

The MESSENGER Mission: Initial Results from Mercury Orbit

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NASA's MERcury Surface, Space ENvironment, GEOchemistry, and Ranging (MESSENGER) spacecraft is now well into its primary mission to initiate a new era in our understanding of the innermost planet. MESSENGER became the first spacecraft to orbit Mercury on 18 March 2011. MESSENGER's Mercury Dual Imaging System is acquiring a global monochrome image mosaic at better than 90% coverage and at least 250 m average resolution, a global color image mosaic at better than 90% coverage and at least 1 km average resolution, and global stereo imaging at better than 80% coverage and at least 250 m average resolution. Higher-resolution images are also being obtained of more than 2,000 targeted areas. The X-Ray Spectrometer and Gamma-Ray and Neutron Spectrometer are determining the abundances of most major and some trace elements. The Visible and Infrared Spectrograph channel of MESSENGER's Mercury Atmospheric and Surface Composition Spectrometer is acquiring a global map of spectral reflectance from 300 to 1450 nm at a range of incidence and emission angles. Targeted areas have been selected for spectral coverage into the ultraviolet with the Ultraviolet and Visible Spectrometer (UVVS). MESSENGER's Mercury Laser Altimeter is acquiring topographic profiles when the slant range to Mercury's surface is 1800 km or less, encompassing latitudes from 20°S to the north pole. Topography over remaining areas is being derived from stereo imaging, radio occultations, and limb profiles. MESSENGER's radio science experiment is determining Mercury's gravity field from Doppler signals acquired during frequent downlinks. The UVVS is determining the three-dimensional, time-dependent distribution of Mercury's exospheric neutral and ionic species via their emission lines. During each orbit, MESSENGER's Magnetometer is determining the vector magnetic field at sampling rates up to 20 samples/s, the Energetic Particle Spectrometer is measuring energetic electrons and ions, and the Fast Imaging Plasma Spectrometer is documenting the energies and mass per charge of thermal plasma components, both within Mercury's magnetosphere and in Mercury's solar-wind environment. In this paper we summarize scientific findings from the first four months of Mercury orbital operations.