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ATTITUDE STATE EVOLUTION OF SPACE DEBRIS DETERMINED FROM OPTICAL LIGHT CURVE OBSERVATIONS

Abstract

Space debris population increased drastically during the last years. One of the contributing factors is the incidental collisions involving massive objects which are predicted to be more pronounced in the future. The removal of large, massive space debris is considered necessary to stabilize the population. In this respect, not only precise orbits, but also more detailed information about their attitude states such as spin period and spin axis orientation is required.

Non-resolving optical observations of the magnitude variations, so-called light curves, are a promising technique to determine the rotation or tumbling rates and the orientations of the actual objects' rotational axis, as well as their temporal changes. For this purpose, we use the 1-meter telescope ZIMLAT at the Astronomical Institute of the University of Bern (AIUB) to collect light curves of LEO, MEO and GEO objects on a regular basis. So far, we have acquired more than 3,000 light curves with this system.

We will present spin rates and their temporal evolution for a large set of decommissioned LEO, MEO and HEO spacecraft and upper stages, including more than 60 abandoned GLONASS satellites. Spin rates for objects acquired with the ZIMLAT telescope during the last ten years will be discussed, their spin properties as a function of the orbital region and object type will be summarized and the morphology of the reconstructed phases will be presented. More than a dozen of defunct spacecrafts showed a periodic change of the apparent spin rates over time. These cases will be discussed, as well.