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Magnetic Configurations of the Tilted Current Sheets and Dynamics of Their Flapping in Magnetotail

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Based on multiple spacecraft measurements, the geometrical structures of tilted current sheet and tail flapping waves have been analyzed and some features of the tilted current sheets have been made clear for the first time. The geometrical features of the tilted current sheet revealed in this investigation are as follows: (1) The magnetic field lines (MFLs) are generally plane curves and the osculating planes in which the MFLs lie are about vertical to the magnetic equatorial plane, while the tilted current sheet may lean severely to the dawn or dusk side. (2) The tilted current sheet may become very thin, its half thickness is generally much less than the minimum radius of the curvature of the MFLs. (3) In the neutral sheet, the field-aligned current density becomes very large and has a maximum value at the center of the current sheet. (4) In some cases, the current density is a bifurcated one, and the two humps of the current density often superpose two peaks in the gradient of magnetic strength, indicating that the magnetic gradient drift current is possibly responsible for the formation of the two humps of the current density in some tilted current sheets. Tilted current sheets often appear along with tail thick current sheet flapping waves. It is found that, in the tail flapping current sheets, the minimum curvature radius of the MFLs in the current sheet is rather large with values around $1R_E$, while the neutral sheet may be very thin, with its half thickness being several tenths ofR_E. During the flapping waves, the current sheet is tilted substantially, and the maximum tilt angle is generally larger than 45°. The phase velocities of these flapping waves are several tens Km/s, while their periods and wavelengths are several tens of minutes, and several earth radii, respectively. These tail flapping events generally last several hours and occur during quiet periods or periods of weak magnetospheric activity. It seems that these tail flapping waves a manifestation of global oscillation of the magnetosphere caused by the interaction between the magnetosphere and the solar wind with enhancements of its velocity or/and its dynamic pressure.