



ID de Contribution: 121

Type: **Invited**

Time-stamping photons with sub-nanosecond resolution for quantum-enhanced imaging and telescopey

mardi 19 novembre 2024 14:00 (40 minutes)

Correlations of photons from entangled quantum sources offer advantages and provide additional opportunities such as low light imaging or new sensing approaches. In general, strong spectro-temporal correlations inherent for entangled photons make those sensing techniques much more precise and resource efficient. To take advantage of the correlations one would need efficient single photon imagers with excellent timing resolution. In the presentation I will review the existing detector options focussing on the time-stamping CMOS and SPAD cameras, which have been used recently in a variety of quantum imaging experiments, in particular the Tpx3Cam and LinoSPAD2 cameras, both based on data-driven readouts. As a motivation for fast imaging in astrophysics I will also review the standard techniques of single-photon amplitude (Michelson) interferometry and two-photon (Hanbury Brown & Twiss) intensity interferometry, and then visit recent ideas for how they can be improved in the optical through the use of entanglement distribution. A proposed new technique of two-photon amplitude interferometry requires precise spectral binning and 10 picosecond scale time-stamping of single optical photons with a product of resolutions close to the Heisenberg Uncertainty Principle limit. Another prominent example of multi-dimensional quantum correlations is the parametric down-conversion of x-rays in diamond. In this case all three types of correlations, in momentum, energy and time, can be measured simultaneously. In all cases I will illustrate the concepts with recent results and will discuss future directions for the technology.

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- [4] T. Milanese et al. "LinoSPAD2: an FPGA-based, hardware-reconfigurable 512×1 single-photon camera system." *Optics Express* 31.26 (2023): 44295.
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- [6] J.Goodrich et al, "Imaging of X-ray Pairs in a Spontaneous Parametric Down-Conversion Process," *arXiv:2310.13078* (2023).

Auteur principal: NOMEROTSKI, Andrei (Czech Technical University in Prague)

Orateur: NOMEROTSKI, Andrei (Czech Technical University in Prague)

Classification de Session: Timing with pixels

Classification de thématique: Invited speakers