Karlsruher Institut für Technologie

KIT-Fakultät für Physik

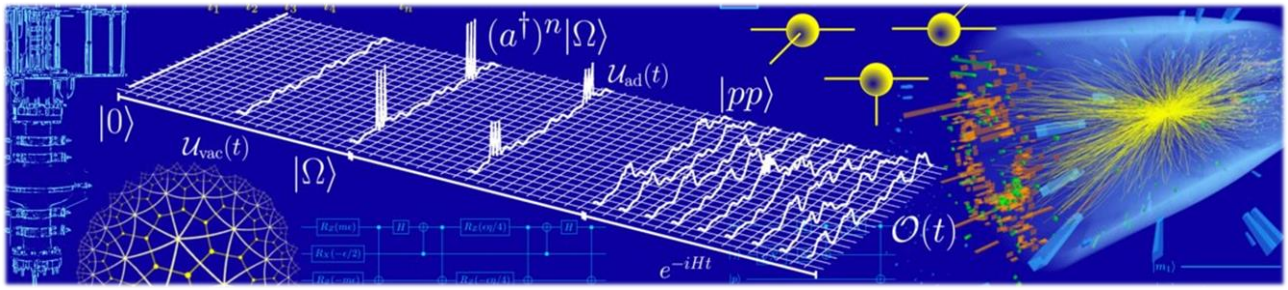
Einladung zum Physikalischen Kolloquium

20.11.2026 **Michael Spannowsky, Karlsruher Institut für Technologie**

»Walking the Quantum Tightrope:
Simulating Quantum Field Theories on the Lattice«

Einführung: M.M. Mühlleitner

Particle collisions and the decay of a metastable vacuum involve quantum fields evolving in real time. Following these processes from first principles remains difficult, particularly when interactions are strong and entanglement grows. Hamiltonian simulation provides a route to studying such dynamics and connects quantum computing with methods that can already be used on classical computers. I will introduce the basic principles of quantum computing and Hamiltonian simulation, and explain how quantum field theories can be represented on a spatial lattice. I will then discuss tensor networks, showing how they represent quantum states and how entanglement affects the cost of preparing and evolving them. Tensor network results for false vacuum decay and fermion scattering will illustrate how these methods capture bubble dynamics and the formation and decay of particle resonances. These examples connect the computational framework to questions in early-Universe and particle physics, while providing benchmarks for quantum algorithms. Throughout the talk, I will discuss the balancing act between resolving the relevant physics, controlling the approximations and keeping the computation manageable, and consider how quantum hardware could extend these calculations.



Der Vortrag findet **am Freitag, den 20. November 2026 um 15:45 Uhr im Otto-Lehmann-Hörsaal**, Physik-Flachbau (Geb. 30.22), KIT-Campus Süd statt.

Karlsruher Institut für Technologie (KIT)
Universitätsaufgabe • Campus Süd
KIT-Fakultät für Physik

Physik-Hochhaus, Geb. 30.23
76128 Karlsruhe
Wolfgang-Gaede-Straße 1

www.physik.kit.edu
fakultaet@physik.kit.edu
Tel.: (07 21) 6 08 – 4 35 18