Abstract Submitted
for the DAMOP11 Meeting of
The American Physical Society

Coupling of NV centers to microscopic cavities Y. CHU, E. TOGAN, M. GOLDMAN, A. KUBANEK, A. ZIBROV, M. LUKIN, Harvard University — Recently there has been a great interest in using individual nitrogen vacancy centers in diamond in a quantum optics context. For instance, the light-matter quantum interface achievable with an NV center at low temperatures has been used to coherently manipulate NV degrees of freedom [1], as well as to entangle the electronic spin of a single NV center with a photon [2]. However, for most applications low collection efficiency of photons out of the NV center imposes a significant limit. To solve this problem, the NV center has been integrated into different photonic structures, where the coupling of the NV center to a single cavity mode is enhanced [3, 4]. Here, we show progress towards integrating NV centers, in a thin ($\sim$20μm) bulk diamond, with a microscopic cavity, which consists of two mirrors and has a small mode waist of $\sim 5\mu$m. This approach has the advantage of using both a high quality single crystalline bulk diamond that contains NVs with good optical properties, and an independently optimized cavity design. This method should drastically increase the rate at which entangled photons may be obtained from single NV centers and hence should allow remote NV based quantum nodes to be connected by the photons that are emitted by the NVs. In the future, a strong interaction of the light field with a single solid-state emitter could open the field of cavity quantum electrodynamics to a new, scalable quantum system.
[1] B. Buckley, et al., Science 330, 1212-1215 (2010). [2] E. Togan, et al., Nature 466, 730-734 (2010). [3] D. Englund, et al., Nano Lett. 10, 3922 (2010). [4] A. Faraon, et al., arXiv:1012.3815 (2010).

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Date submitted: 07 Feb 2011 Electronic form version 1.4