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RECENT RESULTS FROM THE LARES MISSION ON TESTING GENERAL RELATIVITY

Abstract

The Italian Space Agency's (ASI) LARES satellite was placed in orbit with a dedicated launch using the qualification flight of ESA's VEGA (ESA-ASI-ELV-AVIO). After four years in orbit, preliminary analysis of the Satellite Laser Ranging (SLR) data to LARES in combination with the SLR data from the LAGEOS 1 & 2 missions show an improvement in the measurement of Earth's frame-dragging. The frame-dragging phenomenon is predicted by General Relativity (GR) and it is induced by Earth's rotation that twists the space-time fabric and drags inertial frames with it. The orbital plane of an object subjected only to a central force determines an inertial frame according to Galilei-Newton mechanics. In GR however, that plane is dragged by the rotation of the central mass. The dragging of the orbital plane is in the same direction of the rotation of the body. This motion, very small around Earth, may be dramatically large around supermassive rotating black holes. The LARES mission experiment aims at measuring this effect around Earth with an accuracy of about 1%, thus improving the previous measurement obtained with the two LAGEOS satellites by one order of magnitude. The data are collected by the International Laser Ranging Service (ILRS) network, from ground stations that transmit ultra-short laser pulses towards the 400 kg satellite equipped with retroreflectors and measure the travel time of the reflected pulse's arrival at the station. Using the data collected from the global ILRS network, one can determine LARES' orbital position with an accuracy that can reach a few millimeters. The paper will present the mission objectives

and the design characteristics of the LARES satellite and will report the recent results obtained with the analysis of the two LAGEOS and LARES satellites' data using a recent gravitational field model for Earth, obtained from the dedicated GRACE and GOCE geopotential mapping missions.