

ARUL RHIK MAZUMDER

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Education

Imperial College London

MSc, Physics with Quantum Dynamics

Sep. 2025 – Present

London, UK

Carnegie Mellon University

B.S. in Computer Science; ML and Algorithms & Complexity concentrations

Aug. 2023 – May 2026

Pittsburgh, PA

- Dean's List High Honors; GPA: 3.7 / 4.0.
- Relevant Coursework: Quantum Computing, Complexity Theory, Learning Theory, Randomized Algorithms, Convex Optimization, Probabilistic Graphical Models, Deep Learning Systems, Parallel Computer Architecture
- Activities: President and Founder of [CMU Quantum](#), Quant Club, ACM @ CMU, Project Olympus, Fencing Club.

Research/Work Experience

Waterloo Institute for Quantum Computing (IQC)

Undergraduate Researcher

May 2026 – Aug. 2026

Waterloo, ON, Canada

- Selected for the Undergraduate School on Experimental Quantum Information Processing (USEQIP) and an Undergraduate Research Award (URA) at IQC; two weeks of training in experimental quantum information processing followed by research on quantum algorithms with Michele Mosca and Vlad Gheorghiu. Supported by a MITACS Globalink Scholarship.
- T-count lower bounds for Clifford+T synthesis via Amy–Mosca moments ([manuscript in preparation](#)).

BlueQubit

Part-time Scientific Communicator and Researcher

Oct. 2025 – Present

Los Angeles, CA

- Reviewed and synthesized BlueQubit research to produce accessible, technically accurate blog posts for the broader quantum community; attended and mentored students at quantum hackathons (e.g., YQuantum 2026).
- Benchmarked GPU-accelerated quantum circuit simulators (MPS and Pauli path) against AWS Braket, Quantum Rings, and open-source backends; conducted runtime scaling studies across simulation backends ([preprint on arXiv](#)). Findings informed research-driven product decisions and improved simulator cost estimators.

Caltech Institute for Quantum Information and Matter (IQIM)

Undergraduate Researcher

May 2025 – Aug. 2025

Pasadena, CA

- Conducted research on resource-efficient quantum matrix processing using commutator scaling, achieving significant improvements in algorithmic efficiency with Samson Wang and James Watson (Google Quantum AI). [Accepted to TQC 2026](#) (poster); work showcased at IQIM.

Quantum Technologies Group

Research Intern

May 2023 – Oct. 2025

Pittsburgh, PA

- Created a tutorial on quantum optimization for IBM and D-Wave machines, with a [GitHub repo](#); [presented at INFORMS 2025](#) and published in *Tutorials in Operations Research*.

George Mason University Algorithms Lab

Research Intern

May 2022 – Jan. 2024

Fairfax, VA

- Developed a quantum string-matching algorithm in Qiskit and compared it to classical methods; published in *ACM AISS*, 2022.
- Created a hybrid quantum-classical TSP algorithm outperforming classical approaches; published in *IEEE IPDPS*, 2023.
- Developed a quantum algorithm for the Shipment Rerouting Problem, tested on real-world networks; published in *J. Student-Scientists' Research*, 2024, with an extension on [arXiv](#).

Leadership & Outreach in Quantum

CMU Quantum

Founder and President

Sep. 2024 – May 2026

Pittsburgh, PA

- Founded and grew CMU's first student quantum organization to 200+ members with 10+ leaders; secured sponsorships from General Motors and Boeing. Developed educational materials ([slides/handouts](#)), organized workshops with industry leaders (IBM, IonQ, Quantinuum), and led hackathon tracks and sponsored trips including the Quantum Leap Career Nexus.

Duke Software-Tailored Architectures for Quantum (STAQ)

NSF-Funded Invited Scholar

June 2025

Durham, NC

- Completed a PhD-level seminar on quantum simulation, error correction, and architecture with Peter Love, Kenneth Brown, and Yu Tong.
- Visited the Duke Quantum Center to learn about experimental research on ion traps and neutral atoms.

Publications and Ongoing Work

Selected Publications and Manuscripts

1. **A. R. Mazumder**, J. Watson, S. Wang. “Resource-Efficient Quantum Matrix Processing with Commutator Scaling.” *TQC*, 2026 (poster).
2. **A. R. Mazumder**, M. Mosca, V. Gheorghiu. “T-Count Lower Bounds for Diagonal Third-Level Gates via Amy–Mosca Moments.” Manuscript in preparation, 2026.
3. **A. R. Mazumder**, J. Lee. “How Much Workspace Does Optimal-T Synthesis Need? Ancilla Complexity in the Mixed Clifford+T Model.” Manuscript in preparation, 2026.

Peer-Reviewed and Accepted Publications

1. **A. R. Mazumder**. “An End-to-End Hybrid Quantum–Classical Sampling Workflow for Discrete Markov Random Fields.” *IEEE QCE*, 2026 (QECS track).
2. **A. R. Mazumder**, S. R. Mazumder. “Depth-Efficient Quantum Topological Data Analysis for Regime-Specific Detection of Financial Stress.” *IEEE QCE*, 2026 (QAPP track).
3. **A. R. Mazumder**, S. Tayur. “Five Starter Problems: Solving Quadratic Unconstrained Binary Optimization Models on Quantum Computers.” *Tutorials in Operations Research*, INFORMS 2025, pp. 145–183.
4. M. Zhao, **A. R. Mazumder**, F. Li. “Improved Classical and Quantum Algorithms for Shipment Rerouting Problems.” *J. Student-Scientists’ Research*, 2024.
5. **A. R. Mazumder**, A. Sen, U. Sen. “Benchmarking Metaheuristic-Integrated QAOA Against Quantum Annealing.” *LNNS*, 2024.
6. F. Li, **A. R. Mazumder**. “An Adaptive Hybrid Quantum Algorithm for the Metric Traveling Salesman Problem.” *IEEE IPDPS*, 2023.
7. A. Sen, **A. R. Mazumder**, U. Sen. “Differential Evolution Algorithm Based Hyperparameter Selection of Transformer Neural Networks.” *IEEE SSCI*, 2023.
8. A. Sen, **A. R. Mazumder**, D. Dutta, U. Sen, P. Syam, S. Dhar. “Comparative Evaluation of Metaheuristics for Short-Term Weather Forecasting.” *ECTA*, 2023.
9. M. Gao, R. Huang, **A. R. Mazumder**, F. Li. “Comparisons of Classic and Quantum String Matching Algorithms.” *ACM AISS*, 2022.

Preprints and Other Publications

1. **A. R. Mazumder**, M. Z. Mullath, H. Tepanyan. “Benchmarking Zero-Setup Quantum Circuit Simulators.” *arXiv preprint*, 2026.
2. F. Li, **A. R. Mazumder**, M. Zhao. “Quantum Annealing Approaches to Shipment Rerouting Problems.” *arXiv preprint arXiv:2501.05624*, 2025.

Awards and Honors

MIT IQuHacks – 2nd Place, NVIDIA Track (2026): Among 90+ teams; variational LABS approach with Pauli Correlation Encodings and GPU simulation, solving instances more than twice the size of prior work.

Yale Quantum Institute – 2nd Overall, YQuantum Advancement Track (2025): Wigner-function state reconstruction via convex optimization and CNN denoising; presented at QuantumCT among 300 participants from 30+ universities.

Citadel/Correlation One Datathon – 2nd Place (2024): Top 150 of 3,000+; pairs-trading strategy across processed food and healthcare (Sharpe 1.58), judged by Citadel QAs.

HackCMU – GSA Infrastructure Prize (2023): Eco-Bin AI waste sorting (95% accuracy); pilot with CMU Dining among 200+ participants.

Regeneron STS Scholar (2023): Top 300 nationally from 2,000+ applicants.

Olympiads: USA(J)MO Qualifier, USAPhO Bronze, USACO Gold, USNCO National Finalist

Technical Skills

Programming: Python, Julia, C++, Java, TensorFlow, PyTorch, CVXPY, PICOS

Quantum Toolkits: Qiskit, Pennylane, BlueQubit, IBM Q Experience, D-Wave Ocean SDK, CUDA-Q

Systems: Linux, Git, CUDA, MPI, OpenMP, pthreads