Shi Jie Samuel Tan

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Introduction

I am a PhD student at the Joint Center for Quantum Information and Computer Science (QuICS) at the University of Maryland, College Park. I am broadly interested in quantum error correction (QEC) and fault tolerance. I utilize concepts and tools in quantum information theory, homological algebra, and graph theory to understand and advance the construction of quantum error correcting codes and fault-tolerant protocols. I also dabble in quantum algorithms and quantum metrology.

Education

University of Maryland, College Park — College Park, MD
Ph.D. in Computer Science; Advisors: Daniel Gottesman and Michael J. Gullans — 2023–2027 (Expected)

Haverford College — Haverford, PA
B.S. in Computer Science and Physics — 2019–2023
Magna Cum Laude; High Honors in Computer Science and Physics

Work

University of Maryland, College Park — College Park, MD
Research Assistant; Supervisors: Daniel Gottesman and Michael J. Gullans — 2023–Current

University of Maryland, College Park — College Park, MD
Grader and Teaching Assistant — Fall 2025

QuEra Computing Inc. — Boston, MA
QEC Research Intern; Mentors: Hengyun Zhou, Arpit Dua, Chen Zhao, Hossein Dehghani — Summer & Fall 2025

Los Alamos National Laboratory — Los Alamos, NM
Quantum Algorithms Research Fellow; Mentors: Yiğit Subaşı and Andrew Sornborger — Summer 2023

California Institute of Technology — Pasadena, CA
QEC SURF Fellow; Mentors: John Preskill and Christopher A. Pattison — Summer 2022

University of Maryland, College Park — College Park, MD
REU-CAAR Summer Researcher; Mentors: Matthew Coudron and Gorjan Alagic — Summer 2021

Haverford College — Haverford, PA
Computational Biology Undergraduate Researcher; Supervisor: Sara Mathieson — 2020–2023

Haverford College — Haverford, PA
Grader and Teaching Assistant — 2020–2023

Publications & Preprints

♦ denotes equal contribution. ♠ denotes alphabetical order.

[1] **S.J.S.T.**♦, Yifan Hong♦, Ting-Chun Lin♦, Michael J Gullans, and Min-Hsiu Hsieh, "Single-Shot Universality in Quantum LDPC Codes via Code-Switching", arXiv preprint arXiv:2510.08552 (2025), [**Accepted as a plenary talk at QIP 2026; under review for STOC 2026**].

[2] ♠ Noah Berthusen, Michael J. Gullans, Yifan Hong, Maryam Mudassar, and **S.J.S.T.**, "Automorphism gadgets in homological product codes", arXiv preprint arXiv:2508.04794 (2025).

[3] Noah Berthusen, **S.J.S.T.**, Eric Huang, and Daniel Gottesman, "Adaptive syndrome extraction", PRX Quantum **6**, 030307 (2025), [**Accepted as a talk at TQC 2025**].

[4] **S.J.S.T.** and Lev Stambler, "Effective Distance of Higher Dimensional HGPs and Weight-Reduced Quantum LDPC Codes", Quantum **9**, 1897 (2025).

[5] **S.J.S.T.**, Christopher A. Pattison, Matt McEwen, and John Preskill, "Resilience of the surface code to error bursts", arXiv preprint arXiv:2406.18897 (2024), [Under review for Physical Review A].

[6] **S.J.S.T.**, Huyen Trang Dang, Sarah Keim, Maja Bucan, and Sara Mathieson, "Identity-by-descent (IBD) segment outlier detection in endogamous populations using pedigree cohorts", bioRxiv, 2024–08 (2024).

[7] Dhrumil Patel♦, **S.J.S.T.**♦, Yigit Subaşı, and Andrew T. Sornborger, "Optimal Coherent Quantum Phase Estimation via Tapering", arXiv preprint arXiv:2403.18927 (2024), [Under review for PRX Quantum].

[8] ♠ Yongtao Deng and **S.J.S.T.**, "Random Walks on the Generalized Symmetric Group: Cutoff for the One-sided Transposition Shuffle", arXiv preprint arXiv:2211.10462 (2022).

[9] Suchetan Dontha♦, **S.J.S.T.**♦, Stephen Smith, Sangheon Choi, and Matthew Coudron, "Approximating Output Probabilities of Shallow Quantum Circuits Which Are Geometrically-Local in Any Fixed Dimension", in Proceedings of the 17th Conference on the Theory of Quantum Computation, Communication and Cryptography (TQC 2022) (2022), [**Accepted as a talk at TQC 2022**].

[10] Kelly Finke, Michael Kourakos, Gabriela Brown, Huyen Trang Dang, **S.J.S.T.**, Yuval B. Simons, Shweta Ramdas, Alejandro A. Schäffer, Rachel L. Kember, Maja Bućan, and Sara Mathieson, "Ancestral haplotype reconstruction in endogamous populations using identity-by-descent", PLOS Computational Biology, edited by Degui Zhi, 10.1371/journal.pcbi.1008638 (2021).

Talks

Invited talks are indicated by ★.

- 29th Annual Quantum Information Processing Conference **(Short Plenary)** — January 26, 2026
  Single-Shot Universality in Quantum LDPC Codes via Code-Switching
- ★ Freie Universität Berlin — November 18, 2025
  Single-Shot Universality in Quantum LDPC Codes via Code-Switching
- Joint Quantum Institute (JQI) Friday Quantum Seminar (College Park, MD) — October 3, 2025
  Adaptive Syndrome Extraction
- 20th Conference on the Theory of Quantum Computation, Communication and Cryptography — September 18, 2025
  Adaptive Syndrome Extraction
- ★ National University of Singapore (NUS) Centre for Quantum Technologies (CQT) — May 22, 2025
  Automorphism gadgets in homological product codes
- ★ University of Maryland Communication, Control and Signal Processing (CCSP) Seminar — October 17, 2024

Effective Distance of Higher-Dimensional HGPs and Weight-Reduced Quantum LDPC Codes

- Caltech SFP Summer Seminar Day — August 18, 2022
  Proving the existence of an accuracy threshold for the Union-Find decoder
- University of Maryland Research Experience for Undergraduates Combinatorics and Algorithms for Real Problems (REU-CAAR) Research Presentation — August 13, 2021
  Simulation of Low-Depth Quantum Circuits

Posters

- 7th International Conference on Quantum Error Correction — August 12, 2025
  Automorphism gadgets in homological product codes
- 7th International Conference on Quantum Error Correction — August 11, 2025
  Adaptive Syndrome Extraction
- 28th Annual Conference on Quantum Information Processing — February 26, 2025
  Effective Distance of Higher-Dimensional HGPs and Weight-Reduced Quantum LDPC Codes
- 19th Conference on the Theory of Quantum Computation, Communication and Cryptography — September 11, 2024
  Tapered Quantum Phase Estimation
- 6th International Conference on Quantum Error Correction — November 1, 2023
  Resilience of the surface code to error bursts
- 13th ACM International Conference on Bioinformatics, Computational Biology and Health Informatics — August 7, 2022
  Comparison of cohort-based identical-by-descent (IBD) segment finding methods for endogamous populations
- 25th Annual Conference on Quantum Information Processing — March 10, 2022
  Approximating Output Probabilities of Shallow Quantum Circuits which are Geometrically-local in any Fixed Dimension
- 7th–8th International Conference on Algorithms for Computational Biology — November 9, 2021
  Improvements to ancestral haplotype reconstruction in pedigrees
- Research in Computational Molecular Biology – 25th Annual International Conference — August 29, 2021
  Improvements to ancestral haplotype reconstruction in pedigrees
- Haverford College Marian E. Koshland Integrated Natural Sciences Center (KINSC) Undergraduate Science Research Symposium — September 10, 2020
  Validating Ancestral Haplotype Reconstruction In Endogamous Populations using Identical-by-Descent

Fellowships and Awards

- National University of Singapore Development Grant — 2024–2026
- MathQuantum Graduate Fellowship (University of Maryland) — 2023
- QuICS Lanczos Graduate Fellowship (University of Maryland) — 2023–2025
- Louis B. Green Prize in Physics and Astronomy (Haverford College) — 2023
- Phi Beta Kappa — 2023
- Los Alamos National Laboratory Quantum Computing Summer School Fellowship — 2023
- Singloh Hsu Scholarship (Haverford College) — 2023
- Computing Research Association (CRA) Outstanding Undergraduate Researcher Award Finalist — 2023
- Caltech Summer Undergraduate Research Fellowship — 2022

- Marian E. Koshland Integrated Natural Sciences Center Summer Scholarship (Haverford College) 2022
- An Zhu-Google University of Maryland REU-CAAR Fellowship 2021
- Brian Kovaric Fellowship (Haverford College) 2020
- Prime Minister's Book Prize (Ministry of Education, Singapore) 2016

Other attendance

- Los Alamos Quantum Computing Summer School June–August 2023

Teaching (as TA or Grader)

- Computer Science 657 (University of Maryland, College Park) Fall 2025
  Introduction to Quantum Information Processing
- Physics H302 (Haverford College) Spring 2023
  Advanced Quantum Mechanics
- Computer Science B340 (Bryn Mawr College) Fall 2022
  Analysis of Algorithms
- Physics H214 (Haverford College) Spring 2022
  Introductory Quantum Mechanics
- Computer Science H345 (Haverford College) Spring 2022
  Theory of Computation
- Mathematics Question Center Fall 2021–Spring 2022
  Calculus, Linear Algebra, and Abstract Algebra
- Physics H213 (Haverford College) Fall 2021
  Waves and Optics
- Mathematics H121 (Haverford College) Spring 2021
  Multivariable Calculus
- Computer Science H311 (Haverford College) Fall 2020
  Computer Security: Attacks and Defenses

Reviewing

I have been invited to review articles and abstracts for the following conferences and journals.

- Annual Quantum Information Processing Conference (QIP)

Computer skills

Ordered from most to least familiar.

- **Languages**: Python, Julia, SageMath
- **QC toolkits**: Stim

References

- **Dr. Daniel Gottesman**, Brin Family Endowed Professor in Theoretical Computer Science
  Department of Computer Science, the Institute for Advanced Computer Studies, and the Joint Center for Quantum Information and Computer Science, University of Maryland, College Park
  dgottesm@umd.edu

- **Dr. Michael J. Gullans**, Adjunct Assistant Professor
  Department of Physics, Department of Computer Science, and the Institute for Advanced Computer Studies, University of Maryland, College Park
  mgullans@umd.edu