A Two-Node Quantum Network with Silicon-Vacancy Centers in Diamond

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Long-range quantum networks constitute an important enabling technology in quantum information science, with applications in quantum key distribution, nonlocal sensing, and distributed quantum computation [1].
Silicon-Vacancy (SiV) Centers in diamond (Fig. 1) have recently emerged as promising candidates for quantum networks due to their long coherence time, fast and high-fidelity single and two-qubit gates, and efficient spin-photon interface owing to their integration in nanofabricated optical cavities [2]. The integration of all these features into a single device has led to the demonstration of memory-enhanced quantum communication with the SiV [3].
We show here the realization of a two-node quantum network and demonstrate entanglement across the two nodes containing a single SiV each separated by a 20-meter optical fiber link (Fig. 2). This result paves the way for larger SiV-based quantum networks and quantum repeaters.

References

[1] H. J. Kimble, Nature, 453 (2008) 1023–1030
[2] P.-J. Stas et al, Science, 378 (2022) 557-560
[3] M. K. Bhaskar et al, Nature, 580 (2020) 60-64

Figures

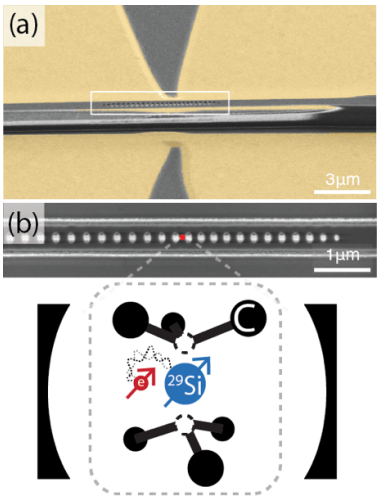

Figure 1: (a) SEM of nanobricated optical cavity, waveguide, and gold striplines for MW delivery. (b) Zoomed in section of the cavity. The SiV is located at the optical mode maximum (red dot).

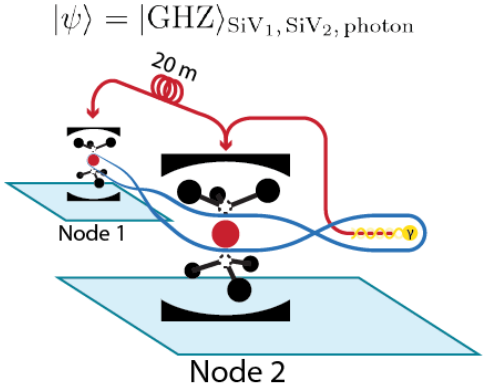

Figure 2: schematic of the two-node setup, with a photon mediating remote entanglement.