MESSENGER Observations of Extreme Loading and Unloading of Mercury's Magnetic Tail

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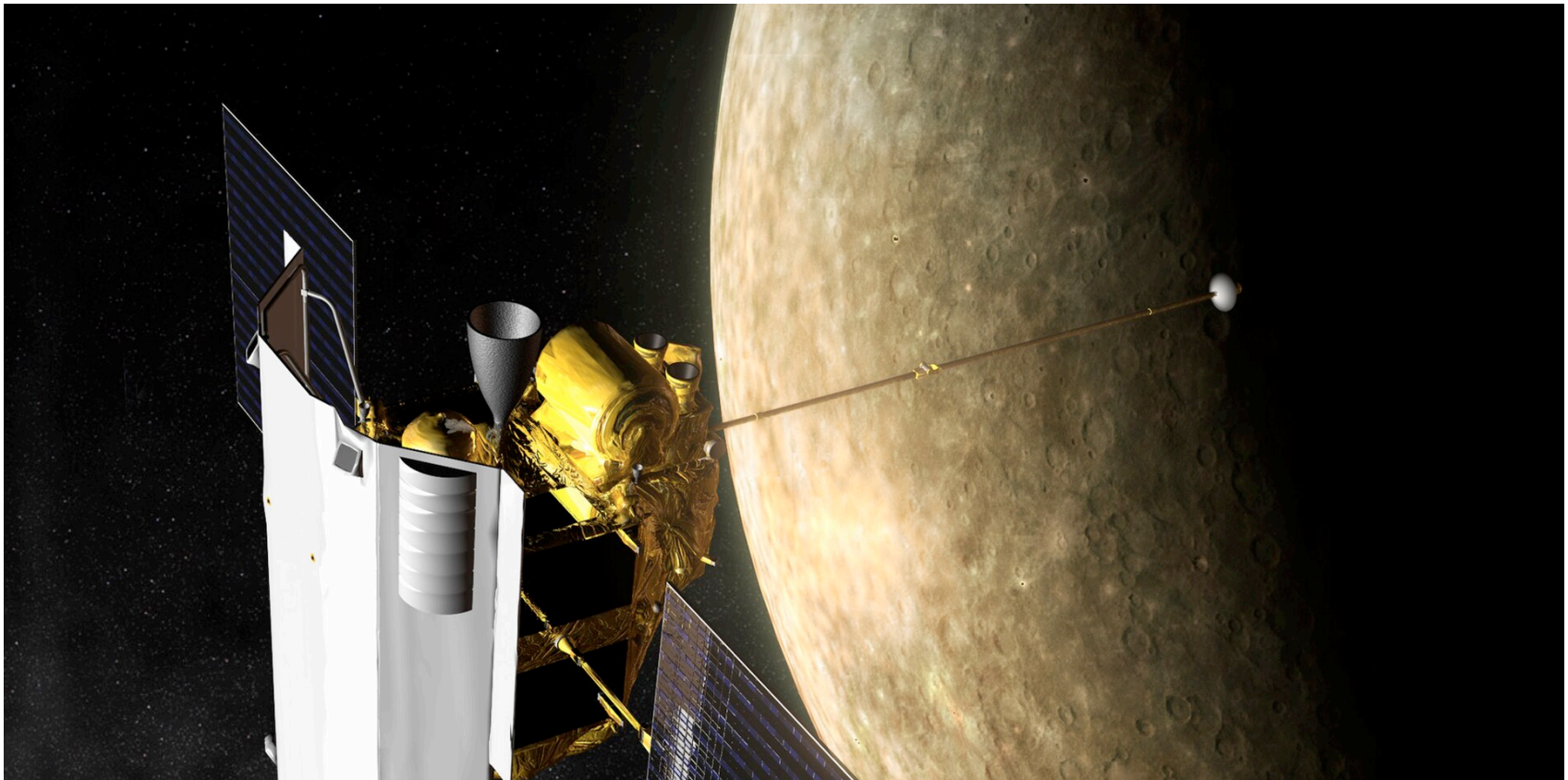
Introduction

Quick facts

Messenger (Mercury Surface, Space Environment, Geochemistry, and Ranging)

- A NASA robotic space probe that orbited the planet Mercury between 2011 and 2015
- *Magnetometer (MAG)* and *Energetic Particle and Plasma Spectrometer (EPPS)*



- six intervals of several seconds each when the total magnetic field weakened, indicating entry into a region with high plasma thermal pressure and low magnetic field pressure.
- These minima in field magnitude coincide with either rapid northward-then-southward or just southward variations in BZ, followed by a slower recovery back to BZ 0
- the near-Mercury neutral line (NMNL). The NMNL was observed near XMSO = –2.6 RM during MESSENGER's second flyby (5), but it was closer to the planet, near XMSO –1.6 RM, for this flyby. The third flyby results therefore suggest that the NMNL develops much closer to the planet when the magnetic tail is heavily loaded with magnetic flux, such as during events 2 and 3.

Schematic view

The total magnetic flux emanating from Mercury's surface can be calculated for a simple centered dipole:

$$\Phi_M = 2\pi B_{\text{eq}} R_{\text{M}}^2 \approx 9.5\text{MWb}$$