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Mercury: The New View from Orbit (B0.7)
Either poster or oral presentation (no preference).

GRAVITY, TOPOGRAPHY, AND MAGNETIC FIELD OF MERCURY FROM MESSENGER

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On 18 March 2011, the MErcury Surface, Space ENvironment, GEochemistry, and Ranging (MESSENGER) spacecraft was inserted into a ˜12-hour, near-polar orbit around Mercury, with an initial periapsis altitude of 200 km, initial periapse latitude of 60°N, and apoapsis at ˜15,200 km altitude in the southern hemisphere. This orbit has permitted the mapping of regional gravitational structure in the northern hemisphere, and laser altimetry from the MESSENGER spacecraft has yielded a geodetically controlled elevation model for the same hemisphere. The shape of a planet combined with gravity provides fundamental information regarding its internal structure and geologic and thermal evolution. Elevations in the northern hemisphere exhibit a unimodal distribution with a dynamic range of 9.63 km, less than that of the Moon (19.9 km), but consistent with Mercury's higher surface gravitational acceleration. After one Earth-year in orbit, refined models of gravity and topography have revealed several large positive gravity anomalies that coincide with major impact basins. These candidate mascons have anomalies that exceed 100 mGal and indicate substantial crustal thinning and superisostatic uplift of underlying mantle. An additional uncompensated 1000-km-diameter gravity and topographic high at 68°N, 33° E lies within Mercury's northern volcanic plains. Mercury's northern hemisphere crust is generally thicker at low latitudes than in the polar region. The low-degree gravity field, combined with planetary spin parameters, yields the moment of inertia $C/MR^2 = 0.353 \pm 0.017$, where $M=3.30 \times 10^{23}$ kg and R=2440 km are Mercury's mass and radius, and a ratio of the moment of inertia of Mercury's solid outer shell to that of the planet of $C_m/C = 0.452 \pm 0.035$. One proposed model for Mercury's radial density distribution consistent with these results includes silicate crust and mantle layers overlying a dense solid (possibly Fe-S) layer, a liquid Fe-rich outer core of radius 2030 ± 37 km, and an assumed solid inner core. Magnetic field measurements indicate a northward offset of Mercury's axial magnetic dipole from the geographic equator by 479 ± 3 km and provide evidence for a regional-scale magnetic field approximately collocated with the northern volcanic plains of possible crustal origin. These results from MESSENGER indicate a complex and asymmetric

evolution of internal structure and dynamics in this end-member inner planet.