Q@TN SEMINAR

Distributed Quantum Computing between Two Ion-Trap Nodes in a Quantum Network

SPEAKER

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ABSTRACT

No quantum computing platform has yet established a clear path to the scalability required for achieving practical quantum advantage, meaning the ability to outperform classical systems in solving useful problems. In classical computing, scalability is achieved through clusters of interconnected processors, which act as individual nodes and communicate through a shared network to execute tasks collaboratively. A similar architectural approach is emerging as a promising direction for quantum computing.

In this presentation, I will describe our recent experimental results toward building such quantum clusters. In particular, we have used a photonic network to generate remote entanglement between two quantum processors based on trapped ions, located several meters apart. This entanglement enables the deterministic execution of distributed quantum computing protocols, including quantum gate teleportation and, for the first time, a distributed implementation of Grover's search algorithm across two quantum nodes [1], as well as quantum error correction in a delocalized logical qubit.

I will also present our results on multi-partite multi-species entanglement shared across multiple nodes and involving different atomic species, advancing the prospects for scalable and modular quantum networks.

[1] Nature **638**, 383–388 (2025)

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