Tanish Singh Rajpal

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Quantum software and verification: simulation, statistical certification, learning, and quantum-safe security

EDUCATION

Carnegie Mellon University — *Mountain View, CA*

M.S. in Information Technology - Information Security, Information Networking Institute — *Expected May 2027*

Incoming Head Teaching Assistant (Spring 2027), Quantum Security, Prof. Michael Mattarock; helping build the course

NMIMS University — *Shirpur, India*

B.Tech. in Computer Engineering | GPA: 3.83/4.00 | Valedictorian, graduating class — *May 2025*

RESEARCH EXPERIENCE

Entanglement Delivery Guarantees in Quantum Networks — *May 2026 - present*

Independent Study, CMU Information Networking Institute | Advisor: Prof. Michael Mattarock

- Built a **model-based delivery guard** and a **random-test certificate** that also measures model optimism.
- Pre-registered simulations: **0 bad pairs in 8.8 million deliveries** on 3D and diagonal topologies with a declared margin against a model wrong by 0.044; **83 of 95 primary hypotheses passed**, all 12 failures reported.
- Re-analyzed **seven experimental datasets**, including Harvard and IonQ: **predicted IonQ's certificate in advance (0.817 vs. 0.818 measured)**; Oxford above 0.9 after ~220,000 kept pairs. Manuscript complete; code and evidence.

Differentiable Quantum-Chemical Models (DFTBML) — *Sep 2026 - present*

Independent Study, CMU Chemistry | Advisor: Prof. David Yaron

- Extending **DFTBML** (Hu, He, and Yaron, *J. Chem. Theory Comput.* 2023) to a split-valence basis: designed a **four-shell PyTorch architecture (75 to 266 parameters)** and a randomized test suite for tied parameters.

Post-Quantum EAP-TLS for Enterprise Wi-Fi — *Aug 2026 - present*

Master's Thesis, CMU | Advisors: Prof. Pedro Bustamante and Prof. Michael Mattarock

- Built **LockStep**, an ns-3 sign-in simulator; showed ML-DSA certificates raise round trips **from 6 to 29**, and an edge QUIC proxy cut sign-in time **about 10× (1.50 s to 135 ms)**.

SELECTED QUANTUM PROJECTS

The Last Call - Quantum Interference Horror Game — *Oct 2026*

Qollab × IonQ Global Quantum Hackathon | Global Best of Quantum Playground | CMU node first place | Team Popeyes

- Built an AR horror game: trace interference to the right door, lose it, then erase a record to restore it. Website.

Dicke-State Circuits for Google Willow — *Oct 2026*

DuQuantum 2026 (Duke), Google Quantum AI Challenge | Third place, Standard Track | Team Popeyes

- Built Dicke-state circuits from CZ and PhasedXZ gates, placed using the day's calibration data. Website.

Phase Hunter - Mapping Quantum Spin Phases under Noise — *Sep 2026*

Team Lead, Q-SITE Hacks 2026 | Quantum Coalition Scientific Track runner-up | Team Popeyes

- Led team of 3 to build a playable phase-boundary search game on noisy and error-mitigated PennyLane maps. Code.

Quantum Portfolio Optimization Using QAOA — *Apr 2026*

Team Lead, Yale YQuantum Hackathon | Third place

- Led team of 5 on the Markowitz-to-QUBO-to-Ising formulation and QAOA circuit design. Repository.

INDUSTRY EXPERIENCE

AI and SEO Intern — *Feb 2025 - May 2025*

MotionGility, Indore, India

- Built **seven AI content and automation tools**, including script and blog generators and a **sales voice assistant**.

Vulnerability Assessment and Penetration Testing Intern — *Oct 2023 - Jan 2024*

Newton's Apple, Pune, India

- Found and helped fix **three critical vulnerabilities** in a confidential Android app; performed static Java code analysis.

HONORS AND PUBLICATIONS

- IBM Qiskit Global Summer School 2026: **Quantum Excellence (Advanced)**.
- **First-author article**, *IEEE Transactions on Artificial Intelligence* (2026); three IEEE conference papers (2024-25).

SKILLS

Quantum and Statistics: network simulation, anytime-valid inference, certification, VQE, QAOA, error mitigation.
Software and ML: Python, Qiskit, Cirq, PennyLane, NetSquid, ns-3, Git; reinforcement learning (PPO), deep learning.
Security and Systems: ML-DSA, QKD, 802.1X, Burp Suite, Metasploit; C, x86-64 assembly, Linux administration.