Hemish Ahuja

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Education

York University Sept 2022 – May 2026

Hons. Bachelor of Science in Physics, Minor in Computer Science

Experience

York University Sep 2024 – Present

Research Intern – EDM^3 High-Precision Atomic Physics Lab

- Designed and implemented a cryogenic detection system to measure the eEDM using matrix-isolated BaF molecules, improving precision in ultra-cold quantum environments.
- Applied high-vacuum and cryogenic stabilization protocols to maintain BaF molecular integrity, resulting in increased spin coherence and a significant improvement in observation duration.
- Co-designed and calibrated optical and magnetic field alignments, enabling precise quantum state control and improved signal fidelity in polar molecule experiments.
- Partnered with theoretical and experimental physicists to test time-reversal symmetry violation, using custom simulations to refine detection sensitivity to sub-meV shifts.
- Conducted diagnostics and iterative optimization cycles that extended quantum coherence time and enhanced polarization fidelity in precision-controlled cryogenic matrices.

Canadian Association of Physicists Nov 2023 – Jan 2025

Undergraduate Chair – Student Advisory Council (SAC)

- Chairing the SAC, representing 10,000+ physics students nationally, and leading strategic initiatives on education, policy, and engagement.
- Spearheaded nationwide EDI and education programs, organizing 5+ national panels/webinars attended by 500+ students and professionals.
- Established Canada's first formal partnership with IAPS, enhancing international mobility and collaboration for student researchers as Committee President.
- Appointed to elite CAP Medal Committee and the UN IYQ Taskforce to shape national recognition and quantum education strategies.
- Leading PSYU as President, coordinating academic events and outreach for 100+ members; previously served as Vice President.

Goethe University, Germany Jun 2024 – Aug 2024

Research Intern – GREP Fellow

- Researched quantum gravity corrections on black hole shadow structures under Dr. Laura Sagunski, focusing on modeling observational signatures.
- Built a Python-based simulation framework for black hole shadow imaging, incorporating quantum gravity effects to increase model precision by 20%
- Integrated EHT datasets into simulation pipeline to refine model accuracy, achieving 15% closer alignment with quantum gravity-based theoretical predictions.
- Delivered a peer-reviewed presentation on quantum gravity effects in black holes at the EXPLORE International Conference, engaging researchers from 5+ countries.

University of Alberta Sep 2023 – May 2024

Research Intern – Quantum Gravity

- Investigated theoretical models of quantum gravity under Dr. Saeed Rastgoo, focusing on reconciling spacetime curvature with quantum field behavior.
- Analyzed loop quantum gravity and string-inspired frameworks to examine the unification of GR and quantum theory.
- Contributed to the international EXPLORE initiative with York, Goethe, UofA, and MIT, focusing on theoretical consistency checks and cross-institutional simulation validation.

York University May 2023 – Aug 2023

Research Intern – York Science Scholars Award (YSSA)

- Investigated quantum error mitigation strategies on IBM Q systems under Dr. Randy Lewis, focusing on circuit-level decoherence reduction.

- Applied Dynamic Decoupling sequences to minimize idling/crosstalk errors, increasing quantum gate fidelity by 10 on IBM Q hardware.
- Used Qiskit to simulate the Stern-Gerlach experiment on IBM quantum processors, demonstrating spin measurement and hardware consistency.
- Presented experimental findings on quantum error correction at the York Summer Undergraduate Research Conference, engaging 50+ faculty and students.

Independent Research Internship Jun 2021 – Aug 2021

Under Dr. F. M. D. Esmailie

- Co-authored a paper analyzing time-dependent behavior of the Hubble Parameter and its correlation with cosmological constants using observational datasets and Python-based statistical modeling.

Skills

Programming & Tools: Python, Java, Qiskit, Git, LaTeX, Bash, PostgreSQL, QMOD, Computer Vision, NLP

Scientific Techniques: Experimental Optics, Quantum Error Mitigation, Quantum/General Simulation, Ultra-High-Vacuum Systems

Research & Communication: Scientific Writing, Public Speaking, Conference Presentation

Soft Skills: Leadership, Strategic Planning, Event organization, Cross-cultural Collaboration

Awards

International Presidential Scholarship of Excellence | *York University*

- **$180,000** merit-based scholarship covering full tuition and living costs.

York Science Scholars Award (YSSA) | *Faculty of Science, York University*

- **$10,000** research award funding first-year summer project.

Hackathon Winner | *Qsite Canada*

- Won 1st Prize in Haiqu Circuit Packing and Optimisation challenge and 3rd Overall winner.

Hackathon Winner | *FLIQ – Future Leader of Quantum*

- 1st Prize in Classiq's and Duke University's Quantum Phase Classification (Quantum Machine Learning) Challenge among international teams.