

The Galileo for Science project: Fundamental Physics and Technology development for the Constellations of Galileo satellites

Feliciano Sapio (1), David Lucchesi (1), Massimo Visco (1), Carlo Lefevre (1), Emiliano Fiorenza (1), Marco Cinelli (1), Alessandro Di Marco (1), Natalia Gatto (1), Pasqualino Loffredo (1), Marco Lucente (1), Carmelo Magnafico (1), Roberto Peron (1), Francesco Santoli (1) and Francesco Vespe (2)

(1) Istituto Nazionale di Astrofisica (IAPS-INAF), Via Fosso del Cavaliere n. 100, 00133 Roma, Italy; (2) Centro di Geodesia Spaziale (CGS) "Colombo" – Agenzia Spaziale Italiana (ASI), 75100 Matera, Italy

The Galileo for Science (G4S 2.0) project, funded by the Italian Space Agency (ASI), aims to perform a set of measurements about gravitation with the two Galileo satellites GSAT-0201 (E14) and GSAT-0202 (E18) exploiting the relatively high eccentricity of their orbits with respect to those of the other satellites of the Full Operational Capability (FOC) constellation. These two satellites have been already used in 2018 by both ZARM and SYRTE collaborations for a new measurement of the Gravitational Red shift that has improved the 1976 measurement of Gravity Probe A by a factor between 4 and 6 respectively. In fact, from an accurate analysis of the orbits and clocks of these two Galileo satellites, a set of relativistic tests can be performed with the objectives of comparing the predictions of Einstein's theory of General Relativity with those of other gravitational theories concerning, mainly, the motion of a test particle along a geodesic of space-time and the time dilation of the on-board clocks. Conversely, the clocks of the full Galileo-FOC constellations will be analyzed to set possible constraints on the presence of dark matter in the Milky Way in the form of Domain Walls. Finally, a new accelerometer concept will be developed to be embarked on a next generation of Galileo satellites to measure non-gravitational accelerations. These, in fact, constitute the main source of uncertainty for a further improvement in the precise orbit determination of navigation satellites. Three Italian research institutes are involved in G4S 2.0: Center for Space Geodesy (ASI-CGS) in Matera, Istituto di Astrofisica e Planetologia Spaziali (IAPS-INAF) in Roma and Politecnico (POLITO) in Torino. The project will be presented with some of the ongoing activities at IAPS-INAF.