TESTING FUNDAMENTAL PHYSICS WITH SATELLITE LASER RANGING: PERSPECTIVES AND GOALS OF THE LARASE EXPERIMENT

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**Introduction:** Passive laser-ranged satellites, launched for geodynamics and geophysics purposes, not only have contributed to significant measurements in space geodesy [1,2], but they also provided an outstanding test bench to fundamental physics. Two significant examples in this field are represented by the first measurement of the Lense-Thirring precession on the combined nodes of the two LAGEOS satellites [3], and by the measurement of the total relativistic precession of the argument of pericenter of the LAGEOS II satellite [4,5]. Indeed, the physical characteristics of such satellites — such as their low area-to-mass ratio — as well as those of their orbits, and the availability of high-quality tracking data provided by the International Laser Ranging Service (ILRS) [6], allow for precise tests of gravitational theories.

The aim of LARASE (LAser RAnged Satellites Experiment) is to go a step further in the tests of the gravitational interaction in the field of Earth (i.e. in the weak-field and-slow motion (WFSM) limit of general relativity) by the joint analysis of the orbits of the two LAGEOS satellites and that of the most recent LARES satellite [7]. To reach such a goal, a key ingredient is to provide high-quality updated models for the perturbing non-gravitational (i.e. non-conservative) forces acting on the surface of such satellites.

A large amount of Satellite Laser Ranging (SLR) data of LAGEOS and LAGEOS II has been analyzed using a set of dedicated models for satellite dynamics, and the related post-fit residuals have been analyzed. A parallel work is on-going in the case of LARES that, due to its much lower altitude, is subject to larger gravitational and non-gravitational effects; the latter are in part mitigated by its much lower area-to-mass ratio.

Recent work on the data analysis of the orbit of such satellites will be presented together with updated constraints on non-Newtonian gravitational dynamics. The measurement error budget will be discussed, emphasizing the role of the modeling of gravitational and, especially, non-gravitational forces on the overall precise orbit determination quality.

**References:**