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SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 1 (2A)

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LUNAR LASER RANGING RETROREFLECTOR ARRAYS FOR THE 21ST CENTURY: HISTORY, SCIENCE, TECHNOLOGY AND SCIENCE

Abstract

Lunar Laser Ranging (LLR) to the Apollo retroreflectors on moon over the past four decades has provided some of the best tests of General Relativity and Gravitation. The history, technology and scientific accomplishments of the Lunar Laser Ranging Retroreflectors (LLRR) deployed during the Apollo 11, 14 and 15 missions will be briefly described. While the Apollo retroreflectors are still operating, over the past four decades the technology deployed on the ground stations has improved the ranging accuracy for a single photo-electron by more than a factor of 200. Thus the retroreflector arrays deployed during the Apollo missions now limit the single photo-electron range accuracy. The new science that can be accomplished by a next generation retroreflector that supports 1 mm ranging will be described. Then background and status of the Lunar Laser Ranging Retroreflector Array for the 21st Century (LLRRA-21) being developed at the University of Maryland, College Park in collaboration with Istituto Nazionale di Fisica Nucleare Laboratori Nazionali di Frascati and Agenzia Spaziale Italiana, Italy and Institute for Geodesy, Leibniz University Hannover, Germany will be addressed. This will particularly involve the thermal/optical simulation that has been developed to optimize the performance of the solid CCRs in the harsh environment of the lunar surface. In addition, the recent simulation of the thermal/optical performance of the Apollo arrays will be described. In particular, this will address the observations of the APOLLO station during the 2010 eclipse, during which the change in solar illumination changes at a rate that is comparable to the time constants of the CCRs and the panel. The latter allows a detailed investigation into the behavior of the coatings and housing of the Apollo arrays.