AOGS 2006

Electron and Ion Dynamics in the Mercury's Magnetosphere: Recent Results from Systematic Trajectory Tracings

KANAKO SEKI[1], DOMINIQUE C. DELCOURT[2], NAOKI TERADA[3], FRANCOIS LEBLANC[4], TATSUKI OGINO[1]

[1] *Solar-Terrestrial Environment Laboratory, Nagoya University (Japan)*

[2] *Observatoire de Saint-Maur, CETP-CNRS (France)*

[3] *National Institute of Information and Communications Technology (Japan)*

[4] *Service dAeronomie du CNRS (France)*

Observations by Mariner-10 in 1970s revealed existence of an intrinsic magnetic field at Mercury, with a reduced (∼1/1500) dipole moment compared to that of Earth [Ness et al., 1975]. The spatial and temporal scales of the resulting magnetosphere are expected much smaller than Earth's magnetosphere. During a passage in the magnetotail of Mariner-10, high-energy (> several tens of keVs) electron injections were observed in conjunction with a rapid change of the magnetic field orientation. However, the mechanism responsible for the particle acceleration in the small magnetosphere remains controversial [e.g., Siscoe et al., 1975; Luhmann et al., 1979]. In order to examine the issue further, one needs to understand basic structure and dynamics of Mercury's magnetosphere, such as global convection pattern and plasma supply processes. This has motivated several numerical studies using a variety of modelling approaches [e.g., Kabin et al., 2000; Delcourt et al., 2003; Kallio and Janhunen, 2003]. A recent study of ion dynamics in the Mercury's magnetosphere, which uses a rescaled analytical model of the geomagnetic and electric fields for Mercury, shows that non-adiabatic motion of ions in the magnetotail can cause a narrow band of energetic (several keV) Na+ precipitation in each hemisphere [Delcourt et al., 2003]. Since these precipitation bands extend over several degrees in latitude and a wide range of longitude, it may lead to additional sputtering of planetary material at the surface. On the other hand, it is not evident that the magnetospheric configuration and global convection pattern in the Mercury's magnetosphere can be described with the rescaled geomagnetospheric model. In order to investigate whether the ion dynamics in the self-consistent field configuration differs from that in the rescaled model, we conducted systematic trajectory tracings of Na+ ions in the electric and magnetic fields obtained from MHD simulations of the Mercury-solar wind interaction. The comparison with rescaled analytical model shows that the formation of the near-Mercury neutral line (NMNL) can change the precipitation pattern dramatically for certain solar wind conditions. In order to investigate electron accelerations, systematic electron trajectory tracings are also conducted in a substorm dipolarization-like rapidly changing field configuration. In this presentation, we review those recent results obtained from systematic single-particle trajectory tracings using either an analytical model or field configurations obtained from MHD simulations.