Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Screening nuclear field fluctuations to generate highly indistinguishable photons from negatively charged self-assembled InGaAs quantum dots RALPH MALEIN, TED SANTANA, JOANNA ZAJAC, Heriot Watt University, PIERRE PETROFF, University of California Santa Barbara, BRIAN GERARDOT, Heriot Watt University — Quantum dots (QDs) can generate highly coherent and indistinguishable single photons. However, a ground-state electron spin interacts with a QD's nuclear spins to create an effective Overhauser field (δB_n) of $\sim$30mT. We probe this interaction using resonance fluorescence. We observe the effect of δB_n in high resolution (27 MHz) spectroscopy of the elastic and inelastic scattered photons, and characterize the effect of δB_n on photon indistinguishability by monitoring the visibility of two-photon interference. With no external magnetic field ($B_z = 0$), δB_n effectively splits the ground state, and at low Rabi frequencies we observe two broad ($\Gamma = 200$MHz) peaks equally spaced by $\sim$100MHz from the central elastic peak. The ratio of elastic to inelastic photons in the spectra gives a dephasing time $T_2 = 0.52\ T_1 = 406$ps, far from the transform limit. With an external field $B_z > \delta B_n$, we can successfully screen the fluctuating nuclear field. For $B_z = 300$mT, nearly all photons in the spectrum are elastically scattered and we extract $T_2 = 1.94\ T_1 = 1512$ps. This transform limited linewidth enables us to demonstrate very high visibility two-photon interference. These results point towards robust generation of indistinguishable photons.

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Date submitted: 14 Nov 2014 Electronic form version 1.4