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Interference of photons from quantum dots and lasers

Single self-assembled semiconductor quantum dots can act as efficient sources of coherent single photons. When electrically excited within a *p-i-n* diode it is possible to observe two-photon interference between successive photons emitted from the same dot under CW excitation [1] or with novel pulsed excitation schemes [2].

More recently we have demonstrated two-photon interference with photons from two unsynchronized sources operating via different physical processes, with different photon statistics [3]. One source is spontaneous emission from the X^{\pm} state of an electrically-driven InAs/GaAs single quantum dot with μeV linewidth, the other stimulated emission from a laser with a neV linewidth. We mix the emission from these sources on a balanced non-polarising beamsplitter and measure correlations in the photons that exit using Si-avalanche photodiodes and a time-correlated counting card.

This experiment is a first step towards the exchange of quantum information between the attenuated lasers widely used for quantum cryptography and the more exotic systems that are being investigated for quantum information applications.

- [1] R. B. Patel et al, Phys. Rev. Lett. 100 (2008) 207405.
- [2] A. J. Bennett et al, Appl. Phys. Lett. 92 (2008) 193503
- [3] A. J. Bennett et al, Nature Physics 5 (2009) 715

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