NOISE SPECTROSCOPY OF MICROPILLAR BASED SINGLE-PHOTON SOURCE

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Epitaxial quantum dots (QDs) embedded in an optical micropillar cavity have proven to be high-performance single-photon sources with high purity, high indistinguishability and high brightness [1]. These devices are now being used to produce photonic qubits for quantum-computing platforms [2] and quantum communication [3]. A major requirement to scale up these photonic qubit systems is the emission of indistinguishable photons from independent sources [4]. One major limit to mutual indistinguishability is the fluctuating charges around the quantum dot, known as charge noise, which varies differently for independent micropillars [5]. The charge noise results in a spectral wandering of the quantum-dot emission, producing a detuning of one emitter relative to the other, reducing drastically the indistinguishability of photons emitted from two sources. In this study, we investigate the charge noise using the resonant fluorescence (RF) [6] of our micropillar devices. Based on the noise spectral density of measured RF counts, we quantify the magnitude and origin of the noise sources for ours QDs. By comparing the noise spectral density of multiple QDs in different devices, we can identify key device growth characteristics that contribute to the charge noise seen by the QD. This work paves the way for producing high-quality, low-noise processed single-photon devices.

References

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Figures

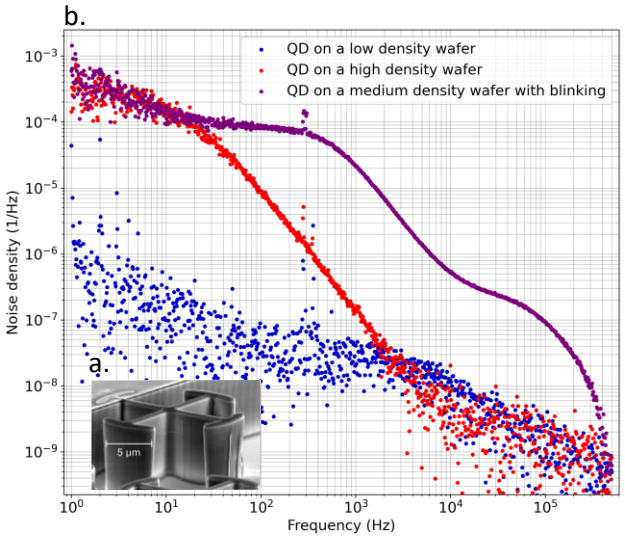

Figure 1: a.) SEM picture of the micropillar single-photon source. b.) Noise spectral density characteristic for different QDs embedded in micropillar devices, presenting different growth parameters and behaviour.