Jue Xu

juexu@terpmail.umd.edu
xujuexujue@hotmail.com
GitHub Homepage

Education

University of Hong Kong *Jun 2022 - Present*
Research Intern (Remote)

University of Maryland, College Park *Aug 2018 - Jun 2021*
Master in Computer Science

University of Chicago, IL *Aug 2017 - Jun 2018*
Master in Physical Sciences, Physics

National University of Singapore *Jan 2016 - Jun 2016*
Exchange student, University Scholarship Program

Fudan University, Shanghai, China *Aug 2013 - Jun 2017*
Bachelor, Department of Nuclear Science and Technology

Research Interests

Intersection of Physics and Computation: Models of Quantum Computation, Quantum Simulation, Complexity of Quantum Algorithms, Machine Learning for Physical Problems, Quantum Information.

Courses Taken

Physics: Quantum Field Theory, The Physics of Quantum Information, General Relativity, Advanced Statistical Mechanics, Implementation of Quantum Information Processors, etc.

Computer Science: Theory of Algorithms, Quantum Information Processing, Machine learning, Cryptography, Algorithmic Lower Bounds etc.

Mathematics: Discrete Mathematics, Quantum Computing, Stochastic Methods with Applications, Scientific Computing, Group Theory etc.

Teaching Assistant Experience

Introduction to Quantum Computing (Prof. Andrew Childs) *2019 Spring*

Design and Analysis of Computer Algorithms (Prof. Andrew Childs) *2019 Fall*

Introduction to Data Science *2019 Summer & 2020 Fall*

Discrete Structures *2018 Fall & 2019 Spring*

Research Experience and Publication

Quantum graph kernels, symmetries, and speedups [In progress] *2022*
We discuss the quantum analogue of graph kernels in machine learning, mainly based on quantum random walks. Quantum advantages in learning graph properties are investigated from the perspective of groups and symmetries.

Towards efficient and generic entanglement detection by machine learning [arXiv][Code] *2022*
J. Xu, Q. Zhao. Summer Research Intern at Univeristy of Hong Kong supervised by Dr. Qi Zhao
We propose a flexible, machine learning assisted entanglement detection protocol that is robust to different types of noises and also experimental-friendly. In this protocol, an entanglement classifier for a generic

entangled state is obtained by training a classical machine learning model with a synthetic dataset. The dataset contains classical features of two types of states and their labels (either entangled or separable). The classical features of a state, that is expectation values of a set of k-local Pauli observables, are estimated sample-efficiently by the classical shadow method.

On Lagrangian formalism of quantum computation [arXiv] [QIP2022 Poster] *2021*
J. Xu. Research Project at University of Maryland
We reformulate quantum computation in terms of Lagrangian (path integral) formalism, in contrast to the common Hamiltonian (unitary gate) formulation. We exemplify this formalism with some widely-studied models, including standard quantum circuit model, quantum optimization heuristics, and quantum random walk. The meanings of Lagrangian (action), such as complexity, are interpreted in various contexts of quantum computation. Furthermore, an analog quantum simulation scheme is suggested where the Lagrangian serves as the starting point and the sum-over-path method is applied.

Separations between different complexity measures: a survey [PDF] *2018*
Master Thesis at University of Chicago supervised by Prof. Alexander Razborov
Complexity measures and techniques for lower bounds are surveyed in different computational models, including deterministic, randomized and quantum computation. The separations between quantum and classical computation are reviewed from the view of structure and symmetry.

Phase transitions of finite-size systems *2015-2017*
Research Project at Fudan University supervised by Prof. Yongli Ma
A novel statistical mechanics framework for finite-size systems is proposed by giving a new form of density matrix. We numerically calculate the specific heat capacity of the finite-size Bose-Einstein condensation system according to the proposed theory and compare it with the experiment data.

Energy levels and transition rates for Al-like Cu XVII [DOI] *2017*
Y. Liu, R. Si, C. Zhang, K. Wang, Y. Cai, **J. Xu**, M. Gu, C. Chen, *Atomic Data and Nuclear Data Tables* 127 (2019): 140-161. (*I did part numeric calculation*)

Transverse vibrations of a thin loaded rod: theory and experiment [DOI] *2014*
J. Xu, Y. Chen and Y. Ma, *Eur. J. Phys.* 36 055035 (2015)
The general formulation of a determinate solution problem is deduced for the transverse vibrations of a thin loaded rod. The vibration frequencies of a thin homogeneous rod carrying a concentrated mass as a function of the load's position and mass are analytically solved. The dynamic measurement method of Young's modulus of the rods is presented within this theory and this method is validated by our experiments.

Conferences

The Conference on Quantum Information Processing (QIP) *Mar 2022*
California Institute of Technology (Present Poster Online)

Theory of Quantum Computation, Communication and Cryptography (TQC) *Jun 2019*
University of Maryland, College Park

Workshop on Quantum Machine Learning *Sep 2018*
University of Maryland, College Park

Honors & Awards

Scholarship to cover one-half tuition granted by University of Chicago *2017*

Scholarship granted by Shanghai Institute of Applied Physics *2015*

Science and Technology Innovation Prize for Undergraduate awarded by Fudan University *2015*