Dipanjan Bera

PhD Researcher | Quantum Information & Communication

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Education

Indian Institute of Technology (IIT), Delhi July 2025 – Present
Ph.D. in Applied Electronics
CGPA: 7.50

Indian Institute of Technology (IIT), Hyderabad Graduated July 2025
M.Tech. in Quantum and Solid-State Devices
CGPA: 8.25

College of Engineering and Management, Kolaghat Graduated June 2023
B.Tech. in Electronics and Communication Engineering
CGPA: 8.57

Research Publications

1. Performance Analysis of Multiparty GHZ-State Quantum Conference Key Agreement over Optical Fiber Channel
PhD Research, IIT Delhi · First author · Submitted to IEEE TCOM *arXiv:2610.05448*

- Analyze an N-party GHZ-state quantum conference key agreement (QCKA) protocol using the N-BB84 scheme over realistic optical-fiber channels.
- Model fiber attenuation, polarization-mode-dispersion-induced dephasing, and detector dark counts; derive closed-form bit- and phase-error rates.
- Incorporate channel-derived errors into finite-key secret-key-rate analysis and optimize the parameter-estimation probability using Brent's method.

2. Redundant Routing Protocol for Key Rate Maximization in QKD Networks
PhD Research, IIT Delhi · Co-author · Accepted at IEEE ANTS 2026

- Study key-rate maximization for multiple source–destination pairs in multi-hop QKD networks with trusted quantum repeaters.
- Develop a redundant-routing framework using Key Distribution Link Establishment (KDLE), formulated as a linear program, and Key Distribution Path Selection (KDPS).
- Evaluate the approach through E91-based simulations, focusing on reliable path construction and improved key-distribution rates.

Research Projects

Classical Simulation of Quantum Algorithms using Binary Methods
Master's Thesis Research, IIT Hyderabad *Sept. 2024 – June 2025*

- Developed a Python-based framework for quantum operations and circuits, enabling classical simulation of quantum algorithms using binary-method techniques.
- Implemented and simulated the Quantum Fourier Transform (QFT) and Grover's algorithm using the custom framework.
- Benchmarked time complexity against Qiskit and PennyLane packages. - Thesis

Simulation of Measurement-Induced Phase Transition of Qubits
Master's Research, IIT Hyderabad *Jan. 2024 – Apr. 2024*

- Investigated measurement-induced phase transitions by varying measurement probabilities and analyzing their effects on quantum entanglement.
- Designed quantum circuits using single- and two-qubit gates with projective measurements to simulate system behavior under different probabilities.
- Used entanglement entropy to track transitions between entangled and non-entangled regimes. - Thesis

Digital Logic IC Tester
Bachelor's Research, CEMK *August 2022 – May 2024*

- Designed and developed an Arduino-based digital logic IC tester to assess the functionality of logic integrated circuits.
- Implemented a user-friendly interface and configurable automated tests to provide immediate feedback on IC operating status. - Thesis.

Professional Experience

Engineering Trainee April 2025 – August 2025
DiracQ Systems Pvt. Ltd.

- Contributed to the development of a Quantum Key Distribution (QKD) system using an optical setup and single-photon detectors. Certificate.

Web Development Intern Summer 2022
Ardent Computech Pvt. Ltd.

- Gained hands-on experience with MongoDB, Express.js, React, and Node.js for end-to-end web application development.
- Developed TextUtils, a React web application for word counting, text transformations, and text analysis. Certificate.

Technical Skills

- **Research interests:** Quantum communication, Quantum computation, Quantum networks.
- **Programming:** Python.
- **Scientific computing / ML:** NumPy, TensorFlow, PyTorch, Keras, Scikit-learn, Pandas, Seaborn, Matplotlib.
- **Quantum algorithms and protocols:** QFT, Grover's algorithm, BB84, E91, Teleportation, Super dense coding.
- **Quantum frameworks:** Qiskit, PennyLane.
- **Tools:** OOMMF, Origin, Matlab, LaTeX, VS Code.

Relevant Coursework

Quantum Mechanics; Introduction to Quantum Computing; Quantum Computing Lab; Advanced Quantum Information and Communication; Mathematical and Computational Methods for Quantum Computing; Quantum Measurement and Sensing; Optimization, Deep Learning.

Certifications and Professional Development

- **Introduction to Quantum Information** — Coursera, Winter 2024. Certificate.
- **Quantum Communication** — IBM, Summer 2025. Certificate.
- **Quantum Computations and Its Application in Molecular Structure** — IIT Kharagpur, Winter 2025. Certificate.
- **Supervised Machine Learning: Regression and Classification** — Coursera, Winter 2024. Certificate.
- **Semiconductor Workforce Development Program** — SPARC, IIT Hyderabad, Winter 2024. Certificate.
- **A Conference to Shape the Future of Semiconductor Technology** — CENSE, IISc, Winter 2024. Certificate.

Leadership and Extracurricular Activities

- **Inspection Head, Mess Monitoring Council, IIT Hyderabad** 2024.
- **Head Coordinator, Annual Tech Fest** 2022.

Interest: Running, Badminton.