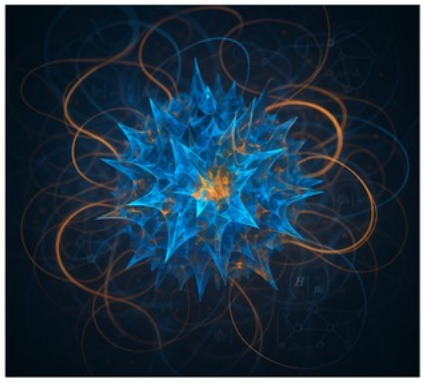
institute for pure & applied mathematics

Random Quantum Hamiltonians: Physics, Computation, and Complexity

FEBRUARY 8 - 12, 2027



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Scientific Overview

Disordered models have become the canonical starting point for probing the emergent behavior of many highly complex systems. Originally motivated by the study of magnetism in materials, the theory of disordered systems has blossomed into a unifying and powerful theory spanning physics, mathematics, computer science, statistics, machine learning, and beyond. Random Quantum Hamiltonians are quantum variants of these models that exhibit intriguing phenomena such as quantum chaos, entanglement growth, and holographic dualities, which are largely poorly understood.

This IPAM workshop will convene mathematicians, physicists, and computer scientists to map the state of the art and chart new directions in this field. We hope to formulate open problems in this exciting area and introduce them to the broader community. Core themes include rigorous mathematical understanding of spectral properties, analysis of thermalization, and bridges to holography. These themes will link to computational questions, including the average-case hardness of simulating these systems using either quantum or classical computation, and lead to the formulation of classically-hard problems that are interesting to study using quantum computers.

This workshop will include a poster session; a request for posters will be sent to registered participants in advance of the workshop.

Organizers

Eric Anschuetz
National University of Singapore

Anurag Anshu
Harvard University

David Gamarnik
Massachusetts Institute of Technology

Bobak Kiani
Bowdoin College

Alexey Milekhin
University of Kentucky

Leo Zhou
University of California, Los Angeles (UCLA)

Invited Speakers

Omar Al-Ghattas (Massachusetts Institute of Technology), **Arpon Basu** (Princeton University), **Chi-Fang Chen** (University of California, Berkeley (UC Berkeley)), **Sitan Chen** (Harvard University), **Anatoly Dymarsky** (University of Kentucky), **Ahmed El Alaoui** (Cornell University), **Vedika Khemani** (Stanford University), **Wonjun Lee** (Massachusetts Institute of Technology), **Kunal Marwaha** (University of Chicago), **Anand Natarajan** (Massachusetts Institute of Technology), **Silvia Pappalardi** (University of Cologne), **Yihui Quek** (EPFL (Ecole Polytechnique Fédérale de Lausanne)), **Subir Sachdev** (Harvard University), **Monika Schleier-Smith** (Stanford University), **Simone Warzel** (Technical University Munich (TUM)), **Benjamin Wong** (University of Waterloo), **Alexander Zlokapa** (Massachusetts Institute of Technology)

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For program details and registration:

Scan the QR code or visit ipam.ucla.edu/RQH2027