

SYMPOSIUM ON SPACE DEBRIS (A6)  
Measurements (1)

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## LIGHT CURVE DATABASE OF ASTRONOMICAL INSTITUTE OF THE UNIVERSITY OF BERN

**Abstract**

Since 2007 the Astronomical Institute of the University of Bern (AIUB) is using its 1-meter telescope ZIMLAT situated in Zimmerwald observatory, Switzerland to collect light curves of space debris type of objects including defunct spacecraft, upper stages and debris pieces. Last two years, 2014 and 2015, can be considered as the most productive ones for the Zimmerwald light curve acquisition. Several different photometric campaigns have been performed focused on e.g. Low Earth Orbit (LEO) targets suitable for future Active Debris Removal (ADR) missions, regular monitoring of large defunct spacecraft on LEO and in GLONASS constellation and new discoveries performed during the Zimmerwald and ESA Geosynchronous Earth Orbit (GEO) surveys. For each light curve extracted is information about the stable/tumbling behavior, and if applicable, also the apparent spin period is extracted the phase reconstructed. In total there have been acquired and processed 995 light curves within years 2014 (319) and 2015 (676) for 236 objects. For majority of the objects, namely 112 (47.5%), observed has been stable behavior. In 38 cases (16.1%) we observed slow tumbling. These were the objects for which we observed complex brightness variation patterns but the time length of time series was not sufficient to cover the whole rotation period. This happened often for LEO targets which have relatively short passage times. Finally, there have been 86 (36.4%) objects which could be reliably marked as tumbling. In case that objects were observed several times we extracted also their spin acceleration/deceleration properties. For majority of LEO targets, mostly cylindrical upper stages, we observed quite stable behavior. Special emphasis has been put on monitoring of decommissioned GLONASS satellites. In total monitored have been 60 GLONASS satellite, from which 46 showed tumbling behavior with apparent periods from 10 seconds to 5 minutes. In our work we will discuss and describe the photometry observation techniques currently used at Zimmerwald observatory, their processing in sense of apparent period extraction and phase reconstruction, and further scientific application of obtained products. Spin rates for objects acquired by ZIMLAT telescope during last two years will be discussed and morphology of their reconstructed phases will be presented.