Arul Rhik Mazumder

39 Steele Lane, Boxborough, Massachusetts 01719

1-978-710-1802 arul.rhik@gmail.com arulrhikm.github.io Arul (Rhik) Mazumder Arul Mazumder

Education

Ph.D. Program Applicant **Intended Start: Fall 2026**

Actively applying to Ph.D. programs in Computer Science and Quantum Information Science

Carnegie Mellon University **Aug. 2023 – May 2026 (expected)**

Bachelor of Science in Computer Science, Dean's List High Honors *Pittsburgh, PA*

- GPA: 3.75 / 4.0.
- Relevant Coursework: Probabilistic Graphical Models, Quantum Computing, Deep Learning Systems, Parallel Architecture, Complexity Theory, Learning Theory, Randomized Algorithms, Convex Optimization
- Activities: President and Founder of CMU Quantum, Quant Club, ACM @ CMU, Project Olympus, Fencing Club.

Research/Work Experience

Caltech Institute for Quantum Information and Matter (IQIM) **May 2025 – Aug. 2025**

Undergraduate Research Fellow *Pasadena, CA*

- Collaborated with Samson Wang and John Preskill to develop early fault-tolerant quantum algorithms using Trotter extrapolation, achieving exponential improvements in circuit depth. Presented findings at the SURF final presentation and showcased research at the IQIM poster session. Drafted a report, currently under revision for paper publication.

Quantum Technologies Group **May 2023 – Present**

Research Intern *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.*
- Developed semidefinite programming (SDP) formulations for entanglement detection using PICOS and CVXPY; programs are in QuantumSDPs GitHub.

George Mason University Algorithms Lab **May 2022 – May 2023**

Research Intern *Fairfax, VA*

- Developed a quantum string-matching algorithm in Qiskit, compared to classical methods; published in *ACM AISS '22.*
- Created a hybrid quantum-classical TSP algorithm, outperforming classical approaches; published in *IEEE IPDPS 2023.*
- Developed a quantum algorithm for the Ship Rerouting Problem, tested on real-world networks, outperforming classical solvers; published in *Journal of Student-Scientists' Research, 2024*, with an extension preprinted on arXiv.

Leadership & Outreach in Quantum

CMU Quantum **August 2024 – Present**

Founder and President *Pittsburgh, Pennsylvania*

- Founded and grew the club to 200+ members with 10+ leadership team members, securing sponsorships from General Motors and Boeing. Serve as Head of Leadership, liaising with external organizations and representing the club as a student speaker for the Center for Quantum Computing and Information Technologies (QCiT). Develop educational materials for the club, including tutorials and slides on key quantum topics (pdf, pdf, pdf, slides, slides, slides).
- Organized high-impact workshops and talks featuring industry leaders from IBM, Quantinuum, IonQ, and others. Collaborated with the Quantum Coalition to design a track for the UN-sponsored Future Leaders in Quantum hackathon. Led a sponsored trip to the Quantum Leap Career Nexus at the University of Maryland.

BlueQubit **October 2025**

Growth and Engagement Lead *Los Angeles, California*

- Led and expanded an online community of 100+ BlueQubit users, driving engagement and promoting the platform and research initiatives among students. Coordinated all communications and support for the Quantinuum x BlueQubit x Stanford Peaked Circuits Hackathon, ensuring smooth participant experience and problem resolution.

Duke Software-Tailored Architectures for Quantum Codesign (STAQ) **June 2025**

NSF-Funded Invited Scholar *Durham, North Carolina*

- Completed a PhD-level, week-long quantum computing seminar featuring advanced lectures on quantum simulation, error correction, and architecture, taught by leading researchers including 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

Peer-Reviewed Publications

1. **A. R. Mazumder**, S. Tayur. "Five Starter Problems: Solving Quadratic Unconstrained Binary Optimization Models on Quantum Computers." *Tutorials in Operations Research: Advances in Analytics and Operations Research: Improving Decisions to Secure the Future*, INFORMS, 2025, pp. 145-183. [PDF] from arxiv.org

2. M. Zhao, **A. R. Mazumder**, F. Li. "Improved Classical and Quantum Algorithms for Shipment Rerouting Problems." *Journal of Student-Scientists' Research*, 2024.

3. **A. R. Mazumder**, A. Sen, U. Sen. "Benchmarking Metaheuristic-Integrated QAOA Against Quantum Annealing." *Lecture Notes in Networks and Systems*, 2024.

4. A. Sen, **A. R. Mazumder**, U. Sen. "Differential Evolution Algorithm Based Hyperparameter Selection of Transformer Neural Networks." *IEEE SSCI*, 2023.

5. A. Sen, **A. R. Mazumder**, D. Dutta, U. Sen, P. Syam, S. Dhar. "Comparative Evaluation of Metaheuristics for Short-Term Weather Forecasting." *ECTA*, 2023.

6. F. Li, **A. R. Mazumder**. "An Adaptive Hybrid Quantum Algorithm for the Metric Traveling Salesman Problem." *IEEE IPDPS*, 2023.

7. M. Gao, R. Huang, **A. R. Mazumder**, F. Li. "Comparisons of Classic and Quantum String Matching Algorithms." *ACM AISS*, 2022.

Preprints

1. F. Li, **A. R. Mazumder**, M. Zhao. "Quantum Annealing Approaches to Shipment Rerouting Problems." *arXiv preprint arXiv:2501.05624*, 2025.

Ongoing Work

- **A. R. Mazumder**, S. Wang, J. Preskill. "Early Fault-Tolerant Quantum Algorithms for Matrix Functions via Trotter Extrapolation." In preparation, Caltech IQIM, 2025.

Awards and Honors

Yale Quantum Institute Grand Prize – 2nd Place Overall, Advancement Track Winner (YQuantum 2025)
Awarded for reconstructing density operators from Wigner functions using convex optimization and CNN-based denoising. Presented at the QuantumCT Industry Collaboration Forum, competing among 300 participants from 30+ universities.

2nd Place – Correlation One & Citadel Securities Datathon (Summer Invitational 2024)
Selected as one of the top 150 from 3,000+ participants. Developed a pairs-trading strategy linking the processed food and healthcare sectors, achieving a Sharpe ratio of 1.58. Judged by Citadel Quantitative Analysts and awarded a cash prize.

Best Campus Infrastructure Hack – HackCMU 2023
Developed "Eco-Bin," an AI-driven waste sorting system using computer vision and deep learning (95% accuracy). Recognized by the CMU Graduate Student Association among 200+ participants. Selected to pilot the system with CMU Dining Services.

Regeneron Science Talent Search Scholar (Top 300 Teen Scientists 2023)
Recognized as one of the top 300 scholars in the nation's premier science and math competition for high school seniors, selected from over 2,000 applicants across 712 schools in 46 states, Puerto Rico, Guam, and 10 other countries.

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

Other: International Math Modelling Competition National Finalist, United States Math Talent Search Bronze

Technical Skills

Programming: Python, Julia, C++, Java, TensorFlow, PyTorch, CVXPY, PICOS
Quantum Toolkits: IBM Q Experience, D-Wave Ocean SDK, BlueQubit, Qiskit, Pennylane
Systems: Linux, Git, CUDA, MPI, OpenMP, pthreads

References

Available upon request.