

Jiakai Wang

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Education

University of Wisconsin-Madison

Madison, WI

PH.D. IN PHYSICS (IN PROGRESS); M.S. IN PHYSICS (MAY 2025)

September 2024 - Present

- 50% Graduate Research Assistantship with Prof. Maxim Vavilov.
- **Courses:** High Performance Computing, Quantum Comp Lab, Solid-State Phys, Electrodynamics.

University of Wisconsin-Madison, B.A.

Madison, WI

B.A. IN DATA SCIENCE, GPA: 3.67/4, RESEARCH INTERN JANUARY 2024 - AUGUST 2024 W/ PROF. MAXIM VAVILOV.

September 2021 - December 2023

- **Courses:** Quantum Mech, Atomic Structure, Grad. Stochastic Processes, Artificial Intelligence, Combinatorics, Optimization, Time Series.
- **Extracurricular:** Wisconsin Quantum Computing Club, Peer TA for CS 540 Intro to AI.

South China University of Technology

Guangzhou, China

UNDERGRADUATE STUDY IN SOFTWARE ENGINEERING.

September 2019 - May 2021

- **Courses:** Computer Architecture, Operating Systems, Computer Network, Algorithms, Data Structures.

Publications & Presentations

Wang J, Mencia RA, Manucharyan VE, Vavilov MG. Erasure conversion in integer fluxonium qubits.

PRX Quantum accepted. doi: <https://doi.org/10.1103/jzsm-48h7>

PRESENTED AT APS MARCH MEETING 2025, ANAHEIM, CA, "ERASURE CONVERSION IN INTEGER FLUXONIUM QUBITS", PRESENTED AT

March 2026

APS MARCH MEETING 2026, DENVER, CO, "SELECTIVE DARKENING GATE FOR GOF INTEGER FLUXONIUM ERASURE DETECTION"

ARXIV: [HTTPS://ARXIV.ORG/ABS/2603.21003](https://arxiv.org/abs/2603.21003)

Perlin MA, Premakumar VN, Wang J, Saffman M, Joynt R. Fault-tolerant measurement-free quantum error correction with Multiqubit Gates. Physical Review A. 2023;108(6). doi:10.1103/physreva.108.062426

PRESENTED AT APS MARCH MEETING 2024, MINNEAPOLIS, MN

March 2024

ARXIV: [HTTPS://ARXIV.ORG/ABS/2007.09804](https://arxiv.org/abs/2007.09804)

Research

GPU-based Pauli Frame QEC simulation

UW-Madison ECE

ADVISOR: PROF. TSUNG-WEI HUANG

October 2024- present

- Maximizing compute efficiency by using multiple CUDA cores in the same streaming multiprocessor to parallelize instructions, keeping most of the active data in shared memory (L1 cache). Fast simulation generates enough data for training ML models.
- Delivers **C++ executable** linked with static library compiled from a subset of Stim source code (C++20) and custom GPU code (C++17).

QEC with dual-species superconducting qubits

UMass-Amherst Physics

ADVISORS: PROF. CHEN WANG, PROF. MAXIM VAVILOV

November 2024- present

- Numerically evaluating the fault-tolerance and error propagation of a novel implementation of surface code.

Erasure Conversion Methods and Erasure-Biased Gates in Fluxonium

UW-Madison Physics

MENTORS: PROF. MAXIM VAVILOV, DR. RAYMOND MENCIA, PROF. VLADIMIR MANUCHARYAN

June 2023- present

- Analytically derived the coherence and incoherent dephasing rates in qubit subspace during resonator readout. Designed leakage detection protocols that preserve qubit coherence via harmonic and anharmonic resonator. Performed Monte Carlo simulations to characterize SNR.
- Estimated fluxonium lifetimes. Proposed gates that preserve the erasure-dominant error structure. **Established integer fluxonium as an erasure qubit for hardware-efficient FTQC.**
- Developed package to streamline gate-level noise simulation with vectorized computation of posterior probabilities for decoding erasure conversion using distributed computing. Enables deterministic injection of errors for importance sampling and simulating correlated error. Importance sampling with heuristic ansatzes or landscape reconstruction techniques can significantly enhance the efficiency of logical error rate estimation compared to traditional Monte Carlo simulations.
- Developed a package to enable Hamiltonian simulation of superconducting qubits with low-user-friction and high-performance.

Hardware-Tailored Measurement-free Quantum Error Correction

UW-Madison Physics

MENTORS: PROF. ROBERT JOYNT, DR. MICHAEL PERLIN, PROF. MARK SAFFMAN

September 2022- March 2023

- We explored combinatorial design-inspired circuits to enable fault-tolerance of measurement-free QEC under noise model derived from Hamiltonian simulation. Evaluated the applicability of fault-tolerance techniques like flag scheme, logical ancilla, concatenation using transversal gates, and approximately bias-preserving gadgets.

Measurement Error Detection/Correction in NISQ

UW-Madison CS

ADVISOR: PROF. SWAMIT TANNU

April 2022- August 2022

- Designed a NISQ compiler subroutine to use repetition codes to mitigate measurement error.

Other Research

- DNN for brain disease prediction, PyTorch | Mentor Prof. Kai Wu, SCUT

March 2021- May 2021

Work Experience

PricewaterhouseCoopers Management Consulting (Shanghai) Limited

Guangzhou, China

RISK ASSURANCE INTERN

June 2021- August 2021

- Data audit and business analysis for client.

Honors & Awards

SOUTH CHINA UNIVERSITY OF TECHNOLOGY

2020 **2nd-Class University Level Scholarship (5/60)**, 2019-2020 Academic Year

Guangzhou, China

2020 **Completion Award**, 37 Interactive Programming Contest, (used Dart, Flutter, PHP, MySQL)

Guangzhou, China

Skills

Blender, ComfyUI, Photoshop, Illustrator, Docker, Flutter, Final Cut Pro, Logic Pro, C++ (CUDA, OpenMP), Python, Mathematica
TeX, Bash, Julia, JavaScript, HTML/CSS, English, Chinese, Cantonese