# Haochen (Harry) Wang

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## SUMMARY

Physics graduate student with a concentration in high energy physics, quantum information science, excellent computer skills, and a passion for computer music.

## EDUCATION

**University of California, Los Angeles, CA**                     *Sep 2023 – Sep 2024 Expected*
MQST (Master of Quantum Science and Technology), CIQC Fellowship                     GPA: 3.5/4.0

Capstone Project (Thesis) (in progress):                     *Supervisor: Prof. Zhongbo Kang*
Quantum Simulation in 1D Schwinger Model

**Hampshire College, Amherst, MA**                     *Sep 2018 – May 2023*
B.A. in Physics and Computer Science                     Five College GPA: 3.8/4.0

DIV III (Senior Thesis):                     *Supervisor: Prof. Michael Ramsey-Musolf*
High Energy Physics - Precision Electroweak Computation

**Relevant Courses:**
High Energy Physics, Solid State Quantum Computing Lab, Ensemble Quantum Computing Lab, Quantum Optics, Quantum Algorithms, Quantum Computation, Quantum Information, Quantum Mechanics, Electrodynamics, Statistical Mechanics, Classical Mechanics, Modern Physics, PDE & ODE, Statistics, Calculus, Linear Algebra, Discrete Math, Machine Learning, Artificial Intelligence, Data Structure, Digital Circuit and Computer Systems

## RESEARCH INTERESTS

• High Energy Physics: precision electroweak physics as probe for physics beyond the standard model; machine learning for processing particle collider data
• Quantum Information Science: quantum simulation for topics in high energy physics, with a focus on quantum field theory; quantum error correction
• Computer Music: jazz music theory (progression) with group theory

## RESEARCH EXPERIENCE

**Kang Research Group**                     Mar 2024 - Present
*Research Assistant*
UCLA, CA                     *Advisor: Dr. Zhongbo Kang*
• Performing quantum simulation on 1D Schwinger Model
• Investigating QCD with quantum simulation

### Amherst Center for Fundamental Interactions
*Undergraduate Research Assistant*
Sep 2022 - Jul 2023

UMass Amherst, MA *Advisor: Dr. Michael Ramsey-Musolf*
- Performed precision higher order (NLO, NNLO) electroweak computation on Standard Model and beyond
- Investigated impact of non-perturbative strong interaction on "radiative corrections"

### Krastanov Lab @ UMass Amherst
*Undergraduate Research Assistant*
Dec 2022 - Jun 2023

UMass Amherst, MA *Advisor: Dr. Stefan Krastanov*
- Wrote Julia-based simulator library for Quantum Clifford circuit
- Utilized CUDA.jl to develop a GPU-accelerated Quantum Clifford library, surpassing the performance of state-of-the-art CPU-based libraries by a 300% speed improvement

### Center for Knowledge and Communication
*Undergraduate Research Assistant / Software Engineer*
Jul 2022 - May 2023

UMass Amherst, MA *Advisors: Dr. Beverly Woolf, Dr. Ivon Arroyo*
- Overhauled the admin software system for the MathSpring experiment
- Created the data pipeline for the back-end system
- Optimized the efficiency of the software system by decreasing the processing time
- Built new software features for research workflow using Python and FastAPI

### Independent Research on High Energy Physics
May 2022 - Aug 2022

NA *Mentor: Dr. Gunther Roland*
- Analyzed the dihadron correlation of 2015 LHC CMS PbPb data of $\sqrt{S_{\mathrm{NN}}} = 5.02$TeV
- Wrote optimized the code using python and tensor (CUDA) processing to improve code efficiency: less than 1 hour processing time compared to 10+ hours of for-in-loops

### Independent Research on NISQ-Algorithm
Apr 2022 - Jul 2022

NA *Mentor: Dr. Sukin (Dylan) Sim*
- Investigated near-term quantum algorithms
- Conducted analysis of simulations with IBM qiskit
- Compared between NISQ Quantum Algorithm and Fault-Tolerant Quantum Algorithm

## TECHNICAL and COURSE PROJECTS

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### NV- Center Diamond Quantum Computing, UCLA
Apr 2024 - Present
- Setting up pulse quantum computation with NV- centers in diamond

### Ensemble Quantum Computing with NMR, UCLA
Jan 2024 - Mar 2024
- Performed ensemble quantum computing with nuclear magnetic resonance

### Knapsack Problem with QAOA, UCLA
Sep 2023 - Dec 2023
- Solved knapsack problem in Quantum Approximate Optimization Algorithm (QAOA), achieved lower time complexity compared to classical dynamic programming

### Quantum Simulator, UCLA
Sep 2023 - Dec 2023
- Wrote stated based quantum simulator with Julia.

### Machine Learning, UMass Amherst
Jan 2022 - Jun 2022
- Created various range of machine learning model from scratch (without ML library)
- Compared the performance of different methods with different data sets

**Intro to Quantum Computation,** UMass Amherst                                   Jan 2022 - Jun 2022
- Conducted simulation of Quantum Counting Algorithm w/o noise on Transmons Quantum Computation

**Applied Partial Differential Equation,** Smith College                          Jan 2022 - Jun 2022
- Attempted to investigate method on solving certain types of PDE using Quantum Computation method - Hamiltonian Simulation
- Performed one simple numerical solve of PDE on quantum system

**Evolutionary Music Composer,** NA                                               May 2020 - Jul 2020
- Proposed and created a mock AI music composer with variational autoencoder algorithm

**Wuhan2020 Data Collection,** NA                                                 Jan 2020 - Feb 2020
- Volunteered to collect and analyze the data of medical resources at the very beginning of the COVID-19 outbreak

**Data Structure,** Smith College                                                Sep 2019 - Dec 2019
- Developed a mock 2048 game
- Created AI model to get high score using min-max tree and reinforcement learning

**Five College Data Fest,** Five College Consortium                              Mar 2019 - Mar 2019
- Worked on athletes' health recovery data in one-week data fest/hackathon

## TECHNICAL SKILLS

**Programming:**
Proficient in Julia, Python, QASM, Java, JavaScript, Unix shell scripting , C, Swift, MySQL, HTML and LaTeX
Working knowledge of Verilog/FPGA Programming

**Lab:**
Quantum Optic Equipment, QuTools, SpinSolve NMR System, NV- Center Diamond System

**Software/Pipelines:**
Machine Learning, Reinforcement Learning, Neural Network, IBM-qiskit, SciPy, NumPy, PyTorch, Pandas, R, Matlab, Mathematica, Jupyter Notebook, FastAPI, Django, Flutter

**Languages:**
Native/Bilingual proficiency in English and Chinese; limited proficiency in Japanese and German

## JOB EXPERIENCE

**SailEagle. Co.**                                                               Jun 2023 - Feb 2024
*Business Development*
Beijing, P.R.China
- Coordinated transnational conferences to showcase company products
- Attended industry convention to showcase products

**I.N.T. UNIT**                                                                  Dec 2020 - Aug 2021
*Audio Engineer, Music Production Tutor, DJ Tutor*
Beijing, P.R.China
- Taught students about music production, DJ skills and techniques
- Designed a new curriculum integrating cultural background of different music genres

**IT Diagnostic Center** — Sep 2018 - Dec 2019
*Student Technician*
Hampshire College, MA — *Supervisor: Rae-Ann Wentworth*
• Performed daily maintenance to hardware devices and software issues of Hampshire College IT system
• Co-designed an update for the IT Ticket system

**Hampshire College Media Lab** — Sep 2018 - Dec 2019
*Lab Monitor*
Hampshire College, MA — *Supervisor: John Bruner*
• Guided student on how to use all the equipment and software in the lab, including: 3D printers, video editing, audio recording and more
• Troubleshooted glitches of equipment

## AWARDS and GRANTS

**NSF Challenge Institute for Quantum Computation Fellowship** — 2023-2024
**Humanitas Award Scholarship,** Hampshire College — 2018-2019, 2021-2023
**Dr. Lucy McFadden Grant,** Hampshire College — 2023