Testing and physics analysis of old (Lunokhod) and new (MoonLIGHT) lunar laser retroreflectors

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Since its foundation, one of the most important objective of the INFN's SCF_Lab (Satellite/lunar/GNSS laser ranging/altimetry and cube/microsat Characterization Facilities Laboratory) has been the development, design, manufacturing, and qualification for space flight of an 'innovative' LRA (laser retroreflector array) of CCRs (cube corner retroreflectors) especially intended for laser ranging operations in the Earth-Moon system; in fact, the innovation is the use of a single, large retroreflector for lunar laser ranging from MLRO (Matera Laser Ranging Observatory) for precision tests of general relativity.

The SCF_Lab Team, with support by ASI, is reaching the aforementioned goal, and is going to fly to the Moon its MoonLIGHT (Moon Laser Instrumentation for General relativity High-accuracy Tests), after about 50 years from the last deployment of devices of the same kind on our natural satellite. MoonLIGHT is a LRA, which makes use of a single CCR; it has got a unique and original design, aimed at compensating for the detrimental effect of lunar librations on the precision of lunar laser ranging 'shots' and their respective observational products, the so-called normal points.

This paper describes INFN's unprecedented payload, its target use, and its space qualification process (which is currently ongoing) for TeamIndus and Moon Express 1 missions to the Moon, which are both scheduled for 2019.

As a figure of merit, MoonLIGHT's thermal and optical behaviours will be compared to those of the one of the very few remaining Lunokhod CCRs, cut and polished in France about 50 years ago.