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Recent findings from MESSENGER on the magnetosphere of Mercury

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Over the last seven years, investigations of Mercury's small magnetosphere through MESSENGER observations have revealed it to be a highly dynamic environment, driven by reconnection at the dayside magnetopause. Though the MESSENGER mission ended in 2015, the dataset is still proving to be rich for new insights. Novel asymmetries have been discovered in cross-tail current sheet thickness, suprathermal proton energy, as well as the occurrence frequency of flux ropes, reconnection fronts and energetic electrons associated with dipolarizations. These are in addition to previously discovered strong asymmetries in Na+-group ion density, Kelvin-Helmholtz waves on the magnetopause and energetic electron-associated surface X-ray emission. These nearly-ubiquitous asymmetries may reflect another fundamental difference between the magnetospheres of Mercury and Earth, though their full significance is not yet known. The behavior of substorms at Mercury are also becoming clearer. Direct evidence for a substorm current wedge has been identified and the total current estimated. Furthermore, a statistical study of loading and unloading of Mercury's magnetotail has revealed that a typical substorm cycles through about 40% of its total magnetic flux, almost a factor of 4 larger than a typical substorm at Earth. We will briefly review these recent findings and discuss their implications.