Abstract Submitted
for the DAMOP08 Meeting of
The American Physical Society

Towards Spin Photon Entanglement Using Nitrogen Vacancy Center in Diamond EMRE TOGAN, YIWEN CHU, ALEXEY TRIFONOV, Harvard University, M.V. GURUDEV DUTT, University of Pittsburgh, LIANG JIANG, Harvard University, LILY CHILDRESS, Bates College, ALEXANDER S. ZIBROV, Harvard University, PHILIP HEMMER, Texas A&M, MIKHAIL LUKIN, Harvard University — In recent years there has been an increase in demand for using small, few qubit systems for optically scalable quantum information processing. Earlier work indicates that an ideal candidate is using qubits formed by individual nuclear spin state of ^{13}C in diamond that can be addressed and manipulated using electronic spin state of a nearby Nitrogen Vacancy (NV) center. Demonstrations so far have been in manipulating both the NV and some nearby ^{13}C nuclear spins. Here we describe the progress that we've made towards entangling two separate NVs, allowing isolated few qubit systems to be scaled up. To entangle two NVs one needs to isolate emission from single NV centers that are sufficiently narrow in bandwidth, and understand the underlying selection rules for this emission process. In this work we estimate emission linewidth of the zero phonon line of several different NVs. We also show by using resonant absorption spectroscopy on single NVs one can selectively excite different optical transitions and study their selection rules. Finally we propose and evaluate a method to demonstrate spin-photon entanglement, to act as an initial step to entangle two NVs.

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Date submitted: 04 Feb 2008 Electronic form version 1.4