

# William Hardesty

Columbia, MD, USA

Webpage: <https://hardes11.github.io/>

LinkedIn: [www.linkedin.com/in/william-hardesty-414007236](http://www.linkedin.com/in/william-hardesty-414007236)

Google Scholar: <https://scholar.google.com/citations?user=y6uNULUAAAAJ&hl=en>

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hardes11@gmail.com

## 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, L<sup>A</sup>T<sub>E</sub>X**, 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, 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.

## 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 separation 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 Workshop 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.