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Time series of SpinSat return intensity: How long can BK7 reflectors survive in space?

SpinSat is a spherical satellite developed by the Naval Research Laboratory (NRL), USA, and was deployed from the International Space Station in November 2014. Since then it has been tracked by a number of the ILRS laser ranging stations. Unlike the other geodetic satellites that are equipped with fused-silica retroreflectors, it carries 68 12.7-mm-diameter reflectors made of BK7. Whereas the fused-silica reflectors have survived for many decades, the BK7 reflectors are not radiation resistant and are expected to degrade in a short time. We looked into the detailed SLR tracking records from Herstmonceux, UK, where the single-photon intensity is kept by controlling a neutral-density (ND) filter wheel. Based on the return rate and the ND filter information, with a range^4 correction, the actual number of photons can be inferred. We observed that the intensity has kept at the initial level for the first one year, which indicates that the BK7 reflector in a low orbit can survive for a year. However, the intensity has not reached the initial level since the beginning of 2016. Because of the difficulty in tracking in a very low altitude and the atmospheric transmission variability from day to day, this study has not been conclusive and we are not certain that the energy decrease, i.e. the degradation of BK7, is observed. We hope to use the data set of other stations for further investigations.