MICROGRAVITY SCIENCES AND PROCESSES (A2)
Gravity and Fundamental Physics (1)

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HIGH ACCURATE GEOMETRICAL MACHINING AND METROLOGY FOR THE MICROSCOPE INSTRUMENT

Abstract

The instrument of the MICROSCOPE space mission dedicated to the test of the Equivalence Principle is now in its qualification phase. At the core of the satellite, the payload is composed of two differential electrostatic space accelerometers developed in ONERA. Each of the accelerometers embarks two pairs of test-masses made of Platinum Rhodium alloy and Titanium alloy for the first, and only Platinum Rhodium for the second. The in orbit expected resolution of the differential acceleration measurements is at least 8.10-15ms-2 at or near the orbital frequency, i.e the test measurement frequency, after the in flight instrument calibration. This challenging performance is achieved with low noise electronics and overall highly accurate geometry of the sensor core, at the limits of the present technologies. The paper will address the huge effort paid to reach the micro-meter production of the sensor core made of gold coated silica and of the test masses produced and controlled in collaboration with the PTB, Physikalisch-Technische Bundesanstalt. In particular the silica parts were obtained thanks to the ONERA specific ultra-sonic machining process able to exhibit a few micrometers accuracy when assisted by laser interferometry in-situ control. The QM parts have been machined in agreement with the FM specifications and have served to prepare all the metrology process. The metrology results will be presented emphasizing the impact on the mission performance, that is to say the in-flight test-mass geometry, alignment and centring and so the identity of sensitivity to the gravitational and acceleration fields.