current sheet

[1];   [2];   [3]
[1]   ; [2]   ; [3]   PD/

A survey of the magnetotail current sheet structure

Keita Ishikura[1]; Tsugunobu Nagai[2]; Yoshihiro Asano[3]

[1] Dept. of Earth and Planetary Sciences, Tokyo Tech; [2] Tokyo Institue of Technology; [3] JSPS/Tokyo Institute of Technology

The magnetotail current sheet lies in the center of the tail, embedded within the plasma sheet, and it separates the magnetotail into the two regions with opposite magnetic field polarities. The study of the current sheet is of great importance in understanding physical processes of plasma transport. The current sheet generally has a dawn-dusk electric current with maximum intensity at the center of the sheet, and can be presented by the Harris-type current sheet solution. In the Harris current sheet model, the electric current varies across the sheet as cosh (z/h) and the magnetic field along the earth-sun direction varies as tanh (z/h) where h is the scale of the current sheet thickness.

In this study, using magnetic field and plasma data from the Cluster spacecraft in the magnetotail (-20 <Xgsm <-10 Re), the structure of the current sheet is statistically examined. We use the magnetic field gradient to estimate electric current density, and fit the data to the Harris current sheet model. We found that the average current density in the center of the current sheet is about 2 nA/m^2. We also found that the current sheet thickness is about 2 Re in the midnight region (|Ygsm|<5 Re), whereas it extends to 4 Re in the dawn and dusk region (|Ygsm|<5 Re). A more detailed current sheet structure is discussed.

Cluster
Harris   -20 <Xgsm
<-10 Re   current sheet   2 nA/m^2 current sheet
        midnight   (|Ygsm|<5 Re)   2 Re   dawn,dusk   (|Ygsm|<5 Re)   4 Re