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Stark tuning spin qubits in diamond for quantum optical networks VICTOR ACOSTA, CHARLES SANTORI, ANDREI FARAON, ZHIHONG HUANG, Hewlett Packard Laboratories, Palo Alto, CA, KAI-MEI FU, University of Washington, Dept. of Physics, ALASTAIR STACEY, DAVID SIMPSON, TIMOTHY KARLE, BRANT GIBSON, LIAM MCGUINESS, KUMARAVELU GANESAN, SNJEZANA TOMLJENOVIC-HANIC, ANDREW GREENTREE, STEVEN PRAWER, University of Melbourne, School of Physics, RAYMOND BEAUSOLEIL, Hewlett Packard Laboratories, Palo Alto, CA — Integrated diamond networks based on cavity-coupled spin impurities offer a promising platform for scalable quantum computing. A key ingredient for this technology involves heralding entanglement by interfering indistinguishable photons emitted by pairs of identical spin qubits. Here we demonstrate the required control over the internal level structure of nitrogen-vacancy (NV) centers located within 100 nm of the diamond surface using the DC Stark effect. By varying the voltages applied to lithographically-defined metal electrodes, we tune the zero-phonon emission wavelength of a single NV center over a range of $\sim$0.5 nm. Using high-resolution emission spectroscopy, we directly observe electrical tuning of the relative strengths of spin-altering lambda transitions to arbitrary values. Under resonant excitation, we apply dynamic feedback to stabilize the optical transition against spectral diffusion. Progress on application of gated control to single NV centers coupled to single-crystal diamond photonic crystal cavities and other nanophotonic structures will be presented. This work was supported by DARPA and the UC Regents.

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