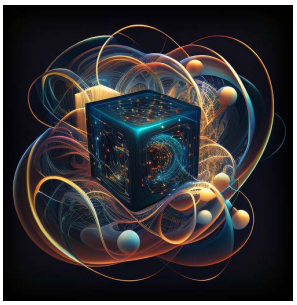
institute for pure & applied mathematics

Workshop III: Many-body Quantum Systems via Classical and Quantum Computation

NOVEMBER 6 - 9, 2023



Scientific Overview

The ability to coherently manipulate complex quantum many-body states offers the potential for dramatic improvements in a wide range of applications such as fast computation, enhanced sensing, and secure communications. However, understanding and ultimately controlling the dynamics of such entangled quantum states pose a number of challenges in mathematics and physics. In particular, the description of such complex quantum states often lies beyond the standard approach used in different areas of physics owing to their rich complexity.

This workshop is devoted to the related questions of how quantum and classical computers can be used to address important problems in quantum many-body physics, ranging from simulating quantum chemistry to understanding information dynamics in quantum circuits. While the faithful representation of full many-particle Hilbert spaces on a classical computer is exponentially costly, efficient approximate descriptions for specific purposes have been developed such as tensor network representations or mapping random circuits to statistical mechanics models. Also, recent advances of quantum technologies enable the empirical investigation of previously unexplored regimes of physics with high complexity, demanding new approaches to robustly controlling and utilizing near-term quantum devices for scientific discoveries and practical applications. This workshop will report the status quo of these developments and facilitate discussions for future research directions.

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

Participation

Additional information about this workshop including links to register and to apply for funding, can be found on the web page listed below. Encouraging the careers of women and minority mathematicians and scientists is an important component of IPAM's mission, and we welcome their applications.

Organizers

Soonwon Choi (Massachusetts Institute of Technology), **Sophia Economou** (Virginia Tech), **Lloyd Hollenberg** (University of Melbourne), **Prineha Narang** (UCLA), **Richard Ross** (UCLA).

Speakers

Andrew Daley (University of Strathclyde)
Bill Fefferman (University of Chicago)
Vedika Khemani (Stanford University)
Isaac Kim (UC Davis)
Jooho Lee (Harvard University)
Nick Mayhall (Virginia Polytechnic Institute and State University)
Prineha Narang (UCLA)
Roman Orus (Donostia International Physics Center)
Stephanie Reimann (Lund University)
Norbert Schuch (University of Vienna)

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For more information, visit the program webpage:
www.ipam.ucla.edu/CQCWS3