Universität Heidelberg



PHYSIKALISCHES





We work on quantum simulation with **deterministically** prepared lithium atoms.

If you want to join our team there are many possibilities for:

Projektpraktika Bachelor and Masters theses PhD theses

> Just get in touch! ultracold-pi@physi.uniheidelberg.de



Experimental control

- Develop electronic modules to control the experiment
- PCB design
- Synchronize the control
- Program a full experimental sequence from a bulk of lithium to a single atom picture

2D Magnetooptical-trap

Lithium oven

A New Experiment to Explore Quantum Matter: Heidelberg Quantum Architecture

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Homepage

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Mechanical Platform Design

Design versatile, modular optical and mechanical systems

Get experience in CAD drawing, 3D printing and testing your designs

Setting up lasers and optical tweezers

Trap, image and play with single atoms * Shape the dimensionality of atomic clouds Detect phase transitions and other many-body phenomena connecting to many parts of physics Assemble quantum systems from scratch

> Super small glass cell

Magnetic field coils (up to 0.2 Tesla)

High resolution optics

- Design high performance **optics** (with e.g. Zemax)
- Implement the objective to see individual atoms
- Implement high power IR lasers
- Generate arbitrary optical potentials with e.g. DMDs

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Rapid optical lattice simulator



Random unitary readout

New general probe of many-body systems Fluctuations under random rotations Information scrambling, entanglement etc

$\operatorname{Tr}(\rho_A \rho_B)$

Cross-validation Phase transitions Loschmidt echo

$\langle W(t)V^{\dagger}W(t)V\rangle$

OTOCs Scrambling Chaos



Optical lattice with single site resolution Direct assembly from laser-cooled atoms In-lattice rearrangement Programmable initial states



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