

William Hardesty

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November 29, 2023

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Education

- **University of Georgia** Athens, Georgia
Ph.D. Mathematics 08/15/2011 – 05/30/2016
 - Advisor: Daniel Nakano
 - Thesis: On support varieties for algebraic groups
 - GPA: 3.9
- **University of Maryland, Baltimore County** Baltimore, Maryland
B.S. Mathematics 02/05/2008 – 06/05/2010
 - Minor: Computer Science
 - GPA: 4.0 (*summa cum laude*)

Work Experience

- **University of Sydney** Sydney, New South Wales
Research Fellow, Level B 08/15/2019–06/30/2021
 - Hours per week: 40
 - Produced several high quality research articles in pure mathematics, presented at international conferences and mentored both graduate and undergraduate students.
- **Louisiana State University** Baton Rouge, Louisiana
Postdoctoral Researcher 08/15/2016–05/30/2019
 - Hours per week: 40
 - Produced numerous research papers in geometric representation theory, including joint work with top researchers in the area. I also presented at international conferences and mentored graduate students.
 - Courses taught include: Calculus II, Ordinary Differential Equations and Discrete Mathematics.

Additional Experience

- **Westlake University Affiliation/Independent Research** 09/01/2021 – 09/04/2022
 - Affiliated with Westlake University for one year after accepting an assistant professor position in 2021. Was unable to relocate to China due to the COVID-Zero policy.
 - During this time period I continued to conduct mathematical research.
- **Undergraduate Research Project at UMBC** 06/01/2010 – 02/01/2011
 - Project Title: “Electromagnetic modeling and simulation for surface enhanced Raman spectroscopy”

- Employed FEniCS, a numerical finite element package, to solve Maxwell's equations on complex multi-layered surfaces.
- Advisor: Dr. John Zweck
- **Research Experience for Undergraduates at GMU** 06/01/2009 – 08/01/2009
 - Project Title: “Nucleation and Spinodal Decomposition in Ternary-component Alloys”
 - Modeled the dynamics of phase separation in multi-component alloys using the AUTO math package.
 - Advisors: Dr. Thomas Wanner and Dr. Evelyn Sander

Technical Skills

- Programming Experience: **Python, Java, C, C++, MATLAB, L^AT_EX**, Beamer, HTML
- Software/Libraries: **NumPy, pandas, Matplotlib, bokeh, tensorflow, sklearn**, unix/linux, **bash**, Sympy
- Additional Skills and Interests: **Stochastic Calculus, Quantitative Finance, Derivative Pricing, Numerical Analysis, Linear Algebra, Probability Theory, Statistics, Mathematical Modeling, Machine Learning, Data Science, Algorithms, Data Structures, OOP, Backtesting**

Academic Research Summary

My academic research has centered around the representation theory of **reductive algebraic groups** over fields of positive characteristic and associated objects such as **quantum groups, Frobenius kernels** and **restricted Lie algebras**. As well as related topics in geometry, such as the study of **perverse sheaves, parity sheaves, exotic t-structures**, the **nilpotent cone** and the **Springer resolution**. An important instance of the deep connection between representation theory and geometry arising in my work can be seen in a series of papers (joint with Pramod Achar) where we resolved the classical **Humphreys conjecture** on support varieties of tilting modules by developing a theory of **exotic co-t-structures** for the nilpotent cone.

Publications

13. (with P. Achar) Silting complexes of coherent sheaves and the Humphreys conjecture, to appear in **Duke Mathematical Journal**, arXiv:1810.06157.
12. (with P. Achar) Nilpotent centralizers and good filtrations, **Transformation Groups** (2022).
11. (with P. Achar) Co-t-structures on derived categories of coherent sheaves and the cohomology of tilting modules, to appear in **Representation Theory of the American Mathematical Society**.
10. (with P. Achar, S. Riche) Integral exotic sheaves and the modular Lusztig–Vogan bijection, **J. London Math. Soc.** 106 (2022), 2403-2458.
9. On the centralizer of a balanced nilpotent section, submitted, arXiv:1810.06157.
8. Explicit calculations in an infinitesimal singular block of SL_N , **Proceedings of the Edinburgh Mathematical Society** 65 (1), 19 - 52.

7. (with P. Achar, S. Riche) Conjectures on tilting modules and antispherical p -cells, to appear in **RIMS Kokyuroku Bessatsu**, arXiv:1812.09960.
6. (with P. Achar, S. Riche) Representation theory of disconnected reductive groups, **Documenta Mathematica** 25 (2020), 2149-2177.
5. (with P. Achar) Calculations with graded perverse coherent sheaves, **The Quarterly Journal of Mathematics** 70 (4), 1327-1352.
4. (with P. Achar, S. Riche) On the Humphreys conjecture on support varieties, **Transformation Groups** 24 (3), 597-657.
3. On support varieties and the Humphreys conjecture in type A , **Adv. Math.** 329 (2018), 392–421.
2. (with D. Nakano, P. Sobaje) On the existence of Mock Injective modules for algebraic groups, **Bull. Lond. Math. Soc.** 49 (2017).
1. Support varieties of line bundle cohomology groups for $SL_3(k)$, **J. Algebra** 448 (2016), 127-173.

Invited Presentations

- University of Bonn Representation Theory Seminar (January 2021)
- $D^b(days)$: An informal journey into derived categories of coherent sheaves - Sydney, Australia (February 2020)
- Representations of Lie and Jordan Algebras, Their Representations and Applications - Chengdu, China (January 2020)
- University of Sydney Algebra Seminar (September 2019)
- AMS special session on Geometric Methods in Representation Theory - Auburn, Alabama (March 2019)
- AMS special session on Representations of Lie algebras, algebraic groups, and quantum groups - Auburn, Alabama (March 2019)
- Oberwolfach Seminar: Character Formulas for Reductive Algebraic Groups - Oberwolfach, Germany (November 2018)
- "Théorie géométrique des représentations" in Besse, France (September 2018)
- University of Louisiana Lafayette Algebra Seminar (April 2018)
- University of South Alabama, Colloquium (November 2017)
- University of South Alabama, Algebra Seminar (November 2017)
- AMS Special Session on Geometric Methods in Representation Theory - Charleston, South Carolina (March 2017)
- AMS Special Session on Lie Theory, Representation Theory and Geometry - Athens, Georgia (March 2016)
- AMS Special Session on Categorical and Geometric Methods in Representation Theory - Seattle, Washington (January 2016)

- 8th Southeastern Lie Theory Workshop on Algebraic and Combinatorial Representation Theory - Raleigh, North Carolina (October 2015)
- Southwest Group Theory Day 2015 - Tucson, Arizona (March 2015)
- Joint Mathematics Meetings (JMM) - San Francisco, California (January 2010)

Teaching Experience

- Louisiana State University: Honors Calculus I, Calculus II, Ordinary Differential Equations, Discrete Mathematics
- University of Georgia: Precalculus, Calculus I

Awards, Grants & Honours

Graduate Student Travel Grant to the Joint Mathematics Meetings 2016
 University of Georgia, Graduate Student Assistantship 2011-2013
 Outstanding Senior in Mathematics, University of Maryland, Baltimore County 2010
 Outstanding Graduating Senior in Mathematics, University of Maryland, Baltimore County 2009

Service

- Co-organizer for the Southeastern Lie Theory Worskhop XI (Baton Rouge, May 2019)
- Service as a T.A. for Oberwolfach Seminar: Character Formulas for Reductive Algebraic Groups - Oberwolfach, Germany (November 2018)
- Service as an anonymous referee for multiple journals.