Space Debris: Extraction of the Rotational State from Multistatic Light Curves

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With the rapid increase of space debris in the last decades, the risk for collisions of objects in orbit grows significantly. To avoid collisions it is important to catalog the objects and determine their orbits. In order to propagate accurate orbits, it is necessary, to know the orientation of the object, so that the perturbation forces acting on it, can be taken into account in the orbit determination. Due to the changing observation geometry during a pass, an observed object reflects sunlight with different intensities. This change in brightness over time can provide information about rotation parameters such as rotation speed and axis. These data can be used to propagate future orbits with higher accuracy.

The goal of this work is to quantify the information content of multistatic light curves, trying to investigate the sensitivity to the rotation parameters. Analyses are planned with respect to the initial orientation, the geometry change due to the motion in the orbit, as well as the optical parameters and the size of the object. The information obtained can also be used to simplify a time- and computationally-intensive simulation if the maximum resolvable step size is determined for each rotation axis. In a forward simulation, the findings from the theoretical analyses will then be used and analysed in the context of multistatic images.

Furthermore, a database is to be built up which, in addition to the light curves, also contains further information about the objects and the stations involved. Not only information about the sensitivity of the individual measuring instruments, but also about the measuring conditions will be available. This will allow a quantification of the quality of the measurements. The multistatic measurements are performed by a local measurement network, which includes the observatories in Munich, Wettzell, Graz, Uedem and Zimmerwald. But others are welcome.