

TRR Guest Scientist Lecture / Seminar

Date/Time: Mon, 16.07.2018 / 15:00 Uhr
Location: Paderborn, P8.4.09



Jean-Phillipe MacLean
*Institute for Quantum Computation,
Waterloo, Canada*

Direct characterization of ultrafast energy-time entangled photon pairs

Abstract:

In the famous example suggested by Einstein, Podolsky and Rosen (EPR), two particles can be highly correlated in position and momentum. For photons, strong EPR-like correlations can also occur in the energy-time degree of freedom, that is, between the frequency and the time of arrival of the photons. This type of entanglement enables fundamentally quantum effects such as dispersion cancellation and clock synchronization.

However, detection of this entanglement and observation of these effects can require ultrafast time resolution beyond the capabilities of current photon detectors. Thus, for operations on ultrafast timescales, more powerful and complex methods are required.

We use a nonlinear technique known as optical gating to surpass the limitations in current detectors and achieve subpicosecond time resolution for single photon pairs. Optical gating in conjunction with single photon spectrometers then enables us to measure both the spectral and temporal correlations of a two-photon state, allowing us to observe for the first time EPR correlations but *in frequency and in time*.

The ability to characterize laser pulses on ultrafast timescales has been critical to innovations in laser physics, nonlinear optics, and spectroscopy, and we believe similar measurement capabilities will be critical in the quantum regime as well.

Contact: Jun.-Prof. Dr. Tim Bartley
tim.bartley@upb.de