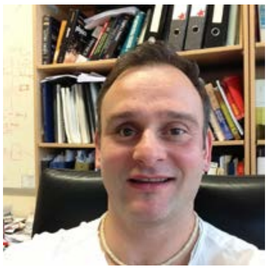
Einladung

zum

Physikalischen Kolloquium
Montag, 30.11.2015
16:15 Uhr in N24/H13



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http://www.sussex.ac.uk/physics/iqt

Constructing a long-wavelength radiation trapped-ion quantum computer

Quantum computers may revolutionize the way we live. Trapped ions constitute one of the most successful physical implementations to build such a device. To this point, entanglement operations on ion qubits have predominantly been performed using lasers. When scaling to larger qubit numbers this will become more challenging due to the required engineering that might be required in order to engineer hundred-thousands of laser beams needed to operate millions of qubits that would be needed for a practical quantum computer. Using long-wavelength radiation along with static magnetic field gradients provides a powerful method [1] capable of significantly simplifying the construction of a large scale quantum computer. Instead of aligning numerous pairs of Raman laser beams into designated entanglement zones, the use of a single microwave horn outside the vacuum system is sufficient. Such gate operations are vulnerable to decoherence due to fluctuating magnetic fields, however the use of microwave-dressed states protects against this source of noise; with radio-frequency fields being used for qubit manipulation [2]. I will present an industrial blue-print to scale this scheme to build a large scale quantum computer [3]. I will report the experimental demonstration of important tools towards this end such as the realisation of spin-motion entanglement [4], a new method to efficiently prepare dressed state qubits and qutrits [5], the demonstration of ground state cooling using long wavelength radiation [6] and the demonstration a high-fidelity long-wavelength two-ion quantum gate using dressed states [7]. Finally, I will present results concerning the development of ion microchips that can be used as an architecture for such a quantum computer.

References

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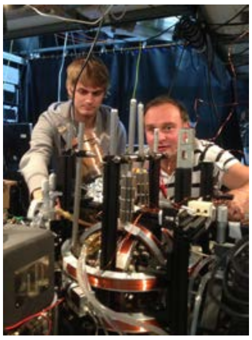
[3] B. Lekitsch, S. Weidt, A.G. Fowler, K. Mølmer, S.J. Devitt, Ch. Wunderlich, and W.K. Hensinger, arXiv:1508.00420 [quant-ph] (2015)
[4] K. Lake, S. Weidt, J. Randall, E. Standing, S. C. Webster, W. K. Hensinger, Phys. Rev. A 91, 012319 (2015)
[5] J. Randall, S. Weidt, E. D. Standing, K. Lake, S. C. Webster, D. F. Murgia, T. Navickas, K. Roth, and W. K. Hensinger, Phys. Rev. A 91, 012322 (2015)
[6] S. Weidt, J. Randall, S. C. Webster, E. D. Standing, A. Rodriguez, A. E. Webb, B. Lekitsch, W. K. Hensinger, Phys. Rev. Lett. 115, 013002 (2015)
[7] Manuscript in preparation



Ab 16.00 Kaffee, Tee und Kekse vor dem Hörsaal H13, Org. Prof. Dr. F. Jelezko, Tel. 23750;
Host: Prof.Plenio Tel. 22900, off.: 22911