Quantum Information Science Talks

UNIVERSITÄT DES SAARLANDES

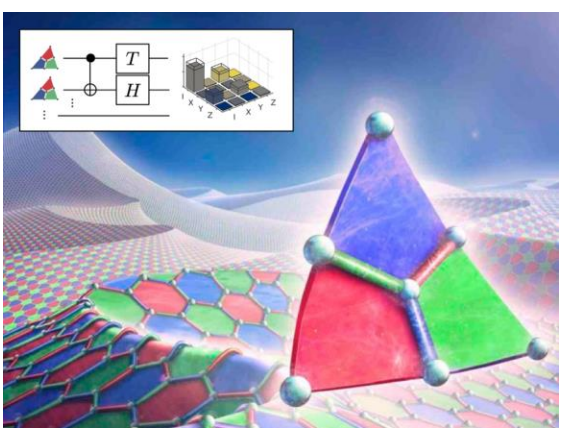
Donnerstag
12.12.24
12:00 Uhr, Raum 0.01,
Geb. E2 1
Alle Interessierten
sind herzlich willkommen

Markus Müller
RWTH Aachen University
Forschungszentrum Jülich, Germany

The Dawn of Quantum Fault-Tolerance

Thursday, December 12th, 2024 at 12:00p.m.
Building E2 1, Room 0.01

To date, the construction of scalable fault-tolerant quantum computers remains a fundamental scientific and technological challenge. In my talk, I will first introduce basic concepts of fault-tolerant quantum error correction (QEC), which allows one to protect quantum information during storage and processing, by redundant encoding of quantum information in logical qubits formed of multiple physical qubits. I will then discuss recent progress in QEC, based on new theory concepts and collaborative experimental breakthroughs in state-of-the-art physical quantum processors, including trapped ions, Rydberg atoms and superconducting qubits. Specifically, I will present new protocols for autonomous quantum error correction, which do not require in-sequence measurements of qubits, which are often slow or technically challenging in state-of-the-art quantum processors. I will also show how quantum cellular automata can be designed to give rise to emergent, error-correcting many-body dynamics. Towards universal fault-tolerant quantum computing with logical qubits, I will present new protocols and first experimental demonstrations of fault-tolerant code switching. These results mark exciting first steps into the era of early fault-tolerant quantum computing with logical qubits.



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