RUHR-UNIVERSITÄT BOCHUM
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Single ion microscopy and single ion implantation for novel quantum technologies

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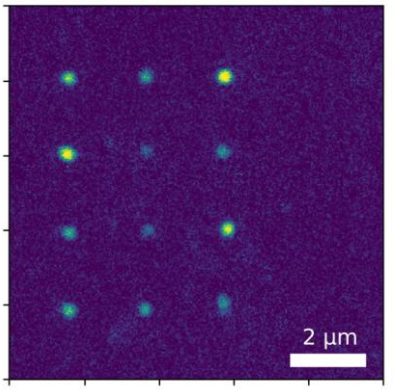

Implantation pattern of Pr^+ with distance 2µm and spot size of about 30nm. The confocal optical microscope has a 200nm resolution

Quantum technologies allow for fully novel schemes of computing, simulation and sensing. For quantum computing, we employ trapped ions in modern segmented ion traps as scalable and freely reconfigurable qubit register. I will give an overview of the recent progress, where gate fidelities of 99.995% (single bit) and 99.6% (two bit) are reached. Alternative platforms for quantum computers in solid state technology would largely benefit from deterministic schemes to fabricate qubit registers with nm-accuracy. I describe our deterministic ion source, which allows for delivering Ca^+ ions on demand and focus it into a spot of a few nm. The source can be operated with any other doping ion, which is co-trapped and sympathetically cooled together with a single Ca^+ ion, eventually extracted and implanted. We have started structuring solid state samples such as diamond with $N2^+$ molecular ions to generate NV centers, and implanting rate-earth Presodym or Cer ions. In the last part of my talk I highlight perspectives for solid state quantum devices and ultimately for building a quantum repeater. In a common effort with several groups in Germany we aim for such demonstrator to provide secure quantum key exchange over large distances.

Einführung: Prof. Dr. A. Wieck

Die Fakultät lädt alle Interessierten herzlich ein.