Daniel Y. Liang

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Summary

My focus is on the application of learning theory to quantum problems. That is, given some unknown quantum system, try and learn it, under varying definitions of the word "learn". During my PhD, I focused on leveraging properties of the stabilizer formalism to tackle topics such as tomography, PAC/SQ/Agnostic learning, property testing, and pseudorandomness. I am additionally broadly interested in quantum information, quantum complexity theory, and theoretical computer science.

Education

University of Texas at Austin — **Austin, TX**
PhD in Computer Science — *2017-2023*
Advisor: Dr. Scott Aaronson
Dissertation: On Computationally Efficient Learning for Stabilizers and Beyond

Cornell University College of Engineering — **Ithaca, NY**
Bachelors of Science in Engineering, Magna Cum Laude — *2013–2017*
Double Major in Computer Science and Engineering Physics

Academic Positions

Rice University & Portland State University
Postdoctoral Fellow — *2023-2025*
Co-advised by Dr. Nai-Hui Chia and Dr. Fang Song

Work Experience

X, the Moonshot Factory (formerly Google[x]) — **Mountain View, California**
Quantum Resident — *Summer 2019*
Published Work: Investigating quantum approximate optimization algorithms under bang-bang protocols.

Microsoft — **Redmond, Washington**
Software Engineering Intern — *Summer 2017*
Anti-Spam Machine Learning for Microsoft Office Exchange.

FedEx Services — **Memphis, Tennessee**
Information Technology Intern — *Summer 2016*

Publications (Alphabetical Author Order Unless Stated Otherwise)

[1] V. Iyer and **D. Liang**. Tolerant Testing of Stabilizer States with Mixed State Inputs, 2024. URL https://arxiv.org/abs/2411.08765.

[2] N.-H. Chia, **D. Liang**, and F. Song. Quantum State Learning Implies Circuit Lower Bounds, 2024. URL https://arxiv.org/abs/2405.10242.
Presented at TQC 2024

[3] S. Grewal, V. Iyer, W. Kretschmer, and **D. Liang**. Agnostic Tomography of Stabilizer Product States, 2024. URL https://arxiv.org/abs/2404.03813.

[4] S. Grewal, V. Iyer, W. Kretschmer, and **D. Liang**. Pseudoentanglement Ain't Cheap, 2024. URL https://arxiv.org/abs/2404.00126.
Presented at TQC 2024

[5] S. Grewal, V. Iyer, W. Kretschmer, and **D. Liang**. Efficient Learning of Quantum States Prepared With Few Non-Clifford Gates, 2023. URL https://arxiv.org/abs/2305.13409.
Presented at QIP 2024

[6] S. Grewal, V. Iyer, W. Kretschmer, and **D. Liang**. Improved Stabilizer Estimation via Bell Difference Sampling. In *Proceedings of the 56th Annual ACM Symposium on Theory of Computing*, STOC 2024, page 1352–1363, New York, NY, USA, 2024. Association for Computing Machinery. ISBN 9798400703836. URL https://doi.org/10.1145/3618260.3649738.
Presented at QIP 2024

[7] **D. Liang**. Clifford Circuits can be Properly PAC Learned if and only if RP $=$ NP. *Quantum*, 7:1036, June 2023. ISSN 2521-327X. URL https://doi.org/10.22331/q-2023-06-07-1036.
Presented at QTML 2022

[8] S. Grewal, V. Iyer, W. Kretschmer, and **D. Liang**. Low-Stabilizer-Complexity Quantum States Are Not Pseudorandom. In Y. Tauman Kalai, editor, *14th Innovations in Theoretical Computer Science Conference (ITCS 2023)*, volume 251 of *Leibniz International Proceedings in Informatics (LIPIcs)*, pages 64:1–64:20, Dagstuhl, Germany, 2023. Schloss Dagstuhl – Leibniz-Zentrum für Informatik. ISBN 978-3-95977-263-1. URL https://drops.dagstuhl.de/opus/volltexte/2023/17567.
ITCS 2023 Best Student Paper

[9] A. Gollakota and **D. Liang**. On the Hardness of PAC-learning Stabilizer States with Noise. *Quantum*, 6:640, feb 2022. URL https://doi.org/10.22331%2Fq-2022-02-02-640.

[10] **D. Liang**, L. Li, and S. Leichenauer. Investigating quantum approximate optimization algorithms under bang-bang protocols. *Physical Review Research*, 2(3), sep 2020. URL https://doi.org/10.1103%2Fphysrevresearch.2.033402.
Author Contribution Order

[11] P. Rall, **D. Liang**, J. Cook, and W. Kretschmer. Simulation of qubit quantum circuits via Pauli propagation. *Physical Review A*, 99(6), jun 2019. URL https://doi.org/10.1103%2Fphysreva.99.062337.
Author Contribution Order

TA Experience

UT-Austin

Spring 2023: Algorithms and Complexity

Spring 2022: Introduction to Quantum Information Science II — *Helped create the following lecture notes:* https://www.scottaaronson.com/qisii.pdf

Fall 2020: Introduction to Quantum Information Science

Fall 2018: Introduction to Quantum Information Science

Cornell University

Spring 2017: AEP 4220: Mathematical Physics II

Fall 2016: CS 3110: Data Structures and Functional Programming

Spring 2016: CS 4820: Introduction to Analysis of Algorithms

Fall 2015: CS 3110: Data Structures and Functional Programming

Spring 2015: CS 2110: Object-Oriented Programming and Data Structures

Service

Graduate Representative Association of Computer Sciences at UT-Austin — **Austin, TX**
Elected Representative — *Fall 2018 – Fall 2020*

Journal Reviewer
SIAM Journal on Computing (SICOMP), Quantum, IEEE Transactions on Information Theory, Quantum Machine Intelligence

Conference Reviewer
QIP (2025, 2024, 2023, 2020), TQC (2024), QCrypt (2024), YQIS (2024), AQIS (2024), STOC (2021, 2025), FOCS (2024, 2023), QTML (2022), ISIT (2022)