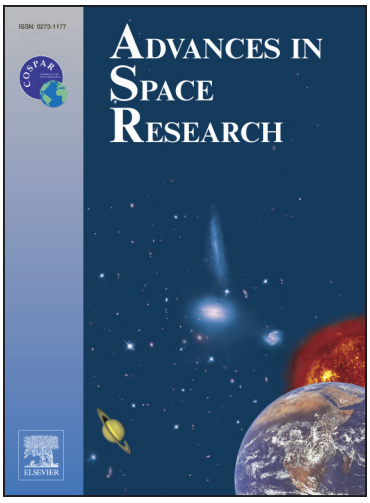

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First laser measurements to space debris in Poland

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Abstract

The Borowiec Satellite Laser Ranging station (BORL 7811, Borowiec) being a part of the Space Research Centre of the Polish Academy of Sciences (SRC PAS) went through modernization in 2014-2015. One of the main tasks of the modernization was the installation of a high-energy laser module dedicated to space debris tracking. Surelite III by Continuum is a Nd:YAG pulse laser with 10 Hz repetition rate, a pulse width of 3-5 ns and a pulse energy of 450 mJ for green (532 nm). This new laser unit was integrated with the SLR system at Borowiec performing standard satellite tracking. In 2016 BORL 7811 participated actively to the observational campaigns related to the space debris targets from LEO region managed by the Space Debris Study Group (SDSG) of the International Laser Ranging Service (ILRS).

Currently, Borowiec station regularly tracks 36 space debris from the LEO regime, including typical rocket bodies (Russian/Chinese) and cooperative targets like the inactive TOPEX/Poseidon, ENVISAT, OICETS and others. In this paper the first results of space debris laser measurements obtained by the Borowiec station in period August 2016 – January 2017 are presented. The results gained by the SRC PAS Borowiec station confirm the rotation of the defunct TOPEX/Poseidon satellite which spins with a period of approximately 10 s. The novelty of this work is the presentation of the sample results of the Chinese CZ-2C R/B target (NORAD catalogue number 31114) which is equipped (probably) with retroreflectors. Laser measurements to space debris is a very desirable topic for the next years, especially in the context of the Space Surveillance and Tracking (SST) activity. Some targets are very easy to track like defunct ENVISAT or TOPEX/Poseidon. On the other hand, there is a big population of different LEO targets with different orbital and physical parameters, which are challenging for laser ranging like small irregular debris and rocket boosters.

Key words

Laser ranging; Space debris; Satellites; LEO orbit; optical cross-section

1. Introduction

In the last years the number of space debris objects has been growing very rapidly. This fact is very well illustrated by the historical SATCAT Growth published at CELESTRACK (Clestrack Service, 2017), which shows the increase of the number of space targets in the last 10 years (e.g. Chinese ASAT missile test, Iridium 33 and Cosmos-2251 collision, others). A collision of two targets can cause a cascade effect, where each collision generates new space debris targets that increase the probability of further collisions and so on. This effect is known as a Kessler syndrome (Kessler and Cour-Palais, 1978). Currently, the number of known objects (December, 2017, Clestrack Service) is estimated at almost 19 000 (composed of active and inactive satellites and space junk) with the size of the targets