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Interference of Photons from a Weak Laser and a Quantum Dot
DAVID RITCHIE, University of Cambridge, ANTHONY BENNETT, RAJ PATEL, Toshiba Research Europe Ltd, CHRISTINE NICOLL, University of Cambridge, ANDREW SHIELDS, Toshiba Research Europe Ltd — We demonstrate two-photon interference from two unsynchronized sources operating via different physical processes [1]. One source is spontaneous emission from the X^- 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 beam splitter and measure correlations in the photons that exit using Si-avalanche photodiodes and a time-correlated counting card. By periodically switching the polarisation state of the weak laser we simultaneously measure the correlation for parallel and orthogonally polarised sources, corresponding to maximum and minimum degrees of interference. When the two sources have the same intensity, a reduction in the correlation function at time zero for the case of parallel photon sources clearly indicates this interference effect. To quantify the degree of interference, we develop a theory that predicts the correlation function. Data and experiment are then compared for a range of intensity ratios. Based on this analysis we infer a wave-function overlap of 91%, which is remarkable given the fundamental differences between the two sources. [1] Bennett A. J *et al* Nature Physics, **5**, 715–717 (2009).

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