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The Italian Spring Accelerometer (ISA) and the BepiColombo mission to Mercury: the RSE (Radio Science Experiments) and ISA technical features

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The main goals of the European Space Agency (ESA) cornerstone mission to Mercury denominated BepiColombo are connected to the study of the planet internal structure. In order to reach such very ambitious objectives, a set of closely related experiments, namely a gravimetry experiment and a rotational experiment, are necessary. These experiments, together with a General Relativity experiment for the measurement of the post-newtonian parameters, form the so-called Radio Science Experiments (RSE). One of the instruments involved in the RSE is a high sensitivity accelerometer. The key rôle of the onboard accelerometer is to remove from the list of unknowns the strong non-gravitational perturbations (NGP) acting on the Mercury Planetary Orbiter (MPO) spacecraft, in such a way to reconstruct, a-posteriori, the “pure” gravitational orbit of the MPO. Indeed, the accelerometer accuracy in the spacecraft orbit reconstruction will allow to remove the disturbing and subtle non-gravitational accelerations acting on the MPO surface without the necessity of their (very complex) modeling. The Italian Spring Accelerometer (ISA) developed at IFSI has been selected by ESA to fly onboard the MPO as a category 2B instrument. ISA is a three-axis torsional accelerometer with an intrinsic noise level of about 10ˆ-10g/sqrt(Hz) (g=9.8 m/sˆ2) in the frequency band 3*10ˆ-5-10ˆ-1 Hz. We reassume the results of the experimental and theoretical activities related to the implementation of ISA onboard the MPO spacecraft, with particular emphasis on the accelerometer physical characteristics and performances, its configuration and thermal control, its preliminary error budget estimate and, finally, on its preliminary in-flight calibration procedures. We will also give the indication of the RSE objectives, the characteristic of the radar-tracking measure-

ments from the Earth and the precise orbit determination technique necessary for their achievement, focusing on the main non-gravitational perturbations acting on the MPO spacecraft and their reduction using ISA measurements.