Prateek P. Kulkarni

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Final Year Undergraduate, Dept. of ECE, PES University, India

EDUCATION

PES University, India *June 2026*
Bachelor of Technology (B. Tech.), Electronics & Communication Engineering (Quantum Tech Track)
Thesis: Programmable Photonic Processor for Quantum Machine Learning

PRIMARY RESEARCH FOCUS

- Quantum property testing, especially for graphs.
- Quantum (learning) algorithms, for simulations and separability.
- Quantum query and communication complexity theory.
- Resource estimation and quantification of quantum advantage.

WORK EXPERIENCE

Fujitsu Research of India Pvt. Ltd. (FRIPL), Bangalore
Research Intern, Quantum Lab at FRIPL
Mentor: Dr. Aritra Sarkar *April 2026 - Present*

Indian Institute of Science (IISc.), Bangalore
Pre-Doctoral Fellow, Department of Computer Science & Automation
Advisor: Prof. Sumit K. Mandal *November 2025 - April 2026*

- Derived closed-form, hardware-aware models relating shot count to success probability, circuit partitioning and resource allocation in noisy-settings, achieving about **95%** accuracy on real quantum devices.
- Based on this, proposed an optimal, variance-aware shot allocation strategy across circuit partitions, reducing estimation error by up to **63%**.
- Demonstrated up to **58%** reduction in shot requirements and **60%** energy savings across standard quantum benchmarks via noise-aware optimization.

Indian Institute of Science (IISc.), Bangalore
Research Intern, Department of Computer Science & Automation
Advisor: Prof. Sumit K. Mandal *March 2024 - October 2025*

- Developed analytical models to estimate quantum processor fidelity and execution time from coupling maps and hardware constraints, achieving >**98%** accuracy on real devices.
- Designed an efficient coupling map generation algorithm, improving circuit fidelity by up to **35%**.
- This work won the **3rd Prize** in the ACM Student Research Competition at 58th MICRO (UG category).

RELEVANT COURSEWORK AND SKILLS

Grades in parentheses.

Probability, Statistics & Complex Analysis (A)
Quantum Entanglement & Quantum Computation (A)
Chip-Level Photonics (A)
Quantum Transport & Logic Gates (S)
Non-Linear Optics & Quantum Technology (A)

Languages: Python, Julia, C, Matlab. **Platforms**: Qiskit, Stim, QuNetSim, Cirq, PennyLane, CUDA-Q.

PUBLICATIONS

PPK = Prateek P. Kulkarni, * = Equal contribution, † = Alphabetical ordering in last name.

1. **PPK*** and Aakarsh Alam*. QuSim-Join: Provably Optimal Quadratic Speedup in Set Similarity Joins via Quantum Amplitude Estimation. *3rd Workshop on Quantum Computing and Quantum-Inspired Technology for Data-Intensive Systems and Applications, co-located with SIGMOD'26 (**Q-Data 2026**).*
2. **PPK**. One Key Good, *L* Keys Better: List Decoding Meets Quantum Privacy Amplification. *16th Conference on Quantum Cryptography (**QCrypt 2026**).* [arXiv:2603.18097]
3. **PPK**. Entanglement-Dependent Error Bounds for Hamiltonian Simulation. *Poster at 21st Conference on the Theory of Quantum Computation, Communication and Cryptography (**TQC 2026**).* [arXiv:2602.00555]
4. **PPK**. Quantum Algorithms for Approximate Graph Isomorphism Testing. *Under Submission.* [arXiv:2603.02656]
5. Ramaseshan R, Abhishek Kumar V S, Adith Rajeev, Prathik V, Aditya Aravind, **PPK**, Kaustav Bhowmick. A Generalized Hamiltonian Approach for Designing Simple Single Photon-based Optical Quantum Devices. ***J. Supercomput. 81, 1395***, 2025. [Springer Nature]

SOFTWARE

- **surface2cirqit** (Link: https://github.com/prateekpkulkarni/surface2cirqit/)
  - Developed a (simple) pipeline translating surface-code QEC constructs into Cirq circuits, reducing gate counts by about 20–40%, enabling simulation and analysis on NISQ devices.

TALKS

- Systems Day, Dept. of Computer Science and Automation, IISc (Poster Listing)
  - Presented a poster-talk on: *Multi-core Quantum Computing with Superconducting Qubits*
- 2nd Workshop on Automata and Games for Synthesis, at FSTTCS 2025. (WAGS@FSTTCS '25)
  - Contributed short talk on: *Quantum Communication Exponentially Speeds-up Circuit Synthesis*

ACHIEVEMENTS, RECOGNITIONS AND GRANTS

- *INAE Mentee*, Advised by Prof. Sumit K. Mandal. (1/60 positions) — May 2026
- *Pre-Doctoral Fellowship*, SPARKS Programme, CSA, IISc (1/4 positions) — Nov. 2025
- *3rd Place Globally*, ACM SRC at MICRO 2025, UG Category — Oct. 2025
- *Student Travel Grant*, MICRO 2025 – $580 for ACM SRC presentation — Aug. 2025
- *Q-Pragathi Project Funding*, KITS, Govt. of Karnataka – 1.2L INR — Sept. 2024
- *Long-Term Internship (Post-Quantum Cryptography)*, ISFCR, PES University (declined) — Jan. 2024
- *National Runner-up*, Explain The Concept, Pravega (Undergraduate Fest), IISc — Feb. 2019

SERVICE

Peer-Reviewing: Reviewer, IEEE Transactions on Quantum Engineering (TQE), 2025

Teaching Assistant: Quantum Transport & Logic Gates, PESU (Class Size: 90, 4 Credits; Spring 2025)

REFERENCES

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