Curriculum Vitae: Jack Jeffries

Investagador Titular A (tenure-track faculty), Centro de Investigación en Matemáticas, A.C., Guanajuato, México.

Ph. D.: The University of Utah, May 2015. Advisor: Professor Anurag K. Singh

B. S.: The Ohio State University, June 2010.

Appointments:

- Investigador Titular A, CIMAT, 2019–present.
- NSF Postdoctoral Fellow, The University of Michigan, 2016–2019.
- RTG Assistant Professor, The University of Michigan, 2015–2016.
- Graduate Teaching/Research Assistant, The University of Utah, 2010–2015.
- Graduate Research Fellow, The University of Utah, 2014–2015.
- MSRI Program Associate, 2012–2013.
- Undergraduate Teaching Assistant, The Ohio State University, 2008–2010.

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Research Interests:

My research interests are in Commutative Algebra. More particularly, my interests include invariant theory, positive characteristic techniques, differential operators, local cohomology, generalized multiplicities, symbolic powers, and applications to neuroscience.

Publications and Preprints:

- Faithfulness of top local cohomology modules in domains, with Melvin Hochster, to appear in *Math. Res. Lett.*, 7 pp., arXiv:1909.08770
- Bernstein-Sato functional equations, V-filtrations, and multiplier ideals of direct summands, with Josep Àlvarez Montaner, Daniel J. Hernández, Luis Núñez-Betancourt, Pedro Teixeira, and Emily E. Witt, submitted, 40 pp., arXiv:1907.10017
- Transformation rules for natural multiplicities, with Ilya Smirnov, submitted, 10 pp., arXiv:1904.07755
- Quantifying singularities with differential operators, with Holger Brenner and Luis Núñez-Betancourt, to appear in *Adv. Math*, 75 pp., DOI: 10.1016/j.aim.2019.106843, arXiv:1810.04476
- Algebraic signatures of convex and nonconvex codes, with Carina Curto, Elizabeth Gross, Katherine Morrison, Zvi Rosen, Anne Shiu, and Nora Youngs, *J. Pure Appl. Algebra*, **223** (2019), 3919–3940.
- Derived functors of differential operators, to appear in *Int. Math. Res. Not. IMRN*, 21 pp., DOI: 10.1093/imrn/rny284, arXiv:1711.03960

- A Zariski–Nagata theorem for smooth $\mathbb{Z}$-algebras, with Alessandro De Stefani and Eloísa Grifo, to appear in *J. Reine Angew. Math.*, 14 pp., DOI: 10.1515/crelle-2018-0012, arXiv:1709.01049
- Polarization of neural ideals, with Sema Güntürkün and Jeffrey Sun, to appear in *J. Algebra Appl.*, 15 pp., DOI: 10.1142/S021949882050146, arXiv:1706.08559
- Local Okounkov bodies and limits in prime characteristic, with Daniel J. Hernández, *Math. Ann.* **372** (2018), no. 1, 139–178.
- Mapping toric varieties into low dimensional spaces, with Emilie Dufresne, to appear in *Trans. Amer. Math. Soc.*, 28 pp., DOI: 10.1090/tran/7026, arXiv:1602.07585
- Appendix to: On the behavior of singularities at the F-pure threshold, with Alessandro De Stefani, Jack Jeffries, Zhibek Kadyrsizova, Robert Walker, George Whelan; paper by Eric Canton, Daniel Hernández, Karl Schwede, Emily Witt, *Illinois J. Math.* **60** (2016), no. 3, 669–685.
- What makes a neural code convex?, with Carina Curto, Elizabeth Gross, Katherine Morrison, Mohamed Omar, Zvi Rosen, Anne Shiu, and Nora Youngs, *SIAM J. Appl. Algebra Geom.* **1** (2017), no. 1, 222–238.
- Separating invariants and local cohomology, with Emilie Dufresne, *Adv. Math.*, **270** (2015) 565–581.
- Multiplicities of classical varieties, with Jonathan Montaño and Matteo Varbaro, *Proc. London Math. Soc.*, **110** (2015), no. 4, 1033–1055.
- Non-simplicial decompositions of Betti diagrams of complete intersections, with Courtney Gibbons, Sarah Mayes, Claudiu Raicu, Branden Stone, and Bryan White, *J. Commut. Algebra*, **7** (2015), no. 2, 189–206.
- The j-multiplicity of monomial ideals, with Jonathan Montaño, *Math. Res. Lett.*, **20** (2013) no. 4, 1–16.

Teaching:

CIMAT

- Fall 2019: Commutative Algebra

Course responsibilities: Primary instructor (all semesters). Original lecture notes for Commutative Algebra.
Contact: Xavier Gómez Mont — gmont@cimat.mx

The University of Michigan

- Winter 2019: Math 412 Intro to Abstract Algebra
- Fall 2018: Math 614 Commutative Algebra I
- Winter 2018: Math 615 Commutative Algebra II
- Fall 2017: Math 412 Intro to Abstract Algebra
- Winter 2016: Math 217 Linear Algebra
- Fall 2015: Math 115 Calculus I

Course responsibilities: Primary instructor (all semesters). Developing course materials to make 412 an inquiry-based learning (IBL) course. Math 217 is an entirely IBL course; Math 115 is a partially IBL course. Original lecture notes for 614 and 615.
Contact: Joe Conlon — conlon@umich.edu

The University of Utah

- Spring 2014: Math 2270 Linear Algebra

- Fall 2013: Math 1070 Introduction to Statistical Inference
- Summer 2013: Math 3160 Applied Complex Variables
- Fall 2011: Math 1220 Calculus II
- Summer 2011: Math 1070 Introduction to Statistical Inference
- Spring 2011: Math 1010 Intermediate Algebra
- Fall 2010: Math 1100 Quantitative Analysis

Course responsibilities: Primary instructor (all semesters).
Contact: Henryk Hecht — hecht@math.utah.edu

The Ohio State University

- Winter 2010: Math 150 Elementary Functions
- Autumn 2009: Math 150 Elementary Functions
- Winter 2009: Math 150 Elementary Functions
- Autumn 2008: Math 150 Elementary Functions

Course responsibilities: Recitation instructor (all quarters).
Contact: John Lewis — jlewis@math.ohio-state.edu

Fellowships and scholarships:

- AMS Simons travel grant, 2019–present.
- AIM SQUARES grant, 2018–present.
- NSF Postdoctoral Research Fellowship, 2016–2019.
- NSA Young Investigator Grant (awarded)
- University of Utah Graduate Research Fellowship (university-wide research fellowship for Ph. D. students), 2014–2015
- T. Benny Rushing Fellowship, University of Utah Mathematics Dept., 2014
- Gordon Memorial Fund Scholarship, 2008–2010, The Ohio State University Mathematics Department
- National Merit Scholarship, 2006–2010, NMSC
- Distinguished Merit Scholarship, 2006–2010, The Ohio State University
- Undergraduate Research Scholarship, 2009, OSU College of the Arts and Sciences

Service and Organization:

- Co-organizer: Pan-American School on Commutative Algebra, Barranquilla, Colombia, June 2020.
- Co-organizer: AMS Special Session on Advances in Commutative Algebra, Ann Arbor, MI, October 2018.
- MathSciNet reviewer: 2017–present.
- Wolverine Pathways volunteer, 2016–2018.
- Teaching Assistant, OIST Summer Graduate School 2017, Okinawa, Japan, May 2017.
- University of Michigan Math club, Spring 2017.
- REU co-advisor, Summer 2016.
- Wayne County Math Teachers Circle volunteer, Fall 2016.
- Co-organizer: AMS-AWM (JMM) Special Session on Commutative Algebra and Its Interactions with Algebraic Geometry, Seattle, WA, January 2016.
- Program Assistant, MRC Program in Commutative Algebra, June 2015.
- Co-organizer: AMS Special Session on Homological Methods in Commutative Algebra, October 2015.

- Co-organizer: BIKES (University of Utah Commutative Algebra student seminar), Fall 2014.
- Co-organizer: AMS Special Session on Developments from MSRI Programs in Commutative Algebra and Noncommutative Algebraic Geometry and Representation Theory, San Francisco, CA, October 2014.
- Co-organizer: AMS Special Session on Developments from PASI 2012: Commutative Algebra and Interactions with Related Disciplines, Lubbock, TX, April 2014.
- Co-organizer: MSRI Program Associate Seminar, Berkeley, CA, Fall 2012.

Invited Talks:

- *From Zariski-Nagata to local fundamental groups*, Tulane Colloquium, January 2019.
- *From Zariski-Nagata to local fundamental groups*, UNL Colloquium, December 2019.
- *Bernstein-Sato polynomials, V-filtrations, and multiplier ideals*, Workshop on p-adic methods and Hodge theory, Mérida, México, November 2019.
- *Neural rings*, Fall school in Commutative Algebra, Guanajuato, México, November 2019.
- *Differential signature*, Workshop on Algebraic and Topological Methods in Singularity Theory, Guanajuato, México, November 2019.
- *Primary decomposition and differentiating by integers*, Congresso Nacional de Sociedad Matemática Mexicana, Monterrey, México, October 2019.
- *Neural rings*, Coloquio Latinamericano de Álgebra, Mexico City, México, August 2019.
- *Bernstein-Sato polynomials and singularities*, Coloquio Latinamericano de Álgebra, Mexico City, México, August 2019.
- *From Zariski-Nagata to local fundamental groups*, CIMAT Colloquium, Guanajuato, México, February 2019.
- *From Zariski-Nagata to local fundamental groups*, Iowa State Math Department Colloquium, Des Moines, IA, February 2019.
- *Differential operators and reduction to positive characteristic*, FACARD, Barcelona, Spain, January 2019.
- *Lifting differential operators and the unique splitting property*, AMS Fall Sectional Meeting, Ann Arbor, MI. October 2018.
- *Quantifying singularities with differential operators*, KUMUNU, Lawrence, KS, October 2018.
- *A Zariski-Nagata Theorem for smooth $\mathbb{Z}$-algebras*, University of Nottingham Algbera Seminar, Nottingham, UK, July 2018.
- *Differential operators and symbolic powers* (Lecture series), Topics in Commutative Algebra RTG Workshop, Salt Lake City, UT, May 2018.
- *Derived functors of differential operators*, Kansas Commutative Algebra Seminar, Lawrence, KS, April 2018.
- *Derived functors of differential operators*, AMS Spring Sectional Meeting, Nashville, TN, April 2018.
- *Derived functors of differential operators*, AMS Spring Sectional Meeting, Columbus, OH, March 2018.
- *Derived functors of differential operators*, Mini-workshop in Commutative Algebra, Charlottesville, VA, March 2018.
- *A Zariski-Nagata Theorem for smooth $\mathbb{Z}$-algebras*, JMM, San Diego, CA, January 2018.

- *A Zariski-Nagata Theorem for smooth $\mathbb{Z}$-algebras*, Purdue Commutative Algebra Seminar, West Lafayette, IN, October 2017.
- *Quantifying Singularities with differential operators*, AMS Fall Sectional Meeting, Denton, TX, September 2017.
- *Quantifying Singularities with differential operators*, PRIMA, Oaxaca, MX, August 2017.
- *Quantifying Singularities with differential operators*, UU Commutative Algebra Seminar, Salt Lake City, UT, April 2017.
- *Local Okounkov bodies and limits in positive characteristic I*, UNL Commutative Algebra Seminar, March 2017.
- *Local Okounkov bodies and limits in positive characteristic II*, UNL Commutative Algebra Seminar, March 2017.
- *Local Okounkov bodies and limits in positive characteristic*, CMS Winter meeting, Niagara Falls, ON, December 2016.
- *Local Okounkov bodies and limits in positive characteristic*, GSU Commutative Algebra Seminar, November 2016.
- *Subspace arrangements in invariant theory*, CIMAT Algebra Seminar, Guanajuato, MX, October 2016.
- *Separating sets for actions of tori*, AMS Spring Sectional Meeting, Salt Lake City, UT, April 2016.
- *Separating sets for actions of tori*, AMS Spring Sectional Meeting, Fargo, ND, April 2016.
- *Separating sets for actions of tori*, AMS Fall Sectional Meeting, New Brunswick, NJ, November 2015.
- *How many invariants are needed to separate orbits?*, Algebra Seminar, University of Edinburgh, February 2015.
- *How many invariants are needed to separate orbits?*, International Conference on Representation Theory, A conference in honor of Jerzy Weyman's 60th Birthday, Storrs, CT, April 2015.
- *How many invariants are needed to separate orbits?*, JMM, San Antonio, TX, January 2015.
- *Neural rings and neural codes*, San Jose State University Combinatorics Seminar, San Jose, CA, October 2014.
- *p-bodies: limits in positive characteristic*, University of Virginia Commutative Algebra Seminar, Charlottesville, VA, October 2014
- *Separating invariants and local cohomology*, University of Nebraska Commutative Algebra Seminar, Lincoln, NE, April 2014.
- *Minimal separating sets for finite group actions*, UC Berkeley Commutative Algebra and Algebraic Geometry Seminar, Berkeley, CA, February 2014.
- *How many invariants are needed to distinguish orbits?*, AMS Fall Sectional Meeting, Riverside, CA, November 2013.
- *Examples of j and ϵ-multiplicity*, University of Kansas Algebra Seminar, Lawrence, KS, October 2013.
- *How many invariants are needed to distinguish orbits?*, AMS Fall Sectional Meeting, Louisville, KY, October 2013.

- *The j-multiplicity of monomial ideals*, CMS Summer Sectional Meeting, Halifax, CA, June 2013.
- *Splittings for rings of modular invariants*, KUMUNUjr, Lincoln, NE, April 2013.
- *Splittings for rings of modular invariants*, MSRI Commutative Algebra Seminar, Berkeley, CA, February 2013.
- *Finite F-representation type and F-signature*, KUMUNUjr, Lincoln, NE, April 2012.