Alex Kroitor

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Education

2024–Present **PhD in Mathematics**, *University of Toronto*, Toronto, Canada, (GPA: –).

2022–2024 **M.Math. in Combinatorics and Optimization**, *University of Waterloo*, Waterloo, Canada, (GPA: 94/100).

- **Thesis Advisor:** Prof. Stephen Melczer.
- **Thesis Title:** Asymptotics of Generalized Fourier-Laplace Integrals.
  It is combinatorially useful to know the asymptotic behaviour of modified Fourier-Laplace integrals that do not fit into standard results from analysis (for instance, when the amplitude of the integral is not analytic at its saddle-point). A method to find asymptotics of these integrals is developed, proven, and applied to combinatorial objects.

2019–2022 **B.Sc. in Honours Mathematics**, *McGill University*, Montréal, Canada, (GPA: 3.90/4.00).

- Minor in Computer Science.
- Graduated with First Class Honours.

Publications

1. Alexander Kroitor and Stephen Melczer. Completing the asymptotic classification of mostly symmetric short step walks in an orthant. *ArXiv e-prints*, 2401.00837, 2024.
2. Alexander Kroitor. A first result in complex approximation. *Notes from the Margin*, XIV, 2023.

Research Interests

- Complex analysis in one and several variables.
- Geometry, analysis on surfaces, PDEs.
- Combinatorics, analytic combinatorics, algebraic combinatorics.

Conference Talks

- **Restricted Lattice Walks using Analytic Combinatorics in Several Variables**, *Canadian Mathematical Society Winter Meeting*, Dec. 3 2023

Seminar Talks

Apr 2024 **Lattice Path Enumeration Through ACSV**, *Algebraic Enumeration Seminar*, April 11 2024

Jan 2024 **Speaker**, *Waterloo Crystals Learning Seminar*

Nov 2023 **Speaker**, *Waterloo Causal Set Theory Learning Seminar*

Oct 2023 **Speaker**, *Waterloo Toric Varieties Learning Seminar*

Sep 2023 **Speaker**, *Waterloo Chip Firing Learning Seminar*

Jul 2023 **Speaker**, *Waterloo Bott and Tu Learning Seminar*

Jun 2023 **Analytic Combinatorics via Fourier-like Integrals**, *Algebraic Enumeration Seminar*, June 29 2023

May 2023 **Speaker**, *Waterloo Morse Theory Learning Seminar*

Nov 2022 **Speaker**, *Waterloo Grad Seminar*

Research

Summer 2022 **The Weil Conjectures and the Local Zeta Function**, *McGill University*, Montréal, Canada
In this research project, the local zeta function and its properties were studied. The Weil conjectures and related properties were reviewed. Funded by a McGill SURA grant.
Supervised by Prof. Dmitry Jakobson, Dr. Mohammad Shirazi, and Prof. Paul Gauthier.

Winter 2022 **Spectral Graph Theory and The Trace Formula** , *McGill University*, Montréal, Canada
Reviewed spectral graph theory and their relationship with spectral geometry using Chung. Read through a set of notes on analysis on manifolds. Also studied Selberg's trace formula and related background from Chavel.
Supervised by Prof. Dmitry Jakobson.

Summer 2021 **A Review of Complex Approximation Theory in One Variable**, *McGill University*, Montréal, Canada
In this research project, important approximation theorems of functions on the Riemann sphere were studied, particularly on compact and closed subsets. Multiple applications, such as the boundary behaviour of analytic functions and Birkhoff's universality theorem, were then examined. Funded by an ISM Undergraduate Summer Research Scholarship.
Supervised by Prof. Dmitry Jakobson, Dr. Mohammad Shirazi, and Prof. Paul Gauthier.

Fall 2021 **Hyperbolic Geometry**, *McGill University*, Montréal, Canada
Defined and studied Riemannian metrics and surfaces. Studied hyperbolic geometry and the spectra of compact manifolds using Buser.
Supervised by Prof. Dmitry Jakobson.

Experience

Vocational

2022–2024 **Teaching Assistant**, *University of Waterloo*, Waterloo
- TA for introductory algebra class (1 term)
- TA for introductory combinatorics/graph theory class (3 terms)
  - Conducted tutorials, enhancing student engagement and understanding.
  - Acted in leadership role in Fall 2023, designing tutorial questions beyond course material.
  - Stepped in to deliver 6 lectures and teach during instructor's absence.
  - Frequently offered additional office hours to provide support for students.

2021–2022 **Student Grader**, *McGill University*, Montréal
Evaluated and provided feedback on student assignments for 2 terms in an introductory algebra course.

Public Outreach

July 2023 **Teaching Assistant**, *Université Paris-Saclay*, Paris
Helped run an exercise session at the 2023 *Mathematical Summer in Paris*, a Summer school for advanced high school students.

Feb 2023 **Speaker**, *Vanier College*, Montréal
Gave a talk at Vanier College's 2023 *Science Week*.

Awards

2024–2029 **Faculty of Arts and Science Top Doctoral Fellowship**, *University of Toronto*, Toronto

Fall 2024 **Faculty of Arts and Science Doctoral Recruitment Award**, *University of Toronto*, Toronto

Fall 2024 **Blyth Fellowship**, *University of Toronto*, Toronto

Summer 2022 **Science Undergraduate Research Award**, *McGill University*, Montréal

Summer 2021 **ISM Undergraduate Summer Scholarship**, *McGill University*, Montréal

Summer Schools

Jun 2024 **MSRI Summer School on Special Geometric Structures and Analysis**, *St. Mary's College, California*

Conferences

Dec 2023 **Canadian Mathematical Society Winter Meeting**, *Montréal*
June 2023 **Canadian Mathematical Society Summer Meeting**, *Ottawa*
Jan 2023 **Combinatorial Algebra meets Algebraic Combinatorics**, *University of Waterloo*
Dec 2022 **Canadian Mathematical Society Winter Meeting**, *Toronto*
June 2022 **Canadian Mathematical Society Summer Meeting**, *Saint-John's*

Interests

I enjoy playing guitar and singing.

Choir **Waterloo University Choir**, *Sept 2022 - Present*
Choir **Orchestre Philharmonique et Choeur des Mélomanes**, *Sept 2021 - Sept 2022*