



Contribution ID: 223

Type: **Poster**

Erbium 3+ Ions in Silicon Nanostructures

Thursday 4 December 2025 15:10 (1 hour)

Optically active spins in solids are promising for many applications in quantum information science, such as entanglement distribution nodes in quantum networking, single photon sources for linear optical quantum computing, and as a platform for cluster state quantum computing. Their optical connectivity could also be leveraged to implement low-density parity check (LDPC) error correction codes. Erbium ions implanted in silicon are a particularly promising system, due to their excellent optical and electron spin coherence properties, erbium's emission in the Telecom C band, and the maturity of Silicon nanofabrication. We undertook PLE spectroscopy of Erbium in Silicon nanopillars to study the effect of surface proximity on Erbium Sites in Silicon. We find that annealing in a nanostructure results in formation of different sites compared to the bulk. Also detailed are our design and fabrication of a electrode integrated waveguide to probe the Stark shifts of Erbium in silicon. This study will tell us the tunability of our emitter, their robustness to electric noise, and provide us information about the symmetry of these Erbium sites.

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Session Classification: Poster Session

Track Classification: Topical Groups: Quantum Science and Technology