Mike Cummings

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Education

University of Waterloo — Waterloo, ON
PhD Combinatorics and Optimization — 2024–
- Supervisor: Oliver Pechenik

McMaster University — Hamilton, ON
MSc Mathematics — 2022–2024
- Supervisor: Jenna Rajchgot
- Thesis: Gröbner Geometry for Hessenberg Varieties

McMaster University — Hamilton, ON
BSc Honours Mathematics and Statistics, *summa cum laude* — 2018–2022

Papers

Published

5. Gröbner geometry for regular nilpotent Hessenberg Schubert cells
   with Sergio Da Silva, Megumi Harada, and Jenna Rajchgot
   Journal of Pure and Applied Algebra **228** (2024), no. 7, 107648

4. Geometric vertex decomposition and liaison for toric ideals of graphs
   with Sergio Da Silva, Jenna Rajchgot, and Adam Van Tuyl
   Algebraic Combinatorics **6** (2023), no. 4, 695–997

Software

3. The GeometricDecomposability package for Macaulay2
   with Adam Van Tuyl
   Journal of Software for Algebra and Geometry **14** (2024), no. 1, 41–50
   Software included with versions 1.21 and higher of *Macaulay2*

Theses

2. Gröbner Geometry for Hessenberg Varieties
   Master's thesis, McMaster University, 2024
   Supervisor: Jenna Rajchgot

1. Geometric Vertex Decomposition and Hessenberg Patch Ideals
   Undergraduate thesis, McMaster University, 2022
   Supervisors: Sergio Da Silva, Megumi Harada, Jenna Rajchgot

Teaching

Instructor of Record

McMaster University

Summer 2024	Applications of Linear Algebra, Math 2LA3

Teaching Assistant

University of Waterloo

Winter 2025	Introduction to Optimization, CO 250
Fall 2024	Introduction to Combinatorics (Non-Specialist Level), Math 229

McMaster University

Winter 2024	Theory of Linear Algebra, Math 2R03
Fall 2023	Abstract Algebra, Math 3GR3
Winter 2023	Theory of Linear Algebra, Math 2R03
Fall 2022	Calculus for Math and Stats I, Math 1X03
Winter 2022	Calculus for Math and Stats II, Math 1XX3
Spring 2021	Introduction to Mathematical Scientific Computation, Math 1MP3
Spring 2020	Introduction to Mathematical Scientific Computation, Math 1MP3

Talks

The $^\vee$ denotes a virtual talk.

Research

Geometric vertex decomposition: a computational technique for liaison theory

Mar. 2025	Graduate Skills Seminar for the Department of Combinatorics and Optimization, University of Waterloo

Combinatorial rules for the geometry of Hessenberg varieties

Nov. 2024	Algebraic and Enumerative Combinatorics Seminar, University of Waterloo, ON, CAN

Geometric vertex decomposition: introduction and connections

Feb. 2024	Graduate Student Seminar in Number Theory and Algebraic Geometry at Simon Fraser University, BC, CAN$^\vee$

Gröbner geometry for regular nilpotent Hessenberg Schubert cells

Jan. 2024	Combinatorial Algebra meets Algebraic Combinatorics at LaCIM à l'Université du Québec à Montréal, QC, CAN
Dec. 2023	Commutative Algebra session at the CMS 2023 Winter Meeting in Montréal, QC, CAN
Mar. 2023	Algebra & Algebraic Geometry Seminar at McMaster University, ON, CAN

Degenerations of toric ideals of graphs

May 2023	Open problem session, Commutative Algebra and its Interactions with Algebraic Geometry, SLMath/CMND Summer School at the University of Notre Dame, IN, USA

An introduction to Hessenberg varieties

Aug. 2022	Mathematics & Statistics Undergraduate Summer Research Seminar at McMaster University, ON, CAN

Geometric vertex decomposition

May 2022	Mathematics & Statistics Undergraduate Summer Research Seminar at McMaster University, ON, CAN

Poster

Geometric vertex decomposition, substitution, and toric ideals of graphs

Feb. 2025	Computational Interactions between Algebra, Combinatorics, and Discrete Geometry, IPAM, CA, USA
Jan. 2025	CAAC 2025 at the Fields Institute and University of Toronto, ON, CAN

Gröbner geometry for regular nilpotent Hessenberg Schubert cells

Jun. 2023	CMS 2023 Summer Meeting in Ottawa, ON, CAN
May 2023	SLMath/CMND Summer School on Commutative Algebra and its Interactions with Algebraic Geometry at the University of Notre Dame, IN, USA

Expository

An introduction to algebraic geometry

Apr. 2024	Student Math Colloquium at Niagara University, NY, USA

Graph colouring, symmetric functions, and open problems

Nov. 2023	Casual Math Seminar at McMaster University, ON, CAN

Play with your food: Brussel sprouts and other games on graphs

Apr. 2023	Casual Math Seminar at McMaster University, ON, CAN

Conferences Attended

Conferences with future dates are tentative. The $^\vee$ denotes a virtual conference.

2025	May	AlCoVE: an Algebraic Combinatorics Virtual Expedition at the University of Waterloo, ON, CAN$^\vee$
	Feb.	Computational Interactions between Algebra, Combinatorics, and Discrete Geometry, IPAM, CA, USA
	Jan.	Combinatorial Algebra meets Algebraic Geometry at the Fields Institute and University of Toronto, ON, CAN
2024	Jun.	AlCoVE: an Algebraic Combinatorics Virtual Expedition at the University of Waterloo, ON, CAN$^\vee$
	May	Macaulay2, Computational Algebraic Geometry, and String Theory at the University of Utah, UT, USA
		Why are we teaching mathematics today? FYMSiC$^\vee$
	Jan.	Combinatorial Algebra meets Algebraic Combinatorics at LaCIM à l'Université du Montréal à Québec, QC, CAN
2023	Dec.	2023 CMS Winter Meeting in Montréal, QC, CAN
	Nov.	Route 81 Conference on Commutative Algebra and Algebraic Geometry at Syracuse Univeristy, NY, USA
	Jun.	AlCoVE: an Algebraic Combinatorics Virtual Expedition at the University of Waterloo, ON, CAN$^\vee$
		2023 CMS Summer Meeting at the University of Ottawa, ON, CAN
	May	MSRI/SLMath CMND Summer School: Commutative Algebra and its Interactions with Algebraic Geometry at the University of Notre Dame, IN, USA
		8$^\text{th}$ Lake Michigan Workshop on Combinatorics and Graph Theory at the University of Notre Dame, IN, USA
		Teaching: The Backstage of Our Courses, FYMSiC$^\vee$
	Jan.	Combinatorial Algebra meets Algebraic Combinatorics at the University of Waterloo, ON, CAN
2022	Dec.	2022 CMS Winter Meeting in Toronto, ON, CAN
	Jun.	ISM Discovery School: Geometry and Combinatorics of Hessenberg Varieties at the Université du Québec à Montréal, QC, CAN

Scholarships and Awards

All values Canadian dollars.

2024–27	NSERC Canada Graduate Scholarship–Doctoral, $40,000 per year
2024–25	University of Waterloo President's Graduate Scholarship, $10,000
2024	McMaster Graduate Student Association Travel Assistance Grant, $500
2023–24	Ontario Graduate Scholarship, $10,000

Bernhard Banashewski Ontario Graduate Scholarship, $5,000
Milos Novotny Fellowship, $4,000

2022–23 NSERC Canada Graduate Scholarship–Masters, $17,500
Milos Novotny Fellowship, $2,500

2022 NSERC USRA, supervisor: Adam Van Tuyl, $8,400
2019–22 Dean's Honour List
2021 NSERC USRA, supervisors: Sergio Da Silva, Jenna Rajchgot, Adam Van Tuyl, $8,120

Service

Organization

2023–24 McMaster Casual Math Seminar
co-organizer with Alexi Block Gorman (Winter 2023), Justin Gebel (Fall 2023–Winter 2024), Dicle Mutlu, and Adele Padgett

2022 McMaster Math & Stats Undergraduate Summer Research Seminar
co-organizer with Hainan Xu

Professional Membership

2022– Canadian Mathematical Society
American Mathematical Soceity