

# Justin Yirka

703-229-7956 | yirka@utexas.edu | [JustinYirka.com](https://JustinYirka.com) | [linkedin.com/in/yirkajk](https://linkedin.com/in/yirkajk)

## SUMMARY

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Ph.D. candidate in quantum computing advised by Scott Aaronson, graduating in 2025.

Proven research skills complemented by effective technical and non-technical communication.

- 7+ publications appearing in top venues.
- 20+ professional and public presentations.
- Comfortable in independent, non-student roles.
- 8+ semesters teaching both as TA and Instructor.

## EDUCATION

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**Ph.D. in Computer Science** | The University of Texas at Austin Expected May 2025

Advised by Scott Aaronson

Quantum computing, Theoretical computer science, Complexity theory, Algorithms

**M.S. in Computer Science** | The University of Texas at Austin 2022

Highlighted courses: Randomized algorithms, Graph theory and combinatorics, Unconventional computation, Machine learning, Algorithmic Perspective on Microeconomics

Awards: **Honorable Mention**, NSF Graduate Research Fellowship Program 2019 & 2020

**B.S. in Computer Science** | Virginia Commonwealth University 2018

**B.S. in Mathematical Sciences** (Concurrent degrees)

Specialization in Data Science. Minor in Physics.

Awards: **Pure Mathematics Award**. Highest GPA among pure math graduates. 2018

**Capstone Design Award**. \$660 grant for senior project Android app. 2017

**VCU Presidential Scholarship** (\$110,000). Awarded to 0.6% of students. 2014

## EXPERIENCE

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**R&D Intern** | Sandia National Laboratories June 2023 – present

- Initiated and completed a project in 6 months which was accepted to QIP (top venue).
- Studied Hamiltonians, product states, Quantum Max-Cut, Vector Max-Cut, alternative quantum query models, and quantum constrained optimization problems.
- Advised by John Kallaugh and Ojas Parekh.

**Summer School Fellow** | Los Alamos National Laboratories Summer 2019

- Designed algorithms for entanglement spectroscopy using mid-circuit measurements & resets.
- Programmed noisy quantum circuit simulations in Qiskit Python up to 24 qubits. Engineered project code and data using git, Jupyter, and Unix tools.
- Contracted with Honeywell Quantum to test our new circuit designs on their hardware.
- Advised by Yigit Subasi.

**Research Assistant** | Computational Graph Theory Lab, VCU Summer 2018

- Maintained a growing database of graphs, their properties, and known theorems.
- Improved project management using git, GitHub. Programmed in Sage/Python.

**NSF REU Researcher** | QuICS, The University of Maryland Summer 2017

- Investigated minimum number of measurements for pure state quantum tomography.
- Advised by Andrew Childs, Jianxin Chen, and Amir Kalev.

**Research Assistant** | Quantum Computing Lab, VCU 2015 – 2016

- Started as a freshman and self-taught necessary linear algebra, TCS, and QC over the summer.
- Researched QMA oracles, Hamiltonian problems beyond QMA, quantum polynomial hierarchy.
- Advised by Sevag Gharibian.

## Teaching

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

- Led entire course except for pre-recorded lectures. 2022 class: 200 students, 1500 discussion posts.
- Supervised 4 graduate teaching assistants.
- For first iteration, adapted all course materials for online format, working with school production team.

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

- Developed entire course including lectures and assignments. Taught remotely/virtually.

**Teaching Assistant** | Remedial College Algebra, VCU 2016 – 2017  
Undergraduate Rhetoric (English), VCU 2015

## PUBLICATIONS

Author order determined alphabetically except in #5

1. S. Grewal and J. Yirka. The entangled quantum polynomial hierarchy collapses. Conference on Computational Complexity (CCC), July 2024 ([link](#))
2. J. Yirka. Even quantum advice is unlikely to solve PP. Preprint, March 2024 ([link](#))
3. J. Kallaugh, O. Parekh, K. Thompson, Y. Wang, J. Yirka. Complexity classification of product state problems for local Hamiltonians. Conference on Quantum Information Processing (QIP), January 2024. ([link](#))
4. S. Gharibian, M. Santha, J. Sikora, A. Sundaram, J. Yirka. Quantum generalizations of the polynomial hierarchy with applications to QMA(2). *Computational Complexity*, 31:12, 2022. ([link](#))
5. J. Yirka and Y. Subasi. Qubit-efficient entanglement spectroscopy using qubit resets. *Quantum*, 5:535, 2021. ([link](#))
6. S. Gharibian, S. Piddock, J. Yirka. Oracle complexity classes and local measurements on physical Hamiltonians. Conference on Quantum Information Processing (QIP), 2020. ([link](#))
7. S. Gharibian and J. Yirka. The complexity of simulating local measurements on quantum systems. Conference on Theory of Quant. Comp., Comm., and Crypto. (TQC), 2017 and *Quantum*, 3:189, 2019. ([link](#))
8. J. Yirka. Evaluation of TCP header fields for data overhead efficiency. 2015.
  - Award: Launch Award for Outstanding Research Poster at VCU Undergraduate Symposium.

## ADDITIONAL ACTIVITIES

**Reviewer** | *Quantum* '22 '20, QIP '24 '22, TQC '23 '22, ITCS '23, RANDOM '23, CCC '22, YQIS '21

**Co-PI** (\$10,000, NSF CIQC) | Quantum seminar series at UT with invited speakers Fall 2024

**Chair** | UT Computer Science Graduate Student Association Sep 2020 – Dec 2021

- GRACS representative to UTCS Diversity, Equity, and Inclusion (DEI) Council.
- Co-Organized Application Assistance Program for under-represented Ph.D. applicants. 2020

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

- Coordinated 46 weekly seminars including 9 corporate speakers and several hackathon trips.
- Secured and managed \$2400 in funding and resources.
- Increased weekly attendance to 20+ students, becoming largest C.S. organization at VCU.