

Kent Vashaw

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Research Interests

Cohomological support varieties, homological algebra, Hopf algebras and quantum groups, noncommutative ring theory, representation theory, tensor categories, and tensor triangular geometry.

Employment

Instructor in Mathematics at the Massachusetts Institute of Technology, 9/1/2022 – present.

National Science Foundation Postdoctoral Fellow at the Massachusetts Institute of Technology, 9/1/2021 – present.

Education

PhD. Mathematics, Louisiana State University, 2021, primary advisor M. T. Yakimov, secondary advisor D. K. Nakano.

Thesis: *Noncommutative tensor triangular geometry and its applications to representation theory*

M.A. Mathematics, Wake Forest University, 2016, advisor E. Kirkman.

Thesis: *Dual reflection groups of low order*

B.A. Mathematics (minor in English), Appalachian State University, 2014 (summa cum laude).

Papers

Preprints / submitted:

12. (Joint with Hongdi Huang, Van C. Nguyen, Padmini Veerapen, and Xingting Wang) *Quantum-symmetric equivalence is a graded Morita invariant*, preprint arXiv:2405.12201.
11. (Joint with Hongdi Huang) *Group actions on monoidal triangulated categories and Balmer spectra*, preprint arXiv:2311.18638.
10. (Joint with Daniel K. Nakano and Milen T. Yakimov) *A Chinese remainder theorem and Carlson's theorem for monoidal triangulated categories*, preprint arXiv:2311.17883.
9. (Joint with George Cao) *On the decomposition of tensor products of monomial modules for finite 2-groups*, preprint arXiv:2301.04274.

Published / accepted:

8. (Joint with Hongdi Huang, Van C. Nguyen, Charlotte Ure, Padmini Veerapen, and Xingting Wang) *Twisting Manin's universal quantum groups and comodule algebras*, Adv. Math. **445** (2024), Paper No. 109651.

7. (Joint with Daniel K. Nakano and Milen T. Yakimov) *On the spectrum and support theory of a finite tensor category*, accepted for publication in *Math. Ann.*, DOI:10.1007/s00208-023-02759-8.
6. *Balmer spectra and Drinfeld centers*, *Algebra Number Theory* **18** (2024), no. 6, 1081–1116.
5. (Joint with Hongdi Huang, Van C. Nguyen, Charlotte Ure, Padmini Veerapen, and Xingting Wang) *A cogroupoid associated to preregular forms*, accepted for publication in *J. Noncommut. Geom.*, DOI:10.4171/JNCG/558.
4. (Joint with Hongdi Huang, Van C. Nguyen, Charlotte Ure, Padmini Veerapen, and Xingting Wang) *Twisting of graded quantum groups and solutions to the quantum Yang-Baxter equation*, accepted for publication in *Transform. Groups*, DOI:10.1007/s00031-022-09779-9.
3. (Joint with Daniel K. Nakano and Milen T. Yakimov) *Noncommutative tensor triangular geometry and the tensor product property for support maps*, *Int. Math. Res. Not. IMRN* (2022), no. 22, 17766–17796.
2. (Joint with Daniel K. Nakano and Milen T. Yakimov) *Noncommutative tensor triangular geometry*, *Amer. J. Math.* **144** (2022), no. 6, 1681–1724.
1. (Joint with Milen Yakimov) *Prime spectra of abelian 2-categories and categorifications of Richardson varieties*, *Representations and nilpotent orbits of Lie algebraic systems*, 501–553, *Progr. Math.*, 330, Birkhäuser/Springer, Cham, 2019.

In preparation:

(Joint with Justin Zhang) *Induced p' -symmetry and a generalized Benson conjecture*.

(Joint with Peter Goetz, Ellen Kirkman, and W. Frank Moore) *Artin–Schelter regular algebras from dual reflection groups*.

Awards and Grants

Summer Research in Mathematics Program grant, SLMath, joint with Hongdi Huang, Van Nguyen, Padmini Veerapen, and Xingting Wang, awarded Fall 2023.

Lusztig PRIMES mentorship for 2023, awarded Fall 2022.

SQuaRE grant, American Institute of Mathematics, joint with Hongdi Huang, Van Nguyen, Charlotte Ure, Padmini Veerapen, and Xingting Wang, awarded Spring 2022.

College of Science Distinguished Dissertation Award, Louisiana State University, Spring 2022.

NSF Mathematical Sciences Postdoctoral Research Fellowship, beginning Fall 2021.

Arthur K. Barton Superior Graduate Student Scholarship in Mathematics, Louisiana State University, Fall 2020.

Pasquale Porcelli Graduate Student Research Excellence Award, Louisiana State University Mathematics Department, Fall 2020.

Pasquale Porcelli Graduate Student Academic Excellence Award, Louisiana State University Mathematics Department, Spring 2017.

Board of Regents Fellowship, Louisiana State University, Fall 2016–Spring 2020.

Talks and Presentations

* indicates an invited talk, † indicates a poster presentation.

Talks on **Group actions on monoidal triangulated categories and Balmer spectra:**

*University of Iowa Algebra Seminar, Iowa City, IA, April 17, 2024.

*University of Michigan Representation Stability Seminar, Ann Arbor, MI, April 10, 2024.

*2024 Spring Western Sectional Meeting of the AMS, Special Session on Commutative and Noncommutative Algebra, Together at Last, San Francisco, CA, May 4, 2024.

*University of Georgia Algebra Seminar, virtual, March 25, 2024.

Talks on **A Chinese remainder theorem and Carlson's theorem for monoidal triangulated categories:**

IPAM Workshop on Symmetric Tensor Categories and Representation Theory, Los Angeles, CA, January 9, 2024.

Talks on **On the decomposition of tensor products of monomial modules for finite 2-groups:**

*2023 Summer Meeting of the CMS, Special Session on Noncommutative Algebra and Noncommutative Geometry, Ottawa, CA, June 4, 2023.

Talks on **Twisting Manin's universal quantum groups and comodule algebras:**

*Quantum Groups Seminar, virtual, February 12, 2024.

*2024 Joint Math Meetings, Special Session on Homological Techniques in Noncommutative Algebra, San Francisco, CA, January 3-6, 2024.

*2023 Fall Southeastern Sectional Meeting of the AMS, Special Session on New Directions in Noncommutative Algebras and Representation Theory, Mobile, AL, October 14, 2023.

Oberwolfach Workshop on Tensor-Triangular Geometry and Applications, Oberwolfach, DE, September 20, 2023.

*2023 Fall Eastern Sectional Meeting of the AMS, Special Session on Geometry, Physics and Representation Theory, Buffalo, NY, September 9, 2023.

*2023 Spring Western Sectional Meeting of the AMS, Special Session on Artin-Schelter Regular Algebras and Related Topics, Fresno, CA, May 6, 2023.

Maurice Auslander Distinguished Lectures and International Conference, Woods Hole, MA, May 1, 2023.

Talks on **A cogroupoid associated to preregular forms:**

*2023 Spring Western Sectional Meeting of the AMS, Special Session on Methods in Non-semisimple Representation Categories, Fresno, CA, May 6, 2023.

*2023 Spring Central Sectional Meeting of the AMS, Special Session on Interactions Between Noncommutative Ring Theory and Algebraic Geometry, Cincinnati, OH, April 15, 2023.

BIRS Workshop on Noncommutative Geometry and Noncommutative Invariant Theory, Banff, AB, Canada, September 27, 2022.

Talks on **On the spectrum and support theory of a finite tensor category:**

*2023 Fall Southeastern Sectional Meeting of the AMS, Special Session on Representation Theory of Finite and Algebraic Groups, Mobile, AL, October 15, 2023.

Oberwolfach Workshop on Tensor-Triangular Geometry and Applications, Oberwolfach, DE, September 20, 2023.

*Workshop: Spectra, triangles, and higher structures at the Hausdorff Institute of Mathematics, Bonn, DE, December 8, 2022.

*Maurice Auslander Distinguished Lectures and International Conference, Woods Hole, MA, October 29, 2022.

*International Workshop at the Atlantic Algebra Centre on Groups, Rings, Lie and Hopf Algebras IV, St. John's, NL, Canada, May 30, 2022.

*Seattle Noncommutative Algebra Day, virtual, March 26, 2022.

*MIT Infinite Dimensional Algebras Seminar, Cambridge, MA, November 19, 2021.

Talks on Twisting of graded quantum groups and solutions to the quantum Yang-Baxter equation:

*2021 Fall Southeastern Sectional Meeting of the AMS, Special Session on Cohomology, Representation Theory, and Lie Theory, virtual, November 20, 2021.

*University of Georgia Algebra Seminar, virtual, October 25, 2021.

Talks on Noncommutative tensor triangular geometry and the tensor product property for support maps:

*FD Seminar, virtual, July 8, 2021.

*Northeastern University Representation Theory and Related Topics Seminar, virtual, May 14, 2021.

*University of California Santa Barbara Quantum Algebra and Topology Seminar, virtual, May 12, 2021.

*Oberseminar in Representation Theory at Bonn, virtual, April 30, 2021.

*2021 Spring Central Sectional Meeting of the AMS, Special Session on Interactions between Representation Theory, Poisson Geometry, and Noncommutative Algebra, virtual, April 17, 2021.

*2021 Spring Eastern Sectional Meeting of the AMS, Special Session on Hopf Algebras, Tensor Categories, and Related Homological Methods, virtual, March 20, 2021.

Talks on Balmer spectra and Drinfeld centers:

Recent Advances and New Directions in the Interplay of Noncommutative Algebra and Geometry, Seattle, WA, June 21, 2022.

*Fourth Canada-Mexico-US Conference in Representation Theory, Noncommutative Algebra, and Categorification, Boston, MA, June 9, 2022.

*2021 Joint Math Meetings, Special Session on Interactions between Noncommutative Algebra and Noncommutative Algebraic Geometry, virtual, January 9, 2021.

*2020 Fall Western Sectional Meeting of the AMS, Special Session on Geometry and Representation Theory of Quantum Algebras and Related Topics, virtual, October 25, 2020.

Talks on Noncommutative tensor triangular geometry:

Louisiana State University Algebra Seminar, Baton Rouge, LA, February 11, 2020.

*Seminario Itinerante CCMUNAM-CIMAT-IMUNAM de Teoría de Representaciones, Oaxaca, Mexico, December 9, 2019.

*2019 Fall Western Sectional Meeting of the AMS, Special Session on Geometric Methods in Representation Theory, Riverside, CA, November 10, 2019.

*2019 Fall Central Sectional Meeting of the AMS, Special Session on Connections Between Noncommutative Algebra and Algebraic Geometry, Madison, WI, September 14, 2019.

*2019 Spring Eastern Sectional Meeting of the AMS, Special Session on Representation Theory of Quantum Algebras and Related Topics, Hartford, CT, April 14, 2019.

*2019 Spring Southeastern Sectional Meeting of the AMS, Special Session on Representations of Lie Algebras, Algebraic Groups, and Quantum Groups, Auburn, AL, March 16, 2019.

Talks on **Prime spectra of abelian 2-categories and categorifications of Richardson varieties:**

*2019 Fall Western Sectional Meeting of the AMS, Special Session on Canonical Bases, Cluster Structures and Non-commutative Birational Geometry, Riverside, CA, November 9, 2019.

*Quantum Flag Manifolds in Prague, Prague, Czech Republic, September 17, 2019.

*2019 Fall Central Sectional Meeting of the AMS, Special Session on Hall Algebras, Cluster Algebras and Representation Theory, Madison, WI, September 15, 2019.

*International Conference on Representation Theory VIII, Harbin, China, July 13, 2019.

11th Southeastern Lie Theory Workshop, Baton Rouge, LA, May 13, 2019.

University of California Santa Barbara Algebra Seminar, Santa Barbara, CA, April 1, 2019.

University of Georgia Algebra Seminar, Athens, GA, October 22, 2018.

† Representation Theory, Mathematical Physics and Integrable Systems, Luminy, France, June 4, 2018.

*2018 Spring Western Sectional Meeting of the AMS, Special Session on Noncommutative Algebraic Geometry and Related Topics, Portland, OR, April 14, 2018.

Recent developments in noncommutative algebra and related areas, Seattle, WA, March 17, 2018.

*2017 Fall Central Sectional Meeting of the AMS, Special Session on Noncommutative and Homological Algebra, Denton, TX, September 9, 2017.

† Algebra Extravaganza! in honor of Ellen Kirkman and Martin Lorenz, Philadelphia, PA, July 25, 2017.

*Fourth Conference on Geometric Methods in Representation Theory, Columbia, MO, November 19, 2016.

Workshop Participation

SLMath Noncommutative Algebraic Geometry Introductory Workshop, Berkeley, CA, February 5-9, 2024.

Mentoring in the Mathematical Sciences Workshop at Rice University, Houston, TX, November 4-5, 2023.

Oberwolfach workshop on Tensor-Triangular Geometry and Applications, Oberwolfach, DE, September 18-22, 2023.

SQuaRE at the American Institute of Mathematics on Quantum symmetries: Noncommutative geometry and solutions to the QYBE (focused collaborative research with Hongdi Huang, Van Nguyen, Charlotte Ure, Padmini Veerapen, and Xingting Wang), San Jose, CA, April 3-7, 2023.

Trimester Program on Spectral Methods in Algebra, Geometry, and Topology at the Hausdorff Center, Bonn, DE, November 27 - December 16, 2022.

SQuaRE at the American Institute of Mathematics on Quantum symmetries: Noncommutative geometry and solutions to the QYBE (focused collaborative research with Hongdi Huang, Van Nguyen, Charlotte Ure, Padmini Veerapen, and Xingting Wang), San Jose, CA, March 28 - April 1, 2022.

MSRI Quantum Symmetries Introductory Workshop, Berkeley, CA, January 27-31, 2020.

OSU Quantum Symmetries Summer Research Program, Columbus, OH, June 3-14, 2019.

MSRI Derived Categories Summer School, Berkeley, CA, June 25-July 6, 2018.

Teaching Experience

At MIT, I was a teaching assistant and ran recitations for the following courses:

Fall 2023: Math 18.02 Multivariable Calculus.

Spring 2023: Math 18.06 Linear Algebra.

At MIT, I was the instructor of record for the following courses:

Fall 2023: Math 18.700 Linear Algebra.

Fall 2022: Math 18.704 Seminar in Algebra. In this seminar-style undergraduate course, students give the majority of in-class presentations on topics from "Finite groups: an introduction" by J. P. Serre.

At MIT, I contributed to the following course:

Spring 2022: Math 18.708 Topics in Algebra, Instructors: Roman Bezrukavnikov and Pavel Etingof; I taught a two-week mini-course on support varieties and tensor triangular geometry.

At Louisiana State University, I was the instructor of record for the following courses:

Summer 2021: Math 2057 Calculus III

Fall 2018: Math 1550 Calculus I

At Wake Forest University, I was a teaching assistant for the following courses in the time period 2014-2016.

Calculus with Analytic Geometry I

Calculus with Analytic Geometry II

Discrete Mathematics

Linear Algebra I

Journal Refereeing

I have done refereeing work for the following journals:

The Annals of K-Theory

Comptes rendus de l'Académie des Sciences

International Mathematics Research Notices

Journal of Algebra

Journal of Pure and Applied Algebra

Proceedings of the AMS

Selecta Mathematica

Transformation Groups

Conference and Seminar Organizing

(Joint with Van Nguyen, Xingting Wang, and Robert Won) 2024 Spring Eastern Sectional Meeting of the AMS, Special Session on Recent Developments in Noncommutative Algebra and Tensor Categories, April 6-7, 2024.

(Joint with Pavel Etingof) Seminar on strict polynomial functors and the work of Friedlander-Suslin, Summer and Fall 2021.

Service and Outreach

In a jointly organized program between MIT and the Petey Greene Program, I was co-instructor of the Bridge to College Math course in Spring 2023 at the MCI-Framingham correctional facility. This course was designed to give inmates the tools that would allow them to pursue college degrees upon their release.

MIT PRIMES program: this program is a free year-long after-school program, run by Slava Gerovitch and Pavel Etingof, that offers research projects and guided reading to high school students.

Mentor, 2023: I supervised a research project with Justin Zhang, a high school student, which explored representations of a finite 3-group over a field of characteristic 3 which have nontrivial summands of the representation tensor with its dual. We produced a large family of new examples of such representations.

Mentor, 2022: I supervised a research project with George Cao, a high school student, which explored dimensions of summands of tensor powers of indecomposable representations for finite 2-groups, related to recent conjectures of Dave Benson and Benson-Symonds. A preprint of our work is on the arXiv. Based on the work we did together, George was selected as a 2023 Regeneron STS Scholars, based on his submission to the Regeneron Science Talent Search competition. He also placed in Honourable Mention in the Davidson Fellows Scholarship based on this work.

Assistant Head Mentor, Fall 2021: gave feedback on the drafts of research papers and helped students with practice presentations on their work.

LSU Geaux Program: this is a two-week program held by the LSU Mathematics Department every August in which older graduate students mentor new graduate students. Activities include panel discussions, question and answer sessions, and talks on both mathematical and non-mathematical aspects of graduate student life. I volunteered with the Geaux Program the following years:

August 2020 (virtual)

August 2019

August 2018

LSU Vertically Integrated Research Algebra Seminar: this seminar runs every semester at LSU, in which Professors, graduate students, and undergraduate students take turns giving talks to learn a topic of active research. Older graduate students are given the opportunity to mentor and teach both younger graduate students and undergraduate students. I participated in the following semesters of the seminar:

Fall 2020 and Spring 2021: Algebraic categorification

Fall 2019 and Spring 2020: Buildings associated to Coxeter groups

Spring 2019: Pattern avoidance in the geometry of Schubert varieties

Fall 2018: The infinite-dimensional representations of $\mathfrak{sl}_2(\mathbb{C})$

Spring 2018: The McKay correspondence, and conjugacy classes in Weyl groups

Fall 2017: Chern classes of Schubert varieties

Fall 2016 and Spring 2017: Hall algebras of categories of quiver representations and coherent sheaves on projective space

The Mathematics Student Colloquium Committee: this organization is run by graduate students in the LSU Math Department, and brings visiting researchers to LSU to give expository lectures to both general and specialized audiences. Graduate student members are responsible for all planning and coordination of events. I have held positions during the following school years on the committee:

Vice President (2019-2020 and 2020-2021)

Treasurer (2018-2019 and 2017-2018)

Committee member (2016-2017)

St. George's School Math Club: During 2018-2020 I participated in outreach to St. George's School, a middle school in Baton Rouge, LA. The first four visits to the school consisted of giving a 45-minute talk to the math and science club, and the last consisted in judging the STEAM Optical Illusion Art Show. The dates and topics of the talks are as follows.

March 2, 2020: STEAM Optical Illusion Art Show judge

May 3, 2019: Gödel's Incompleteness Theorem

October 5, 2018: What is it like to be a graduate student in math?

May 10, 2018: Symmetry in nature and its connection to abstract mathematics

January 11, 2018: Comparing infinite sets and Cantor's diagonalization

Super Science Saturday at LSU, October 27, 2018: I played the board game Hex with middle school students who attended the event, and spoke to them about how games and combinatorics intersect.

LSU High School Mathematics Contest, March 18, 2017: I volunteered as a proctor and grader for the contest, which had over 200 participants from various high schools.

Last updated: May 21, 2024