MATTHEW DUSCHENES

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SUMMARY

A PhD student at the University of Waterloo with Dr. Raymond Laflamme and Dr. Juan Carrasquilla, a graduate of the University of Michigan Applied Physics and Scientific Computing joint Master's programs, a graduate of the Perimeter Scholars International Master's program at the Perimeter Institute, and an Engineering Physics graduate of Queen's University. Research interests in both theoretical and computational condensed matter physics, including graph-theoretic, Monte Carlo, and machine learning approaches. Highly proficient in Python (JAX), C++, and Bash languages. A driven, ambitious, and passionate learner who is teachable, develops new techniques efficiently, and enjoys both team and independent work in a challenging environment.

EDUCATION

Physics PhD Program   **Fall, 2021 - Summer, 2025**
University of Waterloo, Institute for Quantum Computing, Vector Institute, Perimeter Institute

- Research in theoretical and computational quantum information and many-body systems with Dr. Raymond Laflamme and Dr. Juan Carrasquilla. PhD student in residence at the Perimeter Institute and Vector Institute. Current research in efficient hamiltonian simulation, and optimization and learning theory for quantum control problems.

- *Relevant Courses:* Quantum Many-Body Physics Theory and Computation (96%), Quantum Information Processing (95%).

- *Conferences and Symposia:*
  - Duschenes, M., J., C. & R., L. "Overparameterization of Realistic Quantum Systems" (2023). APS March Meeting, Session Y70: Quantum System Learning
  - Duschenes, M. "Overparameterization of Realistic Quantum Circuits". In *Perimeter Institute Quantum Matter Workshop* (2022)
  - Duschenes, M. "Learning and Overparameterization of Constrained Variational Quantum Circuits". In *IAIFI Summer School and Workshop* (2022)

Applied Physics and Scientific Computing Master's Degree   **Fall, 2018 - Summer, 2021**
University of Michigan, Michigan Institute for Computational Discovery & Engineering

- Research with Dr. Krishna Garikipati on development of numerical and graph-theoretic approaches for modelling high dimensional physical systems.

- Achieved PhD candidacy and voluntarily wrote and passed Physics qualifying exam in 2020 before transferring to Master's program in 2021 to pursue doctoral studies in theoretical physics at the University of Waterloo.

- *Relevant Courses:* Bayesian Inference, Scientific Computing, Monte Carlo methods, Electricity and Magnetism, Renormalization group, Linear Algebra, Numerical Methods.

- *Publications:*
  - Duschenes, M., Srivastava, S. & Garikipati, K. Numerical analysis of non-local calculus on finite weighted graphs. *Comput. Methods Appl. Mech. Eng.* **402**, 115513 (2022)
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- *Conferences and Symposia:*

- Duschenes, M. "Reduced order models using non-local calculus on unstructured weighted graphs". In *US Natl. Congr. Comput. Mech.* (2021)

Perimeter Scholars International Master's Degree **Summer, 2017 - Spring, 2018**
Perimeter Institute

- Fully funded 2-year Masters of Science in a 1-year program.
- *Relevant Courses:* Quantum Measurement Theory, Quantum Field Theory I, II, and III, Condensed Matter I, II and III, Quantum Information, Machine Learning for Many-Body Physics, Perimeter Winter School 2017.
- *Master's thesis:* With Dr. Roger Melko, on the use of Monte Carlo and dimensional reduction machine learning to distinguish phases in Ising-like systems with local and non-local order.

Engineering Physics, Electrical Specialization Degree **Fall, 2013 - Spring, 2017**
Queen's University

- Graduated with Honours, with a 4.0 cumulative GPA, and several additional physics courses within the double-major program.
- *Relevant Courses:* Statistical Mechanics, Quantum Mechanics, Mathematical Methods.
- *Undergraduate thesis:* With Dr. Marc Dignam, defended on Metallic Waveguides with Biased Semi-conducting Superlattice for Terahertz source gain.

EXPERIENCE

Graduate Research Assistant **Fall, 2021 - Present**
Department of Physics, University of Waterloo

- Developed approaches to simulate quantum systems and to understand optimization methods.

Research Intern **Summer, 2023 - Present**
Los Alamos National Lab

- Selected as one of 20 students from 600 applicants for the Quantum Computing Summer School.
- Developed approaches using group theory to understand the effects of noise on the expressiveness of parameterized quantum systems.

Teaching Assistant - Electricity and Magnetism **Winter, 2023-2024**
University of Waterloo

- Assisted with lectures, office hours, grading, and exams, with Dr. Raymond Laflamme.

Teaching Assistant - International Summer School for Young Physicists Summer, 2022-2024
Perimeter Institute

- Taught lectures and mentored students on analytical and numerical approaches in physics.

Teaching Assistant - Machine Learning Certificate Program **Winter, 2022**
Vector Institute

- Developed course content, gave lectures and tutorials, and lead office hours sessions.

Graduate Research Assistant **Winter, 2019 - Summer, 2021**
Department of Mechanical Engineering, University of Michigan

- Developed graph theoretic methods and a mathematical formalism for representing dynamics.

Optical Engineering Assistant **Summer, 2016**
Christie Digital Systems

- Developed apparatuses and algorithms for balancing colour output in laser projection systems.

Research Assistant **Summer, 2015**
Institute for Quantum Computing, University of Waterloo
- Performed NMR experiments and developed Bayesian inference techniques with Dr. David Cory.

ACTIVITIES AND INTERESTS

Perimeter Mentorship Program **2021-2022**
Perimeter Institute for Theoretical Physics
- Mentor of Perimeter master's students for academic and contributor to academic outreach.

Society for Women in Physics **2019 - 2020**
University of Michigan
- Lead events promoting diversity and inclusion for careers in the science communities.

Varsity Cross Country and Track and Field Teams **2013 - 2017**
Queen's University
- Competed across North America in long distance running events, and coordinated workouts.

International Summer School for Young Physicists **2012**
Perimeter Institute for Theoretical Physics
- Attended courses in physics with 30 international students and visited the SNOLAB observatory.

AWARDS

NSERC PGS-D Graduate Scholarship **2023 - 2025**
Natural Sciences and Engineering Research Council of Canada

Vector Research Grant **2022 - 2024**
Vector Institute

Perimeter PhD Student Residency **2021 - 2025**
Perimeter Institute

Graduate Research Studentship **2021 - 2025**
Institute for Quantum Computing and University of Waterloo

Applied Physics Graduate Fellowship **2018 - 2020**
Applied Physics Program, University of Michigan

Perimeter Scholar Scholarship **2017 - 2018**
Perimeter Institute and University of Waterloo

Principal's Scholarship, W.W. King Scholarship **2013 - 2014**
Faculty of Applied Science, Queen's University

REFERENCES

References available upon request.