

Planetary Pickup Ions at Mercury

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The production of planetary ions from Mercury's extended exosphere (and to a lesser extent the surface) is the most fundamental example of Exosphere- Magnetosphere Coupling at Mercury. The exospheric neutrals provide a plasma source on short timescales, and exospheric parameters such as the scale height affect the distribution of planetary ions circulating on magnetospheric field lines. For instance, if a neutral species has large scale height compared to the mean magnetopause distance (e.g., Ca, Mg), a large fraction of ions from this species rapidly pick up thermal speeds comparable to the bulk flow speed of the Hermean magnetosheath whence they originate. The penetration of energetic pickup ions into the magnetosphere, as well as the circulation of the less energetic but more abundant ions originating inside the magnetopause, might produce localized diamagnetic decreases of Mercury's magnetospheric topology such as those observed during the MESSENGER flybys. Presently, the role of planetary ions in magnetospheric processes cannot be ascertained but can be studied through ion transport simulations. The existing measurements and simulations will be summarized and future directions for progress given the measurements to be returned by the MESSENGER and BepiColombo spacecraft will be discussed.