

Integrated Thermal and Optical Tests of LRAs at the LNF SCF

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The Space Climatic Facility (SCF) at INFN-LNF in Frascati, Italy, is devoted to the characterization of the thermal properties and the optical performance of laser-ranged payloads (the "SCF-test").

To study the thermal thrusts on the LAGEOS satellites two prototypes are available: a 3x3 array (the "matrix") built at LNF and a partial engineering model property of NASA-GSFC (the "sector"). The SCF-test of the matrix and the sector are also done in preparation of the full characterization of the new LARES laser-ranged test mass. The LAGEOS and LARES studies include extensive thermal modelling and, since recently, also optical modelling. The LAGEOS spin analysis of select periods has also been performed. We also started to study thermal thrusts along fully orbits, as a function of the satellite thermo-optical parameters and satellite spin. This is done separately for LAGEOS and for LARES at a typical altitude reachable by the new VEGA launcher (1200 Km).

The SCF turned is well suited to characterize GNSS retro-reflector arrays. For this purpose, the LNF and Tor Vergata groups plus R. Vittori in 2006 proposed to INFN a new experiment, ETRUSCO (approved by INFN in October 2006). A flight model of a retro-reflector array for the GPS-2 (property of the Univ. of Maryland) and three GLONASS retro-reflectors (property of ROSKOSMOS-IPIE) are currently at LNF to be SCF-tested.

The LNF and Tor Vergata groups plus R. Vittori are among the proponents of a new generation of lunar laser ranging array, answering the call "Suitcase Science to the Moon" by NASA, which was approved in August 2007. A concept study for a robotic-deployment version of this proposal (MoonLIGHT) was performed for ASI (Nov. 2006 - May 2007).

Within the context of a three-year study on "Cosmology and Fundamental Physics" funded by ASI, the groups of LNF, Tor Vergata and Vittori are working on the construction and SCF-test of a prototype laser-ranged test mass for the DSGP mission, proposed to ESA and NASA to accurately study the Pioneer Anomaly. In addition, ASI has also approved the R&D studies for the SCF-test of hollow retro-reflectors for the future GPS-3, in collaboration with NASA / GSFC.

This talk describes the SCF-test, the first experimental measurements and the results of thermal and optical simulations.