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Quantum nanophotonics with nitrogen vacancy centers in diamond YIWEN CHU, NATHALIE DE LEON, RUFFIN EVANS, BIRGIT HAUSMANN, BRENDAN SHIELDS, MICHAEL BUREK, Harvard University, MATTHEW MARKHAM, ALASTAIR STACEY, DANIEL TWITCHEN, Element Six Ltd, HONGKUN PARK, MARKO LONCAR, MIKHAIL LUKIN, Harvard University — Individual color centers in diamond have emerged as a promising solid-state platform for quantum communication and quantum information processing systems, as well as sensitive nanoscale magnetometry with optical read-out. Engineering the light-matter interaction between defect centers and nanophotonic devices can greatly enhance the performance of these systems. We demonstrate individual Nitrogen-Vacancy (NV) centers embedded in nanofabricated hybrid photonic crystal cavities consisting of single crystal diamond and PMMA based Bragg structures. Devices with quality factors up to 3,000 coupled to NV centers have been obtained, leading to Purcell factors of up to 14. We also investigate the optical coherence properties of NV centers inside these nanoscale structures. These nanophotonic devices could potentially enable strong coupling between the cavity field and NV centers as well as enabling applications such as quantum networks and single photon transistors.

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