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INSIGHT SEMINAR: Quantum simulation of many-body physics in the presence of errors

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May 26, 2025
15:00 to 16:00
Elements Room

ABSTRACT:

Quantum computers offer a promising solution to the task of simulating many-body physics. A scalable fault-tolerant quantum computer with a large supply of logical qubits would allow us to answer many interesting questions about physical systems. In the near term we can only access a limited number of noisy physical qubits, and thus cannot do full error correction. This has raised an important theoretical question of identifying the limitations and applicability of near-term quantum hardware. With the goal of finding physically relevant many-body models that are target candidates for available devices, I will describe our efforts to using tools from quantum complexity theory and quantum many-body physics to identify?

(i) No-go results for quantum advantage with noisy quanutm hardware [1, 4, 5]

(ii) Many-body physics problems that are both Classically non-trivial to solve and Intrinsic lly robust to errors both due to imperfect mapping of these problems to the simulator, as wel as due to decoherence in the simulator [2,

References

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S. D. Mishra, M. Frias, R. Trivedi, Classically computing performance bounds on depolarized quantum circuits, Physical Review X Quantum (2024)
G. Gonzalez*, R. Trivedi*, J. I. Cirac, Error propagation in NISQ devices for solving classical optimization problems, Physical Review X Quantum (2022)

BIO:

Rahul Trivedi is currently a tenured Research Group Leader in the Theory Division at the M x Planck Institute of Quantum Optics. His current research focusses on the theoretic l quantum information and quantum science, with an emphasis on the role of decoherence n many-body quantum systems. Rahul is an engineer by training and researches topics n physics - his work often lies at the inter-disciplinary boundary of physics and technology. e was previously an assistant professor (Tenure track) of Electrical and Computer Engineeri g (ECE) at the University of Washington (Seattle) and a recipient of the Max-Planck Harva d Quantum optics postdoctoral fellowship. He obtained my PhD and MS in Electri al Engineering from Stanford University, and my undergraduate also in Electrical Engineer ng from the Indian Institute of Technology (Delhi).

Hosted by: Prof. Dr. Antonio Acin and Prof. Dr. Darrick Chang