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Testing the equivalence principle in space with MICROSCOPE: countdown to the final results

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The MICROSCOPE satellite was launched in April 2016 and ended its operations in October 2018. Aiming at testing the Equivalence Principle (EP) with an accuracy better than ever tested, the satellite has provided usefull scientific data during more than two years. The EP is the funding hypothesis of the General Relativity (GR) established by Einstein in 1917. It states the equivalence between gravitational and inertial mass: commonly called the universality of free-fall. The science motivation relies mainly in the observation of an eventual violation that could give the first clue of a new interaction, bridging GR to Quantum Physics.

Onera was responsible for the instrument developpement, production and test. In addition, it is also responsible for the science and the mission science center which deals with the science operations and data process. In December 2017, the first results, based on only 7% of the available data, were published in PRL and improved the best laboratory results by one order of magnitude.

The de-orbitation of MICROSCOPE has started, thanks to two deployed wings. The final data process is almost complete in conjonction to the assessment of systematic errors. A particular emphasis will be placed on the handling of glitches. The glitches are mainly produced by the satellite MLI cracking when it is more or less enlightened by the Sun or the Earth. Their temporal distribution could be in competition to an eventual violation signal.

With the preparation of the final result paper, a mission called MICROSCOPE 2 is beeing studied in order to improve by an additional factor 100 the previous mission. By taking advantage of of the MICROSCOPE experiment return, the instrument and satellite design will be improved. Three concentric test-masses are envisaged with optical sensing as the main deep change.

Primary authors: RODRIGUES, Manuel (ONERA); Mr TOUBOUL, Pierre (ONERA); Prof. MÉTRIS, Gilles (Observatoire de la Côte d'Azur); Dr BERGÉ, Joël (ONERA); Dr HARDY, Emilie (ONERA)

Presenter: RODRIGUES, Manuel (ONERA)

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