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Planetary geodesy as a tool to study the deep interior of planets and satellites

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Geodesy, the study of the gravity field, the shape and the rotation of the Earth and by extension of other planets and moons, is a remarkably effective tool to gain insight into the interior of planetary bodies. The gravity field is an integrated quantity over the whole planetary body and rotation and topography depend in an intricate way on the deeper interior below the surface. Planetary geodesy's view on the interior is therefore blurred in the sense that it cannot uniquely determine local interior properties, but its strong sensitivity to differences in solid and liquid behaviour of internal planetary layers creates a unique view on the global planetary interior.

Interpretation of geodesy data requires physically consistent interior modelling. These models integrate results from high-pressure mineral physics, computational materials science, geomagnetism, geodynamics and igneous petrology, among others. The role of geodesy in these models will be highlighted and possible synergies will be discussed.

The best geodesy information can be obtained by spacecraft orbiting or flying by the object under study since gravity rapidly decreases with increasing distance, and rotation and topography require precise position determination. I will review the basic ideas, focus on results recently obtained by missions to terrestrial planets (Mercury, Mars) and on geodesy studies of upcoming missions to Jupiter and its moons.