A Monolithic Platform for Strong Coupling of SPEs to a BIC Cavity

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Abstract

This study explores the utilization of single photon emitters (SPEs) in hexagonal boron nitride (hBN) crystals, combining theoretical investigations with practical experimentation. Various methods were tested to induce SPEs, their viability confirmed through experimentation. Additionally, we established a confocal mapping software for measuring $g^{(2)}(\tau)$, enhancing our measurement capabilities.

Concurrently, we delved into the theoretical aspects, investigating bound states within a continuum for hBN photonic crystals. We also explored the intriguing coupling of SPEs with Bloch modes within a photonic crystal, particularly within Bound States in the Continuum (BIC) cavities. Further efforts were made to optimize hBN BIC cavities using focused ion beam (FIB) and electron beam (e-beam) lithography.

The primary objective of this research is to better understand the emission wavelengths and quality factors (Q factors) of hBN-based SPEs, as well as to enable their strong coupling with BIC cavities. Our establishment of a photoluminescence (PL) confocal mapping measurement setup paves the way for precise future investigations. This research holds the potential to advance our knowledge of single photon emitters and their interactions within photonic structures, with implications for quantum optics and photonics.

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