Summary of 21st ILRW, session 6

Characteristics of Retroreflector Arrays

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Chairs: Linda Thomas, José Rodríguez, Simone Dell'Agnello

Most of the attention, time and effort invested in the technological development of SLR is concerned with the ground segment of the network. This follows from the working principle of the technique, which only necessitates active components at the tracking stations, leaving the space segment considerably unburdened. The resulting simplicity and low cost required to make a space mission trackable by SLR is a clear advantage over other techniques. However, the importance of the passive elements in SLR measurements, the retroreflector devices, can not be overstated. The design, characteristics and behaviour of retroreflector arrays set an absolute limit to the accuracy achievable by SLR, as well as determine whether measurements are at all possible to obtain. An unsuitable retroreflector design may compromise both the quality and quantity of the data, and therefore the scientific objectives they are meant to support. Thus, research on novel designs and the optimisation of retroreflector performance and characteristics, e.g. thermal behaviour, size, mass, reflectivity, and cost, is necessary to ensure SLR continues to serve upcoming missions as efficiently as possible. Beyond this, ingenious use and placement of retroreflector devices open up new applications for this technique, such as attitude determination of spacecraft or spacecraft components, and support for missions elsewhere in the Solar System. In this session we had six oral contributions and a poster presenting work on several of these important topics, briefly summarised below.

Stephen Merkowitz, *Thermal-Optical Performance of the GPS III Laser Retroreflector Array*

The retroreflector array designed for the GPS III constellation is proven to meet ILRS cross section requirements, and to be stable throughout the full range of solar incidence angles. Full thermal-optical performance verification to be performed next.

Chiara Mondaini, *Characterization of the optical performance of COTS laser retroreflectors for ASI-INFN Joint Projects*

The convenience of employing COTS laser retroreflectors for future missions, such as those planned by ASI-CGS for space geodesy and gravitational physic studies, is explored. At INFN-LFN's facility for space research and testing of retroreflectors, SCF_Lab, work is ongoing on the solar-orbital-thermo-vacuum optical characterisation of COTS for future missions.

Peiyuan Wang. *kHz SLR application on the attitude analysis of Technosat*

Analysis of high-repetition SLR tracks to TechnoSat mission is shown capable to provide detailed attitude information of the spacecraft, which is compared to results from the onboard gyroscope. Successful tracking of this mission by the ILRS network demonstrates the feasibility of using COTS retroreflectors for LEO missions.

Marco Muccino, *Microreflectors for Mars, Phobos/Deimos and Asteroids/Comets*

Retroreflector designs and analysis to support various Solar System missions are presented. Microreflectors to be deployed on Mars landers and rovers, Mars' satellites Phobos and Deimos, and on asteroids/comets. These retroreflectors enable scientific and technological applications such as accurate positioning on Mars surface, laser communication diagnostics, atmospheric probing by lidar, and General Relativity testing.

Vyacheslav Murashkin, *Experimental determination of photometric characteristics of the BLITS-M satellite and its range correction*

Discussion on the light-curves of the satellite mission BLITS-M, preseting results of measurements of the propagation time periods of laser pulses inside the optical glass sphere, in order to calculate the range correction, its variation, and to compute the satellite star magnitude.

Andrey Sokolov, *Retroreflector systems to determine the coordinates of SC moving parts*

This paper presents several retroreflector systems that can be employed to obtain positional information of moving parts of spacecraft. Different solutions can be employed depending on the particular task and motion of the components involved. A combination of two retroreflector devices was already used on the mission Lomonosov, demonstrating the possibility of measuring the differential range to two points on the satellite body.

Takehiro Matsumoto, *Development of reflectors for motion grasp of space debris*

Work towards developing small and cost-effective retroreflector arrays to mount on upper stages of rocket bodies that are disposed of without controlled re-entry. The goal is to improve the orbit determination and re-entry prediction for these objects. JAXA aims to standardize the installation of the developed retroreflectors on the upper stages of Japanese rockets.