Magnetospheric Charged Particle Observations and Modeling at Mercury

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Measurements during flybys of Mercury by the MESSENGER spacecraft in 2008-2009 confirm, 34 years after Mariner-10, that the planet possesses an intrinsic magnetic field. This planetary field likely is strong enough to stand off the solar wind and form a magnetosphere with characteristic spatial and temporal scales much smaller than those at Earth. So far, unlike the puzzling measurements of Mariner-10, MESSENGER data do not show evidences of abrupt energetic particle injections from the magnetotail. On the other hand, these data do display signatures of processes similar to those at work in the terrestrial magnetosphere such as Flux Transfer Events, Traveling Compression Regions, or Kelvin-Helmholtz instabilities. Mass resolved ion measurements as well as UV observations from MESSENGER also reveal the presence of species of planetary origin (e.g., O+, Na+-Mg+, Ca+) in the inner hermean environment. Because of the weak intrinsic magnetic field as well as proximity to the Sun, the small magnetosphere of Mercury is expected to be very dynamical, likely leading to a variety of nonadiabatic transport features for magnetospheric charged particles. On the modeling side, the recent years have seen the realization of a number of studies dedicated to analysis of the plasma circulation at Mercury, using distinct approaches (single-particle, MHD, hybrid). I will review some of these observations and modeling results, both for characteristics of their own and to put them into perspective with the terrestrial case.