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OPTICAL TECHNOLOGIES FOR OBSERVATION OF LOW EARTH ORBIT OBJECTS

Abstract

In order to avoid collisions with space debris, the near Earth orbit must be continuously scanned by either ground- or spaced-based facilities. For the low earth orbit, radar telescopes are the workhorse for this task, especially due to their continuous availability. However, optical observation methods can deliver complementary information, especially towards high accuracy measurements.

Passive-optical observations are inexpensive and can yield very precise information about the apparent position of the object in the sky via comparison with background stars. However, the object's distance from the observer is not readily accessible, which constitutes a major drawback of this approach for the precise calculation of the orbital elements.

Two experimental methods have been devised to overcome this problem: Using two observatories a few hundred kilometres apart, strictly simultaneous observations of the same object yields an accurate, instantaneous 3D position determination through measurement of the parallax. If only one observatory is available, a pulsed laser can be used in addition to the passive-optical channel to measure the distance to the object, in a similar fashion as used by the satellite laser ranging community. However, compared to conventional laser ranging, a stronger laser and more elaborate tracking algorithms are necessary. The two approaches can also be combined by illuminating the object with a pulsed laser from one observatory and measuring the return times at both observatories.

First successful tests of these techniques were conducted by a cooperation between the Satellite Laser Ranging station in Graz, the Geodetic Observatory in Wettzell and the orbital debris research observatory operated by German Aerospace Center in Stuttgart. This contribution will present some of the results and plans for further measurement campaigns.