

Plasma acceleration along the distant tail magnetopause: Implication for lobe reconnection on the tail flanks for northward IMF

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GEOTAIL often encounters double-component ion populations along a thin layer between the magnetosheath and the distant tail lobe, which is consistent with an idea that the field lines threading the layer are disconnected from the Earth through magnetic reconnection occurring on the tail surface. These events are observed for northward and southward IMF with almost equal probabilities, which means that the lobe reconnection occurs regardless of the sign of IMF Bz. In the previous meeting, we suggested that for southward IMF cases, the lobe reconnection occurs on the tail surface near the Earth. In this study, we extend our analysis to the northward IMF case, and discuss favorable conditions and locations for the occurrence of the lobe reconnection for northward IMF cases.

The GEOTAIL spacecraft often encounters double-component ion populations along a thin layer between the magnetosheath and the distant ($X < -100R_E$) tail lobe. The two components flow tailward with different speeds, one with a speed higher than the magnetosheath flow, and the other with a lower speed. The two components are both smoothly linked with the magnetosheath ions, accompanied by the rotation of the magnetic field direction across the magnetopause. Our interpretation is that the field lines threading the layer are disconnected from the Earth through magnetic reconnection occurring on the tail surface. The higher-speed component is interpreted as the solar wind ions injected into the layer and accelerated tailward by the tension of the detached field lines, while the lower-speed component as the ions having been resident in the tail lobe before the detachment. These events are observed for northward and southward IMF conditions with almost equal probabilities, which means that the lobe reconnection occurs regardless of the sign of IMF Bz.

In the last SGPSS Fall Meeting, we suggested that for southward IMF cases, the lobe reconnection occurs on the tail surface near the Earth. In this study, we extend our analysis to the northward IMF case, and discuss favorable conditions and locations for the occurrence of lobe reconnection for northward IMF cases. The detached field lines, that are formed on the anti-sunward side of the reconnection site, are convected poleward (equatorward) for the northward (southward) IMF condition. Thus, it is rather surprising that even during northward IMF periods, the detached field lines are observed at the low latitudes surveyed by GEOTAIL. We suggest that for northward IMF cases, the reconnection site is close to the observation site, i.e., is located at low latitudes, hence the detached field lines can be detected by GEOTAIL. We note that this interpretation has a potential difficulty in that the observed magnetic shear across the magnetopause is not high enough to trigger reconnection locally. A key to overcome this difficulty is that these events are preferentially found in the northern dawn (dusk) and southern dusk (dawn) quadrants, that is, at locations where the northward IMF with a duskward (dawnward) component is strongly draped around the magnetopause. Furthermore, it is noted that the tail flank magnetopause is in wavy motions during intervals of northward IMF and that the magnetosheath field lines are locally draped on the sunward edge of the surface wave [e.g., Chen et al., 1993]. A combination of steepened surface waves and draped magnetic field lines with significant By and/or Bz components may induce localized reconnection at the sunward edge of the waves even at low latitudes.

Reference:

Chen, S.-H., et al., *J. Geophys. Res.*, 98, 5727, 1993.