

**Friday, 11.04.2025, 1:15 p.m.
in Lecture Hall I of the Physics Institute**

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**„Probing Quantum Phases of Matter
on Quantum Processors“**

Quantum fluctuations and interactions give rise to exotic phases of matter with remarkable properties, challenging our understanding of many-body quantum systems. The inherent complexity of these systems makes them notoriously difficult to simulate using classical computers due to the exponential growth of required computational resources. However, quantum processors offer a powerful alternative, providing direct access to quantum many-body physics and enabling new avenues for exploration.

In this talk, we will first present an efficient quantum circuit for preparing the ground state of the toric code Hamiltonian on a superconducting quantum processor [1]. We measure the topological entanglement entropy, which closely matches the expected value of $\log 2$, and simulate anyon interferometry to extract the braiding statistics of emergent excitations. We then explore a class of highly entangled quantum phases that arise exclusively in non-equilibrium settings, demonstrating how their stability can be probed using quantum processors [2].

[1] Satzinger, Liu, Smith, et al., Knap, FP, Roushan, Science 374, 1237 (2021)

[2] Will, Cochran, Rosenberg, Jobst, Eassa, Smith, Roushan, Knap, FP, arXiv:2501.18461

Everybody is welcome, especially students of all semester

