Structure of the magnetopause during quasi-continuous spatially-extended magnetic reconnection: Geotail and MMS conjunction on 2015-10-02

*Hiroshi Hasegawa[1], Naritoshi Kitamura[1], Yoshifumi Saito[1], Iku Shinohara[1], Shoichiro Yokota[1], Tsugunobu Nagai[2], Seiji Zenitani[3], The MMS team

1.Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency, 2.Tokyo Institute of Technology, 3.National Astronomical Observatory of Japan

We present observations on 2 October 2015 when Geotail, near the Earth's equatorial plane, and Magnetospheric Multiscale (MMS), at mid-southern latitudes, simultaneously traversed the Earth's postnoon magnetopause and detected southward magnetic reconnection jets under southward interplanetary magnetic field (IMF) conditions. Such fortuitous observations allow us to estimate the length of the reconnection site, and to reveal spatial evolution of the jets along the magnetopause. Our observations show that the primary reconnection X-line under modest solar wind Alfven Mach number condition can be extended over a wide range of local time and remain active for hours. During a due southward IMF interval when anti-parallel reconnection was occurring, MMS encountered a localized ion-scale current sheet within the jet far downstream (>300 ion inertial lengths) of the primary reconnection site. The current sheet contained super-Alfvenic perpendicular electron flow, perpendicular electric current of order 500 nA/m^2, electron flow reversal, and both Hall current and Hall magnetic field signatures. The observations are consistent with the occurrence of secondary reconnection within the jets of quasi-continuous spatially-extended reconnection. It appears that the primary site of magnetopause reconnection under favorable conditions is two-dimensional, but the resulting reconnection jets and secondary reconnection are three-dimensional.

Keywords: magnetic reconnection, magnetopause, ion diffusion region

