

Observations of Suprathermal Electrons in Mercury's Magnetosphere During the Three MESSENGER Flybys

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In 2008 and 2009 the MESSENGER spacecraft flew by Mercury three times and made the first direct observations of Mercury's magnetosphere in the more than 30 years since the Mariner 10 encounters of 1974-75. The Energetic Particle Spectrometer (EPS), one of two sensors within the Energetic Particle and Plasma Spectrometer (EPPS) instrument that measures electrons from ~35 keV to 1 MeV and ions from ~35 keV to 2.75 MeV, saw no increases in particle intensity above instrumental background (~5 particles/cm²-sr-s-keV at 45 keV) at any time during the three magnetospheric passages. Even though the MESSENGER Magnetometer documented several substorm-like signatures (tail loading) during the third flyby (29 September 2009), EPS measured no energetic ions or electrons above instrument background for the inbound portion of the flyby. In Earth's magnetosphere, substorm events produce powerful particle acceleration bursts that appear to be absent at Mercury under the conditions witnessed by MESSENGER to date. MESSENGER's X-Ray Spectrometer (XRS) detected the presence of low-energy (~10 keV) electrons impinging on its detectors during each of the three flybys. We conclude that such suprathermal plasma electrons below the EPS energy threshold probably caused the bremsstrahlung and filter fluorescence seen by XRS.