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

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LARES 2 AN APPROVED MISSION FOR TESTING GENERAL RELATIVITY

Abstract

LARES 2 is a satellite, with a laser retroreflector array (LRA), developed by the Italian Space Agency (ASI), approved for a launch in early 2020, on the new ESA launcher VEGA C. The launcher is an enhanced version of VEGA that can place the payload/satellite in a much higher orbit than the 1450 km, which was the case with the LARES launch in 2012. The orbit of LARES 2 is supplementary to the one of NASA's LAGEOS satellite thus with an altitude of almost 6000 km and an inclination of about 70 degrees. The satellite is passive and covered with 303 cube corner reflectors (CCRs) that will allow the orbit reconstruction with extremely high accuracy thanks to the technique of laser ranging. Fifty years ago, Apollo 11 placed the first LRA on the surface of the moon, comprising of CCRs like those on LARES. With Lunar Laser Ranging (LLR) over these five decades a wealth of scientific and engineering achievements, including relativistic tests, materialized. In developing LARES 2, the improved design will test the use of smaller COTS CCRs for even higher ranging accuracy. This will be further supported by a similar to LARES approach in building the satellite out of a single piece of very high density metal alloy, much higher than LAGEOS. Thus, the very low surface-to-mass ratio of the satellite in addition to the use of an updated gravitational field model from the GRACE mission and the butterfly orbital configuration of LARES 2 and LAGEOS, will allow us to reach an accuracy in the determination of Einstein's General Relativistic prediction of frame-dragging around Earth to a few parts in a thousand. This objective is quite demanding being one order of magnitude better than what is expected from the LARES mission. The addition of LARES 2 in the constellation of geodetic laser ranged satellites will improve results also in Earth science and in particular in the determination of the International Terrestrial Reference Frame (ITRF). The paper will address the scientific objectives of the LARES 2 mission both in fundamental physics and in Earth science with particular emphasis on how the improvement in the measurement is obtained with this new satellite. Also, the technical aspects encountered in the design phase of LARES 2 will be described. The current results obtained by the orbital determination of LARES will be compared with simulations of the LARES 2 experiment.