Contribution ID: **22** Type: **not specified**

Experiments: Fundamental Physics with GNSS satellites and the Galileo for Science Project

Monday, September 4, 2023 2:30 PM (30 minutes)

Agency (ASI) that aims to provide Fundamental Physics measurements with the Galileo-FOC constellation of the Global Navigation Satellites System (GNSS). The measurements concern both the analysis of satellite orbits and of their atomic-clocks data. A new accurate analysis of the satellites onboard atomic-clocks can lead to the following significant results: i) measuring the gravitational redshift and, consequently, making a local position invariance (LPI) test, and ii) searching for possible Dark Matter candidates in the form of Domain-Wall of Galactic origin. Conversely, precise orbit determination (POD) of satellites allows the relativistic precessions of satellite orbits to be measured at a much higher altitude than previous measurements with passive geodetic satellites such as LAGEOS, LAGEOS II and LARES.

The two satellites GSAT-0201 (Doresa) and GSAT-0202 (Milena) in elliptical orbits will be exploited for the measurement of the gravitational redshift, as the on-board atomic clocks frequency is periodic-modulated with respect to on-ground clocks. Whereas for the Dark Matter constraints, the entire Galileo constellation will be considered: the goal is searching for interactions with possible Dark Matter candidates, such as Domain Walls, that would cross the whole constellation. If this happens, on-board clocks would impulsively change their frequency relative to a reference clock on Earth. Finally, measuring the relativistic precessions will allow us to study possible deviations from General Relativity by comparing its predictions with those of other theories of gravitation.

To pursue the goals of G4S_2.0 project, a fundamental key point in our analysis is obtaining the satellite's position as a product of the POD. As a consequence, modeling, as better as possible, the complex effects of the Non-Gravitational Perturbations (NGPs), such as the direct solar radiation pressure, is essential. Many of our efforts go in this direction. The state of the art will be presented, both as regards the Fundamental Physics measurements and the development of new models for the NGPs.

Presenter: SAPIO, Feliciana (IAPS-INAF)

Session Classification: Parallel Sessions