

Space Debris Laser Ranging with range-gate-free SNSPD

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Abstract. Space Debris Laser Ranging (DLR) is a technique to measure range to defunct satellites, rocket bodies or other space targets in orbits around Earth. The analysis shows that one of the reasons for the low success probability of DLR is the inaccurate orbital prediction of targets. Then it is proposed to use the Superconducting Nanowire Single-Photon Detector (SNSPD) running in automatic-recoverable range-gate-free mode, in which case, the effect of the accuracy of the target's orbital prediction on the success probability of DLR is greatly reduced. In this way, 249 space debris were successfully detected and 532 passes of data were obtained. The smallest target detected was the space-debris (902) with an orbital altitude of about 1000 km and a Radar Cross Section (RCS) of 0.0446 m². The farthest target detected was the space-debris (12,445) with a large elliptical orbit and an RCS of 18.2505 m², of which the range of the normal point (NPT) of the measured arc-segment on January 27, 2019 was 6260.805 km.