SFB/TRR 21 - Seminar
8. Oktober 2009, Ulm

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Scalable quantum information processing with trapped ions

I will describe recent work with trapped ions which combines all of the basic building blocks for a large-scale quantum information processor.
We use scalable methods, allowing all operations to be performed at the same fidelity over long timescales, and before and after qubit transport. Decoherence of qubits stored in the ions' electronic states is heavily suppressed by the use of a magnetic field insensitive transition. We have used this system to implement arbitrary unitary operations on two qubits. A crucial component of this work is simultaneous trapping of two species of ion (Mg+ and Be+), which allows the motional degree of freedom to be cooled while preserving qubit coherence. This has also allowed us to create a novel entangled state of two separated mechanical oscillators.

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