Ishaun Datta

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PhD Candidate, Computer Science Theory Group
Quantum complexity, esp. quantum {*advantage, learning, simulation*}

EDUCATION

Stanford University
PhD Candidate in Computational and Mathematical Engineering — 2021 – 2026
Advisor: Prof. Adam Bouland
MS in Computational and Mathematical Engineering — 2019 – 2021

Massachusetts Institute of Technology — 2014 – 2018
BS in Mathematics with Computer Science and B.S. in Physics

Montgomery Blair High School, Maryland — 2010 – 2014

AWARDS

Gerald J. Lieberman Fellowship — 2024 – 2025

· Year of PhD funding recognizing research, service, and teaching. One of 12 selected across university.

Stanford Three Minute Thesis (3MT) Honorable Mention — 2025

ICME Student Leadership Award — 2022

· Received $1,500 award for founding and leading ICME's student advocacy group.

NSF Graduate Research Fellowship — 2019 – 2022
National Science Foundation

German Academic Exchange Service (DAAD) Research Fellowship — 2018 – 2019
Technische Universität München

· Yearlong grant awarded for quantum learning theory research under the auspices of Prof. Michael Wolf.
· One of only two pre-doctoral students to receive award; all others were PhDs or postdoctoral fellows.

MIT Memorial Scholarship — 2016

Tenth Place nationally at Intel Science Talent Search — 2014

· Received $21,000 scholarship among ∼ 3,000 applicants and 40 national finalists as a result of my nuclear physics research and five rounds of judging interviews on broader scientific knowledge and creativity.

PUBLICATIONS

(Authorship is by default alphabetical)

J. T. Iosue, Y. Wang, **I. Datta**, S. Ghosh, C. Oh, B. Fefferman, A. V. Gorshkov. Higher moment theory and learnability of bosonic states. `arXiv:2510.01610`. In submission.

A. Bouland, **I. Datta**, B. Fefferman, F. Hernández. Exponential improvements to the average-case hardness of BosonSampling. `arXiv:2411.04566`.
Contributed talk at **QIP 2026**.
To appear in Proc. of IEEE Symposium on Foundations of Computer Science (**FOCS 2025**).

D. Harley, **I. Datta**, F.R. Klausen, A. Bluhm, D.S. França, A. Werner, M. Christandl. Going beyond gadgets: the importance of scalability for analogue quantum simulators. arXiv:2306.13739.
Contributed talk at **QIP 2024**.
Nature Communications **15**, 1 (2024).

A. Bouland, D. Brod, **I. Datta**, B. Fefferman, D. Grier, F. Hernández, M. Oszmaniec. Complexity-theoretic foundations of BosonSampling with a linear number of modes (2023). arXiv:2312.00286.
Contributed talk at **QIP 2024**.
In submission to *Physical Review X*.

M.C. Caro,† **I. Datta**.† Pseudo-dimension of quantum circuits. † Equal contributors.
arXiv:2002.01490.
Quantum Mach. Intell. **2**, 14 (2020).

I. Datta. Quantum Mechanics as a Stimulus for American Theoretical Physics.
APS News **27**, 7 (2018).
Published as APS History of Physics Essay Contest Winner.

P. Adhikari, T.D. Cohen, **I. Datta**. Density of saturated nuclear matter at large N_c and heavy quark mass limits. arXiv:1312.3339.
Phys. Rev. C **89**, 065201 (2014).

SELECTED TALKS

(By invitation unless otherwise noted)

"Exponential improvements to the average-case hardness of BosonSampling"

- **QIP 2026**, (Upcoming, Contributed talk) 01/2026
- IEEE Symposium on Foundations of Computer Science (**FOCS 2025**) (Upcoming, Contributed talk) 12/2025
- Sorbonne Université Laboratoire d'Informatique de Paris 6 (LIP6) 10/2025
- International Conference for Young Quantum Information Scientists (YQIS) 2025 (Contributed talk) 10/2025
- IBM Quantum Seminar 08/2025
- Quantum Summer Cluster Workshop, Simons Institute, UC Berkeley 07/2025
- Quantum-Safe Internet Workshop (Contributed talk), Technical University of Denmark (DTU) 05/2025
- MIT, Organizers: Profs. Aram Harrow, Anand Natarajan, Soonwon Choi 03/2025
- Tufts University, Host: Prof. Saeed Mehraban 03/2025
- Harvard University, Prof. Anurag Anshu's Group Meeting 02/2025
- University of Texas at Austin, Host: Prof. Scott Aaronson 02/2025

"The computational complexity of linear optics with linear modes"

- University of Texas at Austin, Host: Prof. Scott Aaronson 02/2025
- The Power of Near-Term Quantum Experiments, IMSI Workshop, UChicago 09/2024
- **QIP 2024** (Contributed talk), Taipei 01/2024

"What's the simplest quantum computation to surpass classical computers?"
(Public outreach talk on research frontiers)

- Pint of Science Festival, Palo Alto 05/2025

· High School Guest Lecture, Stanford Quantum Computing Association 05/2025
· Jadavpur University, Calcutta (Online) 12/2024

"Going beyond gadgets: the importance of scalability for analogue quantum simulators"

· Dartmouth University, Host: James D. Whitfield (Online) 05/2024
· **QIP 2024** (Contributed talk), Taipei 01/2024
· University of Technology Sydney, QSI Seminar (Online) 12/2023

Talk recordings (hyperlinked)

· Quantum Summer Cluster Workshop, Simons Institute, UC Berkeley 07/2025
· The Power of Near-Term Quantum Experiments, IMSI Workshop, UChicago 09/2024
· **QIP 2024** (Contributed talk), Taipei 01/2024

RESEARCH VISITS & INTERNSHIPS

Long-term Invited Visitor Feb – May 2024 & May – July 2025
Simons Institute for the Theory of Computing *Berkeley, CA*

Quantum Research Scientist Summer Intern Summer 2022
IBM Almaden, Demonstrations Team *San Jose, CA*

· Theory of noisy Trotter error, in preparation.

Visiting PhD Student Spring 2022
QMATH, Københavns Universitet *Copenhagen, Denmark*

· Hosts: Profs. Matthias Christandl and Albert Werner. Project: establishing a mathematical framework for analogue quantum simulation. The main results were that existing attempts to capture analogue simulation using perturbative gadgets from Hamiltonian complexity necessarily produce unphysical, system-size dependent scalings in the interaction terms. Therefore, any mathematical theory of analogue simulation must go beyond the Hamiltonian complexity toolkit. As a first step toward building that toolkit, we provide an experimentally-realizable protocol using the quantum Zeno effect that can evade these lower bounds. Published in *Nature Communications.*

Quantum Research Scientist Summer Intern Summer 2019
Intel Labs *Santa Clara, CA*

· Classical simulation of Instantaneous Quantum Polynomial (IQP) circuits using Neural Network Quantum State (NQS) ansätze.

OUTREACH, TEACHING, & SERVICE

Reviewer for {ITCS, QIP, TQC} 2024, {QIP, TQC, AQIS} 2025, {QIP, SOSA} 2026, Quantum Journal.

Co-founded and lead Fellowship for Research, Academic Mentorship and Exploration (FRAME), 501(c)(3) nonprofit initiative. See https://framebengal.com/.

Teaching Assistant for CS 359D Quantum Complexity Theory, Spring 2023.

Created and led ICME's student advocacy group 2020 – 2022. Accomplishments: wrote and disseminated the first comprehensive student survey for ICME, implemented PhD Individual Development Plan, streamlined core curriculum and qualifying exams, refocused CME 300 seminar on aligning with research advisor.

MIT interviewer: interview undergraduate applicants and submit detailed evaluations to Admissions.

Organizer of Real Analysis reading group at Stanford, 2020.

Stanford Engineering Graduate Advisory Council, 2019 – 2021.

Volunteer middle- and high-school teacher at MIT Splash, MIT HSSP, and Institut Salvador Espriu in Barcelona. Created from scratch lessons on special relativity, particle physics, radioactivity, and other topics. Materials available upon request.

Artistic collaborations with Felicitas Rohden, Prof. of Form and Color at Peter Berhens School of Design from 2017 to present.
Completed projects include Shapes of Possibility and companion book project Qubits, conveying key principles of quantum information to the public and premiering in Oct. 2017 at Kunst im Tunnel Museum in Düsseldorf. In 2025, the work is now housed in Kunsthaus NRW in Aachen. I also sat for an interview about our exhibit, which was published in the art magazine *Unbag Magazine* **3** (2018).
In 2022-24, I was a scientific collaborator on Unspoken Spaces, a trio of atomic orbital sculptures onto which Feynman diagrams were etched. The project won a competitive grant to be permanently installed in the foyer of the Fraunhofer Center for RESource-efficient Energy Technologies (RESET) in Dresden. In 2025, FR and I are collaborating on a project on topological quantum computing and anyon braiding, following these prior works.