Savar D Sinha

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Education

California Institute of Technology Pasadena, CA
Bachelor of Science in Computer Science and Physics *Sept 2022 – June 2026*

Objective

I am an undergraduate student eager to pursue theoretical research in quantum computing, particularly in the realm of quantum algorithms, learning theory, and simulation. While much of my past research, primarily in high school, has been related to computational biology, my current interests and future research aspirations lie in quantum computing. Nevertheless, as I transition away from my previous focus, I hope to utilize my past experience with working with large datasets and designing algorithms to contribute to the forefront of quantum computing and immerse myself in the complexities of this rapidly evolving field.

Relevant Graduate-Level Coursework

Computer Science:
- Ph/CS 219ABC — Quantum Computation
- CS 152 — Introduction to Cryptography
- CS/IDS 150B — Probability and Algorithms
- CS/IDS 153 — Current Topics in Theoretical Computer Science: Topics in the Intersection of Theoretical CS and Quantum Computing

Physics:
- *Ph 220 — Quantum Learning Theory*
- Ph/CS 219ABC — Quantum Computation
- APh/Ph 138A — Quantum Hardware and Techniques
- *Ph 135 — Introduction to Condensed Matter*
- Ph 125AB — Quantum Mechanics

Italics indicate course will be taken in Fall 2025

Teaching Experience

Teaching Assistant:
- CS 001X — Intermediate Computer Programming
- CS 011 — Computer Language Lab

YouTube Lectures (VarPi Channel):
25 lectures, 300+ subscribers, 350+ hours of watch time; lecture series include
- Algorithms (15 lectures)
- Quantum Mechanics (5 lectures)
- Quantum Computation (5 lectures)

Research Experience

Prof. Yu Tong, Duke University, Electrical and Computer Engineering Feb 2025 – Present
- Developed algorithm for Hamiltonian emptiness testing with sample complexity and evolution time $\mathcal{O}(1/\epsilon^2)$
- Improved sampling complexity of M-sparse Hamiltonian learning from $\mathcal{O}(M^2 \log M)$ to $\mathcal{O}(M \log M)$
- Developed algorithm for Hamiltonian sparsity testing that achieves evolution time $\tilde{\mathcal{O}}(1/\epsilon^2)$

Dr. Nathanan Tantivasadakarn, California Institute of Technology, The Division of Physics, Mathematics, and Astronomy Jun 2024 – Present
- Developed algorithm for efficient simulation of $d = 4$ qudit measurements in the stabilizer formalism
- Constructed cluster model to simulate the $\mathbb{Z}_4$ projective transverse-field Ising model (PTIM) in $\mathcal{O}(n)$ time
- Demonstrated equivalence between the topological phase transitions in the $\mathbb{Z}_4$ and coupled $\mathbb{Z}_2 \times \mathbb{Z}_2$ PTIMs
- Proved the nonexistence of a unitary mapping between the Hamiltonians of the $\mathbb{Z}_4$ and coupled $\mathbb{Z}_2 \times \mathbb{Z}_2$ PTIMs

Dr. Aadel Chaudhuri, Washington University School of Medicine in St. Louis, Department of Radiation Oncology Jun 2023 – Oct 2023
- Optimized Griffin pipeline to analyze nucleosome protection of prostate cancer marker genes
- Performed Kaplan-Meier and other statistical analyses via R to compare survival rates for risk-stratified patients
- Developed pipeline to calculate conversion rate of lambda phage DNA for genome-wide methylation analysis

Prof. Jeremy G. Wideman, Arizona State University, Center for Mechanisms of Evolution, Biodesign Institute, School of Life Sciences Feb 2020 – May 2023

- Identified orthologues of animal and fungal ATP synthase subunits across over 200 eukaryotes
- Utilized bioinformatic tools (BLAST, MUSCLE, and HMMER) and ML-based protein-folding (AlphaFold) on ASU's AGAVE cluster computing server

Publications and Manuscripts (1 in progress, 5 published, 45 citations)

[6] **Sinha SD** and Tong Y (2025) Improved Hamiltonian learning and sparsity testing through Bell sampling. (manuscript in progress)

[5] Chauhan PS, Alahi I, **Sinha SD**, et. al. (2024) Genomic and Epigenomic Analysis of Plasma Cell-Free DNA Identifies Stemness Features Associated with Worse Survival in Lethal Prostate Cancer. Clin Cancer Res. doi: 10.1158/1078-0432.CCR-24-1658

[4] **Sinha SD**, Wideman JG. (2023) The persistent homology of mitochondrial ATP synthases. IScience, 26(5), 106700. doi: 10.1016/j.isci.2023.106700.

[3] Macher JN, Coots NL, Girard EB, Langerak A, Muñoz-Gómez SA, **Sinha SD**, Vos R, Wissels R, Gile G, Renema W, Wideman JG. (2023) Single-Cell Genomics Reveals the Divergent Mitochondrial Genomes of Retaria (Foraminifera and Radiolaria). MBio, 0(0), e00302-23. doi: 10.1128/mbio.00302-23

[2] Singh RP, Poh Y-P, **Sinha SD**, Wideman JG. (2023) Evolutionary history of oxysterol binding proteins (OSBPs) reveals complex history of duplication and loss in animals and fungi. Contact. 2023;6. doi:10.1177/25152564221150428.

[1] Záhonová K, Lax G, **Sinha SD**, Leonard G, Richards TA, Lukeš J, Wideman JG. (2021) Single-cell genomics unveils a canonical origin of the diverse mitochondrial genomes of euglenozoans. BMC Biology. 19: 103. doi: 10.1186/s12915-021-01035-y.

Oral Presentations (7 total)

[6, 7] **Sinha SD** et. al (2024 – 2025), Exploring Entanglement Transitions in the 4-Level Qudit Projective Transverse Field Ising Model. Presented at Southern California Conference for Undergraduate Research 2024 (Cal State San Bernadino), National Conference for Undergraduate Research 2025 (Pittsburgh, PA)

[3 – 5] **Sinha SD** et. al (2023) Combinatorial genomic and epigenomic analysis of plasma cell-free DNA identifies stemness features associated with worse prognosis in high-risk metastatic castration-resistant prostate cancer. Presented at RadOnc Research Retreat (WashU School of Medicine), Summer Undergraduate Research Fellowship 2023 (Caltech), Southern California Conference for Undergraduate Research 2023 (Cal State Fullerton).

[1, 2] **Sinha SD**, Wideman JG (2020 – 2021) Evolution of Eukaryotic ATP Synthase. Presented at ASU Evolutionary Biology Symposium 2020, ASU CME Lab Meeting Presentation.

Poster Presentations (2 total)

[2] Záhonová K, Lax G, **Sinha SD** et al. (2021) Single-cell genomics unveils a canonical origin of the diverse mitochondrial genomes of euglenozoans. International Society of Protistologists 2021 Online Poster (page 62).

[1] **Sinha SD**, Muñoz-Gómez SA, Wideman JG (2021) The persistence of homology: Diversity and evolution of eukaryotic ATP synthases. International Society of Protistologists 2021 Online Poster (page 83).

Honors, Awards, and Certifications

IBM Quantum Challenge Achievement 2024
IBM Variational Algorithm Design Certification 2024
IBM Practical Introduction to Quantum-Safe Cryptography Certification 2024
IBM Basics of Quantum Information Certification 2023
2023 Radiation Oncology Research Retreat Best Oral Presentation, WashU 2023
SURF Award 2023

Technical Skills

Languages: Python, Java, C, C++, Bash, AWK, R, Matlab, x86-64 Assembly, Wolfram Mathematica, OCaml
Developer Tools: VS Code, PyCharm, IntelliJ, Jupyter Notebook, RStudio, Git
Python Libraries: pandas, NumPy, SciPy, Matplotlib, TensorFlow, sklearn, pytorch, qiskit