

# Alexander Garver

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## RESEARCH INTERESTS

Algebraic combinatorics, representation theory, lattice theory, noncommutative algebra

## EMPLOYMENT

**University of Michigan**, Ann Arbor, MI

Postdoctoral Assistant Professor

*August 2019 - present*

**Laboratoire de Combinatoire et d'Informatique Mathématique (LaCIM)**, Montréal, QC

Postdoctoral Researcher (Mentor: Hugh Thomas)

*August 2016 - July 2019*

On parental leave October 2017 - February 2018

**McGill University**, Montréal, QC

Lecturer

*January 2017 - April 2017, January 2019 - April 2019*

**University of Minnesota**, Minneapolis, MN

Graduate Teaching Assistant

*August 2010 - May 2016*

**University of Saint Thomas**, Saint Paul, MN

Adjunct Instructor

*January 2014 - May 2014*

## EDUCATION

**University of Minnesota**, Minneapolis, Minnesota

Ph.D. (June 2016), Mathematics (Advisor: Gregg Musiker)

*2013 - 2016*

Thesis Title: *On the Structure of Oriented Exchange Graphs*

M.S., Mathematics

*2010 - 2013*

**Augsburg College**, Minneapolis, Minnesota

B.S., Mathematics

*2006 - 2010*

## PUBLICATIONS AND PREPRINTS

An asterisk indicates work with undergraduates

15. "Greene–Kleitman invariants for Sulzgruber insertion," (with R. Patrias) *Electronic Journal of Combinatorics* 26(3) (2019) #P3.25.
- \*14. "Semistable subcategories for tiling algebras," (with M. Garcia) *Beiträge zur Algebra und Geometrie/Contributions to Algebra and Geometry*, to appear.
13. "Oriented flip graphs, noncrossing tree partitions, and representation theory of tiling algebras," (with T. McConville) *Glasgow Mathematical Journal*, to appear.
12. "Combinatorics of Exceptional Sequences in Type  $A$ ," (with K. Igusa, J. P. Matherne, and J. Ostroff) *Electronic Journal of Combinatorics* 26(1) (2019) #P1.20.
11. "Lattice Properties of Oriented Exchange Graphs and Torsion Classes," (with T. McConville) *Algebras and Representation Theory* 22(1) (2019) pp 43-78.
- \*10. "The canonical join complex for biclosed sets," (with A. Clifton and P. Dillery) *Algebra Universalis* (2018) 79: 84.
9. "Oriented flip graphs of polygonal subdivisions and noncrossing tree partitions," (with T. McConville) *Journal of Combinatorial Theory, Series A* **158C** (2018) pp. 126-175.
8. "Minimal length maximal green sequences," (with T. McConville and K. Serhiyenko) *Advances in Applied Mathematics* **96C** (2018) pp. 76-138.
7. "On Maximal Green Sequences for Type  $A$  Quivers," (with G. Musiker) *Journal of Algebraic Combinatorics* 45, no. 2 (2017) pp. 553-599.

6. “Leading terms of  $SL_3$  web invariants,” (with V. Bazier-Matte, G. Douville, R. Patrias, H. Thomas, and E. Yildirim). Submitted to *International Mathematics Research Notices*. Preprint [arXiv: 1903.10529](#).
5. “Minuscule reverse plane partitions via quiver representations,” (with R. Patrias and H. Thomas). Preprint [arXiv: 1812.08345](#).
4. “A categorification of biclosed sets of strings,” (with T. McConville and K. Mousavand). Submitted to *Journal of Algebra*. Preprint [arXiv: 1808.10346](#).
3. “Enumerative properties of Grid-Associahedra,” (with T. McConville). Submitted to *Algebraic Combinatorics*. Preprint [arXiv: 1705.04901](#).
2. “Counting linear extensions of trees using determinants,” (with S. Grosser, J. P. Matherne, and A. H. Morales). *In preparation*.
- \*1. “Combinatorics of type  $D$  exceptional sequences,” (with E. Carrick). *In preparation*.

#### PEER-REVIEWED CONFERENCE PROCEEDINGS

6. “Minuscule reverse plane partitions via quiver representations,” (with R. Patrias and H. Thomas) *Sem. Lothar. Combin.* **82B** (2019) Article #44, 12pp.
- \*5. “Semistable subcategories for tiling algebras,” (with M. Garcia) *Sem. Lothar. Combin.* **80B** (2018) Article #22, 12pp.
- \*4. “The canonical join complex for biclosed sets,” (with A. Clifton and P. Dillery) *Sem. Lothar. Combin.* **80B** (2018) Article #2, 12pp.
3. “Minimal length maximal green sequences,” (with T. McConville and K. Serhiyenko) *Sem. Lothar. Combin.* **78B** (2017) Article #16, 12pp.
2. “Oriented Flip Graphs and Noncrossing Tree Partitions,” (with T. McConville) *Disc. Math. Theor. Comp. Sci.* (2016) pp. 539-550.
1. “A Combinatorial Model for Exceptional Sequences in Type  $A$ ,” (with J. P. Matherne) *Disc. Math. Theor. Comp. Sci.* (2015) pp. 393-404.

#### RESEARCH EXPERIENCE WITH UNDERGRADUATES

##### ISM-CRM Summer Scholarship Mentor

*Summer 2018*

McGill student Emily Carrick and I applied for the ISM-CRM summer scholarship so that we could work on a research problem together during the summer. Emily won the scholarship, and for 16 weeks during the summer, we worked toward classifying exceptional sequences of type  $D$  quiver representations. We are working to prove our conjectures and prepare a manuscript.

##### Mitacs Globalink Research Internship Mentor

*Summer 2017*

The Mitacs Globalink Research Internship is a selective program for undergraduates from Australia, Brazil, China, France, India, Germany, Mexico, Saudi Arabia, Tunisia, and Ukraine to conduct research with a faculty member at a Canadian university. I submitted a proposal to work with a student on describing the semistable subcategories of the module category of a tiling algebra and was eventually matched with Monica Garcia from Mexico. We met regularly for 12 weeks and were able to prove the conjectured description of these categories. After that, we continued to work together electronically to prepare two manuscripts. One manuscript now appears in the FPSAC 2018 conference proceedings, and the other will appear in *Beiträge zur Algebra und Geometrie/Contributions to Algebra and Geometry*.

##### University of Minnesota Combinatorics REU Research Mentor

*Summer 2016*

I prepared a collection of problems on the lattice theory of biclosed sets, which is related to my own research, and I worked closely with MIT student Alexander Clifton and University of Virginia Peter Dillery on two of these problems. We met regularly during the 8-week REU to discuss their progress and write up their results and conjectures. I continued working on the project after the REU ended and proved our conjectures. We submitted two versions of our results: one manuscript now appears in the FPSAC 2018 conference proceedings, and the other has appeared in *Algebra Universalis*.

**University of Minnesota Combinatorics REU Teaching Assistant** *Summer 2012, 2013, 2015*

Each summer I was the teaching assistant for two of the problems posed at this REU. In this role, I answered students' questions about their REU problem and helped students prepare talks about papers related to their REU problem and about their progress. I also edited students' reports of their results.

### CONFERENCE TALKS

Geometric Methods in Representation Theory, Columbia, Missouri	<i>November 2019</i>
FPSAC 2019, Ljubljana	<i>July 2019</i>
Minisymposium on Algebraic and Geometric Methods in Combinatorics, CanaDAM 2019, Vancouver	<i>May 2019</i>
Maurice Auslander Distinguished Lectures and International Conference	<i>April 2019</i>
AMS Special Session on Cluster Algebras and Related Topics, 2019 AMS Sectional Meeting, Hartford	<i>April 2019</i>
Stability Conditions and Representation Theory of Finite-Dimensional Algebras, Casa Matemática Oaxaca, Oaxaca	<i>October 2018</i>
AMS Special Session on Cluster Algebras, Poisson Geometry, and Related Topics, 2018 AMS Sectional Meeting, Ann Arbor	<i>October 2018</i>
AMS Special Session on Combinatorics in Algebra and Algebraic Geometry, 2018 AMS Sectional Meeting, Ann Arbor	<i>October 2018</i>
Special Session on Representation Theory and Related Topics, 2018 CMS Summer Meeting, Fredericton	<i>June 2018</i>
Maurice Auslander Distinguished Lectures and International Conference	<i>April 2018</i>
AMS Special Session on Combinatorial Aspects of Nilpotent Orbits, 2018 AMS Sectional Meeting, Boston	<i>April 2018</i>
BIREP Summer School on Gentle Algebras	<i>August 2017</i>
Maurice Auslander Distinguished Lectures and International Conference	<i>April 2017</i>
28th Meeting on Representation Theory of Algebras, Université de Sherbrooke	<i>September 2016</i>
ICRA 2016, Syracuse University	<i>August 2016</i>
Quivers and Bipartite Graphs: Physics and Mathematics, University of Notre Dame's London Global Gateway	<i>May 2016</i>
AMS Special Session on Algebraic and Geometric Combinatorics, 2016 AMS Sectional Meeting, North Dakota State University, Fargo	<i>April 2016</i>
AMS Special Session on Combinatorial and Geometric Representation Theory, 2015 AMS Sectional Meeting, Loyola University Chicago	<i>October 2015</i>
Positive Grassmannians - Applications to Integrable Systems and Super Yang-Mills Scattering Amplitudes, CRM	<i>July 2015</i>
Maurice Auslander Distinguished Lectures and International Conference	<i>April 2015</i>
AMS Special Session on Cluster Algebras, 2015 JMM	<i>January 2015</i>
Young Mathematicians Workshop on Cluster Algebras, KIAS	<i>December 2014</i>

### SEMINAR TALKS

University of Michigan Combinatorics Seminar	<i>October 2019</i>
Séminaire de LaCIM	<i>February 2019</i>
Dartmouth College Combinatorics Seminar	<i>October 2018</i>
University of Minnesota Combinatorics Seminar	<i>February 2018</i>
Séminaire SAG d'algèbre at Université de Sherbrooke	<i>April 2017</i>
Ottawa-Carleton Joint Algebra Seminar	<i>March 2017</i>
Séminaire SAG d'algèbre at Université de Sherbrooke	<i>November 2016</i>

North Carolina State University Algebra and Combinatorics Seminar	<i>October 2016</i>
Séminaire de LaCIM	<i>September 2016</i>
Northeastern University Representation Theory and Related Topics Seminar	<i>October 2015</i>
Brandeis University EveryTopic Seminar	<i>October 2015</i>
University of Connecticut Cluster Algebras Seminar	<i>October 2015</i>
University of Michigan Combinatorics Seminar	<i>September 2015</i>
UIUC Algebra-Geometry-Combinatorics Seminar	<i>August 2015</i>
LSU Algebra Seminar	<i>March 2015</i>
LSU Combinatorics Seminar	<i>March 2015</i>
University of Minnesota Combinatorics Seminar	<i>April 2014</i>
Augsburg College Mathematics Colloquium	<i>January 2013</i>

### REFEREE EXPERIENCE

Algebraic Combinatorics, Beiträge zur Algebra und Geometrie/Contributions to Algebra and Geometry, Discrete & Computational Geometry, Electronic Journal of Combinatorics, Journal of Combinatorial Theory, Series A, Séminaire Lotharingien Combinatoire, Transactions of the American Mathematical Society

### PROFESSIONAL SERVICE

Co-organizer of AMS Special Session on Cluster Algebras in Representation Theory and Combinatorics at the 2017 AMS Spring Eastern Sectional Meeting

Organizing Committee for Combinatorial Algebra meets Algebraic Combinatorics 2017

Co-organizer of Séminaire du LaCIM *2016-2018*

Member of MAA Committee on Graduate Students *2016-2019*

Co-organizer of the University of Minnesota Math Club Seminar *2014-2015, 2015-2016*

Co-organizer of the University of Minnesota Student Combinatorics Seminar *2013-2014*

Organizing Committee for 2013 Graduate Student Combinatorics Conference

Co-organizer of University of Minnesota Junior Colloquium *2011-2012*

### UNIVERSITY TEACHING EXPERIENCE

#### University of Michigan,

Math 115: “Calculus 1”, Instructor *Fall 2019*

Basic concepts of calculus with an emphasis on teaching students to clearly communicate their ideas and solutions to others by means of in-class group work and Team Homework assignments. Students were required to read ahead in the textbook in order to prepare for class.

#### McGill University,

MATH 140: “Calculus 1,” Instructor *Winter 2019*

MATH 222: “Calculus 3,” Instructor *Winter 2017*

I created my own syllabus and prepared all lectures, exams, and problem sets (via WebWork). Topics included limits, derivatives, and integrals of functions of a single variable and multiple variables in addition to sequences and series.

**University of Saint Thomas**, Math 109: “Calculus with Review II,” Instructor *Spring 2014*

I was responsible for creating my own syllabus and prepared all lectures, exams, worksheets, and problem sets (via WebAssign). Topics included limits, derivatives, and integrals of functions of one variable as well as exponential and trigonometric functions.

**University of Minnesota**, Math 1031: “College Algebra,” Instructor *Summer 2011*

I created my own syllabus and prepared all lectures, exams, worksheets, and problem sets. Topics included solving equations and inequalities, functions, inverse functions, and graphs of functions.

#### University of Minnesota

Math 2243: “Linear Algebra & Differential Eq.,” Teaching Assistant *Spring 2015*

Math 2263: "Multivariable Calculus". Teaching Assistant	<i>Fall 2013</i>
Math 3283W: "Sequences, Series, and Foundations," Teaching Assistant	<i>Spring 2013</i>
Math 2373: "Linear Algebra & Differential Eq.," Teaching Assistant	<i>Spring 2012</i>
Math 1272: "Calculus 2." Teaching Assistant	<i>Fall 2011</i>
Math 1271: "Calculus 1," Teaching Assistant	<i>Spring 2011, Spring 2016</i>
Math 1151: "Precalculus 2". Teaching Assistant	<i>Fall 2010</i>

As a teaching assistant, I lead recitation sessions for three hours per week. In these recitation sessions, I presented examples and answered students' questions. I also assigned problems for students to work on in small groups and answered students' questions about these problems. Additionally, I was responsible for writing quizzes and grading homework, quizzes, and exams.