William Hardesty

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Columbia, MD, USA
hardes11@gmail.com
Webpage: https://hardes11.github.io/
LinkedIn: www.linkedin.com/in/william-hardesty-414007236
Google Scholar: https://scholar.google.com/citations?user=y6uNULUAAAAJ&hl=en

Education

- **University of Georgia** — Athens, Georgia
  Ph.D. Mathematics — *2011- 2016*
  - Advisor: Daniel Nakano
  - Thesis: On support varieties for algebraic groups
  - GPA: 3.9

  University of Maryland, Baltimore County — Baltimore, Maryland
  B.S. Mathematics and Computer Science — *2007 - 2011*
  - GPA: 4.0 (*summa cum laude*)

Employment

- **Westlake University** — Hangzhou, Zhejiang
  Assistant Professor — *2021-2022*
- **University of Sydney** — Sydney, New South Wales
  Research Fellow, Level B — *2019-2021*
- **Louisiana State University** — Baton Rouge, Louisiana
  Postdoctoral Researcher — *2016-2019*

Technical Skills

- Programming Experience: **Python**, **Java**, **C**, ++, **MATLAB**, LaTeX, Beamer, HTML
- Software/Libraries: **NumPy**, **pandas**, **Matplotlib**, **bokeh**, **sklearn**, Sympy Maple, Mathematica
- 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**

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. Silting complexes of coherent sheaves and the Humphreys conjecture, submitted, 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.

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

Undergraduate Applied Mathematics Research

- **Research Experience for Undergraduates (REU)** George Mason
  Applied Mathematics *June 2009 - August 2009*
  - "Nucleation and Spinodal Decomposition in Ternary-component Alloys"
  - Modeled the dynamics of phase seperation in multi-component alloys using the AUTO math package.
  - Advisors: Dr. Thomas Wanner and Dr. Evelyn Sander
- **Undergraduate Research Project** University of Maryland, Baltimore County
  Applied Mathematics *June 2010 - February 2011*
  - "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

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 *International Mathematics Research Notices*, *Journal of Combinatorial Theory, Series A*, and multiple conference proceedings journals.