Trapped Ions/Atoms: Quantum Networks

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The ability to link the quantum states of distant qubit storage and computing units in a controllable fashion is fundamental in building complex quantum communication and information processing systems. In this talk, we briefly discuss the main features of such quantum networks and then detail two particular experimental realizations: first, a probabilistic, heralded entanglement scheme between two ions in different traps [Moehring 07], and second a more flexible cavity-based approach [Ritter 12]. We will briefly review the conceptual foundation of these implementations, highlight the main features of the experimental protocols, and conclude with a comparison of the achieved fidelities.

References

[Moehring 07] D. L. Moehring, P. Maunz, S. Olmschenk, K. C. Younge, D. N. Matsukevich, L.-M. Duan & C. Monroe. *Entanglement of single-atom quantum bits at a distance.* Nature, vol. 449, no. 7158, pages 68–71, September 2007.

[Ritter 12] Stephan Ritter, Christian Nolleke, Carolin Hahn, Andreas Reiserer, Andreas Neuzner, Manuel Uphoff, Martin Mucke, Eden Figueroa, Joerg Bochmann & Gerhard Rempe. *An elementary quantum network of single atoms in optical cavities.* Nature, vol. 484, no. 7393, pages 195–200, April 2012.