

Charles Yuan

MIT Computer Science and Artificial Intelligence Laboratory
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ACADEMIC APPOINTMENTS

University of Wisconsin, Madison, WI.

Assistant Professor of Computer Science

starting August 2025

Massachusetts Institute of Technology, Cambridge, MA.

Graduate Research Assistant

2020–2025

EDUCATION

Massachusetts Institute of Technology, Cambridge, MA.

Ph.D. in Computer Science

expected August 2025

S.M. in Computer Science

May 2022

Advisor: Prof. Michael Carbin. Thesis: *Foundational Abstractions for Quantum Programming*.

Carnegie Mellon University, Pittsburgh, PA.

B.S. in Computer Science

May 2019

Advisor: Prof. Jan Hoffmann. Thesis: *Exact Bayesian Inference with Distribution Transformers*.

SELECTED PUBLICATIONS

The T-Complexity Costs of Error Correction for Control Flow in Quantum Computation.

PLDI 2024

Charles Yuan, Michael Carbin.

Quantum Control Machine: The Limits of Control Flow in Quantum Programming.

OOPSLA 2024

Charles Yuan, Agnes Villanyi, Michael Carbin.

Tower: Data Structures in Quantum Superposition.

OOPSLA 2022

Charles Yuan, Michael Carbin. **Distinguished Artifact Award.**

Twist: Sound Reasoning for Purity and Entanglement in Quantum Programs.

POPL 2022

Charles Yuan, Chris McNally, Michael Carbin.

HONORS AND AWARDS

CQE-LPS Doc Bedard Fellowship

2023–2025

RPI Rising Star in Quantum Computing

2024

Jane Street Graduate Research Fellowship Honorable Mention

2023

OOPSLA 2022 Distinguished Artifact Award

2022

NSF Graduate Research Fellowship Honorable Mention

2020

Allen Newell Award for Undergraduate Research Excellence (Best Undergraduate Thesis)

2019

ADDITIONAL PUBLICATIONS

- Codesign of Error-Correcting Codes and Modular Chiplets in the Presence of Defects.* ASPLOS 2024
Sophia Lin, Joshua Visslai, Kaitlin Smith, Gokul Ravi, **Charles Yuan**, Frederic Chong, Benjamin Brown.
- Semi-Symbolic Inference for Efficient Streaming Probabilistic Programming.* OOPSLA 2022
Eric Atkinson, **Charles Yuan**, Guillaume Baudart, Louis Mandel, Michael Carbin.
- Statically Bounded-Memory Delayed Sampling for Probabilistic Streams.* OOPSLA 2021
Eric Atkinson, Guillaume Baudart, Louis Mandel, **Charles Yuan**, Michael Carbin.

PREPRINTS AND PEER-REVIEWED WORKSHOP PAPERS

- Expressing and Analyzing Quantum Algorithms with Qualtran.* arXiv: 2409.04643, 2024.
M. Harrigan, T. Khatrar, **C. Yuan**, A. Peduri, N. Yosri, F. Malone, R. Babbush, N. Rubin.
- Analyzing Quantum Programs Using the Power of Interaction.* PPlanQC at ICFP 2022
Agnes Villanyi, **Charles Yuan**, Chris McNally.
- Probabilistic Inference for Quantum Programs.* I2Q at ISCA 2021
Charles Yuan, Yipeng Huang, Michael Carbin.
- BLT: Exact Bayesian Inference with Distribution Transformers.* Technical Report, 2019
Charles Yuan, Jan Hoffmann. **Allen Newell Award for Best Undergraduate Thesis.**

TEACHING EXPERIENCE

- Massachusetts Institute of Technology, Cambridge, MA.
6.1120: Dynamic Computer Language Engineering Fall 2023
Teaching Assistant for Prof. Martin Rinard. Class size: 20.
- Carnegie Mellon University, Pittsburgh, PA.
15-312: Principles of Programming Languages Spring 2018–Spring 2019
Teaching Assistant for Profs. Robert Harper and Jan Hoffmann. Class size: 50.
- 98-317: Hype for Types* Spring 2018–Spring 2019
Founding Instructor alongside Vijay Ramamurthy, Chris Grossack, Jeanne VanBriesen. Class size: 20.
- 15-210: Parallel and Sequential Data Structures and Algorithms* Spring 2017–Fall 2017
Head Teaching Assistant for Profs. Guy Blelloch and Robert Harper. Class size: 200.
- 15-122: Principles of Imperative Programming* Spring 2016–Fall 2016
Teaching Assistant for Profs. Rob Simmons, Illiano Cervesato, and Tom Cortina. Class size: 400.

TALKS AND SEMINARS

- DIMACS Workshop on Quantum Software Systems and Theory New Brunswick, NJ, May 2025
Cornell University Ithaca, NY, April 2025
Georgia Institute of Technology Atlanta, GA, March 2025

QuEra Computing	Boston, MA, March 2025
Northwestern University	Evanston, IL, March 2025
University of Michigan	Ann Arbor, MI, March 2025
Carnegie Mellon University	Pittsburgh, PA, March 2025
Columbia University	New York, NY, March 2025
Max Planck Institute for Security and Privacy	Bochum, Germany, February 2025
Purdue University	West Lafayette, IN, February 2025
University of Wisconsin–Madison	Madison, WI, February 2025
Boston University	Boston, MA, February 2025
Tufts University	Medford, MA, December 2024
Harvard University	Boston, MA, October 2024
University of California, Los Angeles	Los Angeles, CA, August 2024
Stanford University	Stanford, CA, May 2024
Raytheon BBN Technologies	Cambridge, MA, May 2024
Northeastern University	Boston, MA, May 2024
University of California, San Diego	San Diego, CA, May 2024
Columbia University	New York, NY, April 2024
University of Chicago	Chicago, IL, April 2024
University of Illinois Urbana-Champaign	Urbana, IL, April 2024
Carnegie Mellon University (seminar and guest lecture)	Pittsburgh, PA, October 2023
EPFL / Swiss Federal Institute of Technology	Lausanne, Switzerland, October 2023
ETH Zurich / Swiss Federal Institute of Technology	Zurich, Switzerland, October 2023
Imperial College London	London, United Kingdom, October 2023
Rensselaer Polytechnic Institute	Troy, NY, October 2023
TTI/Vanguard Rebooting Computing Conference	Montreal, Canada, June 2023
National Research Institute of Poland	Virtual, March 2023
Tsinghua University	Virtual, October 2022
PLanQC 2022 (invited speaker)	Ljubljana, Slovenia, September 2022
University of Chicago	Virtual, May 2022
IBM Quantum	Virtual, March 2022
Implications of Quantum at SXSW	Austin, TX, March 2022
Stanford University	Virtual, January 2022

INDUSTRIAL EXPERIENCE

Google, Venice, CA.

Research Intern, Quantum AI May–August 2024

- Extended Qaltran framework for quantum programming in Python to support arithmetic over block encodings of matrices, enabling users to express leading algorithms for plasma physics simulation.

- Implemented optimizing compiler rewrites in Qualtran that asymptotically improve the performance of physical simulation, gaining several orders of magnitude of speedup at problem sizes of interest.

Hudson River Trading, New York, NY.

Core Developer, Trading Infrastructure

August 2019–August 2020

- Implemented regulatory compliance and risk management systems in a low-latency automated trading system based on C++ that processes a substantial fraction of daily volume on major capital markets.
- Extended trading system to connect with international markets in diverse and emerging asset classes.
- Enhanced primary interface used by firm traders to perform orders with market-impacting volume.

Two Sigma Investments, New York, NY.

Software Engineering Intern, Halite AI Challenge

May–August 2018

- Architected performant, cross-platform game engine in C++ featuring concurrent logic and command processing, as part of the latest iteration of the firm’s Halite artificial intelligence challenge.
- Specified and prototyped metaprogramming DSLs in OCaml to foster broader participation in Halite.

Airbnb, San Francisco, CA.

Software Engineering Intern, Guest Growth

May–August 2017

- Designed search engine using Java, Scala, and Hive to suggest textual content for listing descriptions, featuring custom term frequency functions, geographical queries, and parallel execution.
- Built NLP pipeline in Python for named entity recognition, PoS tagging, and sentiment analysis.
- Investigated unsupervised and supervised learning techniques in Python to derive semantic structure on textual data, and to recognize entities in multilingual texts using word vector models.

Google, Kirkland, WA.

Software Engineering Intern, Cloud Platform

May–August 2016

- Implemented Stackdriver Trace in Cloud Console for iOS, enabling users to see latency profiles of web application endpoints, monitor performance over time, and be notified of significant latency shifts.
- Designed and implemented backend server logic and client API in Java supporting high-performance data queries by control and monitoring features on iOS and Android.

EXTERNAL SERVICE

ACM SIGPLAN Long-Term Mentoring Committee (SIGPLAN-M) Mentor	2023–Present
ACM <i>Transactions on Quantum Computing</i> Journal Reviewer	2024
<i>Quantum</i> Journal Reviewer	2024
ACM <i>Transactions on Programming Languages and Systems</i> Journal Reviewer	2024
OOPSLA 2024 Artifact Evaluation Committee Member	2024
ICFP 2023 Artifact Evaluation Committee Member	2023
PLDI 2023 External Reviewer	2023
PLDI 2023 Artifact Evaluation Committee Member	2023

POPL 2023 Artifact Evaluation Committee Member	2022
PLMW at OOPSLA 2022 Student Mentor	2022

INSTITUTIONAL SERVICE

CSAIL/EECS Student Buddy Program Mentor	2023–2025
EECS Resources for Easing Friction and Stress Member	2022–2025
EECS Faculty Search Student Advisory Group Member	2023
MIT School of Engineering Dean’s Graduate Student Advisory Group Member	2022–2023
MIT Graduate Application Assistance Program Mentor	2021–2023
MIT School of Engineering and EECS Orientation Leader	2021–2022
Quantum Software Reading Group and PL Reading Group Coordinator	2021–2022
CSAIL Ahead Culture Committee Member	2020–2021

PRESS

<u>“A blueprint for making quantum computers easier to program”</u> — MIT News	April 2024
<u>“Meet Twist: MIT’s Quantum Programming Language”</u> — IEEE Spectrum	February 2022
<u>“A new language for quantum computing”</u> — MIT News	January 2022

REFERENCES

Michael Carbin

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Michael Hicks

Department of Computer Science
University of Maryland
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Martin Rinard

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University of California, Los Angeles
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Isaac Chuang

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