

水星磁気圏に関する最近の研究の動向と Bepi-Colombo 計画への期待

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Recent studies of the Mercury's magnetosphere and a perspective toward the Bepi-Colombo mission

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Observations by Mariner-10 in 1970s revealed existence of an intrinsic magnetic field at Mercury, with a reduced ($\sim 1/1500$) 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 (about 1/7 and 1/30 of Earth's magnetosphere, respectively). 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 intensity and orientation. However, the mechanism responsible for the particle acceleration in the small magnetosphere remains controversial [e.g., Siscoe et al., 1975; Luhmann and Friesen, 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 modeling approaches (MHD, single-particle, and hybrid) [e.g., Kabin et al., 2000; Delcourt et al., 2003, 2005; Kallio and Janhunen, 2003; Delcourt and Seki, 2006].

In this paper, we review the recent progress of simulation and modeling studies of Mercury's magnetosphere and its interaction with the solar wind and exosphere with an emphasis on characteristics of the small magnetosphere. The methods used include MHD (magneto-hydrodynamic), hybrid, systematic single-particle simulations, and their combinations. Inclusion of different factors into the numerical simulations sometimes give a contradictory consequence. On the basis of the review, we will discuss also on the increasing demands on strategic observations by the forthcoming Bepi-Colombo mission.

References

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