Dharmik Patel

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EDUCATION

University of Ottawa Ottawa, Canada
Master of Science, Physics Sep 2025 -
Advisor: Prof. Khabat Heshami

University of Toronto, St. George (University College) Toronto, Canada
Honours Bachelor of Science, Mathematics and Physics Sep 2020 - Jun 2024

AWARDS

University of Toronto International Scholar Award University of Toronto
A merit-based scholarship valued at $100,000 CAD over four years.

RESEARCH AND WORK EXPERIENCE

Graduate Research Ottawa, Canada
University of Ottawa, National Research Council of Canada Aug 2025 -
Supervisor: Prof. Khabat Heshami

- Projects in quantum optimal transport and frameworks to relate Gaussian and non-Gaussian states.

Gaussian/Non-Gaussian States: Generation and Applications Toronto, Canada
University of Toronto Jun 2024 - Aug 2025
Supervisors: Prof. John Sipe and Dr. Colin Vendromin

- 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 symmetric Wigner-negative states to determine possible quantum error correcting codes.

- Simulating 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 Research Toronto, Canada
University of Toronto Aug 2023 - Jun 2024
Supervisors: Prof. John Sipe and Dr. Colin Vendromin
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
University of Toronto (Supervisor: 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 (Supervisor: 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.

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   Toronto, Canada
Poster Presentation   Sep 2024

- 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   Toronto, Canada
Seminar Talk   Sep 2024

- 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)   Toronto, Canada
Summer School Student   Jun 2023

- 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   Arizona, USA
Winter School Student   Jan 2025

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