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**Title:** *“Testing General Relativity with the 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. One of the main scientific goals of MORE is to perform a very precise test of General Relativity (relativity experiment). Thanks to the state of the art on-board and on-ground instrumentation, the extremely accurate tracking from the Earth will allow to precisely reconstruct the heliocentric orbit of Mercury enabling to constrain the value of several post-Newtonian and related parameters with an unprecedented accuracy. The Celestial Mechanics Group of the University of Pisa developed a novel dedicated software, ORBIT14, to perform the simulations of the experiment and to determine simultaneously all the parameters of interest within a global least squares fit. We present the results of a full set of numerical simulations, carried out in a mission up-to-date realistic scenario. The results are highly encouraging: in the framework of metric theories of gravitation, an accuracy of some parts in  $10^{-6}$  for the Eddington parameter beta and at least of  $10^{-5}$  for the Nordtvedt parameter  $\eta$  can be attained, while accuracies at the level of  $5 \times 10^{-7}$  and  $10^{-7}$  can be achieved for the preferred frames parameters  $\alpha_1$  and  $\alpha_2$ , respectively. Finally, we will present a comprehensive discussion on the issue of curing rank deficiency in the simultaneous determination of the orbits of Mercury and the Earth with MORE.

Joint work with Giacomo Tommei, Daniele Serra and Andrea Milani.