Physikalisches Kolloquium

Einladung

Physics Colloquium

Invitation

Monday, 05 February 2024

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

Quantum-engine cycles in ultracold gases

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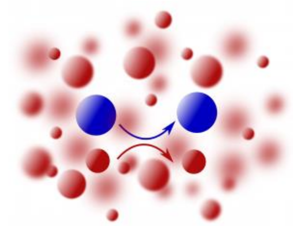
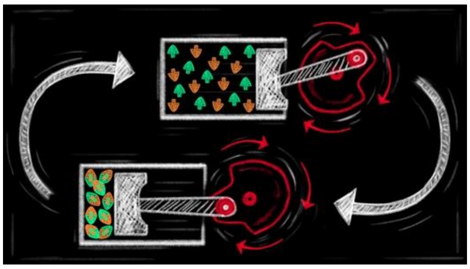
https://physik.rptu.de/ags/widera/arbeitsgruppe/artur-widera

Excellent experimental control over quantum systems is increasingly bringing quantum technological applications within reach. A central question of current research is how to realize, operate, and understand the smallest machines in the quantum world. In particular, it is interesting whether quantum effects can improve these machines somehow. I will discuss our recent progress in addressing such questions experimentally in two different ultracold-atom setups.



First, we immerse single Cs atoms as controlled impurities in an ultracold gas of Rb atoms. Spin-exchange collisions allow a very controlled transfer of energy quanta between bath and impurity. We use this transfer to operate the single atom as a machine in a magnetic field gradient, where the fuel is no longer stored as thermal energy but instead as spin-polarization of the gas. I will show that the properties of this engine cycle offers high efficiency, high power, and low power fluctuations simultaneously.



Second, in another experimental setup, we address whether the significant energy difference between ensembles of different fermionic and bosonic quantum statistics, resulting from the Pauli exclusion principle, can be used as a novel form of energy to drive a quantum machine. To this end, we use a degenerate gas of fermionic Lithium atoms. We show that an Otto-inspired Pauli cycle can be operated by alternating strokes changing the trap frequency and the interaction-induced change of quantum statistics along the BEC-BCS crossover, outperforming comparable cycles relying on a change of interactions.

Host: Prof. Dr. Joachim Ankerhold, Institute of Complexe Quantum Systems

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