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Author: Prof. Antonio Paolozzi
Sapienza University of Rome, Italy

Prof. Ignazio Ciufolini
Università del Salento, Italy
Mr. Claudio Paris
Sapienza University of Rome, Italy
Prof. Maurizio Parisse
University of Rome "La Sapienza", Italy

THERMAL DEFORMATION ON LASER RETRO-REFLECTORS OF LARES SATELLITE

Abstract

LARES is an Italian Space Agency satellite that was successfully put in orbit with the qualification launch of VEGA. The surface of the satellite is covered with 92 Cube Corner Reflectors (CCRs) that allow its precise positioning through the measurements of the International Laser Ranging Service. By measuring the time of flight of the laser pulses sent towards the satellite it is possible to reach ranging accuracies of few millimeters from the best stations. LARES is passive and as such it does not have thermal control. Thermal deformations of the CCRs can be calculated if power input, boundary conditions and thermal heat transfer parameters are known. The reflecting performances of CCRs are typically evaluated through the analysis of the Far Field Diffraction Pattern (FFDP) which provides information on the energy distribution, of the reflected laser pulse, on the ground. The CCR deformations can change the FFDP thus reducing the probability to have good laser returns to the station. Due to its particular CCR mounting system, that minimizes contact with the CCR, heat transfer of the CCR is mainly governed by radiation. It is therefore important to evaluate experimentally the solar absorptivity α_S and the infrared emissivity ε. The paper will describe the experimental set-up, the numerical thermal model of the CCR and mounting system and the experimental measurement of absorptivity and emissivity. The thermal model with the experimentally evaluated α_S and ε will be used to calculate the deformation. It will finally be verified if those deformation are compatible with the Far Field Diffraction Pattern that will be experimentally acquired using a special optical circuit outside the thermal vacuum chamber.