universität ulm

Physikalisches Kolloquium — Physics Colloquium

Einladung — **Invitation**

Monday, 11 December 2023

Lecture Hall N24/H13, at 16:15
Coffee and cookies will be served in front of the lecture hall from 16:00

Quantum simulation and quantum computing with neutral-atom arrays

Dr. Johannes Zeiher

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https://www.mpq.mpg.de/person/107196/4571983

Systems of many interacting quantum particles in and out of equilibrium feature numerous fascinating emergent properties. Their detailed understanding is essential to interesting applications such as quantum sensors or quantum computers. Neutral atoms trapped in optical tweezers or optical lattices are an aspiring platform for experimentally studying the physics of such many-body systems, and to uncover the microscopic physical mechanisms underlying the complexity found in real materials or enhanced performance of quantum sensors.

In this talk, I will report on our recent progress on experimentally realizing large-scale neutral-atom quantum simulators with microscopic single-atom control. I will demonstrate the versatility of our approach to understanding many-body systems by discussing recent experiments performed on Hubbard and Heisenberg models in and out of equilibrium.

Furthermore, I will present neutral atoms as a promising quantum computing platform, which fulfills all of DiVincenzo's criteria. The combination of optical tweezers with optical lattices is a unique approach to scale the register sizes to beyond 1000 atoms, which, together with high-fidelity single and two-qubit gates, will pave the way to realizing highly controllable quantum systems beyond the regime accessible by classical computers.

Host: Prof. Dr. Johannes Hecker Denschlag, Institute of Quantum Matter

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