Zuhair Khan

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EDUCATION

University of Toronto Scarborough — Sep 2022 - Dec 2026 (Expected)
Honours B.Sc. in Computer Science (Software Engineering Specialist) — *Toronto, ON*

- **University of Toronto Scholar Award** — $7,500 merit scholarship (**top 3%**).
- **Key coursework:** Quantum Computing, Networks, Cybersecurity, Algorithms, Operating Systems, Databases.

RESEARCH & QUANTUM COMPUTING | VIEW ALL ↗

Quantum-Safe Security: PQC vs QKD — Aug. 2025 – Present
Undergraduate Researcher — Supervisor: Prof. Marcelo Ponce — *University of Toronto*

- Analyzing **QKD protocols** (**BB84**, **E91**) vs. **lattice-based PQC KEMs** in simulated **TLS-like networks**; benchmarking **key rates**, **QBER thresholds**, and noise tolerance across heterogeneous quantum channels.
- Developed **Python**/**Qiskit**/**PennyLane** simulation pipelines; automated 10^3–10^4-shot parameter sweeps over channel loss, depolarization, and dark counts; implemented **intercept–resend** and **PNS** attacks.
- **Winner**, 2025 **CMS Undergraduate Research Symposium**; leading a **first-author manuscript** on hybrid **PQC/QKD** migration strategies for near-term infrastructures.

PhotonQML: Variational Quantum Classifier — Sep. 2025 – Present
Personal Research Project

- Designing a **CV-VQC** using **PennyLane** and **Strawberry Fields**; training end-to-end with **PyTorch autograd**.
- Benchmarking **CV gates** (beamsplitters, squeezers, Kerr) and interferometric encodings; visualizing **loss landscapes**, decision boundaries, and phase-space embeddings for toy datasets.

Qiskit Global Summer School — Quantum Excellence — Aug. 2025
IBM Quantum — *Remote*

- Completed all labs and capstone in a **two-week intensive** program on quantum algorithms; earned the **Quantum Excellence certificate**.
- Implemented **noise-aware VQE**/**QAOA** workflows and hardware-efficient ansätze; achieved 30–45% **circuit depth reduction** on IBM backends with energy error $< 10^{-3}$.

Quantum Computing Coursework & Training — Apr. 2025 – Aug. 2025
University of Toronto — *Toronto, ON*

- Completed **CSCD94 Intro to Quantum Computing**; delivered a seminar on **post-quantum cryptography vs. QKD** and migration timelines.
- Finished **Xanadu PennyLane Codebook** and SciNet workshops on Bell inequalities, tunnelling, Grover, QFT, and phase estimation.

SOFTWARE & SECURITY PROJECTS | VIEW ALL ↗

Cybersecurity CTF Portfolio (15+ Challenges) | *Python, Bash, Linux, Wireshark, Docker*

- Solved and documented **15+ CTFs** across **cryptography**, TLS inspection, reverse engineering, PCAP analysis, and web exploitation (**CSCD27**).
- Built tooling for **AES**/**ChaCha20** cracking, automated SQLi payloads, and **PCAP analyzers** using **Scapy & Wireshark**; maintained Dockerized redacted repo.

Concurrent System Monitoring Tool | *C, Linux, IPC, Signals, Docker*

- Built a multi-process **Linux system monitor** using `fork()`, pipes, shared memory, and POSIX signal handlers to track CPU and memory for **100+ live processes** in real time.
- Added structured CLI, robust error handling, and Docker deployment; achieved $<$**5% runtime overhead** while emphasizing **systems-level C**, concurrency, and OS internals.

TECHNICAL SKILLS

Languages: Python, C/C++, Java, TypeScript, JavaScript, SQL, Bash, MIPS, PHP, R, Swift, Haskell
Quantum Frameworks: PennyLane, Strawberry Fields, Qiskit, IBM Quantum Lab, Jupyter
Quantum Topics: VQE/QAOA, QML, CV circuits, **BB84**/**E91** QKD, lattice PQC, error mitigation, transpilation
Cybersecurity: PQC & lattice crypto, RSA/ECC, TLS/SSL, SQLi/XSS/CSRF, Wireshark/tcpdump, Scapy, Nmap, IDS/NIDS
Databases & Tools: PostgreSQL, MongoDB, SQLite, Docker, Git/GitHub Actions, Linux, Vercel
Certifications: Google Cybersecurity (V2), Qiskit Summer School (QE), IBM Quantum Developer (In Progress)