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Generation and manipulation of photonic quantum states for quantum network

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Abstract

Quantum network among multiple quantum devices and/or users is one of the important issues for realizing long-distance quantum communication, large-scale quantum computer and quantum sensing. Multimode quantum states and quantum frequency conversion (QFC) play an important role for this purpose. QFC translates the frequency of photons entangled with quantum devices while retaining its quantum properties for various applications. One of the examples for useful QFC is to link the quantum devices to the telecom fiber network. On the other hand, multimode quantum states are suitable for multi-user communications and the enhancement of communication capacity. In this talk, I report an efficient and wide-range generation of the quantum frequency comb based on a quadratic nonlinear optical waveguide inside a cavity, which can be useful for generating multi-dimensional photonic quantum states and frequency multiplexed photon pairs. Using the same device, we also show an efficient QFC and a frequency manipulation method.