

Substorms at Mercury: Old Questions and New Insights

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The MErcury Surface, Space ENvironment, GEochemistry, and Ranging (MESSENGER) spacecraft mission to Mercury offers our first opportunity to explore the planet since the brief flybys by Mariner 10 in the mid 1970s. MESSENGER encounters with the planet in January and October of 2008 and September of 2009 have already given us a wealth of new data about the extended magnetosphere of the Sun's nearest neighbor. Because of Mercury's proximity to the Sun (0.3 – 0.5 AU) the planet and its magnetosphere experience the most extreme driving forces in the solar system. Magnetic reconnection at the dayside magnetopause very likely erodes the outer magnetosphere, often allowing solar wind to impact directly onto the surface. The lack of a dense Mercury ionosphere is probably the underlying reason for the very intense, but short-lived (~ 1-2 min) activity bursts (substorms) observed by Mariner 10 during its first traversal of Mercury's magnetic tail in 1974. All of these factors are expected to produce complicated interactions involving the exchange and recycling of particles among the solar wind, magnetosphere, and surface regolith. I review what presently is thought to be known about Mercury's magnetospheric dynamics and describe the strategy for obtaining answers to the outstanding science questions surrounding this intriguing planetary system.