PHYSIKALISCHES KOLLOQUIUM

Wintersemester 2025/2026

Das Kolloquium findet (soweit nicht anders angegeben) **jeweils montags um 14:15 Uhr im Röntgen-Hörsaal** des Physikalischen Instituts, Hubland Campus Süd, Universität Würzburg **und online via Zoom statt**.
Zugangsdaten siehe https://www.physik.uni-wuerzburg.de/aktuelles/veranstaltungen-aus-der-physik/physikalisches-kolloquium/

27.10.2025
Prof. Dr. Ferdinand Schmidt-Kaler
Johannes Gutenberg-Universität Mainz, Institut für Physik

Scalable quantum computing with trapped ions and selected application examples

Abstract

I will describe the challenges on the way to a scalable, eventually fault tolerant quantum computers [1]. Efforts from physics, informatics [2,3] & mathematics but also engineering [4] are concentrated in demonstrator setups. As a first glance into the power of quantum computing, I will describe a couple of use cases: the VQE-simulation of a two-flavor Schwinger quark model executed on a trapped-ion quantum processor [5], and the quantum autoencoder [6], as a simple instance of machine learning on this hardware. Using, and extending the toolset of quantum computing we are investigating circuits that realize quantum thermodynamic- [7,8,9] and quantum communication processes [10].

Ref.:
[1] Hilder et al., Phys. Rev. X.12.011032 (2022)
[2] Kreppel et al., Quantum 7, 1176 (2023)
[3] Durandeau et al., Quantum 7, 1175 (2023)
[4] Kaustal et al., AVS Qu. Sci. 2, 014101 (2020)
[5] Melzer et al., arXiv:2504.20824
[6] Locher et al., Quantum 7, 942 (2023)
[7] Fox et al., Entropy 26(11), 952 (2024)

[8] Onishchenko et al., Nat. Comm. 15, 6974 (2024)
[9] Stahl et al., arXiv:2404.14838
[10] Hilder et al., arXiv:2507.14383

Für die Dozentinnen bzw. Dozenten der Fakultät

Prof. Dr. Palffy-Buß, Prof. Dr. Klembt, Dr. Hammer, Hr. Baumbach, Fr. Schleicher