Dell'Agnello S, Bianco G, Ciocci E, Contessa S, Chandler J, Currie D, Delle Monache G, Intaglietta N, Maiello M, Martini M, Mondaini C, Porcelli L, Salvatori L, Tibuzzi M, Vittori R

The Moon and Mars as Laser-ranged Test Bodies for General Relativity

Keywords: Gravity, LLR, Mars, SCF_Lab. We developed next-generation laser retroreflectors for the exploration and science of the Earth-Moon and Mars systems in the framework of the INFN-NASA/SSERVI Affiliation membership. We will describe payload design/construction/test, space exploration goals and the precision to test of General Relativity (GR) and new gravitational physics. We will describe INRRI (INstrument for landing-Roving laser Retroreflector Investigations) deployed on ESA's ExoMars Schiaparelli lander and to be deployed on future Moon/Mars rovers/landers. INRRI will be observed Moon and Mars orbiters with laser ranging/altimetry capabilities, like NASA's LRO, and by future lasercom satellites. Since 2004, we developed a large, single, next-generation retroreflector (MoonLIGHT/LLRRA21, Moon Laser Instrumentation for General relativity High accuracy Tests)/Lunar Laser Ranging Array for the 21st century). Since it is unaffected by the lunar librations that currently limit the accuracy of Lunar Laser Ranging to Apollo/Lunokhod reflectors, MoonLIGHT will support significantly improved measurements by ILRS. MoonLIGHT will provide accurate determination of landing sites, of rover positioning during exploration and long-term Moon georeferencing. MoonLIGHT will also support precision tests of GR (improved up to a factor 100): violation of the Weak/Strong Equivalence Principle; measurement of PPN beta; Gdot/G; deviations from 1/r2 force-law; accurate measurement of the geodetic precession. We will discuss specific mission opportunities with space agencies & industries