# Mu-Te **Lau**

Graduate Researcher Specialized in Quantum Circuit Compilation

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## Education

**Northwestern University** — *Evanston, IL, USA*

Ph.D. in Computer Science (Advisor: Nikos Hardavellas) — *Sep. 2025–Jun. 2030 (Expected)*

- Specialization: Quantum Compiler and Quantum System Software

**National Taiwan University** — *Taipei, Taiwan*

M.S. in Electrical Engineering (Advisor: Chung-Yang (Ric) Huang, GPA (3.94/4.30)) — *Sep. 2022–Jun. 2024*

- Studied logical quantum circuit synthesis and optimization
- **Received 2022 GIEE Scholarship for Outstanding Academic Performance (Top 8% GPA in 236 students)**
- **Completed the *Quantum Computation and Quantum Information Program*** organized by Dept. of Physics, NTU

**National Taiwan University** — *Taipei, Taiwan*

B.S. in Electrical Engineering (GPA: (3.86/4.30); GPA since junior: (3.95/4.30)) — *Sep. 2017–Jun. 2022*

## Research Experience

**Design Verification Lab, National Taiwan University** — *Taipei, Taiwan*

Part-Time Research Assistant; later promoted to Research Associate — *Sep. 2022 - Feb. 2025*

- Researched quantum circuit optimization for the *Quantum Program Verification and Transformation* Project, funded by NSTC, Taiwan
- Helped prepare course material for the *Open-Source Software Talent Development in Quantum Computing* Project, funded by MOE, Taiwan
- Led the development and maintenance of Qsyn, an open-source quantum circuit synthesis framework developed by our lab

## Publications

**A Lazy Resynthesis Approach for Simultaneous T Gate and Two-Qubit Gate Optimization of Quantum Circuits | arXiv** — *National Taiwan University, Taiwan*

Mu-Te Lau, Hsiang-Chun Yang, Hsin-Yu Chen, Chung-Yang (Ric) Huang — *Sep. 2025, To appear on IEEE QCE 2025*

- **Reduced 2Q-count overhead by 54.8% for tableau-based quantum circuit optimization while achieving 1.81× speedup**
- A more scalable approach to ZX-calculus-based optimizations while yielding comparable 2Q-counts

**Multi-Objective Quantum Circuit Optimization by Combining Tableau-Based and ZX-Diagram-Based Techniques | Master's Thesis** — *National Taiwan University, Taiwan*

Mu-Te Lau (Advisor: Chung-Yang (Ric) Huang) — *Jul. 2024, Master's Thesis*

- **Proposed a hybrid QCO flow for Clifford+T circuits that give a 29.4% improvement in 2Q-counts over purely tableau-based flows**
- Revealed a trade-off between the choice of data structures that influence the optimization of two-qubit gate counts and T/H- gate counts

**Qsyn: A Developer-Friendly Quantum Circuit Synthesis Framework for NISQ Era and Beyond | arXiv | 160+ ⋆** — *National Taiwan University, Taiwan*

Mu-Te Lau, Chin-Yi Cheng, Cheng-Hua Lu, Chung-Yang (Ric) Huang (Corresponding Author), et al. — *Apr. 2024, Preprint*

- **Poster presented on IEEE QCE 2024 in Montréal, Canada and 6th IWQC in Berlin, Germany**
- A fast, modular, and research-backed open-source framework for quantum circuit synthesis

## Teaching Experiences

**Special Topics on Quantum Design Automation** — *National Taiwan University, Taiwan*

Head of Teaching Assistant, Graduate Institute of Electrical Engineering — *2023 Fall*

- Instructors: Profs. Chung-Yang (Ric) Huang, Jie-Hong (Roland) Jiang, James Chien-Mo Li, Shih-Hao Hung
- **Gave a TA lecture on ZX-calculus-based Quantum Circuit Optimization**
- Designed and graded assignments and final exams

**Quantum Information and Computation** — *National Taiwan University, Taiwan*

Head of Teaching Assistant, Graduate Institute of Electrical Engineering — *2023 and 2024 Spring*

- Instructor: Prof. Hao-Chung Cheng
- Designed and graded assignments and exams

**Web Programming** *National Taiwan University, Taiwan*

Teaching Assistant, Department of Electrical Engineering *2022 and 2023 Fall*

- Instructor: Prof. Chung-Yang (Ric) Huang
- Graded term projects, designed programming assignments, and maintained the course website

## Project Experiences

**Qsyn** | **arXiv** | **160+** ⋆ *National Taiwan University, Taiwan*

Quantum Computing; Modern C++; Docker *2022 Fall–Now*

- **Reimplemented and improved QCO algorithms to assess for scalable, high-performance quantum circuit synthesis**
- Implemented a flexible command-line interface to combine QCO algorithms flexibly
- Coordinated refactorings to core data structures to ensure code quality and flexibility
- Guided new team members with their contributions and taught them good coding practices

**Design Verification Lab Website** | *National Taiwan University, Taiwan*

JS/React; MongoDB; Docker *2021 Spring*

- Developed a new website with other labmates
- Enhanced web development skills, esp. in implementing data flow

**ZX-Diagrams as Intermediate Representation for Lattice Surgery Compilation** *National Taiwan University, Taiwan*

*Survey, C++* *2022 Spring–2023 Summer*

- Term projects of the courses *Fault-Tolerant Computing* and *Quantum Information and Computation*
- **Selected to be Exemplar Presentation Videos in the *2022 Quantum Information and Computation* Course**
- Compiled Fault-Tolerant Quantum Circuit to Lattice Surgery with ZX-calculus-based methods
- Achieved compact compilation results for quantum circuits with a small number of qubits

## Volunteer Experiences

**Community Concert** *Taipei, Taiwan*

National Taiwan University Wind Band *2017 Fall–2023 Fall*

- Held free concerts annually on the Chinese Moon Festival at Ching-Pai Village, Taipei

**College Programming Peer Tutor** *Taipei, Taiwan*

Department of Electrical Engineering, National Taiwan University *Mar. 2021–May 2021*

- Provided coding assistance for other students in the campus

## Leadership Experiences

**Band Leader; Chair Euphonium Player; Social Media Editor** *Taipei, Taiwan*

National Taiwan University Wind Band *Aug. 2019–Aug. 2024*

- Coordinated, as the band leader, the band's rehearsals and performances and solved administrative difficulties during the COVID pandemic
- Promulgated, as the social media editor, the band's events by garnering over 169.7K reaches and growing Instagram followers by 43%

**Server & Network Administrator** *Taipei, Taiwan*

Design Verification Lab, National Taiwan University *Feb. 2022–Feb. 2025*

- Maintained the lab servers and pertinent hardware such as routers, NAS, and firewalls
- Built comprehensive documentation for future administrators

## Certificates

2023 **TOEFL iBT**, 108/120
Reading 30 / Listening 29 / Speaking 22 / Writing 27

2021 **GRE General Test**, 335/340
Quantitative 170 / Verbal 165 / Analytic Writing 4.0

## Skills

**Programming** Modern C++, Shell, Python, JavaScript, Rust
**Quantum Computing Tools** Qiskit, PyZX, Feynman
**Web Development** JS/React, Next.js, Docker, MongoDB
**Languages** Mandarin (Native), English (Proficient), Japanese (Basic), German (Basic)