing the flux rope. The flux rope motion was slow (about 50 km/s \ll magnetosheath Alfvén speed of about 250 km/s), inconsistent with an FTE resulting from a single X-line that would be swept away with an Alfvénic reconnection jet. The flux rope axis was oriented in the southwest to northeast direction, consistent with the X-line orientation expected for the dominantly duskward IMF. These observational signatures are essentially consistent with a multiple X-line reconnection model proposed by Lee and Fu [1985], but in-depth analysis suggests that the two X-lines were not activated simultaneously.

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Keywords: flux transfer event, magnetic reconnection, magnetopause, magnetic flux rope, Grad-Shafranov reconstruction