Polarization entangled photons from quantum dots embedded in nanowires

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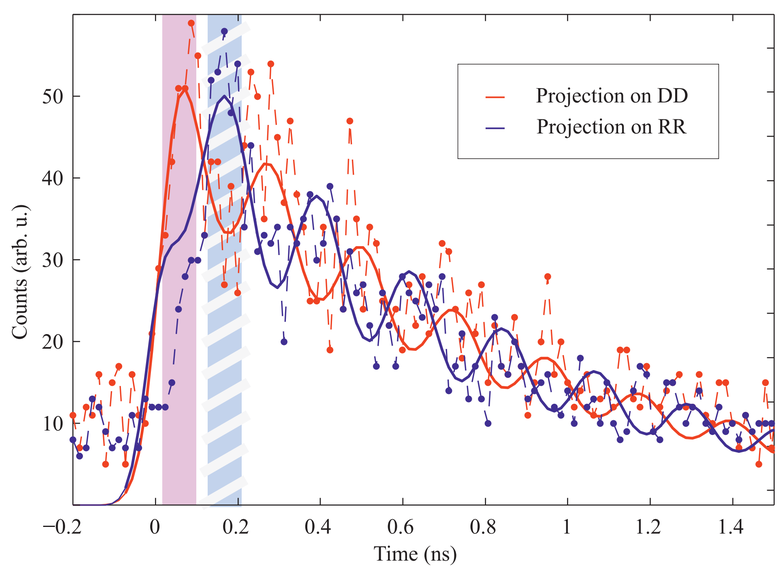
Motivation

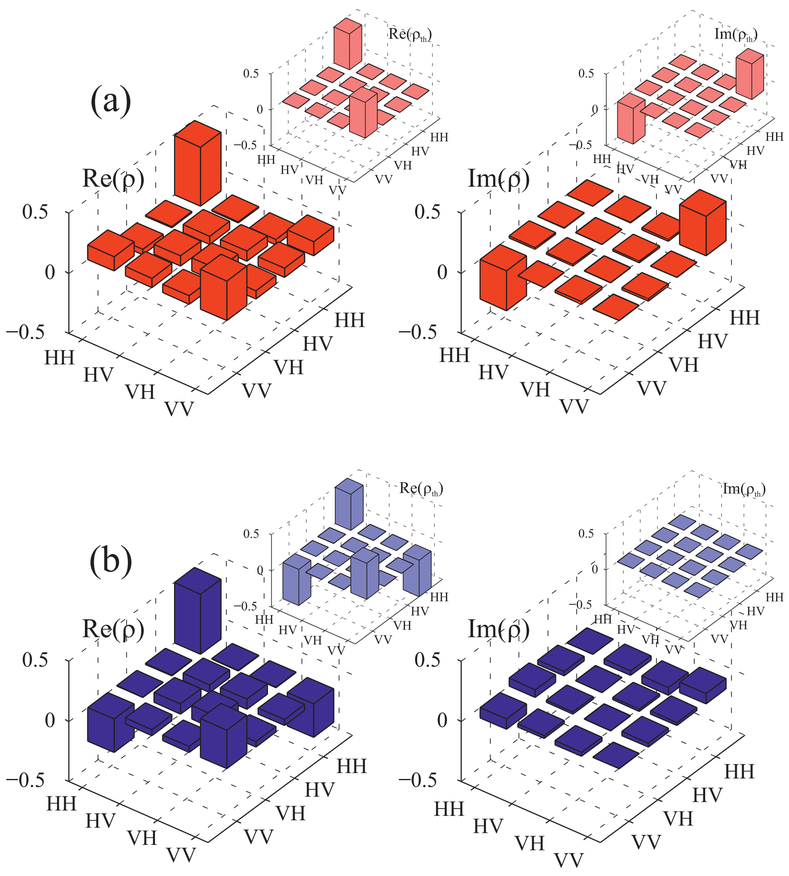
- entangled photons as resource for
  - quantum protocols [1]
  - linear optical quantum computation [2]
- nanowire quantum dots
  - increased emission directivity [3]
  - decreased fine-structure splitting [4]

Polarization entanglement

Time resolved coincidence measurement shows oscillation of the entangled state $|\Phi\rangle = \frac{1}{\sqrt{2}}(|HH\rangle + e^{i\phi}|VV\rangle)$
because of the finite fine-structure splitting [5]



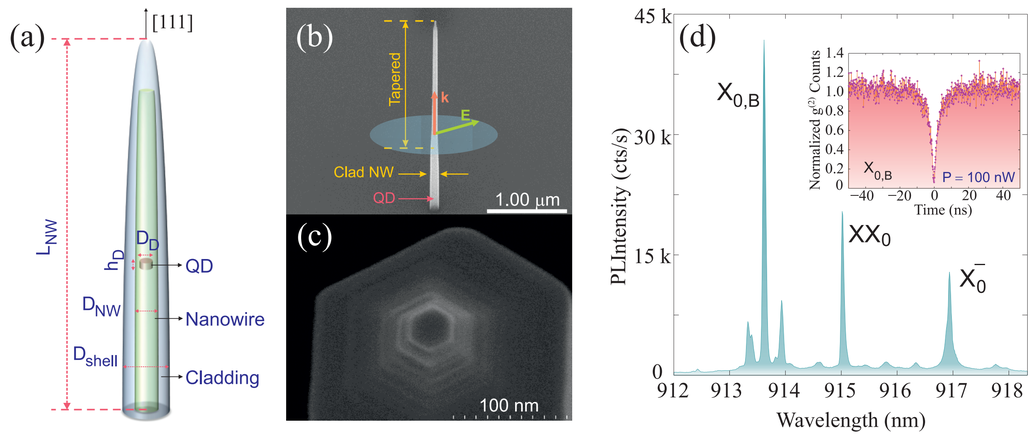
Reconscructed states and their corresponding reference states
a for the maximum of the projection on DD
b for the maximum of the projection on RR



Results

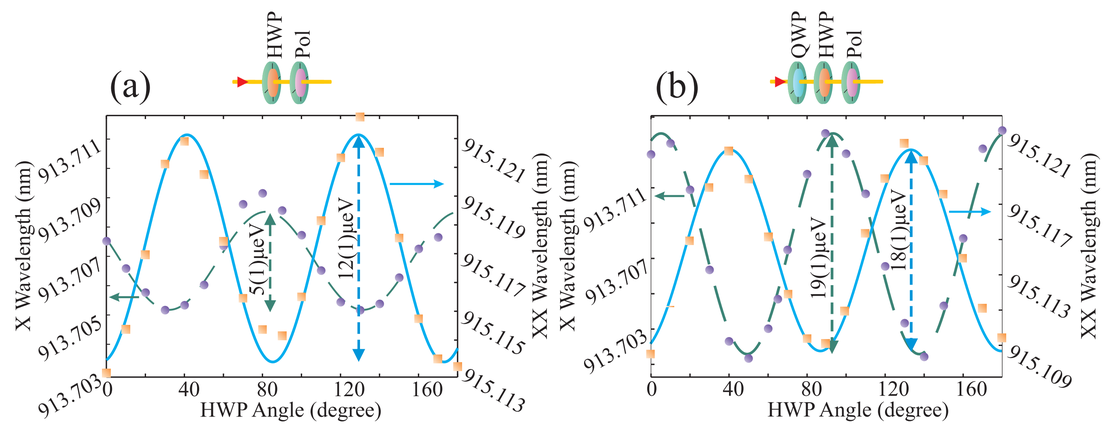
a Concurrence C = 0.57(6), Fidelity F = 0.86(2)
b C = 0.45(2), F = 0.83(1)

Sample structure and spectrum



a Sample schematics **b,c** SEM pictures **d** Spectrum and autocorrelation measurement

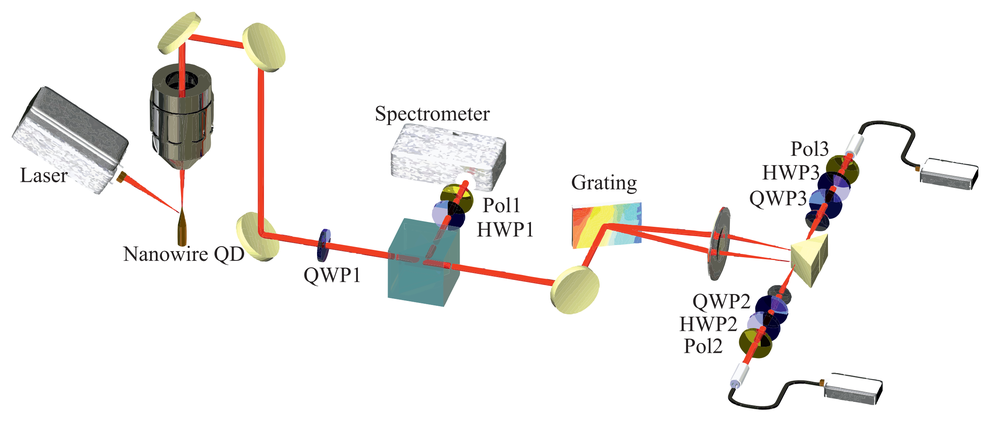
Fine-structure splitting (FSS) measurement



a FSS for exciton (X) and biexciton (XX) using a half wave plate and a polarizer
b FSS for exciton (X) and biexciton (XX) with an additional quarter wave plate

Setup

- Sample containing nanowire quantum dots
- Excited above-band from side under an angle
- Fine-structure splitting measured with spectrometer
- Polarisation entanglement measured using tomographic measurement



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INVESTMENTS IN EDUCATION DEVELOPMENT

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