Proposal Title:	Galileo Galilei
Lead Proposer:	Anna Nobili

The aim is to test the Weak Equivalence Principle (WEP), that is the equivalence between gravitational mass and inertial mass, regardless of composition, to 1 part in 10^{17}. The sensors are two concentric cylinders of different materials, one in Be and the other in Ti, spinning with the spacecraft at a frequency of 1 Hz. Nine laser gauges with sub-picometre performance measure the differential acceleration of the two masses. The source of the field is the Earth.

The scientific goal is very ambitious, challenging the equivalence principle which is at the very basis of general relativity and any other metric theory of gravity. Indeed if a WEP violation with respect to composition was found, it would have profound repercussions on modern physics, and might open the way for completely new concepts and lines of thought.

To test the WEP at the 10^{-17} level, with a precision 2 orders of magnitude higher than Microscope, a mission with similar goals expected to be launched next year, probably requires a space facility, the best achieved so far in a ground based laboratory being 10^{-13}.

Both Microscope and Galileo Galilei (GG) use rotation of the spacecraft to up-convert the violation signal from the orbital frequency of around 0.2 mHz to a higher frequency. In the case of GG, this up-conversion puts the signal closer to 1Hz where some of the noise sources may be less powerful.

In the GG proposal, the description of the payload is vague. Even more important for an experiment whose only aim is to achieve an extremely precise measurement, the systematics of the measurement are not described in a sufficiently convincing way. For example, there are no details on the readout performance of the laser gauges, and not enough details on relevant noise sources, so that it is not clear that all sources of noise have been quantitatively accounted for in an integrated way.

The experimental concept does not include a control measurement, with a second set of cylinders made with the same material, as it is done for Microscope. GG's goal is to improve the accuracy with respect to Microscope by 2 or 3 orders of magnitude. Many aspects of mission design are similar and any successor of Microscope would benefit significantly from the scientific and technical results of that mission.