Pure photon sources for many-photon cluster states generation

PURE PHOTON SOURCES FOR MANY-PHOTON CLUSTER STATES GENERATION

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Abstract

The future of quantum information processing relies on realisation of efficient sources of single photons, the ideal carriers of quantum information. Parametric downconversion (PDC) is a promising route to create highly coherent, spectrally pure single photons for quantum photonics using versatility of group-velocity matching and tailored nonlinearities. We present a new technique of engineered nonlinear crystals, which simultaneously enhances single photon purity and heralding efficiencies. Our technique allows photon spectral purity to be free from the requirement for narrow band filtering which ultimately limits the heralding efficiency of our non-deterministic sources. We experimentally demonstrate 92.7% of single photon purity and heralding efficiency above 63% (directly measured with our 80% efficient superconducting nanowire detectors). We will describe how such sources, embedded into Sagnac interferometers can be used to generate ultrafast photon clusters entangled in the polarisation degree of freedom. The developed platform will benefit wide range of quantum-enhanced technologies utilising many-photon entanglement in scaled photonic networks.

Speaker bio:

Dmytro Kundys obtained his PhD on Nonlinear Spectroscopy of Semiconductor Nanostructures from the University of Sheffield. During his PhD Dmytro explored novel light emission from semiconductor nanostructures exploiting effects of ultrafast nonlinear optics. In 2006 Dmytro joined ORC at the University of Southampton as a postdoctoral research fellow to work on fabrication of integrated quantum photonic circuits. Dmytro then spent 4 years in Manchester where he complemented to exciting project of graphene plasmonics. Now Dmytro works on developing cutting-edge photonic quantum technology with focus on medium-scale photonic cluster state generation for a range of applications in quantum information.