

Justin Yirka

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SUMMARY

Ph.D. candidate in quantum computing with 10+ years of experience. Advised by Scott Aaronson, graduating May 2025. Seeking an industry position applying my 10+ years in quantum research to industry applications. Proven communicator and collaborator in research, teaching, and leadership roles.

- 7+ publications in top venues: QIP, TQC, CCC, *Quantum*, and more
- 2 National Labs internships
- **Coding:** College Java Instructor, simulations in Qiskit Python, project management in git, undergraduate projects with Android, Python, Java, and AWS.

My research has focused on quantum Hamiltonian complexity, query complexity, and quantum algorithms. I've contributed to new areas of complexity theory, such as the difficulty of computing properties in low-energy quantum systems/Hamiltonians both below and above QMA; quantifying the amount of "useful" information in quantum states for games; and the robustness of quantum speed-ups to new input models.

EDUCATION

Ph.D. in Computer Science The University of Texas at Austin	Expected May 2025
Advised by Scott Aaronson. Quantum computation, Complexity theory, Algorithms	
M.S. in Computer Science The University of Texas at Austin	2022
Selected Courses: Machine Learning, Randomized algorithms, Programming languages	
B.S. in Computer Science Virginia Commonwealth University	2018
B.S. in Mathematical Sciences	concurrent degrees
Specialization in Data Science. Minor in Physics.	
Awards: Capstone Design Award. \$660 grant for senior project Android app.	2017
VCU Presidential Scholarship (\$110,000). Awarded to 0.6% of students.	2014

EXPERIENCE

R&D Intern Sandia National Laboratories	June 2023 – present
<ul style="list-style-type: none">• Initiated and completed a project in 6 months characterizing NP-hardness of the Sandia group's approximation problems. Accepted to QIP (top venue).• Analyzed Hamiltonian product state optimization problems and models, e.g. Quantum Max-Cut. Derived geometric approximations to Bloch vector problems. Designed variants of Grover's algorithm.• Advised by John Kallaugh and Ojas Parekh.	
Summer School Fellow Los Alamos National Laboratories	Summer 2019
<ul style="list-style-type: none">• Designed new algorithms for entanglement spectroscopy, improving on the group's previous algorithms by requiring asymptotically fewer qubits while maintaining noise-resilience. Published in <i>Quantum</i>.• Programmed noisy circuit simulations in Qiskit Python up to 24 qubits.• Ran experiments on Honeywell Quantum device.• Maintained code and data using git, GitHub, Jupyter, and Unix tools. (link)	
Research Assistant Computational Graph Theory Lab, Virginia Commonwealth University	Summer 2018
<ul style="list-style-type: none">• Wrote and debugged algorithms for computing graph properties in Sage/Python.• Improved project documentation and data management, working with git, GitHub, Unix. (link)	
NSF REU Researcher QuICS, The University of Maryland	Summer 2017
<ul style="list-style-type: none">• Investigated pure state quantum tomography with minimal measurements. Supervised by Andrew Childs.	
Research Assistant Quantum Computing Lab, Virginia Commonwealth University	2015 – 2016
<ul style="list-style-type: none">• Started as a freshman and self-taught necessary linear algebra, TCS, and QC over the summer.• Contributed key ideas for multiple proofs. Published 2 papers as an undergraduate, including at <i>TQC</i>.• Advised by Sevag Gharibian.	

ADDITIONAL ACTIVITIES

PI | \$10,000 grant from NSF CIQC for quantum seminar and visitor series at UT 2024 – 2025

Head Teaching Assistant | Quantum Information Science for M.S. students Spring '22, '23, '24

- 200+ students and supervised 4 graduate TAs.
- Responsible for all course operations including student assignments, questions, exams, grades, etc.

Instructor | Software Engineering (Java), UT International Academy Summer 2021

- Independently developed and taught entire Java course for undergraduates.

Founder and President | RamDev: Software Development at VCU 2016 – 2018

- Coordinated 46 weekly seminars. Increased attendance, becoming largest C.S. organization at VCU.

Teaching Assistant | Undergraduate Rhetoric (English), Virginia Commonwealth University 2015

PUBLICATIONS

Author order determined alphabetically except in #5

- J. Yirka. Even quantum advice is unlikely to solve PP. Preprint, March 2024. ([link](#))
- S. Grewal and J. Yirka. The entangled quantum polynomial hierarchy collapses. CCC 2024. ([link](#))
- J. Kallaughar, 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](#))