Curriculum Vitae
Reuven Hodges

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Appointments

2021 -	S.E.W Visiting Assistant Professor, University of California San Diego
2019 - 2021	J.L. Doob Research Assistant Professor, University of Illinois at Urbana-Champaign
2018 - 2019	Postdocoral Researcher, Max Planck Institute for Informatics
2017 - 2018	Lecturer, Northeastern University

Education

2012 - 2017	**Ph.D. in Mathematics**, Northeastern University Advisor: Venkatramani Lakshmibai Thesis: "Schubert singularities and Levi subgroup actions on Schubert varieties"
2015 (June)	**Visitor**, FAU Erlangen-Nürnberg
2010 - 2012	**M.S. in Mathematics**, Northeastern University
2000 - 2004	**B.A. in Mathematics and Computer Science**, Goshen College

Grants and Awards

2020 - 2022	AMS-Simons Travel Grant
2021	List of Teachers Ranked as Excellent by Their Students, UIUC (Spring 2021)
2020	List of Teachers Ranked as Excellent by Their Students, UIUC (Spring 2020)

Research Interests

My research focuses on algebraic combinatorics, representation theory, and combinatorial Lie theory. I investigate flag varieties and their Schubert varieties via representation theoretic and combinatorial tools. I also work with straightening relations and study their application to multiplicities of irreducible representations in plethysms and geometric complexity theory.

Publications and Preprints

15. Y. Gao, **R. Hodges**, A. Yong. *Classifying Levi-spherical Schubert varieties.* To appear in the Proceedings of the 34^{th} Conference on Formal Power Series and Algebraic Combinatorics (Bangalore), 2022.
14. D. Brewster, J. Balogh, **R. Hodges**. *Proper elements of Coxeter Groups.* Preprint, arXiv:2111.15105
13. **R. Hodges**, G. Orelowitz. *Approximate counting of standard set-valued tableaux.* To appear in Theoretical Computer Science (2022)
12. Y. Gao, **R. Hodges**, A. Yong. *Classification of Levi-spherical Schubert varieties.* Preprint, arXiv:2104.10101
11. D. Brewster, **R. Hodges**, A. Yong. *Proper permutations, Schubert geometry, and randomness.* Journal of Combinatorics, Vol. 13, No. 4 (2022), pp. 561-574
10. S. Gao, **R. Hodges**, G. Orelowitz. *Multiplicity-free skew Schur polynomials.* Algebraic Combinatorics, Vol 4 Issue 6, 1073-1117 (2021)
9. P. Breiding, **R. Hodges**, C. Ikenmeyer, M. Michałek. *Equations for GL invariant families of polynomials.* Vietnam Journal of Mathematics ; 50 (2022), 545-556

8. **R. Hodges**, A. Yong. *Coxeter combinatorics and spherical Schubert geometry.* Journal of Lie Theory 32 (2022), No. 2, 447–474
7. **R. Hodges**, A. Yong. *Multiplicity-free key polynomials.* To appear in Ann. Comb. (2022).
6. M. B. Can, **R. Hodges**. *Sphericality and Smoothness of Schubert Varieties.* Preprint, arxiv:1803.05515
5. **R. Hodges**, V. Lakshmibai. *A classification of spherical Schubert varieties in the Grassmannian.* Proc Math Sci 132, 68 (2022).
4. **R. Hodges**. *A non-iterative formula for straightening fillings of Young diagrams.* Preprint, arxiv:1710.05214
3. M. B. Can, **R. Hodges**, V. Lakshmibai. *Toroidal Schubert varieties.* Algebr Represent Theor 23, 1927-1943 (2020)
2. **R. Hodges**, V. Lakshmibai. *Levi subgroup actions on Schubert varieties, induced decompositions of their coordinate rings, and sphericity consequences.* Algebr Represent Theor 21: 1219-1239 (2018)
1. **R. Hodges**, V. Lakshmibai. *Free resolutions of some Schubert singularities in the Lagrangian Grassmannian.* Pacific J. Math. **279** (2015), no. 1-2, 329–355.

Academic Service and Mentorship

Co-organizer of the Schubert Summer School @ UIUC, June 2023

Undergraduate Summer Research - Atmik Das - Summer 2022

Faculty Mentor Program (UCSD Undergraduate research mentorship program) - Mingyu Yu - Winter 2022 & Spring 2022

Co-organizer of ALGECOM XIX, March 2020

Co-organizer of the Algebra-Geometry-Combinatorics Seminar at UIUC, 2019-2021

ICLUE undergraduate research mentor, Summer 2020

Project mentor for a summer REU project at Northeastern University, Summer 2018

Served as a referee for: Transactions of the American Mathematical Society, Algebraic Combinatorics, Annals of Combinatorics, the Electronic Journal of Combinatorics, Communications in Algebra.

Talks

2023 Jan. **JMM 2023** (AMS Special Session on the combinatorics of Jordan type and Lefschetz properties):
Approximate counting of standard set-valued tableaux.

2022 Oct. **Brandeis/Northeastern University** (Maurice Auslander Distinguished Lectures and International Conference):
Classifying Levi-spherical Schubert varieties.

Oct. **UMass Amherst** (AMS Special Session on the combinatorics and geometry of Jordan type and commuting varieties):
Classifying Levi-spherical Schubert varieties.

Jun. **UC Davis** (Algebra & Discrete Mathematics Seminar):
Classifying Levi-spherical Schubert varieties.

Apr. **Texas A&M** (Geometry Seminar):
Classifying Levi-spherical Schubert varieties.

Mar. **U. of Minnesota** (Combinatorics Seminar):
Classifying Levi spherical Schubert varieties.

Mar. **U. of Minnesota** (UMN Student Combinatorics and Algebra Seminar):
Split-symmetry in algebraic combinatorics.

Mar. **UC San Diego** (RTG Colloquium in Algebra, Algebraic Geometry and Number Theory):
Classifying Levi spherical Schubert varieties.

2021 Apr. **U. of Illinois Urbana-Champaign** (Undergraduate Seminar):
Straightening fillings of Young diagrams.

Mar. **University of Michigan** (Combinatorics Seminar)
Coxeter combinatorics and spherical Schubert geometry.

2020 Nov. **University of Georgia** (Algebra Seminar):
Coxeter combinatorics and spherical Schubert geometry.

Oct. **Dartmouth College** (Combinatorics Seminar):
A non-iterative formula for straightening fillings of Young diagrams.

Oct. **University of Waterloo** (Combinatorics Seminar):
Coxeter combinatorics and spherical Schubert geometry.

Oct. **Notre Dame** (Algebra Seminar):
Coxeter combinatorics and spherical Schubert geometry.

Oct. **U. of Illinois Urbana-Champaign** (Algebra-Geometry-Combinatorics Seminar):
Coxeter combinatorics and spherical Schubert geometry.

Feb. **Oklahoma State** (Lie Groups Seminar):
Classifying Levi spherical Schubert varieties.

Jan. **Washington U. St. Louis** (Combinatorics Seminar):
Classifying Levi spherical Schubert varieties.

Jan. **Dalhousie U.** (Combinatorial Algebra meets Algebraic Combinatorics 2020):
A non-iterative formula for straightening fillings of Young diagrams.

2019 Dec. **U. of Minnesota** (UMN Combinatorics Seminar):
A non-iterative formula for straightening fillings of Young diagrams.

Dec. **U. of Minnesota** (Graduate Student Seminar):
Straightening and Foulkes' conjecture.

Nov. **U. of Florida, Gainesville** (AMS Special Session on Combinatorial Lie Theory):
Spherical and toroidal Schubert varieties.

Oct. **U. of Illinois Urbana-Champaign** (Algebra-Geometry-Combinatorics Seminar):
The combinatorics of spherical Schubert varieties.

May. **Max Planck Institute for Informatics** (Scientific Review Poster Session):
The kernel of the Hadamard-Howe map.

Jan. **Universität zu Köln** (Oberseminar Algebra):
A classification of spherical Schubert varieties in the Grassmannian.

2018 Nov. **FAU Erlangen-Nürnberg** (Emmy-Noether-Seminars):
A classification of spherical Schubert varieties in the Grassmannian.

Nov. **Northeastern** (Geometry, Algebra, Singularities, and Combinatorics Seminar):
A classification of spherical Schubert varieties in the Grassmannian.

Nov. **Tulane** (Commutative Algebra and Representation Theory Conference):
A classification of spherical Schubert varieties in the Grassmannian.

Oct. **Max Planck Institute for Informatics** (D1 Seminar):
A non-iterative formula for straightening fillings of Young diagrams

Apr. **Northeastern** (AMS Special Session on Topics in Toric Geometry):
Levi subgroup actions on Schubert varieties in the Grassmannian

Apr. **Northeastern** (AMS Special Session on Combinatorial Aspects of Nilpotent Orbits):
A classification of spherical Schubert varieties

May **U. of Illinois Urbana-Champaign** (Algebra-Geometry-Combinatorics Seminar):
A non-iterative formula for straightening fillings of Young diagrams

Jan **Tulane** (Combinatorics Seminar):
A non-iterative formula for straightening fillings of Young diagrams

2017 Nov. **UC Riverside** (AMS Special Session on Combinatorial Aspects of the Polynomial Ring):
Levi subgroup actions on Schubert varieties in the Grassmannian

Oct **CUNY** (New York Combinatorics Seminar):
A closed non-iterative formula for straightening fillings of Young diagrams

Sept **Northeastern** (Matroids in Boston Workshop):
Straightening fillings of Young diagrams

May **Brown** (AMS Graduate Student Conference in Algebra and Number Theory):
Flag varieties, their Schubert subvarieties, and Levi subgroup actions

Apr. **UNC Chapel Hill** (Geometric Methods in Representation Theory):
Levi subgroup actions on Schubert varieties in the Grassmannian

Apr. **UMass Boston** (Colloquium):
Levi subgroup actions on Schubert varieties in the Grassmannian

Mar. **U. of Illinois Urbana-Champaign** (Algebra-Geometry-Combinatorics Seminar):
Levi subgroup actions on Schubert varieties in the Grassmannian

2016 Nov. **Northeastern** (Geometry, Algebra, Singularities, and Combinatorics Seminar):
Levi subgroup actions on Schubert varieties in the Grassmannian

Nov. **Tufts** (Algebra/Geometry Seminar):
Levi subgroup actions

Oct. **Northeastern** (Graduate Student Seminar):
Levi subgroup actions on Schubert varieties

Apr. **Northeastern** (Graduate Student Seminar):
Decompositions of Schubert variety coordinate rings and sphericity

2015 June **FAU Erlangen-Nürnberg** (Emmy-Noether-Seminars):
Free resolutions of some Schubert singularities

2014 Oct. **Northeastern** (Graduate Student Seminar):
A geometric technique for computing free resolutions

Feb. **Northeastern** (Graduate Student Seminar):
Introduction to standard monomial theory

Teaching Experience

2022	Fall	Instructor for *"Applied Linear Algebra"* (two sections)
		Instructor for *MATH 199 - Independent Study/Undergrad (Atmik Das)*
	Spring	Instructor for *"Applied Linear Algebra"*
		Instructor for *MATH 199 - Independent Study/Undergrad (Mingyu Yu)*
	Winter	Instructor for *"Modern Algebra"*
		Instructor for *"Calculus II"*
		Instructor for *MATH 199 - Independent Study/Undergrad (Mingyu Yu)*
2021	Fall	Instructor for *"Modern Algebra"*
	Spring	Instructor for *"Nonlinear Programming"*
2020	Fall	Instructor for *"Linear Programming"*
2020	Spring	Instructor for *"Nonlinear Programming"*
2019	Fall	Instructor for two sections of *"Introduction to Discrete Mathematics"*
2017	Fall	Instructor for two sections of *"Calculus for Biology"*
	Spring	Instructor *"Calculus for Business and Economics"*
2016	Fall	Instructor *"Applied Calculus"*
	Spring	Instructor *"Mathematical Thinking"*
		This course covers logic, discrete probability theory, and combinatorics.
2015	Fall	Instructor *"Mathematical Thinking"*
	Summer	Teaching Assistant *"Linear Algebra"*
	Spring	Instructor *"Mathematical Thinking"*
2014	Fall	Instructor *"Mathematical Thinking"*
	Summer	Instructor *"Applied Calculus"*
	Spring	Instructor *"Mathematical Thinking"*
2013	Fall	Instructor *"Mathematical Thinking"*
	Spring	Instructor *"Mathematical Thinking"*
2012	Fall	Teaching Assistant *"Mathematical Thinking"*

Skills

Programming Languages: C, Sage, Python, Cython