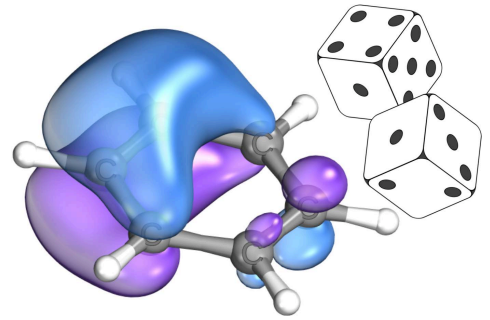# Workshop IV: Monte Carlo and Machine Learning Approaches in Quantum Mechanics

MAY 23 - 27, 2022

Scientific Overview

Quantum mechanics has strong connections with probability theory and statistics. Quantum problems can be formulated in terms of Feynman's imaginary-time path integrals, which maps some quantum partition functions onto classical ones which are then amenable to statistical sampling techniques. New statistical learning approaches are emerging that aim to account for the appropriate quantum physics. This workshop will bring together people interested in quantum systems and machine learning techniques. Specific topics will include topological phases, the sign problem, boundaries between classical and quantum statistics, entanglement, methods to parameterize the phase (or nodes) and amplitude of many-body wavefunctions, statistical approaches to functional approximation in DFT, and auxiliary field techniques. Generally speaking, this workshop will address new opportunities for statistical learning techniques which enable us to extend the reach and overcome the limitations of Monte Carlo and other methods as applied to quantum systems.

Long Program Schedule

This workshop is part of the long program on "Quantum Mechanics with Mathematics and Statistics"

- Opening Day : March 7, 2022
- Advancing Quantum Mechanics with Mathematics and Statistics Tutorials : March 8-11, 2022
- Workshop I: Multiscale Approaches in Quantum Mechanics : March 28 - April 1, 2022
- Workshop II: Model Reduction in Quantum Mechanics : April 11-15, 2022
- Workshop III: Large-Scale Certified Numerical Methods in Quantum Mechanics : May 2-6, 2022
- **Workshop IV: Monte Carlo and Machine Learning Approaches in Quantum Mechanics : May 23-27, 2022**
- Culminating Workshop at Lake Arrowhead : June 5-10, 2022

Participation

Additional information about this workshop including links to register and to apply for funding, can be found on the webpage 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

Kieron Burke (University of California, Irvine), **David Ceperley** (University of Illinois at Urbana-Champaign), **Marivi Fernández-Serra** (SUNY Stony Brook), **Anatole von Lilienfeld** (University of Basel), **Jonathan Weare** (New York University)

Speakers

Speaker list to be announced.