rámcové téma: Photon counting with time magnification

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abstrakt:
Satellite laser ranging (SLR) is a well-established measurement method for estimating satellite dynamically changing distances. A spatial group of satellites like Lageos is used for geodesy, where SLR occupies a unique position because there is no other direct measurement method sensitive to the Earth geocenter. Therefore high precision and accuracy are required. One of the limiting factors in accuracy is the inability to resolve the target signature. Since the satellites are distant, thus they are designed to reflect as many photons as possible. Therefore they are composed of many retroreflectors installed on a sphere or flat panel like on GNSS satellites.

The satellite retro-array structure, the so-called target structure, can be treated from statistics using high repetition rate lasers [1]. The drawback is that you never see the structure of each individual laser pulse, which is delayed as the different retros contribute to the satellite's optical response. Recent research in the field of space–time duality shows the potential of temporal optical magnification. A low-noise, high-efficiency fiber parametric time lens can extend the classical implementation of time-correlated single-photon counting schema (TCSPC). Such a time lens can be based on four-wave mixing Bragg scattering. In literature [2,3], it was shown that this technique can resolve two ultra-short laser pulses with a 130-fs pulse width difference. The frame topic of intended thesis will be to explore experimentally the potential of time lensing for time tagging of reflected satellite laser pulses. The study will be carried out in collaboration with Technical University Munich.

reference:

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[3] B. Li, S. Wang, Y. Wei, S.-W. Huang, and K. K. Y. Wong, Temporal Imaging for Ultrafast Spectral-Temporal Optical Signal Processing and Characterization, IEEE J. Select. Topics Quantum Electron. 27(2), 7600613, Mar. 2021; doi: 10.1109/JSTQE.2020.3012882.

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