SPACE EXPLORATION SYMPOSIUM (A3)
Solar System Exploration (5)

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THE MERCURY ORBITER RADIO SCIENCE EXPERIMENT (MORE) ON-BOARD THE ESA/JAXA BEPICOLOMBO MISSION TO MERCURY.

Abstract

BepiColombo is a joint ESA/JAXA mission for a comprehensive exploration of the planet Mercury. The mission is now scheduled for launch in October 2018 and for orbit insertion at the end of 2025. The Mercury Orbiter Radio science Experiment (MORE) is one of the on-board experiments, devised to enable a better understanding of both Mercury geophysics and fundamental physics. The spacecraft will be equipped with full instrumentation able to perform very precise range and range-rate tracking from the Earth, on-board accelerometry and accurate angular observations by an optical on-board camera. This will give the chance to determine with very high accuracy the spacecraft orbit around Mercury, allowing to achieve the main scientific goals, which are concerned with the gravity and rotation of Mercury and General Relativity (GR) tests.

The global experiment consists in determining the value and the formal uncertainty of a number of parameters of general interest, as the spherical harmonics of Mercury gravity field up to degree and order 25 and its temporal variations due to tides (*gravimetry experiment*) and the parameters defining the rotation state of the planet (*rotation experiment*). Moreover, the accurate measurement of the orbit of Mercury and of the propagation of radio waves between Earth and Mercury will allow to test GR, constraining a number of post-Newtonian and related parameters and providing an improved dynamical model for the Solar System (*relativity experiment*). All the parameters of interest for the radio science experiment are determined simultaneously by means of a global least squares fit, adopting a constrained multiarc strategy.

We present the results of a global numerical simulation of the experiment, carried out with the MORE dedicated software, ORBIT14, developed by the Celestial Mechanics Group of the University of Pisa under an Italian Space Agency constract. The software allows both for the generation of simulated observables and for the determination of the parameters and their uncertainties with a differential corrections method. The simulation has been performed in a realistic up-to-date scenario, which includes the detrimental effects in the parameters estimation due to accelerometer measurement errors, adopting a reliable error model provided by the Italian Spring Accelerometer (ISA) team, the desaturation maneuvers and systematic errors in the range measurement chain. Study performed under ASI constract n. I/080/09/0.