Curriculum Vitae: Jack Jeffries

Assistant Professor, University of Nebraska-Lincoln.

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

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

Appointments:

- Assistant Professor, University of Nebraska-Lincoln, 2020–.
- Investigador Titular A (tenure-track faculty), CIMAT, 2019–2020.
- 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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325 Avery Hall
Department of Mathematics
University of Nebraska-Lincoln
Lincoln, NE 68588-0130

Research Interests:

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

Publications and Preprints:

(1) Bernstein's inequality and holonomicity for certain singular rings, with Josep Àlvarez Montaner, Daniel J. Hernández, Luis Núñez-Betancourt, Pedro Teixeira, and Emily E. Witt, submitted, 34 pp. arXiv:2103.02986
(2) Differential operators on classical invariant rings do not lift modulo p, with Anurag K. Singh, submitted, 38 pp. arXiv:2006.03029
(3) Extensions of Primes, Flatness, and Intersection Flatness, with Melvin Hochster, to appear in *Contemp. Math*, 17 pp. arXiv:2003.02560
(4) Lower Bounds on Hilbert-Kunz Multiplicities and Maximal F-signatures, with Yusuke Nakajima, Ilya Smirnov, Kei-ichi Watanabe, and Ken-ichi Yoshida, submitted, 20 pp. arXiv:2002.06166
(5) Faithfulness of top local cohomology modules in domains, with Melvin Hochster, to appear in *Math. Res. Lett.*, 7 pp., arXiv:1909.08770
(6) 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

(7) Transformation rules for natural multiplicities, with Ilya Smirnov, to appear in *Int. Mat. Res. Not. IMRN*, 10 pp., arXiv:1904.07755
(8) Quantifying singularities with differential operators, with Holger Brenner and Luis Núñez-Betancourt, *Adv. Math*, **358** (2019), 106843, 89 pp.
(9) 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.
(10) Derived functors of differential operators, to appear in *Int. Math. Res. Not. IMRN*, 21 pp., DOI: 10.1093/imrn/rny284, arXiv:1711.03960
(11) A Zariski–Nagata theorem for smooth $\mathbb{Z}$-algebras, with Alessandro De Stefani and Eloísa Grifo, *J. Reine Angew. Math.*, **761** (2020), 123–140.
(12) Polarization of neural ideals, with Sema Güntürkün and Jeffrey Sun, *J. Algebra Appl.*, **19** (2020), 2050146, 15 pp.
(13) Local Okounkov bodies and limits in prime characteristic, with Daniel J. Hernández, *Math. Ann.* **372** (2018), no. 1, 139–178.
(14) 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
(15) 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.
(16) 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.
(17) Separating invariants and local cohomology, with Emilie Dufresne, *Adv. Math.*, **270** (2015) 565–581.
(18) Multiplicities of classical varieties, with Jonathan Montaño and Matteo Varbaro, *Proc. London Math. Soc.*, **110** (2015), no. 4, 1033–1055.
(19) 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.
(20) The j-multiplicity of monomial ideals, with Jonathan Montaño, *Math. Res. Lett.*, **20** (2013) no. 4, 1–16.

Students:

- David Lieberman, Ph.D., UNL, current
- Shelby Castle, Undergraduate Thesis, UNL, current
- Luis Palacios, Masters, CIMAT, 2020.
- Sandra Sandoval, Licensatura, CIMAT, 2020.
- Fangu Chen and Alan Tang, REU, UM, 2019.
- Jeffrey Sun, REU, UM, 2016.

Teaching:

University of Nebraska-Lincoln

- Spring 2021: Math 325 Elementary Analysis
- Fall 2020: Math 314 Linear Algebra

CIMAT

- Spring 2020: D-modules and applications to Commutative Algebra
- Fall 2019: Commutative Algebra

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

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

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

Fellowships and scholarships:

- NSF CAREER grant, 2021–2026.
- Sistema Nacional de Investigadores, Level I, 2020–.
- UNL Research Development Fellows Program (RDFP) 2020–2021.
- AMS Simons travel grant, 2019–2021.
- AIM SQUARES grant, 2018–2020.
- NSF Postdoctoral Research Fellowship, 2016–2019.
- NSA Young Investigator Grant (awarded) 2016.
- University of Utah Graduate Research Fellowship, 2014–2015.
- T. Benny Rushing Fellowship, University of Utah Mathematics Dept., 2014.
- Gordon Memorial Fund Scholarship, The Ohio State University Mathematics Department, 2008–2010.
- National Merit Scholarship, 2006–2010.

Service and Organization:

- Co-organizer: Differential Operators in Commutative Algebra Seminar, Summer–Fall 2020.
- Co-organizer: Pan-American School on Commutative Algebra, Barranquilla, Colombia
- 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:

- *Faithfulness of top local cohomology modules in domains*, IIT Bombay Virtual Commutative Algebra Seminars, October 2020.
- *Bernstein's inequality on singular rings*, UNL Commutative Algebra seminar, October 2020.
- *Differential operators on classical invariant rings*, AMS Fall Sectional Meeting, El Paso, TX (online), September 2020.
- *Two applications of p-derivations in commutative algebra*, MSRI Fellowship of the Ring online seminar, May 2020.
- *From Zariski-Nagata to local fundamental groups*, Tulane Colloquium, January 2020.
- *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.