Quantum-assisted Optical Interferometry and Other Applications of Quantum Optics with Fast Time Stamping of Single Photons

Dr. Andrei Nomerotski
Stony Brook University

Abstract

The highest resolutions in astronomical imaging are achieved through interferometry, the process of combining wave information from multiple separate telescopes. I will 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 quantum networking and entanglement distribution. A proposed new technique of two-photon amplitude interferometry requires spectral binning and picosecond time-stamping of single photons with a product of resolutions close to the Heisenberg Uncertainty Principle limit. I will report on the first bench top results of such fast spectrometers along with future improvements for detector systems and quantum methods. I will also review other applications of similar imaging detectors in quantum information science, material and life sciences.