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Contribution of BepiColombo's MORE radio science experiment to the determination of Mercury's interior structure

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The Mercury Orbiter Radioscience Experiment (MORE) is one of the instruments on board the BepiColombo Mercury Planetary Orbiter (MPO), designed to estimate the Mercury's gravity field and rotational state and to perform a wide set of tests of relativistic gravity. The experiments exploits a highly stable, multi-frequency radio links in X and Ka band. The state-of-the-art microwave equipment enables simultaneous two-way links in X/X (7.2 GHz uplink/8.4 GHz downlink), X/Ka (7.2/32.5 GHz) and Ka/Ka band (34/32.5 GHz), providing range rate accuracies of 3 micron/s (at 1000 s integration time) at nearly all elongation angles. Range observables accurate to 20 cm (two-way) will be attained using a novel, wideband (24 Mcps) ranging system, based upon a pseudo-noise modulation scheme. Non-gravitational acceleration will be provided by a dedicated accelerometer (the Italian Spring Accelerometer, ISA).
We present the results of numerical simulations carried out using the latest mission scenario, entailing a launch date in October 2018 with arrival in Mercury in December 2025. We illustrate as the combination of the gravity and rotation measurements expected from BepiColombo can bring a substantial improvement in understanding the interior of the planet. Particularly, we show that MORE can detect planetary-induced librations, allowing to constrain the size of a possible solid inner core inside the outer liquid core.