

Title:

100 kHz satellite laser ranging demonstration at Matera Laser Ranging Observatory

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Abstract:

The upgrade from 10 Hz satellite laser-ranging stations to high frequency kHz ranging has led to an increase of data rate and enabled the spin rate measurement for many LEO satellites, showing how an increase of the repetition rate can augment the potential of laser ranging technique. In this work, we report the results obtained in the Matera Laser Ranging Observatory during a test with a Ekspla "Atlantic 60" 100 kHz repetition rate laser for satellite laser ranging. The small pulse width (<10 ps FWHM) together with the low single photon detector jitter (<40 ps FWHM) led to a single shot precision comparable to that of traditional stations, but with a much higher return rate. The system has been operational for 4 consecutive nights and allowed the tracking of several LEO satellites, as well as Lageos 1 and 2. All satellites tracked have shown returns, thus demonstrating the robustness of the technique. The histograms of the return have shown in several cases multiple peaks, due to the retroreflection from different corner-cubes. This opens up the possibility of attitude determination of retroreflector arrays, as well as a new method for spin rate measurement. Finally, we show such a high repetition rate laser could be optimized for SLR with a dedicated setup, for increasing return rate and allowing the tracking of high MEO satellite.