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## The Italian Spring Accelerometer (ISA) and the BepiColombo mission to Mercury: concept, physical characteristics, performances and perturbations

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## 1 Abstract

In order to reach the ambitious objectives of the BepiColombo Radio Science Experiment (RSE) it is necessary to allocate onboard the Mercury Planetary Orbiter (MPO) a very high sensitivity accelerometer. The key rôle of the accelerometer is to remove from the list of unknowns the strong non-gravitational perturbations acting on the MPO spacecraft, in such a way to transform the MPO in an *a-posteriori* drag-free satellite. The Italian Spring Accelerometer (ISA), developed at IFSI, has been selected by ESA to fly onboard the Mercury orbiter as a category 2B instrument. The ISA accelerometer is a three-axis instrument with a sensitivity of  $10^{-9}g_{\oplus}/\sqrt{Hz}$  ( $g_{\oplus} \approx 9.8$  $m/s^2$ ) in the frequency band of  $10^{-4}$ – $10^{-1}$  Hz. This sensitivity, dictated by the RSE accuracy in the orbit determination of the MPO spacecraft around Mercury, is enough to remove the disturbing non-gravitational accelerations acting on the MPO surface without the necessity of any modelling of the perturbations. The larger of these surface non-conservative accelerations is due to the incoming visible solar radiation, about  $10^{-6}$  m/s<sup>2</sup> in magnitude. We reassume the results of the laboratory activities with ISA, with particular emphasis to the physical characteristics of the accelerometer, its general architecture, performances and thermal stability. Also the way as the perturbations due to the gravity-gradients accelerations in the field of Mercury and the angular accelerations due to the MPO rotation have been handled will be given.