Nanophotonic Devices Based on Diamond

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Individual color centers in diamond have recently emerged as a solid-state platform for quantum communication systems, quantum information processing architectures, and sensitive nanoscale magnetometers with optical read-out. Here we present novel nanophotonic devices that engineer the optical properties of diamond color centers. In particular, we describe a high-flux, room temperature, source of single photons based on an individual Nitrogen-Vacancy (NV) center embedded in a top-down nanofabricated, single crystal diamond nanowires. Using the nanowire geometry, an order of magnitude brighter single photon source is realized with an order of magnitude lower pump power, compared to an NV center in a bulk diamond. We also describe the integration of these diamond nanowire antennas with metallic nanostructures in order to further increase photon production rate (via Purcell effect) and collection efficiency of emitted photons. Finally, we describe a system consisting of a diamond nanoparticle containing individual NVs coupled to a high-Q photonic crystal nanobeam cavity made in silicon nitride.