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ON THE CAPABILITY OF LASER OBSERVATIONS TO IMPROVE THE ORBIT PREDICTION ACCURACY OF SPACE DEBRIS OBJECTS

Abstract

Since decades, the unambiguous tracking observations obtained from Satellite Laser Ranging (SLR) systems contribute to precise orbit determination and orbit prediction. Apart form the routine tracking of operational spacecrafts and geodetic satellites, laser ranging has the potential to significantly improve the orbit prediction accuracy of selected space debris objects. For the time being the technique is limited, however, to the tracking of large and massive space debris objects, such as abandoned satellites and upper stages. Taking into account that especially these objects pose an increasing threat to all space faring nations, laser ranging can considerably contribute to the important tasks of collision avoidance or the removal of debris objects.

In this contribution we focus on laser-based orbit determination/prediction of the defunct ENVISAT satellite and various intact GLONASS satellites, covering objects in the LEO as well as MEO segments. The sparseness of laser tracking data for this purpose is one of the most severe limitations of the technique. Against this background, we propose and demonstrate a new concept of laser observations. The idea is to extend the existing SLR network by passive telescopes in combination with multi-static observations. Multi-static observations means that an object is tracked by only one active SLR station, but the diffusely reflected photons are detected at several passive units.