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A hybride approach towards “single photon-photonics”

Single photon sources have been realized in many different systems [1]. Important results with the potential to make true devices have been achieved with semiconductor based sources. After a brief overview of several applications of different sources in quantum information processing, such as multiplexed quantum cryptography [2] and demonstration of all-optical quantum computing [3], I will introduce an approach using nanoassembly of single emitters and resonant photonic as well as plasmonic structures. In contrast to first experiments where single quantum dots were positioned within e.g. photonic crystal cavities [4] we exploit scanning probes (AFM) to establish a nano-manipulation technique. With this technique we are able to position single quantum emitters at will and to assemble structures of increasing complexity. Ideal emitters for our approach are single defect centers in diamond nano-crystals. We report results concerning the optimization of SiN photonic crystal structures with bandgaps in the visisble [5], on-demand coupling of single defect centers to spherical microresonators [6], and plasmonic enhancement of single photon emission at room temperature [7].

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