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Present and future perspectives of Mercury's Interior with the missions MESSENGER and BepiColombo

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Our knowledge of Mercury's interior is crucial to provide information on the planet formation and evolution. The presence of a large central metallic and, at least, partly molten core was already demonstrated by the measure of Mercury's high bulk density and weak global magnetic field, respectively. The measurement of the longitudinal librations confirmed the existence of a fluid outer core. A better understanding of Mercury's deep interior is then fundamental to constrain the planet's bulk composition and core cooling history.
The MErcury Surface, Space ENvironment, GEochemistry, and Ranging (MESSENGER) mission accomplished a global exploration of the planet Mercury including geophysical and geodetic investigations. Geodetic measurements were acquired to determine Mercury's topography, gravitational field, rotation, and tides. These quantities represent important tools to reveal details of the planet's internal structure. The analysis of the entire MESSENGER radio science and altimetry datasets enabled the accurate determination of Mercury's gravity anomalies and topography, which led to accurate mapping of the crustal thickness only in the northern hemisphere because of MESSENGER orbit configuration.
Our latest gravity solution with MESSENGER data also includes refined adjustments of the spin axis coordinates (right ascension and declination of the pole) that fully satisfy the equilibrium Cassini state. This result yields our precise estimate of the normalized polar moment of inertia, C/MR2, which is significantly lower than previous studies suggesting a more differentiated Mercury's interior and the possible presence of a large solid inner core.
MESSENGER measurements pave the way for the ESA mission BepiColombo to provide a more comprehensive study of Mercury's interior. The ESA mission BepiColombo will enable highly accurate data for the determination of Mercury's gravity and topography in both hemispheres leading to refined global maps. Furthermore, significant enhancements on Mercury's orientation and tidal parameters will allow us to better characterize sizes and properties of Mercury's internal layers (including the solid inner core).