S-I14

1st Asia-Pacific Conference on Plasma Physics, 18-23, 09.2017, Chengdu, China

The magnetic field structure of Mercury's magnetotail

Z. J. Rong[1, 2], Y. Ding[1, 2], J. A. Slavin[3], J. Zhong[1], W. J. Sun[1], G. K. Poh[3], Y. Wei[1,2], L. H. Chai[1], W. X. Wan[1,2], and C. Shen[4]

[1]Key Laboratory of Earth and Planetary Physics, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing 100029, China

[2]College of Earth Science, University of Chinese Academy of Sciences, Beijing, China

[3] Department of Climate and Space Sciences and Engineering, University of Michigan, Ann Arbor, MI 48109, USA

[4]Harbin Institute of Technology, Shenzhen, China

In this study, we use the magnetic field data measured by MESSENGER from 2011 to 2015 to investigate the average magnetic field morphology of Mercury's magnetotail in the down tail 0~ 3 RM (RM = 2440 km, Mercury's radius). It is found that Mercury has a terrestrial-like magnetotail, the magnetic field structure beyond ~1.5 RM down tail is stretched significantly with the typical flaring lobe field ~50 nT. A tail current sheet separating the antiparallel field lines of lobes is present on the equatorial plane. The magnetotail width in north-south direction is ~5 RM, while the transverse width is ~ 4 RM. Thus, magnetotail is elongated along north-south direction. At current sheet center, the normal component of magnetic field (10~20 nT) is much larger than the cross-tail component. The magnetic field profile over current sheet can be well fitted by the Harris sheet model. The fitting shows that the curvature radius of field lines at sheet center usually reaches a minimum around the midnight (100 ~200 km) with stronger current density (40~50 nA/m2). While the curvature radius increases towards both flanks (400~600 km) with the decreased current density (~20 nA/m2). The typical half-thickness of current sheet around the midnight is about ~0.25 RM (~600 km), and the inner edge of current sheet is located at the down tail ~ 1.5 RM. Our results about the tail field structure does not show the evident dawn-dusk asymmetry as that found in the Earth's magnetotail. Possible reasons are provided and discussed.

References

Slavin, J. A. et al.(2004), Mercurys magnetosphere, Advances in Space Research, 33, 1859–1874.

Slavin, J. A. et al.(2007), MESSENGER: Exploring Mercury's Magnetosphere, Space Sci. Rev., 131(1-4), 133–160, doi: 10.1007/sl 1214-007-9154-x.

Sun, W. J., et al. (2016), Spatial distribution of Mercury's flux ropes and reconnection fronts: MESSENGER observations, J. Geophys. Res. Space Physics, 121, 7590-7607, doi: 10.1002/2016JA022787.

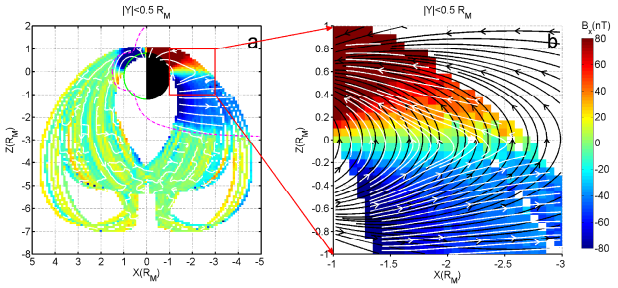
Zhong, J., et al. (2015a), Mercury's three-dimensional asymmetric magnetopause, J. Geophys. Res. Space Physics, 120, 7658–7671, doi: 10.1002/2015JA021425.

Zhong, J., et al. (2015b), Compressibility of Mercury's dayside magnetosphere, Geophys. Res. Lett., 42, 10,135–10,139, doi:10.1002/2015GL067063.

Rong, Z. J. et al. (2010), Statistical survey on the magnetic field in magnetotail current sheets: Cluster observations, Chin. Sci. Bull., 55, 2542–2547, doi: 10.1007/s11434-010-3096-5.

Rong, Z. J., et al. (2011), Statistical survey on the magnetic structure in magnetotail current sheets, J. Geophys. Res., 116, A09218, doi:10.1029/2011JA016489.

Figure xx



The distribution of Bx component in XZ pane near noon-midnight meridian within |Y|<0.5RM, where the magenta dash-dotted line mark the nominal MP on the plane of Y=0 inferred from the model of Zhong et al. [2015b]. Panel b shows the distribution when zoomed in the region |Z|< 1 RM and -1>X>-3 RM. In both panels, the white lines represent the average magnetic field lines, while the black lines superposed in panel b represent dipole field lines.