

Daniel Y. Liang

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Research Interests

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

PhD in Computer Science

Advisor: Dr. Scott Aaronson

Dissertation: On Computationally Efficient Learning for Stabilizers and Beyond

Austin, TX

2017-2023

Cornell University College of Engineering

Bachelors of Science in Engineering, Magna Cum Laude

Double Major in Computer Science and Engineering Physics

Ithaca, NY

2013-2017

Academic Positions

Rice University

Postdoctoral Fellow

Supervisor: Dr. Nai-Hui Chia

Houston, TX

2023-2024

Work Experience

X, the Moonshot Factory (formerly Google[x])

Quantum Resident

Published Work: Investigating quantum approximate optimization algorithms under bang-bang protocols.

Mountain View, California

Summer 2019

Microsoft

Software Engineering Intern

Anti-Spam Machine Learning for Microsoft Office Exchange.

Redmond, Washington

Summer 2017

FedEx Services

Information Technology Intern

Memphis, Tennessee

Summer 2016

Publications (Alphabetical Author Order Unless Stated Otherwise)

- [1] N.-H. Chia, **D. Liang**, and F. Song. Quantum State Learning Implies Circuit Lower Bounds, 2024. URL <https://arxiv.org/abs/2405.10242>.
To be presented at TQC 2024
- [2] S. Grewal, V. Iyer, W. Kretschmer, and **D. Liang**. Agnostic Tomography of Stabilizer Product States, 2024. URL <https://arxiv.org/abs/2404.03813>.
- [3] S. Grewal, V. Iyer, W. Kretschmer, and **D. Liang**. Pseudoentanglement Ain't Cheap, 2024. URL <https://arxiv.org/abs/2404.00126>.
To be presented at TQC 2024
- [4] 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
- [5] 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
- [6] **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
- [7] 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

[8] 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>.

[9] **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

[10] 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
Elected Representative

Austin, TX
Fall 2018 – Fall 2020