Deterministic single-photon hardware for scalable quantum-information processing

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Semiconductor quantum dots embedded in photonic nanostructures offer a highly efficient and coherent deterministic photon-emitter interface enabling on-demand single-photon sources and multi-photon entanglement sources [1,2]. We discuss the fundamental operational principles of these devices and introduce a protocol of deterministic entanglement generation by controlling a single spin in the quantum dot [3]. We will present the experimental state-of-the-art of multi-photon entanglement generation [4,5] including the realization of photon fusion [6], which is a primitive for fusion-based quantum computing. Finally, we discuss potential applications of this novel hardware for quantum communication and photonic quantum computing [7].

References

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Figures