Justin Yirka

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SUMMARY

Ph.D. candidate with 10 years of quantum computing research experience. Graduating May 2025, advised by Scott Aaronson. Seeking an industry position in quantum algorithms, applications, or theory research. Skilled internal & external communicator in teaching and research, with a history of project leadership.

- 7+ publications in top venues: *QIP, TQC, CCC*
- 2 National Labs internships
- 20+ professional presentations

- **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 significantly contributed to developing new research areas, including the complexity of low-energy states in quantum systems, approximation algorithms, quantum algorithms in new input models, the complexity of quantum games, and more.

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
- 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 optimization problems. Derived geometric approximations. Designed new variants of Grover's algorithm.

Summer School Fellow | Los Alamos National Laboratories — Summer 2019
- Designed new NISQ algorithms for entanglement spectroscopy, improving on the group's previous algorithms by requiring asymptotically fewer qubits while maintaining noise-resilience. Published in *Quantum*.
- 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
- 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

Research Assistant | Quantum Computing Lab, Virginia Commonwealth University — 2015 – 2016
- 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 *TQC*.

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

- Responsible for all operations, e.g. assignments and exams. Supervised 4 graduate TAs, 200+ students.

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 (<u>English</u>), Virginia Commonwealth University   2015

PUBLICATIONS   Author order determined alphabetically except in #6
- J. Yirka. A Note on the Complexity of the Spectral Gap Problem. Preprint, March 2025. (link)
- J. Yirka. Even quantum advice is unlikely to solve PP. Preprint, 2024. (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)