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Scientific Motivation and Requirements for Future Space Astronomy and Solar System Science Missions (1)

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GRAVITATIONAL PHYSICS TESTS IN THE SOLAR SYSTEM AND THE BEPICOLOMBO CASE

Abstract

The Solar System environment is a natural arena for performing fundamental physics experiments, in particular related to gravitation. Since decades the deep-space missions (such as the Pioneers, the Voyagers, Cassini) host instrumental packages to perform dedicated experiments on gravitation, gradually extending our knowledge of gravitational phenomena. The BepiColombo mission to Mercury will further extend this knowledge, moving towards the inner parts of the Solar System and employing a dedicated suite of Radio Science Experiments (RSE) to study Mercury internal structure and composition and test important predictions of Einstein's general relativity theory. This mission also should pave the way to further improvements. From one side, the very strict science requirements ask for a very precise spacecraft navigation, employing both very precise tracking (Ka band) and state-of-the-art ground system support. From another side, these strict requirements call for an accurate modelling of the spacecraft dynamics (ideally this should be a test mass), thereby implying the use of an onboard accelerometer (ISA, Italian Spring Accelerometer). This solution, nowadays common for near-Earth geodetic and geodynamic missions, is a novelty for deep-space. In this talk, an overview will be presented of Solar System gravitational tests, with special emphasis to BepiColombo and its RSE. The particular features of high-sensitivity accelerometry will be discussed, and a glance will be casted on future opportunities.