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The Italian Spring Accelerometer (ISA) and the BepiColombo Mission to Mercury: 2) The Rse Goals and ISA Measurements

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The ESA (European Space Agency) cornerstone mission to Mercury denominated BepiColombo is not only devoted to the planet interior structure, surface and environment studies, but also to test Einstein theory of General Relativity (GR) to an unprecedented level of accuracy. To perform such measurements it is necessary to allocate on–board the Mercury Planetary Orbiter (MPO) a set of dedicated instruments to perform the so–called Radio Science Experiments (RSE). The RSE principal task is the accurate determination of the MPO orbit around the planet, and then of Mercury around the Sun, by which it is possible to estimate several parameters related to the planet structure and verify GR. One of the instruments selected by ESA to be included in the payload is a very high sensitivity accelerometer able to measure all the inertial accelerations acting on the MPO spacecraft. The accuracy required by the RSE in the along–track orbit determination of the MPO is about 1 m over one orbital revolution of the spacecraft (8355 s) around Mercury. The Italian Spring Accelerometer (ISA) performances, with an intrinsic noise level of about 10^-10g/sqrt(Hz) (g=9.8 m/s^2) in the frequency band of 3*10^-5—10^-1 Hz, are enough to guarantee the precise orbit determination necessary for the RSE ambitious goals. Indeed, the accelerometer accuracy in the spacecraft orbit reconstruction - about 10^-8 m/s^2 over one orbital revolution of the MPO- will allow to remove the disturbing non–conservative accelerations acting on the MPO surface without the necessity of their (very complex) modelling. We first briefly reassume the RSE objectives, with Earth's radar–tracking measurements characteristics and the precise orbit determination technique necessaries for their achievement. Then we focus on the main non–gravitational perturbations acting on the MPO spacecraft and we show how much we gain with ISA measurements in order to reduce their disturbing effects. We finally give ISA error budget estimate with regard to the non–gravitational accelerations measurement.