Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Violation of Classical Inequalities in the Light Scattered by a Quantum Dot[1] MANOJ PEIRIS, BEN PETRAK, KUMARASIRI KONTHASINGHE, University of South Florida, YING YU, ZHICHUAN NIU, Chinese Academy of Sciences, ANDREAS MULLER, University of South Florida — We report the measurement of the two-photon spectrum of the light scattered near-resonantly by a single InAs semiconductor quantum dot exposed to a monochromatic laser. In contrast to the ordinary (one-dimensional) one-photon spectrum, the two-photon spectrum represents the probability of emitting two photons with two different colors. It is obtained experimentally using a pair of frequency-tunable filters in a modified Hanbury-Brown and Twiss setup. We analyze the resulting two-dimensional maps for different parameters including the Rabi frequency, the laser detuning, and the filter bandwidth. We find excellent agreement with the theory of Del Valle et al. In particular, our measurements reveal the interferences of different decay paths to yield overall anti-bunched photon statistics while the individual filtered pathways may exhibit photon bunching, photon anti-bunching or near-Poisson statistics. We further evidence how the radiative cascade can proceed via virtual intermediate states giving rise to transitions previously termed "leapfrog transitions". Highly nonclassical physics are seen, which can violate well-known classical inequalities such as the Cauchy-Schwarz inequality or Bells inequalities.

[1]NSF grant No. 1254324

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Date submitted: 13 Nov 2014 Electronic form version 1.4