Dharmik Patel

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EDUCATION

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Master of Science, Physics	Ottawa, Canada Sep 2025 -
University of Toronto, St. George (University College) Honours Bachelor of Science, Mathematics & Physics Specialist	Toronto, Canada Sep 2020 - Jun 2024
Awards	
University of Toronto International Scholar Award	University of Toronto

A merit-based scholarship worth \$100,000 CAD.

Research and Work Experience

COU

Theoretical Quantum Optics Research

Toronto, Canada

Research Student (supervised by Prof. John E. Sipe and Dr. Colin Vendromin) Aug 2023 -

- Conducting research on constructing non-Gaussian states via Gaussian resource states and extending previous results to generate non-Gaussian cluster states for photonic quantum computation. Studying the properties of rotationally symmetrical Wigner-negative states to determine possible quantum error correcting codes.
- Conducted research on lossy nonlinear generation of multimode Gaussian states in systems with linear optics circuits and threshold detectors. Helped construct novel methods to calculate coincidence click probabilities in such systems using operator disentangling methods.
- Undergraduate thesis (A Unique Representation for the Unitary Time Evolution Operator of an N-Mode Quadratic Hamiltonian): Wrote an exhaustive reconstruction of an existence and uniqueness proof for the representation as an operator product, with a focus on the mathematical foundations using Lie algebraic and operator calculus methods. As an application, wrote a novel Julia simulation of nonlinear generation of squeezed light in a coupled channel waveguide-ring resonator system via an effective $\chi^{(2)}$ process.

VLT Spectroscopy of Ultra-Faint Dwarf Galaxies	Toronto, Canada
Research Student (supervised by Prof. Ting Li)	Apr 2022 - Aug 2022

- Wrote data classification algorithms using the **astropy** Python package to perform consistent reductions and measurements for three ultra-faint dwarf galaxies using archival data from the GIRAFFE spectrograph on the Very Large Telescope (VLT).
- Customized and optimized cross-matching algorithms using **astropy** to work in conjunction with the data classification algorithms, in close collaboration with the Near-Field Cosmology research group.

Analogue Black Hole Simulation Ahmedabad, India Research Student at CHARUSAT (supervised by Prof. Rucha Desai) Jun 2021 - Aug 2021

- Created novel experimental approaches using videographic analysis techniques (particle image velocimetry) to probe analogue black hole formation in an electromagnetically driven fluid dynamical system.
- Developed algorithms using Python (numpy, scipy) to process data and customized fluid dynamics algorithms for specific experimental setups.

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University of Toronto Jan 2020 **Physics and Mathematics Tutor** Toronto, Canada / Ahmedabad, India Street School Ahmedabad, Bluekey Education, and Superprof.ca Sep 2019 - current

- Tutored K-12, university, and underprivileged students in physics, chemistry, mathematics, and English.
- Prepared and delivered lesson plans encouraging active learning processes, resulting in higher final grades and student satisfaction.

CONFERENCES AND TALKS

Q-SITE 2024

Poster Presentation

Presented a poster titled Multimode Squeezed States in Silicon Nitride Ring Resonators on lossy generation of multimode squeezed states via dual pump spontaneous four wave mixing (SFWM) processes.

UOttawa - NRC PQuIP Group Seminar

Seminar Talk Gave a talk to the University of Ottawa - National Research Council (NRC) Photonic Quantum Information Processing (PQuIP) research group, titled Nonlinear Generation of Gaussian States and Applications (at the invitation of Prof. Khabat Heshami).

SUMMER AND WINTER SCHOOLS

2023 Compute Ontario Summer School (COSS)

Summer School Student

• Attended courses on high-performance computing and scientific applications using Python and Julia, solving assignments with an average grade of 98%. Gained certifications in machine learning, artificial neural networks, ARC (Advanced Research Computing) in Julia, and HPC (High Performance Computing) in Python.

2025 Winter School on Quantum Networks

Winter School Student

• Attended courses on the theory of quantum channels, principles of quantum networks, integrated photonic platforms for quantum networks, and optical communication channels.

Toronto, Canada Sep 2024

Toronto, Canada

Jun 2023

Toronto, Canada

Sep 2024

Arizona, USA Jan 2025