

Deterministic solid-state photon-emitter interfaces for photonic quantum computing

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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

- [1] [Lodahl et al., Rev. Mod. Phys. 87, 347 \(2015\).](#)
- [2] [Lodahl, Ludwig and Warburton, Phys. Today 75, 3-44 \(2022\).](#)
- [3] [Tiurev et al., Phys. Rev. A L030601 \(2022\).](#)
- [4] [Appel et al., Phys. Rev. Lett. 128, 233602 \(2022\).](#)
- [5] [Meng et al., arXiv: 2310.12038](#)
- [6] [Meng et al., arXiv: 2312.09070](#)
- [7] [Uppu et al., Nature Nano. 16, 1308 \(2021\).](#)

