Atomphysik-Seminar

Wednesday, December 6, 13:15, KBW Lecture Room 5.29

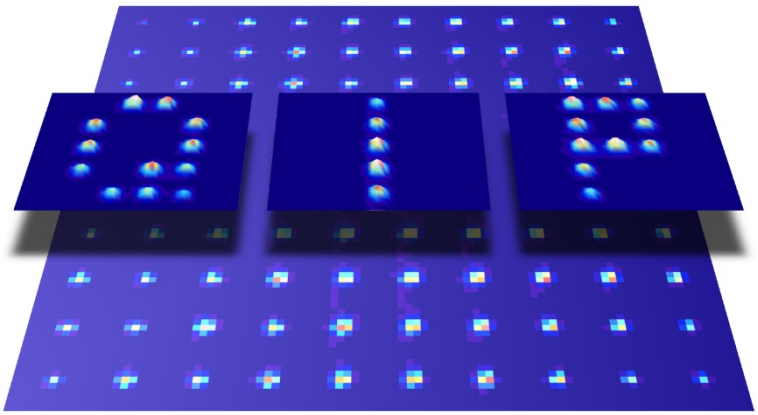
A Multi-Site Quantum Register of Individual Neutral Atoms

Malte Schlosser, TUD

Efficient quantum simulation and quantum information processing, requires scalable architectures that guarantee the allocation of large-scale qubit resources. In our work, we focus on the implementation of multi-site geometries based on micro optical systems. The use of micro lens arrays allows the creation of massive multi-site trap arrays with structure sizes approaching the wavelength of the light applied, yet the geometry is being decoupled from the laser wavelength and therefore customizable.

We give an overview on the investigation of ^{85}Rb atoms in two-dimensional arrays of more than 400 individually addressable dipole traps featuring trap sizes and a tuneable site-separation in the single micrometre regime. We prepare exactly one atom per site in more than 150 sites utilizing light assisted collisions and present single-site resolved addressing in a reconfigurable fashion.

We will discuss progress in introducing Rydberg based interactions and present prospects of our platform for the investigation of many-body physics. Controllable interatomic distances lead to tuneable Rydberg-mediated dipolar or van der Waals type interactions. Our work is aiming towards the utilization of Rydberg interactions in the blockade regime for two-qubit gates and in the unblocked regime for the implementation of many-body spin Hamiltonians, e. g. for the study of topological phenomena.



Fluorescence images of rubidium atoms stored in a reconfigurable two-dimensional architecture of focused beam traps.

Find it on Indico: http://indico.gsi.de/e/AP_Seminar_Schlosser