



## **Mercury's Dynamic Magnetosphere: What Have We Learned from MESSENGER?**

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Mercury's magnetosphere is created by the solar wind interaction with its dipolar, spin-axis aligned, northward offset intrinsic magnetic field. Structurally it resembles that of the Earth in many respects, but the magnetic field intensities and plasma densities are all higher at Mercury due to conditions in the inner solar system. Magnetospheric plasma at Mercury appears to be primarily of solar wind origin, i.e. H<sup>+</sup> and He<sup>++</sup>, but with 10% Na<sup>+</sup> derived from the exosphere. Solar wind sputtering and other processes promote neutrals from the regolith into the exosphere where they may be ionized and incorporated into the magnetospheric plasma population. At this point in time, about one year after MESSENGER's impact and one year prior to BepiColombo's launch, we review MESSENGER's observations of magnetospheric dynamics and structure. In doing so we will provide our best answers to the following six questions:

Question #1: How do magnetosheath conditions at Mercury differ from what is found at the other planets?

Question #2: How do conditions in Mercury's magnetosheath contribute to the dynamic nature of Mercury's magnetosphere? How does magnetopause reconnection at Mercury differ from what is seen at Earth? Are flux transfer events (FTEs) a major driver of magnetospheric convection at Mercury?

Question #3: Does reconnection ever erode the dayside magnetosphere to the point where the subsolar region of the surface is exposed to direct solar wind impact? To what extent do induction currents driven in Mercury's interior limit the solar wind flux to the surface? Do FTEs contribute significantly to the solar wind flux reaching the surface?

Question #4: What effects do heavy planetary ions have on Mercury's magnetosphere?

Question #5: Does Mercury's magnetotail store and dissipate magnetic energy in a manner analogous to substorms at Earth? How is the process affected by the lack of an ionosphere and the expected high electrical resistivity of the crust?

Question #6: How does Mercury's magnetosphere accelerate energetic charged particles?