Frequency tunable single Er ions as telcom quantum emitters

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During the past decade, rare-earth ions doped in crystals have emerged as promising candidates for optical quantum memories, owing to their long optical and spin coherence time [1].

Recently, advancements in high-quality factor and low-mode volume nanophotonic cavities have made individual rare-earth ions optically addressable [2, 3]. Furthermore, deterministic qubit detection [4] and nuclear spin control [5] have been achieved, marking a full-stack quantum node. Among all rare-earth ions, Erbium (Er) ions are of great interest in large-scale quantum networks due to their telecom light-matter interface.

In my talk, I will present our results on coupling single Er ions in a lithium niobate host with silicon nanophotonic cavities. Additionally, we have achieved linear Stark tuning of a single Er ion frequency for the first time, which is a crucial element in establishing a multi-node quantum network.

References

[1] De Riedmatten H, et al., Nature 456.7223 (2008): 773-777.
[2] Zhong, T., et al., Physical review letters, 2018, 121(18): 183603.
[3] Dibos, A., et al., 2018, Physical review letters 120.24 (2018): 243601
[4] Kindem J M, et al. Nature 580.7802 (2020): 201-204
[5] Ruskuc, A., et al. Nature 602.7897 (2022): 408-413.

Figures

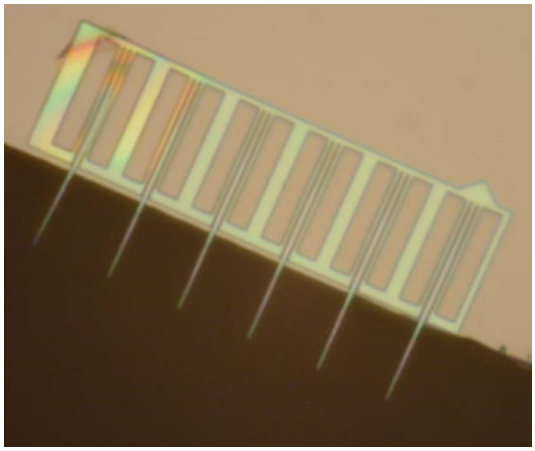

Figure 1: Silicon nanocavities on the Er:$LiNbO_3$.

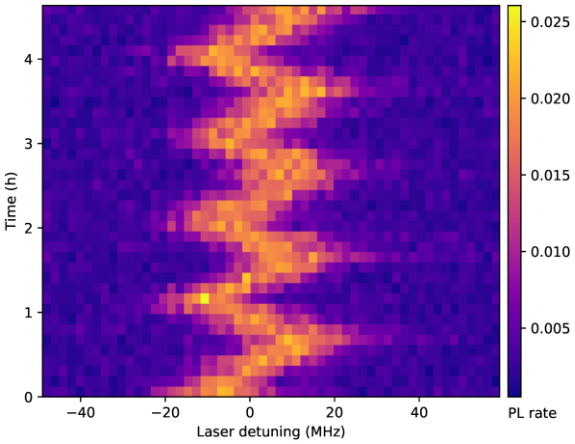

Figure 2: Stark tuning of the single Er ion.