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Energetic-electron flux enhancements in Mercury's magnetosphere: An integrated view with high-resolution observations from MESSENGER

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The MESSENGER mission to Mercury has provided a wealth of new data about energetic particle phenomena. With observations from MESSENGER's Energetic Particle Spectrometer (EPS), as well as data arising from energetic electrons recorded by the X-Ray Spectrometer (XRS) and Gamma-Ray and Neutron Spectrometer (GRNS) instruments, recent work greatly extends our record of the acceleration, transport, and loss of energetic electrons at Mercury. The combined data sets include measurements from a few keV up to several hundred keV in electron kinetic energy and have permitted relatively good spatial and temporal resolution for many events. We focus here on the detailed nature of energetic electron bursts measured by the GRNS system, and we place these events in the context of solar wind and magnetospheric forcing at Mercury. Our examination of data at high temporal resolution (10 ms) during the period March 2013 through October 2014 supports strongly the view that energetic electrons are accelerated in the near-tail region of Mercury's magnetosphere and are subsequently "injected" onto closed magnetic field lines on the planetary night side. The electrons populate the plasma sheet and drift rapidly eastward toward the dawn and pre-noon sectors, at time executing multiple complete drifts around the planet to form "quasi-trapped" populations.