

OPTIMIZATION OF ENTANGLED PHOTON PAIR SOURCES

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The spontaneous parametric down conversion (SPDC) process is widely used in the fields of nonlinear optics and quantum key distribution. The brightness, heralding efficiency and the fidelity are key parameters to be maximized in the SPDC sources. While the heralding efficiency is determined by the collection efficiency and the photon detection efficiencies (PDE) of the single photon detectors, the entanglement quality and brightness of the photon pairs created by spontaneous parametric down conversion process are effected by various parameters. The difference in the arrival times of the signal/idler pairs of two orthogonal polarizations reduces the fidelity of the states by introducing decoherence. Another parameter affecting the fidelity of the states is length tolerance of the nonlinear crystals. The decoherence in the setup can be compensated by the use of a very narrow linewidth pump laser. The limits of the trade-off between the crystal length tolerance and the laser line width have been identified for target entanglement fidelity values. The effect of different types of collection lenses has also been identified for enhancement of the heralding efficiency values. A full analysis of parameters for the optimization of SPDC sources is done via a set of numerical simulations. Further recommendations have also been included in this work for reaching very high brightness, heralding efficiency and entanglement fidelity values of the entangled photon pair sources.

Biography

Kadir Durak has received his BSc degree in Middle East Technical University Physics Department in 2009 and he started his PhD in National University of Singapore at the same year. After receiving PhD in 2015 he worked for two years in Centre for Quantum Technologies as Team Lead in a research group that works on space-ground quantum key distribution via a CubeSat. His main research areas are Quantum Cryptography, Photonics, Quantum Electrodynamics and Quantum Information. He is currently pursuing his Research in Ozyegin University with his research group.

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