Institut für Angewandte Physik

Physikalisches Institut

UNIVERSITÄT BONN

RHEINISCHE FRIEDRICH-WILHELMS-UNIVERSITÄT BONN

COLLOQUIUM „OPTICS AND CONDENSED MATTER“

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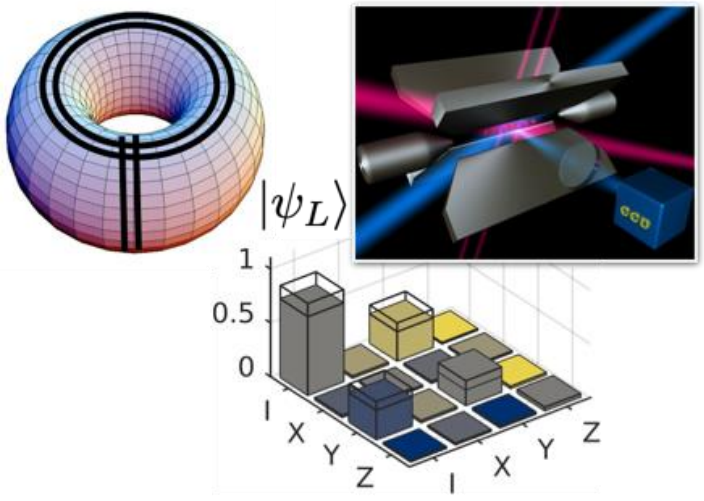
Fault-Tolerant Quantum Error Correction: From Concepts to Experiments

To date, the construction of a scalable fault-tolerant quantum computer remains a fundamental scientific and technological challenge, due to the influence of unavoidable noise. In the seminar, I will introduce basic concepts of quantum error correction and topological quantum codes, which allow one to protect quantum information during storage and computations. When manipulating logical quantum states, it is imperative that errors caused by imperfect operations do not spread uncontrollably through the quantum register, requiring so-called fault-tolerant quantum circuit designs. I will discuss recent theory work, perspectives and recent collaborative experimental breakthroughs towards fault-tolerant quantum error correction on various physical quantum computing platforms. This includes the first realisation of repeated quantum error-correction cycles with superconducting qubits [1] and the first demonstration of a universal and fault-tolerant logical gate set with trapped ions [2].

[1] S. Krinner *et al.*, Realizing repeated quantum error correction in a distance-three surface code, Nature 605, 669 (2022)

[2] L. Postler *et al.,* Demonstration of fault-tolerant universal quantum gate operations, Nature 605, 675 (2022)



April 26th, 15:15 h, live IAP lecture hall or via Zoom

https://uni-bonn.zoom.us/j/98441612025?pwd=a01SSjlkY1Q3SDFhL09JQk1qc1V6dz09

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