

Laser tracking to space debris with low power of ps laser/1 kHz based on the 1.2-meter telescope at Mid-West China

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The high power and nano-lasers have been commonly used at SLR stations while tracking space debris. In this paper, the feasibility of picosecond pulse width laser to debris targets tracking with low power was researched at Shanghai Astronomical Observatory, cooperated with Purple Mountain Observatory. There is a 1.2-meter telescope for laser quantum communication. It is located in mid-west China with an altitude of 3200 meters with seeing about 1 arcsecond. Both Observatories have upgraded its astronomical observation terminal for SLR measurements, while a laser system with the power of 1.2W at a 1 kHz repetition rate and 532nm wavelength was installed. Firstly, the satellites with reflectors were successfully measured. Then, HQE-detector with a narrow spectral filter (2nm) was used, and the large FOV camera was also installed to acquire debris targets. Using the TLE predictions, debris laser ranging was successfully performed for this telescope. Finally, a total of more than 60 debris targets were measured in ten days. Among them, the farthest range was about 1620 km, the RCS was 2.41 m², and the equivalent RCS at the 1000 km range was 0.35 m². In addition, the ranging precision was 10.6cm, which was better than the nano pulse width laser. The results demonstrate the feasibility of laser tracking of space debris using a routine SLR laser system with pico-pulse width. We hope more SLR sites with such good seeing can join the activities of laser tracking space debris by using the routine SLR system with a few modifications.