

Jacob P. Matherne

Curriculum Vitae

North Carolina State University
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Academic Positions

- 2023–Present **Assistant Professor**, North Carolina State University.
- 2021–2023 **Hirzebruch Research Instructor**, Mathematical Institute of the University of Bonn and Max Planck Institute for Mathematics.
- Feb–Mar 2022 **Visitor**, International Center for Theoretical Sciences (ICTS) - Tata Institute for Fundamental Research (TIFR) in Bangalore, India.
- Apr–Jun 2021 **Visitor**, University of Bonn.
- Jan–Mar 2021 **Postdoc**, Max Planck Institute for Mathematics in Bonn.
- Sep–Dec 2020 **Postdoc**, Hausdorff Research Institute for Mathematics in Bonn.
Junior Trimester Program: New Trends in Representation Theory
- Jan–Aug 2020 **Postdoc**, Max Planck Institute for Mathematics in Bonn.
- 2019–2021 **Paul Olum Postdoctoral Scholar**, University of Oregon.
- 2018–2019 **Member**, Institute for Advanced Study.
- 2016–2018 **Visiting Assistant Professor**, University of Massachusetts Amherst.
- Fall 2014 **Program Associate**, MSRI.
Topic: Geometric representation theory

Education

- 2011–2016 **Ph.D. in Mathematics**, Louisiana State University.
Advisor: Pramod N. Achar
Thesis: Derived geometric Satake equivalence, Springer correspondence, and small representations
- 2010–2011 **M.S. in Mathematics**, Louisiana State University.
- 2006–2010 **B.S. in Mathematics (minor in Physics)**, Northwestern State University.
Highest GPA in the College of Science and Technology

Research Interests

- General Algebraic Combinatorics, Combinatorial Representation Theory, Computational Algebra, Geometric Representation Theory
- Specific Hyperplane Arrangements, Matroids, Symmetric Functions, Log-Concave and Real-Rooted Polynomials, Lorentzian and Stable Polynomials, Kazhdan–Lusztig Theory, Quiver Representations, Cluster Algebras, Algebraic Groups, Perverse Sheaves, Flag Varieties, Nilpotent Cones, Deligne–Simpson Problems

Papers

Published papers

1. L. Ferroni, J. Matherne, M. Stevens, L. Vecchi, *Hilbert–Poincaré series of matroid Chow rings and intersection cohomology*, *Sém. Lothar. Combin.* 89B.36, **FPSAC 2023**, 12pp. <https://www.mat.univie.ac.at/~slc/wpapers/FPSAC2023/36.pdf>.
2. T. Braden, J. Huh, J. Matherne, N. Proudfoot, B. Wang, *A semi-small decomposition of the Chow ring of a matroid*, *Adv. Math.*, 409A, **2022**, Paper No. 108646. <https://doi.org/10.1016/j.aim.2022.108646>.
3. M. Kulkarni, N. Livesay, J. Matherne, B. Nguyen, D. Sage, *The Deligne–Simpson problem for connections on \mathbb{G}_m with a maximally ramified singularity*, *Adv. Math.*, 408, **2022**, Paper No. 108596. <https://doi.org/10.1016/j.aim.2022.108596>.
4. J. Huh, J. Matherne, K. Mészáros, A. St. Dizier, *Logarithmic concavity of Schur and related polynomials*, *Trans. Amer. Math. Soc.*, 375, June **2022**, no. 6, 4411–4427. <https://doi.org/10.1090/tran/8606>.
5. J. Matherne, D. Miyata, N. Proudfoot, E. Ramos, *Equivariant log concavity and representation stability*, *Int. Math. Res. Not. IMRN*, **2021**, rnab352. <https://doi.org/10.1093/imrn/rnab352>.
6. A. Garver, S. Grosser, J. Matherne, A. Morales, *Counting linear extensions of posets with determinants of hook lengths*, *Sém. Lothar. Combin.* 85B.60, **FPSAC 2021**, 12pp. <https://www.mat.univie.ac.at/~slc/wpapers/FPSAC2021/60.html>.
7. A. Garver, S. Grosser, J. Matherne, A. Morales, *Counting linear extensions of posets with determinants of hook lengths*, *SIAM J. Discrete Math.* 35, **2021**, no. 1, 205–233. <https://epubs.siam.org/doi/10.1137/20M1320730>.
8. A. Garver, K. Igusa, J. Matherne, J. Ostroff, *Combinatorics of exceptional sequences in type A*, *Electron. J. Combin.*, **2019**, 1–20. <https://www.combinatorics.org/ojs/index.php/eljc/article/view/v26i1p20>
9. A. Garver, J. Matherne, *A combinatorial model for exceptional sequences in type A*, *Disc. Math. & Theor. Comp. Sci. DMTCS proc.*, **FPSAC 2015**, 393–404. <https://dmtcs.episciences.org/2513>
10. J. Matherne, G. Muller, *Computing upper cluster algebras*. *Int. Math. Res. Not. IMRN*, **2015**, 3121–3149. <https://doi.org/10.1093/imrn/rnu027>

Papers accepted and to appear

11. J. Matherne, A. Morales, J. Selover, *The Newton polytope and Lorentzian property of chromatic symmetric functions*, **2022**, [arXiv:2201.07333](https://arxiv.org/abs/2201.07333).
12. P. Anderson, J. Matherne, J. Tymoczko, *Generalized splines on two-labeled graphs and polynomial splines on cycles*, **2021**, to appear in *Electron. J. Combin.*, [arXiv:2108.02757](https://arxiv.org/abs/2108.02757).

Submitted papers

13. L. Ferroni, J. Matherne, M. Stevens, L. Vecchi, *Hilbert–Poincaré series of matroid Chow rings and intersection cohomology*, **2022**, [arXiv:2212.03190](https://arxiv.org/abs/2212.03190).
14. M. Kulkarni, J. Matherne, K. Mousavand, J. Rock, *A continuous associahedron of type A*, **2021**, [arXiv:2108.12927](https://arxiv.org/abs/2108.12927).
15. T. Braden, J. Huh, J. Matherne, N. Proudfoot, B. Wang, *Singular Hodge theory for combinatorial geometries*, **2020**, [arXiv:2010.06088](https://arxiv.org/abs/2010.06088).
16. E. Bucher, C. Eppolito, J. Jun, J. Matherne, *Matroid-minor Hopf algebra: a cancellation-free antipode formula and other applications of sign-reversing involutions*, **2018**, [arXiv:1811.01687](https://arxiv.org/abs/1811.01687).

17. P. Achar, M. Kulkarni, J. Matherne, *Combinatorial Fourier transform for quiver representation varieties in type A*, **2018**, [arXiv:1807.10217](#).

Preprints

18. E. Bucher, J. Matherne, *A cancellation-free antipode formula (for uniform matroids) for the restriction-contraction matroid Hopf algebra*, **2016**, [arXiv:1612.04343](#). (subsumed by Item 16 above)
19. J. Matherne, *Derived geometric Satake equivalence, Springer correspondence, and small representations*, **2016**, Dissertation currently available on the [LSU ETD online library](#).

Supervision

Masters thesis supervision

- 2022–2023 Benedek Dombos (University of Bonn) - now a PhD student with Jehanne Dousse at the University of Geneva
- 2022–2023 Álvaro Gutiérrez (University of Bonn, joint with Catharina Stroppel) - now a PhD student with Mark Wildon at the University of Bristol

Awards, Honors, and Distinctions

University of Oregon

- 2019 **Outstanding teaching and support of students** - Chosen by a student to be recognized for this award on live television.

University of Massachusetts Amherst

- 2017–2018 **Finalist for Distinguished Teaching Award** - Nominated by a student for university-wide Distinguished Teaching Award. One of 12 finalists in a 2-tier selection process for 2 awards.

Massachusetts Society of Professors Research Support Grant - \$1000 grant to support faculty research.

FLEX Grant - \$500 grant to support faculty teaching professional development.

- 2016–2017 **Massachusetts Society of Professors Research Support Grant**
FLEX Grant

Louisiana State University

- 2015–2016 **Graduate School Dissertation Year Fellowship**

- 2015 **Certificate of Teaching Excellence** - Recognizes excellence in teaching by graduate students by awarding up to 5 students per semester.

- 2014 **LINK Grant**

- 2012–2015 **GAANN Fellow**

- 2012 **Certificate of Teaching Excellence**

- 2011 **David Oxley Graduate Student Teaching Award** - Recognizes excellence in teaching by graduate students by awarding 1 student per semester.

Certificate of Teaching Excellence

- 2010–2011 **VIGRE Trainee Fellowship**

Refereeing and reviewing (* denotes quick opinion)

Communications of the American Mathematical Society (CAMS)

Transactions of the American Mathematical Society (TAMS)
 Proceedings of the American Mathematical Society (PAMS)
 Advances in Mathematics (AiM)*
 International Mathematics Research Notices (IMRN)
 Journal of the London Mathematical Society (JLMS)*
 Algebraic Combinatorics (ALCO)
 National Science Foundation (NSF)
 SIAM Journal on Discrete Mathematics (SIDMA)
 Electronic Journal of Combinatorics (EJC)
 Journal of Algebra and its Applications (JAA)
 Symmetry, Integrability and Geometry: Methods and Applications (SIGMA)
 Proceedings of the Royal Society of Edinburgh Section A: Mathematics
 Masters Theses at University of Bonn
 PhD Theses at University of Sydney and University of Bologna

Talks

Invited lecture series

- 2023 **Matroids, M-concave functions, and multivariate stable polynomials (lecture and exercise session)**, Assisting in preparatory lectures/exercise sessions for June Huh's Chow Lectures, *Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany*.
- 2022 **Polynomials in combinatorics (5 lectures)**, *International Centre for Theoretical Sciences (ICTS), Bangalore, India*.
- 2018 **Introduction to cluster algebras and their types (4 lectures)**, School on Cluster Algebras, *International Centre for Theoretical Sciences (ICTS), Bangalore, India*.

Talks at math research institutes

- 2023 **Poincaré polynomials in matroid theory**, Algebraic Aspects of Matroid Theory Workshop, *Banff International Research Station (BIRS), Canada*.
- 2022 **Polynomials in combinatorics**, Bonn Combinatorics Seminar, *MPIM Bonn*.
Lorentzian polynomials in combinatorics and representation theory, MATRIX Workshop on Theory and Applications of Stable Polynomials, *MATRIX Research Institute, Melbourne University*.
- 2021 **(postponed due to pandemic) Preparatory lecture**, for June Huh's Chow Lectures 2020, *MPI MiS*.
- 2020 **Singular Hodge theory of matroids and Logarithmic concavity of weight multiplicities for irreducible $\mathfrak{sl}_n(\mathbb{C})$ -representations**, Oberseminar, *MPIM Bonn*.
- 2019 **Logarithmic concavity of Schur and related polynomials**, KIAS Workshop on Algebra-Geometry-Combinatorics, *Korea Institute for Advanced Study (KIAS)*.
Singular Hodge theory of matroids, Intensive Research Period on Arrangements, *Western University*.
Singular Hodge theory of matroids, Joint Princeton University and IAS Algebraic Geometry Seminar, *Institute for Advanced Study (IAS)*.

- Perverse sheaves and \mathbb{C}^* -actions (two talks)**, Akshay Venkatesh's Working Group on Derived Geometric Satake, *Institute for Advanced Study (IAS)*.
- 2018 **Examples of affine Grassmannians and their singularities**, Akshay Venkatesh's Working Group on Derived Geometric Satake, *Institute for Advanced Study (IAS)*.
Singular Hodge theory of matroids, 15-minute postdoc talks, *Institute for Advanced Study (IAS)*.
- 2017 **Combinatorial Fourier transform for quiver representation varieties in type A**, Geometry and Representation Theory Workshop, *Erwin Schrödinger International Institute for Mathematics and Physics (ESI)*.
- 2014 **Perverse sheaves (two talks)**, Modular Sheaves and Modular Representations Working Group, *Mathematical Sciences Research Institute (MSRI)*
The Tannakian structure on the Satake category, Graduate Student Seminar, *Mathematical Sciences Research Institute (MSRI)*.
- Invited talks**
- 2024 **TBD**, AMS Special Session on Posets in algebraic and geometric combinatorics, *University of Wisconsin - Milwaukee*.
TBD, Suzhou workshop on matroid theory, *Soochow University, Suzhou, China*.
- 2023 **Examples of Lorentzian polynomials in combinatorics and representation theory**, SIAM Applied Algebraic Geometry (AG23) Minisymposium on Lorentzian and Hyperbolic Polynomials, *Eindhoven University of Technology, The Netherlands*.
Polynomials in combinatorics and representation theory, Discrete Math and Geometry Seminar, *TU Berlin*.
Polynomials in combinatorics and representation theory, Oberseminar on Diskrete-Mathematik-Geometrie und Optimierung, *Goethe Universität, Frankfurt am Main*.
Matroids in representation theory, Hausdorff Center for Mathematics (HCM) retreat, *Bad Breisig, Germany*.
- 2022 **Polynomials in combinatorics**, Mathematics Colloquium, *University of Bielefeld*.
Top-heaviness and Kazhdan–Lusztig theory of matroids, Combinatorics meets geometry in Bielefeld workshop, *Bielefeld University*.
Singular Hodge theory for combinatorial geometries, Combinatorial algebraic geometry: tropical and real, *International Centre for Theoretical Sciences (ICTS)*.
Kazhdan–Lusztig theory of matroids, Oberseminar Darstellungstheorie, *RWTH Aachen University*.
Singular Hodge theory for combinatorial geometries, Algebra and combinatorics seminar, *Indian Institute of Science (IISc)*.
Equivariant log-concavity, matroids, and representation stability, F1 World Seminar, *Online Format*.
Singular Hodge theory for combinatorial geometries, Oberseminar on Arrangements and Symmetries, *Ruhr-Universität Bochum*.
- 2021 **Equivariant log-concavity, hyperplane arrangements, and representation stability**, Topology and Singularities Seminar, *University of Wisconsin-Madison*.
Singular Hodge theory for combinatorial geometries, Algebra and Geometry Seminar, *Queen's University*.

- Singular Hodge theory for combinatorial geometries**, AMS Special Session on Geometric and Categorical Methods in Representation Theory, *San Francisco State University*.
- Logarithmic concavity of Schur and related polynomials**, AMS Special Session on Algebraic and Combinatorial Aspects of Polytopes, *San Francisco State University*.
- Singular Hodge theory for combinatorial geometries**, Combinatorics Seminar, *University of Washington*.
- Singular Hodge theory of matroids I: the Top-Heavy conjecture**, Categorification seminar, *Online*.
- (postponed due to pandemic) TBD**, Suzhou Workshop on Geometry, Combinatorics and Representation Theory, *Soochow University*.
- 2020 **Singular Hodge theory for matroids**, Combinatorics Seminar, *Washington University in St. Louis*.
- Singular Hodge theory for matroids: the Top-Heavy Conjecture**, Special MIT–Harvard–MSR Combinatorics Seminar, *Massachusetts Institute of Technology*.
- Singular Hodge theory for combinatorial geometries**, Oberseminar in Representation Theory, *University of Bonn*.
- Singular Hodge theory for combinatorial geometries**, Combinatorics Seminar, *Washington University in St. Louis*.
- Singular Hodge theory for combinatorial geometries**, Cornell Discrete Geometry and Combinatorics Seminar, *Cornell University*.
- A semi-small decomposition of the Chow ring of a matroid**, Arrangements at Home, *Zoom conference held by Western University*.
- 2019 **Logarithmic concavity of Schur and related polynomials**, Geometry and Representation Theory mini-conference, *University of California at Riverside*.
- Logarithmic concavity of Schur and related polynomials**, AMS Special Session on Geometric Methods in Representation Theory, *University of California at Riverside*.
- Two problems about hyperplane arrangements**, Karcher Colloquium, *University of Oklahoma*.
- Kazhdan–Lusztig polynomials of matroids**, Algebra Seminar, *Temple University*.
- Two problems about hyperplane arrangements (secretly about matroids)**, Department of Mathematics and Computer Science Colloquium, *Wesleyan University*.
- Kazhdan–Lusztig polynomials of matroids**, AMS Special Session on Representations of Lie algebras, algebraic groups, and quantum groups, *Auburn University*.
- Kazhdan–Lusztig polynomials of matroids**, Algebraic Geometry and Commutative Algebra Seminar, *University of Notre Dame*.
- Introduction to cluster algebras**, Math Colloquium, *Indian Institute of Science Education and Research (IISER), Pune, India*.
- 2018 **Singular Hodge theory of matroids**, Conferences on Geometric Methods in Representation Theory (CGMRT), *University of Iowa*.
- Two problems about hyperplane arrangements (secretly about matroids)**, Binghamton University’s Graduate Conference in Algebra and Topology (BUGCAT 2018), *Binghamton University*.
- Two problems about hyperplane arrangements (secretly about matroids)**, 6th Encuentro Colombiano de Combinatoria (ECCO 2018), *Universidad del Norte, Barranquilla, Colombia*.

- Singular Hodge theory of matroids**, Maurice Auslander Distinguished Lectures and International Conference, *Woods Hole Oceanographic Institute*.
- Derived geometric Satake equivalence, Springer correspondence, and small representations**, AMS Special Session on Noncommutative Algebra and Representation Theory, *Northeastern University*.
- Singular Hodge theory of matroids**, Combinatorics Seminar, *Binghamton University*.
- Derived geometric Satake equivalence, Springer correspondence, and small representations**, Arithmetic Seminar, *Binghamton University*.
- 2017 **Kazhdan–Lusztig polynomials of matroids**, Representation Theory Seminar, *Northeastern University*.
- Kazhdan–Lusztig polynomials of matroids**, AMS Special Session on Combinatorics and Representation Theory of Reflection Groups: Real and Complex, *University of North Texas*.
- Derived geometric Satake equivalence, Springer correspondence, and small representations**, AMS Special Session on Noncommutative and Homological Algebra, *University of North Texas*.
- A combinatorial Fourier transform for quiver representation varieties in type A**, AMS Special Session on Cluster Algebras in Representation Theory and Combinatorics, *Hunter College, City University of New York*.
- A combinatorial Fourier transform for quiver representation varieties in type A**, Maurice Auslander Distinguished Lectures and International Conference, *Woods Hole Oceanographic Institute*.
- The linear algebra of noncrossing spanning trees in a disk**, Center for Women in Mathematics Thursday Lunch Talks, *Smith College*.
- Combinatorial Fourier transform for quiver representation varieties in type A**, JMM 2017: AMS Special Session on Representations and Related Geometry in Lie Theory, *Hyatt Regency Atlanta and Marriott Atlanta Marquis*.
- Combinatorial Fourier transform for quiver representation varieties in type A**, Research seminar, *Indian Institute of Science Education and Research (IISER Pune)*.
- 2016 **Presentations of cluster algebras**, Cluster Algebras Seminar, *University of Connecticut*.
- A combinatorial Fourier transform for quiver representation varieties in type A**, Algebra/Geometry/Combinatorics Seminar, *Smith College*.
- Derived geometric Satake equivalence, Springer correspondence, and small representations**, ICRA 2016 (International Conference on Representations of Algebras), *Syracuse University*.
- Derived geometric Satake equivalence, Springer correspondence, and small representations**, Southeastern Lie Theory Workshop, *University of Virginia*.
- Derived geometric Satake equivalence, Springer correspondence, and small representations**, Symplectic Duality and Gauge Theory, *Perimeter Institute for Theoretical Physics*.
- 2015 **Combinatorics of exceptional sequences in type A**, Southeastern Lie Theory Workshop, *North Carolina State University*.
- Combinatorics of exceptional sequences in type A**, Combinatorics Seminar, *University of Minnesota*.

- 2014 **The classical theory of Soergel bimodules**, Kazhdan-Lusztig theory and Soergel bimodules, *University of Oregon*.
Computing upper cluster algebras, Southeastern Lie Theory Workshop, *University of Georgia*.
- 2013 **Computing upper cluster algebras**, Commutative Algebra Seminar, *University of Michigan*.
- 2011 **A brief survey of cluster algebras**, Special Seminar, *Northwestern State University*.
- Other talks**
- 2024 **TBD**, First Year Graduate Student Research Seminar, *North Carolina State University*.
- 2023 **Lorentzian polynomials in combinatorics and representation theory**, Algebra and Combinatorics Seminar, *North Carolina State University*.
- 2022 **Introduction to operads**, Operads Seminar, *University of Bonn and Dresden University*.
Brane diagrams, bow varieties, Hanany–Witten transition, and mirror duality, Bow Varieties and Mirror Duality Seminar, *University of Bonn*.
- 2021 **Singular Hodge theory for combinatorial geometries and logarithmic concavity of Schur and related polynomials**, Introduction of postdocs, *University of Bonn*.
Introduction to Nichols algebras, Nichols Algebras and Generalizations of Universal Enveloping Algebras Seminar, *University of Bonn*.
Introduction to cluster algebras, Cluster Algebras Seminar, *University of Bonn*.
- 2019 **Introduction to cluster algebras**, Student Algebra Seminar, *University of Oregon*.
Singular Hodge theory of matroids, Algebra Seminar, *University of Oregon*.
- 2018 **Totally positive and totally nonnegative matrices**, UMass Math Club, *University of Massachusetts Amherst*.
- 2017 **Kazhdan–Lusztig polynomials of matroids**, Representation Theory Seminar, *University of Massachusetts Amherst*.
- 2016 **A combinatorial Fourier transform for quiver representation varieties in type A**, Representation Theory Seminar, *University of Massachusetts Amherst*.
- 2015 **Kac–Moody Lie algebras and their representation theory**, Graduate Student Seminar on Quantum Groups and Crystal Bases, *Louisiana State University*.
Schubert calculus on Grassmannians and Young diagrams, VIGRE Seminar on Combinatorial Representation Theory, *Louisiana State University*.
The Hilbert scheme of points in the plane, LSU Student Algebra Seminar, *Louisiana State University*.
A combinatorial model for exceptional sequences in type A, Joint Mathematics Meetings (JMM2015), *Henry B. Gonzales Convention Center*.
Tinkertoys and the Saturation Conjecture, VIGRE Seminar on Combinatorial Representation Theory, *Louisiana State University*.
Linear algebra, Jordan canonical form, and the Springer correspondence, G.E.A.U.X. Program, *Louisiana State University*.
- 2014 **Representation theory of the symmetric group**, LSU Student Algebra Seminar, *Louisiana State University*.
A categorification of quantum sl_2 , VIGRE Seminar on Diagrammatic Algebra, *Louisiana State University*.
Introduction to algebraic geometry, LSU Math Club, *Louisiana State University*.
2-categories, VIGRE Seminar on Diagrammatic Algebra, *Louisiana State University*.

- 2013 **A Clebsch–Gordan formula for representations of $sl_2(\mathbb{C})$** , VIGRE Seminar on Diagrammatic Algebra, *Louisiana State University*.
Representations of $sl_2(\mathbb{C})$, VIGRE Seminar on Diagrammatic Algebra, *Louisiana State University*.
Jordan canonical form, nilpotent orbits, and the Springer correspondence, G.E.A.U.X. Program, *Louisiana State University*.
Representations of $sl_2(\mathbb{C})$, Math Rants, *Louisiana State University*.
An introduction to category theory and homological algebra, Math Rants, *Louisiana State University*.
Representations of finite groups, LSU Math Club, *Louisiana State University*.
Diagrammatics for Soergel bimodules, GLAMSPOT, *Louisiana State University*.
Soergel bimodules, VIGRE Seminar on Reflection Groups, *Louisiana State University*.
- 2012 **An introduction to Soergel bimodules**, VIGRE Seminar on Reflection Groups, *Louisiana State University*.
Polynomial invariants and Chevalley’s theorem, VIGRE Seminar on Reflection Groups, *Louisiana State University*.
The classification of finite-type quiver representations and Gabriel’s theorem, VIGRE Seminar on Representations of Finite-Dimensional Algebra, *Louisiana State University*.
Linear algebra and the Jordan canonical form, G.E.A.U.X. Program, *Louisiana State University*.
An approach to locally acyclic cluster algebras via trestle quivers, VIGRE Seminar on cluster algebras, *Louisiana State University*.
- 2011 **Cluster algebras**, VIGRE Seminar on cluster algebras, *Louisiana State University*.
Type A cluster algebras, LSU MathCircle, *Louisiana State University*.
Difference equations, LSU MathCircle, *Louisiana State University*.
Cluster algebras of surfaces, VIGRE Seminar on Cluster Algebras, *Louisiana State University*.
- 2010 **Polytopes**, VIGRE Seminar on Cluster Algebras, *Louisiana State University*.
On the bivariate quadratic congruence $x^2 - y^2 \equiv d \pmod{n}$, JOVE Meeting, *Northwestern State University*.
Concerning a quadratic Diophantine equation, LA/MS MAA Section Meeting, *Southeastern Louisiana University*.
More on a quadratic Diophantine equation, JOVE Meeting, *Northwestern State University*.
- 2009 **A nonlinear Diophantine equation of the universe**, JOVE Meeting, *Northwestern State University*.
- 2008 **Studying difference equations**, JOVE Meeting, *Northwestern State University*.

Conferences organized

- July 9–13, **Summer School on Geometric Representation Theory**, <http://ssgrt2018.ist.ac.at>,
 2018 *Institute of Science and Technology, Austria (IST Austria)*. Co-organized with A. Bapat, I. Ganey, T. Hausel, and M. Kulkarni.

Software

SageMath software developed

Ticket #28270 M. Kulkarni, J. Matherne, and B. Strasser, *Allow ClusterSeed to take a double Bruhat cell as input (revisited)*.

Ticket #28252 G. Dorpalen-Barry, B. Gillespie, J. Matherne, and T. McConville, *Implement check for Lorentzian polynomials*.

Ticket #28237 G. Dorpalen-Barry, B. Gillespie, J. Matherne, T. McConville, and F. Saliola, *Implement Atkinson's algorithm for counting linear extensions of (tree) posets*.

Ticket #19408 M. Kulkarni, J. Matherne, and B. Strasser, *Allow ClusterSeed to take a double Bruhat cell as input*.

Ticket #18800 J. Matherne, M. Mills, G. Muller, H. Williams, *Implement a method in ClusterSeed for presenting the upper bound algebra*.

SageMath software reviewed

Ticket #19339 B. Strasser, *Use digraph labels if present for ClusterAlgebra and ClusterQuiver*.

Teaching

Courses marked with † indicate instructor of record, where I had sole responsibility for preparing and presenting the lectures, for writing and grading the tests, and for assigning the course grades.

North Carolina State University

Spring 2024 **Algebraic Geometry** (graduate course) †

Fall 2023 **Calculus I** †

University of Bonn and Max Planck Institute for Mathematics

Summer 2023 **The geometry and representation theory of matroids** (graduate seminar) †

I ran a seminar where master's and PhD students gave talks on topics in the geometry and Hodge theory of matroids, with the goal of culminating in Adiprasito–Huh–Katz's proof of the log-concavity of the characteristic polynomial of a matroid. I planned all of the talks with detailed outlines for each student and met with the students to help improve their talks.

Winter 2022/2023 **Representation Theory II - Introduction to geometric representation theory** (graduate course)

I was the assistant for this course which was taught by Catharina Stroppel. As part of my duties, I wrote weekly exercise sheets, and discussed solutions with two PhD student tutors. I oversaw the two weekly tutorial sessions that the PhD students ran, which had 40 students total in attendance. I also gave a couple of the lectures.

Summer 2022 **Representation Theory I - Lie algebras** (graduate course)

I was the assistant for this course which was taught by Catharina Stroppel. As part of my duties, I wrote weekly exercise sheets, and discussed solutions with four masters/PhD student tutors. I oversaw the four weekly tutorial sessions that the masters/PhD students ran, which had 60 students total in attendance. I also gave a couple of the lectures.

Winter 2021/2022 **Introduction to quantum groups, canonical bases, and crystals** (graduate course)

I was the assistant for this course which was taught by Catharina Stroppel. As part of my duties, I wrote weekly exercise sheets, and discussed solutions with a PhD student tutor. I oversaw the weekly tutorial session that the PhD student ran which had 17 students in attendance.

University of Oregon

- Spring 2021 **History and applications of calculus** †
Total positivity and cluster algebras (graduate course) †
This course was taught virtually and had regular participants from USA (Univ of Oregon), Germany (Univ of Bonn), and Australia (Univ of Sydney).
- Winter 2021 **Calculus I online (300 students)**
Co-developed an asynchronous 300-person online Calculus I course.
- Spring 2020 **Calculus II (two sections)** †
These courses were taught remotely on Zoom.
- Fall 2019 **Calculus I (two sections)** †

University of Massachusetts Amherst

- Spring 2018 **Writing in Mathematics (two sections)** †
This course fulfills the University Writing Requirement and is required for our math majors. They learn how to use LaTeX, prepare papers and presentations appropriately for their audiences, prepare resumes and cover letters, as well as about mathematical careers and interviews.
- Fall 2017 **Fundamental Concepts of Mathematics - Intro to Proofs** †
Honors Calculus I †
- Spring 2017 **Introduction to Linear Algebra (two sections)** †
- Fall 2016 **Multivariate Calculus (two sections)** †

Louisiana State University

- Spring 2015 **Calculus II** †
- Fall 2013 **Honors Calculus I** †
As a part of the course, I helped organize and introduce a program for learning LaTeX and mentoring undergraduate research projects which resulted in the production of research posters and presentations.
- Summer 2013 **VIGRE@LSU SMILE REU Program**
Helped organize, run, and mentor students in a 5-week program to engage undergraduate students from the southern region in mathematics research
- Fall 2012 **Calculus I** †
- Summer 2012 **LSU REU**
Served as a mentor for undergraduate students in the REU.
- Spring 2012 **Calculus I** †
- Summer 2011 **LSU MathCircle**
Helped organize and run a 3-week program to introduce interesting mathematics to accelerated high school students.
- Fall 2011 **College Algebra** †
This course was a part of the R2R framework at LSU. I presented lectures to students for one hour per week, and they were required to log a minimum of three hours per week working on assignments in the R2R math lab. All graded assignments and tests were departmental and online, so exams were automatically generated and graded by the system.
- Assistant Lab Manager for Pleasant Hall R2R Math Lab**
Tutored college algebra, trigonometry, and precalculus, oversaw the undergraduate tutors in the math lab, sent nightly reports to instructors concerning their students' progress, and made sure everything ran smoothly in the two R2R math labs which together housed over 250 students.

Northwestern State University

2006–2010 **Mathematics Tutor**

Subjects: remedial math, college algebra, finite math, trigonometry, precalculus, survey of calculus, calculus I, calculus II, and Microsoft Office applications.

Activites and Outreach

University of Bonn and Max Planck Institute for Mathematics

Spring 2023 **Life in mathematics**, 8th, 9th, and 10th graders in Panchgani, India, *Billimoria High School*.

Institute for Advanced Study

Spring 2019 **Graph theory (two talks)**, Spoke to 8th, 9th, and 10th graders in Pune, India, *New English School*.

University of Massachusetts Amherst

Summer 2018 **TA for Lauren William's Course on Cluster Algebras**, Volunteered to TA a week-long course at ECCO 2018, *Universidad del Norte, Barranquilla, Colombia*.

Spring 2018 **Independent Study**, Led an undergraduate student through an independent study on linear extensions of posets leading to published papers #1 and #2 above, *UMass Amherst*.

Fall 2017 **Graduate student admissions**, Volunteered to review applications for graduate student admissions in the Mathematics and Statistics Department, *UMass Amherst*.

Spring 2017 **Undergraduate/Postbac Research Group on Splines**, Research Mentor for semester-long project (met weekly) leading to submitted paper #10 above, *Smith College*.

Summer 2016 **Careers in Mathematics**, Discussed careers with undergraduates in India, *Modern College*.

Countability and Uncountability, Gave a talk to 8th, 9th, and 10th graders in India, *New English School*.

Louisiana State University

2015 **Mentoring and Activites**, Masters of the Mathematics Common Core; Girls in Mathematics, *Louisiana State University*.

Organized Math Table and Activites, Louisiana STEM Expo, *Kenilworth Middle School*.

2014 **Math with Middle Schoolers**, Gave a talk on Fibonacci numbers, *Louisiana State University*.

2012–2016 **Webmaster**, Student Colloquium Committee, *Louisiana State University*.

2011 **Organizer**, Departmental BBQ and Potluck, *Louisiana State University*.

2011–2012 **Committee Member**, G.E.A.U.X. Orientation Program for New Math Graduate Students, *Louisiana State University*.

Proctor and Grader, High School Math Contest, *Louisiana State University*.

Northwestern State University

2007–2010 **Participant**, Integration Bee and Math Team Competition at LA/MS MAA Section Meeting, various universities in Louisiana and Mississippi.

2009 **Organizer**, Demon Mathematics Classic, *Northwestern State University*.

2009–2010 **President**, LA Gamma Chapter of Kappa Mu Epsilon, *Northwestern State University*.

Recruiter, NSU Mathematics Department, *Northwestern State University*.

Languages

English native
German B1

References

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