Invitation

Semiconductor Devices for Quantum Technology

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We review the development of quantum light emitters and detectors for applications such as long-distance quantum communication and computation based on photonic entanglement. We show that semiconductor quantum dots emit photon pairs in an entangled polarisation state [1], which depends upon the time delay between the two emitted photons [2]. We discuss factors limiting the entanglement fidelity [3] and demonstrate values exceeding 90% [4]. Efficient electrically driven single photon sources demonstrating a Purcell effect are fabricated using an oxide aperture [5]. We show that electrical contacts may also be used to generate indistinguishable photons [6,7]. Quantum information applications also require a detector which can count the photons in an incident light signal. We present a scheme for photon number resolution at telecom wavelengths based on commercial avalanche photodiodes [8]

[1] Stevenson et al, *Nature* 439, 179 (2006)
[2] Stevenson et al, *Phys. Rev. Lett.* 101, 170501 (2008)
[3] Hudson et al, *Phys. Rev. Lett.* 99, 266802 (2007)
[4] Young et al, *Phys. Rev. Lett*. 102, 030406 (2009)
[5] Ellis et al, *New J. Phys*. 10, 043035 (2008)
[6] Patel et al, *Phys. Rev. Lett*. 100, 207405 (2008)
[7] Bennett et al, *Appl. Phys. Lett*. 92, 193503 (2008)
[8] Kardynal, Yuan and Shields, *Nature Photonics* 2, 425 (2008).

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