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Spectral control of spin qubits in diamond photonic structures[1]
VICTOR ACOSTA, CHARLES SANTORI, ANDREI FARAON, ZHIHONG HUANG, RAYMOND BEAUSOLEIL, Hewlett-Packard Laboratories, Palo Alto, CA — Integrated photonic 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. The nitrogen-vacancy (NV) center in diamond is an attractive candidate for such a spin-photon interface, as it exhibits long-lived electronic spin coherence, rapid spin manipulation and readout, and the coexistence of both robust cycling and spin-altering Lambda-type transitions. We discuss current research in our lab to control the spectral properties of single NV centers by dynamic Stark tuning [1] and cavity Purcell enhancement [2]. In particular, we report progress on fabricating photonic structures in ultra-pure diamond, where NV centers are likely to have favorable optical properties.

[1] V. M. Acosta et al., Dynamic stabilization of the optical resonances of single nitrogen-vacancy centers in diamond, arXiv:1112.5490v1 [quant-ph].
[2] A. Faraon et al., Coupling of nitrogen-vacancy centers to photonic crystal cavities in monocrystalline diamond, Submitted.

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Victor Acosta
Hewlett-Packard Laboratories, Palo Alto, CA

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