

PHYSIKALISCHES KOLLOQUIUM

Wintersemester 2018/19

Das Kolloquium findet (soweit unten nicht anders angegeben) jeweils montags 17:15 Uhr im Hörsaal P des Physikalischen Instituts auf dem Hubland Campus Süd der Universität Würzburg statt.

26. November 2018

Prof. Dr. Uwe-Jens Wiese
University of Bern, Institute for Theoretical Physics

Quantum Simulation of Gauge Theories: from Condensed Matter to Particle Physics

Abstract

The Monte Carlo simulation of large and dense strongly coupled quantum systems, such as strongly correlated electrons in condensed matter physics or strongly interacting quarks and gluons in particle physics, suffer from the notorious sign problem, which reflects quantum entanglement. While classical computers are inefficient for simulating high-temperature superconductors or dense nuclear or quark matter, quantum simulators provide an attractive alternative. Quantum simulators are special purpose analog quantum computers which use intrinsically quantum mechanical hardware, such as trapped ions or ultracold atoms in an optical lattice. Since they realize quantum entanglement in their hardware, quantum simulators do not suffer from the sign problem. Gauge theories play a central role in particle and condensed matter physics as well as in quantum information processing. Quantum link models provide an unconventional realization of gauge theories, which is particularly well suited for quantum simulation. In particular, using ultracold Fermi-Bose mixtures or alkaline-earth atoms in optical lattices, quantum simulator constructions have been proposed for Abelian and non-Abelian gauge theories coupled to fermionic matter. This also allows the simulation of the real-time evolution of gauge theories, which is beyond reach of classical simulation techniques.

Für die Dozenten der Fakultät für Physik und Astronomie

Prof. Dr. J. Geurts, Prof. Dr. K. Mannheim, PD Dr. J. Schäfer, L. Bund