Integrated sources and detectors for mesoscopic quantum optics

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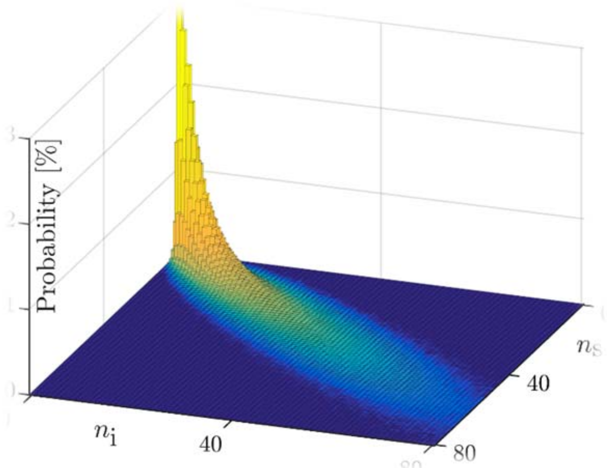
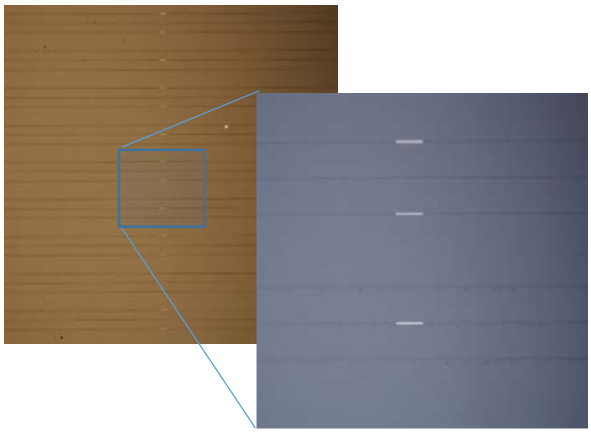
Recent developments in sources and detectors for quantum light have enabled very large nonclassical states to be generated and measured. I will discuss our work on strongly-pumped parametric down-conversion in ppKTP waveguides and show how control over the spatio-spectral mode structure allows bright quantum states to be emitted into a single, well-defined optical mode. We combined this technique with state-of-the-art photon-number resolving superconducting detectors to herald nonclassical states with up to 50 photons, show joint photon-number squeezing of 4.2dB and can calculate correlation functions up to 40th order [1].

As the number of generated nonclassical photons increases, it remains an open challenge to develop detection efficient strategies. With intrinsic number resolution limited to around 40 photons and stringent cryogenic requirements, multiplexing single-photon detectors is a useful alternative for characterising bright quantum states. To that end, I will also discuss our ongoing activities towards integrating superconducting detectors on lithium niobate waveguides, such that efficient multiplexing can be achieved in a low loss environment. We are working towards combining this technology with active components, such a phase- and polarisation modulators, at sub kelvin temperatures on a single monolithic platform.



Joint photon number measurements on strongly-pumped parametric down-conversion.



Deposition of superconducting detectors onto lithium niobate waveguides.

[1] Georg Harder et al., Phys. Rev. Lett. **116**, 143601 (2016)