Justin Yirka, PhD

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SUMMARY

PhD with a decade in quantum computing research. 9+ publications in top venues (QIP, *Quantum*), 20+ professional presentations, intern at Los Alamos and Sandia National Labs. Experienced in Hamiltonian complexity and NISQ algorithms. Professional and academic work with Java, Python, Qiskit, Machine Learning, and scientific computing.

EDUCATION

The University of Texas at Austin, Austin, TX
PhD in Computer Science May 2025
Advised by Scott Aaronson. Quantum computing, algorithms, complexity theory, Hamiltonian complexity
MS in Computer Science May 2022

Virginia Commonwealth University, Richmond, VA
Dual Degrees, BS in Computer Science and BS in Mathematics May 2018
Minor in Physics, Certificate in Data Science
Awards: VCU Presidential Scholarship ($110,000).

EXPERIENCE

Blanqet, Remote August 2025 - Present
Quantum Computing Consultant
- Researcher and consultant for a new startup focused on quantum computing applications.

Sandia National Laboratories, Albuquerque, NM and Remote June 2023 - May 2025
R&D Intern
- Initiated and completed a research project in 6 months that was accepted to QIP (top venue).
- Analyzed Hamiltonian optimization problems and derived geometric approximations to prove NP-hardness of product state approximation problems. Proved hardness even in Heisenberg XYZ / Quantum MaxCut models.
- Developed new variants of Grover's (fault-tolerant) search algorithm with novel input models.

The University of Texas at Austin, Austin, TX
Graduate Research Assistant Aug 2019 - May 2025
- Secured and led a $10,000 NSF grant for quantum seminar and visitor series at UT.
- Produced 6+ original research papers under a famously hands-off adviser.
- Delivered 14+ technical presentations including at international conferences (videos available online).
- Independently identified research problems, managed projects and deadlines, and collaborated with distributed teams.
- Resilient to iterated failure. Learned and discussed new technical ideas and techniques on a constant basis.

Head Teaching Assistant: Quantum Information Science, online M.S. Aug 2021 - May 2024
- Led a 200+ student course for 4 semesters, managing up to 4 graduate TAs.
- Launched the course for the online MS program (key to the department's budget).
- Redesigned and adapted all course content for an online format, ensuring clarity and accessibility at scale.

Instructor: Software Engineering with Java, online June 2021 - July 2021
- Developed a comprehensive curriculum of 30 lectures including assignments and Java coding projects.

Los Alamos National Laboratory, Los Alamos, NM June 2019 - Aug 2019
Graduate Student Researcher
- Designed low-width NISQ algorithms for entanglement spectroscopy with error mitigation using qubit resets.
- Programmed noisy circuit simulations in Python Qiskit, and maintained code using git, Jupyter, and Unix tools. (link)
- Ran experiments with Honeywell (Quantinuum) ion-trap device.
- Designed plots and graphics with Python Matplotlib, interpreted data, and published in *Quantum*.

Graph Theory Discovery Lab at Virginia Commonwealth University, Richmond, VA May 2018 - Aug 2018
Research Assistant

- Programmed and debugged algorithms for computing graph properties in Python Sage and NumPy.
- Improved project documentation and project management, working with git, GitHub, Unix. (link)

RamDev: Software Development at VCU, Richmond, VA April 2016 - May 2018
Founder and President

- Coordinated 46 weekly seminars including 9 corporate speakers, becoming the largest CS organization at VCU.
- Secured and managed $2400 in funding and resources.

QuICS at The University of Maryland, College Park, MD June 2017 - Aug 2017
Undergraduate Researcher

- Studied quantum tomography to characterize measurement complexity. Advised by Andrew Childs.

Quantum Computing Lab at Virginia Commonwealth University, Richmond, VA March 2015 - Aug 2016
Undergraduate Research Assistant

- Began quantum computing research as a freshman. Self-taught linear algebra and complexity theory over the summer.
- Researched Hamiltonian complexity, characterizing complexity of simulating local measurements on low-energy states of correlated quantum systems.
- Contributed key ideas for multiple proofs and published 2 papers as an undergraduate. Advised by Sevag Gharibian.

SKILLS AND PROJECTS

Technical: expert LaTeX; intermediate Python (Qiskit, NumPy, Sage), Java, git, Unix, Mathematica

Quantitative: probability, discrete math, combinatorics, statistics, analysis, algorithms, logic and games, quantum physics

Courses: Machine Learning, Randomized Algorithms, Natural Language Processing, Data Science, Software Engineering

- UT Machine Learning course projects: PCA, ICA, Gaussian regression, Tensorflow Sept 2020 - Dec 2020
- VCU Senior Project: Bluetooth tag network with Android app, Raspberry Pi, AWS Sept 2017 - May 2018
  - Awarded VCU Engineering Capstone Design Award
- Course Project for Software Engineering: Android app with geofencing, AWS Sept 2016 - Dec 2016
- RamHacks Hackathon project: Mathematica program using maps data to create running routes Sept 2016
- VT Hacks Hackathon project: Android app using GroupMe API Feb 2016

SELECTED PUBLICATIONS

- B. Holman, R. Ramachandran, J. Yirka. Quantum search with in-place queries. TQC 2025. (link)
- J. Yirka. A note on the complexity of the spectral gap problem. arXiv:2503.02747, March 2025. (link)
- J. Yirka. Even quantum advice is unlikely to solve PP. *Theory of Computing*, 2025. (link)
- S. Grewal and J. Yirka. The Entangled Quantum Polynomial Hierarchy collapses. CCC 2024. (link)
- J. Kallaugher, O. Parekh, K. Thompson, Y. Wang, J. Yirka. Complexity classification of product state problems for local Hamiltonians. QIP 2024 and ITCS 2025. (link)
- S. Gharibian, M. Santha, J. Sikora, A. Sundaram, J. Yirka. Quantum generalizations of the Polynomial Hierarchy with applications to QMA(2). *computational complexity*, 2022. (link)
- J. Yirka and Y. Subasi. Qubit-efficient entanglement spectroscopy using qubit resets. *Quantum*, 2021. (link)
- S. Gharibian, S. Piddock, J. Yirka. Oracle complexity classes and local measurements on physical Hamiltonians. QIP 2020 and STACS 2020. (link)
- S. Gharibian and J. Yirka. The complexity of simulating local measurements on quantum systems. TQC 2017 and *Quantum*, 2019. (link)
- J. Yirka. Evaluation of TCP header fields for data overhead efficiency. NCUR 2016.
  - Awarded "Launch Award" for Outstanding Research Poster