RICE QUANTUM GROUP MEETING SEMINAR SERIES

Nanophotonic devices for the Purcell enhancement of single T centers

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Adam is a graduate student in Professor Songtao Chen's research group. His work has focused on creating silicon nanophotonic devices for T center spectroscopy experiments. His research interests include photonic design and quantum information experiment.

ABSTRACT

Atomic defects in solids are popular candidates to underpin future quantum networks due to their ready integration with photonic devices. The silicon T center holds particular promise due to its O-band optical transition, long-lived electronic and nuclear spin manifolds, and compatibility with existing silicon photonic and electronic devices. This talk covers the integration of single T centers with silicon photonic crystal cavity structures; we observe cavity-enhanced fluorescence emission, leading to an enhancement factor of $F = 6.89$ compared to the bulk emission rate. The dephasing and spectral diffusion rates of a cavity-coupled T center are extracted through thorough characterization of the cavity-T-center system, and factors contributing to the T center linewidth are discussed. The design and fabrication of the nanophotonic devices used in the cavity-coupled T center experiment are detailed. In addition, the implementation of bus waveguide-type devices for multiplexed T center manipulation is discussed, as well as the fabrication of ring resonator devices that can allow for ensemble T center interactions.

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