SFB/TRR 21 - Colloquium

16. December 2011, Tübingen

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A designer spin-molecule implemented with trapped ions in a magnetic gradient

The experimental investigation of an individual 3-spin pseudo-molecule using trapped ions with adjustable magnetically induced coupling between spin states is reported. This coupling is switchable by state-preparation, and it is employed to entangle distant spins. Resonances of individual spins are well separated and are addressed with high fidelity. Quantum gates are carried out using microwave radiation in the presence of thermal excitation of the pseudo-molecule's vibrations. Demonstrating Conditional-NOT gates between non-nearest neighbors serves as a proof-of-principle of a quantum bus employing a spin chain. Successful experiments with molecules using nuclear magnetic resonance (NMR) and with trapped ions have been an important driving force for quantum information science. Combining advantageous features of NMR and trapped ions, respectively, opens up a new avenue towards scalable quantum information processing.

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