

Education

- 2021–2025 **PhD Mathematics — Algebra / Mathematical Physics**, *University of Regina*, Regina, Canada, (*Meritorious*)
- 2017–2019 **MSc. Physics — Quantum Information**, *University of Waterloo*, Waterloo, Canada
- 2013–2017 **BSc. Honours Physics with Thesis**, *University of Windsor*, Windsor, Canada, *GPA: 96*

Theses

PhD

Title: *A Frobenius and Hopf Algebraic Formulation of Quantum Field Theory*
Supervisor: Martin Frankland

Master's

Title: *A Polar Decomposition for Quantum Channels: Theory and Applications*
Supervisor: Joseph Emerson

Undergraduate

Title: *Entanglement Characterization of Topological Phases of Kitaev's Honeycomb Model*
Supervisor: Eugene Kim

Research Experience

- 2021–2025 **Applications of Category Theory and Frobenius/Hopf Algebras to Quantum Field Theory**, *University of Regina*
- 2017–2019 **Structure and Approximations of Quantum Channels**, *University of Waterloo*
- 2017 **Representation Theory of Lie Algebras**, *University of Windsor*
- 2014–2017 **Non-Abelian Anyons in Kitaev's Honeycomb Model**, *University of Windsor*
- 2014 **Thermographic Imaging**, *Institute for Diagnostic Imaging Research*, Windsor

Publications/Preprints

- [1] Matt Alexander. On diamond-free subgroup lattices, 2023.
- [2] Arnaud Carignan-Dugas, Matthew Alexander, and Joseph Emerson. A polar decomposition for quantum channels (with applications to bounding error propagation in quantum circuits). *Quantum*, 3:173, August 2019.

Grants

- 2022–2025 NSERC CGS D, *University of Regina*
- 2018–2019 Queen Elizabeth II GSST, *University of Waterloo*
- 2017–2018 Queen Elizabeth II GSST, *University of Waterloo*
- 2017 OGS, *University of Windsor*, (Declined)

- 2017 NSERC CGS-M, *University of Guelph*, (Declined)
- 2017 NSERC CGS-M, *University of Windsor*, (Declined)
- 2017 NSERC CGS-M, *University of Western Ontario*, (Declined)

Awards

- 2024 NSERC Enhancement Award, *University of Regina*
- 2024 University Teaching Fellow, *University of Regina*
- 2023 NSERC Enhancement Award, *University of Regina*
- 2022 University Teaching Fellow, *University of Regina*
- 2022 UR Graduate Scholarship, *University of Regina*
- 2022 NSERC Enhancement Award, *University of Regina*
- 2021 FGSR Scholarly Award, *University of Regina*
- 2020 Graduate Teaching Assistantship, *University of Regina*
- 2018 President's Graduate Scholarship, *University of Waterloo*
- 2017 President's Graduate Scholarship, *University of Waterloo*
- 2017 Graduate Scholarship, *University of Waterloo*
- 2017 Board of Governor's Medal (top graduating physics major), *University of Windsor*
- 2017 Best Presentation Award, *Western Undergraduate Mathematical Sciences Conference*
- 2014–2016 Nicholas Copernicus Scholarship (top physics major), *University of Windsor*
- 2014 50th Anniversary Scholarship, *University of Windsor*
- 2013–2016 Outstanding Scholars Program, *University of Windsor*

Presentations

- 2025 **Wightman Axioms for Hopf-Frobenius Modules**, *Theory Canada 17*, University of Regina
- 2025 **Constructions in Infinity-Categories**, *University of Regina Topology Seminar*
- 2024 **Classifying Spaces**, *University of Regina Topology Seminar*
- 2024 **Categories Without Explicit Coherence**, *CMS Meeting 2024*, University of Saskatchewan
- 2024 **Deformation Quantization of Poisson Manifolds**, *University of Regina Topology Seminar*
- 2023 **TQFTs from physical systems**, *University of Regina Topology Seminar*
- 2022 **An Operad of Operad Algebras**, *Categories and Companions Symposium*
- 2022 **The Serre spectral sequence**, *University of Regina Topology Seminar*
- 2022 **Model categories of functors**, *University of Regina Topology Seminar*
- 2021 **A_∞ -algebras and Kadeishvili's theorem**, *University of Regina Topology Seminar*
- 2021 **Modular operads from moduli spaces**, *University of Regina Topology Seminar*
- 2017 **Entanglement Characterization of Kitaev's Honeycomb Model**, *Western Undergraduate Mathematical Sciences Conference*
- 2016 **Entanglement Characterization of Topological Phases Exhibiting Non-Abelian Anyons**, *University of Windsor Physics Thesis Seminar*
- 2014 **Shaping Science: Fantastic Physicists**, *Canada South Science City: Summer Science Soirees*, Windsor

2013 **Thermographic NDE: Basics and Search for Optimal Parameters**, *Institute for Diagnostic Imaging Research. Summer Undergraduate Research Presentations, Windsor*

Leadership/Outreach

2023–2024 **Mathematics Representative**, *Science Graduate Students Association, University of Regina*

Founding member of an organization dedicated to advocating for graduate students in science.

2022–2024 **President**, *Students' Historical Society, University of Regina*

Revitalized the University of Regina's history club, which had no active membership due to COVID-19. Performed outreach and acquired enough new membership to fill all executive positions.

2016–2017 **Secretary**, *Physics Club, University of Windsor*

Recorded meeting minutes and distributed them to executive members of the physics club. Debated and voted on legislation affecting undergraduates in the physics department. Helped plan and run events aimed at increasing camaraderie and comfort between undergraduate physicists.

2015–2016 **Executive Member**, *Mission Possible, University of Windsor*

Helped plan and run events to raise funds for the Downtown Mission of Windsor: a not-for-profit organization which aids those struggling with homelessness and poverty.

2015 **Volunteer**, *Canada South Science City, Windsor*

Arranged and took part in a series of presentations aimed at a public audience, with the goal of increasing the public's interest in science. Assisted with tours of the facility's exhibits and supervised five high school employees in their daily duties.

Teaching

Spring 2024 **Applied Calculus 1**, *University of Regina*

Fall 2022 **Calculus 1**, *University of Regina*

Mentoring Activities

2015–2016 **MySci Advisor Program**, *University of Windsor*

Mentored two first year undergraduate students in physics throughout the academic year. Remained in contact on a monthly basis to monitor their progress and relieve concerns.

Affiliations

2016 **Putnam Team**, *University of Windsor*

Member of a three person team chosen to represent the University of Windsor in the 2016 William Lowell Putnam Mathematics Competition.

2013–2017 **Outstanding Scholars Program**, *University of Windsor*

Member of a program, with enrollment based on academic performance, which gives students an opportunity to pursue academic exploration in a research setting.