Tong Shen

(934) 246-7022 | tong.shen.1@stonybrook.edu | GitHub | LinkedIn | Website

ABOUT ME

Ph.D. student in Applied Mathematics working on distributed quantum computing and quantum control. Experience in quantum simulation and machine learning. Seeking quantum research and engineering internships.

Eligible for the Strategic Partnership for Industrial Resurgence program as a SUNY student. This program offers New York State employers opportunities to save cost and build cooperation with SUNY, while offering employees sponsorship from the Research Foundation of the State of New York.

EDUCATION

Stony Brook University | Stony Brook, NY, USA 08/2025 – Present
Ph.D. in Applied Mathematics and Statistics | GPA: 4.0/4.0 | Expected graduation: May 2029
Track: Computational Applied Mathematics
M.S. in Applied Mathematics and Statistics 08/2024 – 05/2025
Department of Applied Mathematics & Statistics | GPA: 4.0/4.0

Fudan University | Shanghai, China 09/2020 – 06/2024
B.S. in Physics
Department of Physics

RESEARCH EXPERIENCE

Distributed Variational Quantum Linear Solver
09/2025 – 03/2026 | Advisor: Prof. Ji Liu | https://arxiv.org/abs/2604.01426 | Stony Brook University

- Designed a distributed variational quantum linear solver for systems of dimension $2^{50} \times 2^{50}$, using block matrix partitioning and local linear combination of unitaries (LCU) decompositions, coordinated through DIGing and collective Adam.
- Derived a distributed least-squares formulation and local quantum cost functions, with expectation values evaluated through Hadamard tests and gradients through parameter-shift rules.
- Demonstrated in PennyLane simulations that solvable system dimension scales with the number of agents, exceeding single device NISQ limits while tolerating sparse communication graphs. MPS simulation for 51 qubits.

Reinforcement Learning for Quantum Gate Control with Zero-Shot Generalization
04/2026 – Present | Advisors: Prof. Ji Liu and Prof. Hyeongrak Choi | Stony Brook University

- Demonstrated zero-shot generalization across any two-qubit gate, achieving mean average gate fidelity above 0.98 and a tenfold reduction in gate error relative to an analytical baseline; evaluated robustness under modeled non-Markovian detuning noise.
- Developed a reinforcement learning workflow for pulse-level quantum gate control, integrating Walsh-function-based calibration and projection-based observations.
- Used Slurm to run parameter sweeps and aggregate simulation results for analysis.

Federated Variational Quantum Linear Solver
09/2025 – 04/2026 | Advisor: Prof. Ji Liu | Stony Brook University

- Developed a federated VQLS protocol using LCU decomposition of private submatrices on local NISQ clients, with a central classical server coordinating parameter updates.
- Showed in PennyLane simulations that expanding the client pool increases solvable linear system dimension beyond a single NISQ processor.

Machine-Learned Jet Time and Trackless Jet Vertexing
06/2023 – 05/2024 | Advisor: Prof. Zhen Liu | University of Minnesota

- Showed that combining collider timing data with deep learning yields jet-time precision 4 times better than prior work, and built a time-based reconstruction model recovering displaced vertices where current detectors fail.
- Designed the workflow of data generation, input normalization and parameter scan using TensorFlow and C++.

RESEARCH EXPERIENCE (CONTINUED)

Machine Learning for Top Quark Effective Theory
04/2023 – 05/2024 | Advisor: Prof. Jiayin Gu | Fudan University

- Integrated neural networks with the SMEFT framework to tighten constraints on new-physics couplings via learned likelihood scores and Fisher information.

EMPLOYMENT

Research Assistant | Stony Brook University 01/2026 – Present
Department of Applied Mathematics & Statistics | Advisor: Prof. Ji Liu
Distributed quantum computing; Reinforcement learning; Quantum control

Teaching Assistant | Stony Brook University 08/2025 – 01/2026
Fundamentals of Computing | Instructor: Prof. Chenyu You
Led office hours and live code walkthroughs for a 40-student computing course, helping students diagnose programming errors and understand MATLAB, Python, and C++ implementations.

Visiting Scholar | University of Minnesota 06/2023 – 08/2023
School of Physics and Astronomy | Advisor: Prof. Zhen Liu
Energy Flow Network; SHAP; Deep learning; Particle Physics toolkit

PUBLICATIONS & PREPRINTS

Tong Shen, Zeru Zhu, and Ji Liu. *Distributed Variational Quantum Linear Solver*. 2026. Preprint. arXiv:2604.01426
Submitted to the 2027 American Control Conference (ACC 2027).

CONFERENCES

APS Global Physics Summit 2027 — Planned presentation on reinforcement learning for quantum gate control.
IEEE Quantum Week (QCE 2026), IEEE International Conference on Quantum Computing and Engineering — Attendee, Toronto, Canada, 09/2026
SIAM New York–New Jersey–Pennsylvania Section Annual Conference (SIAM NNP 2025) — Attendee, State College, PA, 11/2025

SKILLS

Quantum Algorithms: Distributed and variational quantum algorithms, quantum linear solvers, LCU decomposition, quantum circuit simulation; Qiskit, PennyLane, QuTiP

ML & Optimization: PyTorch, TensorFlow; Deep RL (DDPG / PPO / GRPO), Distributed optimization, Monte Carlo methods, Numerical Methods for PDEs

AI Research Tools: MCP server development, Graph engineering, Autonomous theorem proving

Programming: Python (NumPy, SciPy, Matplotlib), C/C++, MATLAB, Mathematica, Lean 4

Systems & HPC: Linux, Git, Docker, Slurm

Quantum Coursework — Instructor: Prof. Tzu-Chieh Wei

- **Quantum Programming:** Qiskit simulator and runtime; course presentation on HHL and quantum singular value transformation (QSVT).
- **Quantum Information Science:** Quantum algorithms and quantum error correction; course presentation on the general parameter-shift rule.

Selected Coursework: Reinforcement Learning, Natural Language Processing;
Numerical Linear Algebra, Numerical Methods for PDEs, Foundations of Numerical Analysis.

AWARDS & LEADERSHIP

Outstanding Graduates Scholarship, 3rd Prize, Fudan University | 2024
Physics Major Scholarship, Fudan University | 2023
Youth Committee Member, Fudan University New York Alumni Association | 2024 – Present