An integrated diamond nanophotonics platform for quantum optical networks

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Solid-state quantum-emitters with long spin coherence times and strong interactions with single optical photons could form the building blocks of a quantum network. To date, no solid-state quantum-emitter has yet been able to satisfy both of these requirements simultaneously. In this talk, I will discuss experiments[1,2,3,4] which demonstrate that silicon-vacancy (SiV) color centers in diamond can address both of these challenges. First, we integrate SiV centers into diamond nanophotonic devices to obtain strong interactions between a single SiV center and an optical photon. Using this platform, we demonstrate a quantum optical switch controlled by a single SiV center and entanglement generation between two SiVs in a single nanophotonic device [2]. By cooling SiVs down to 100mK, we improve the SiV spin coherence time by five orders of magnitude and achieve a coherence time of 13-milliseconds [3,4]. These results make SiV centers in nanophotonic devices a leading solid-state platform for the realization of quantum networks.