

Josh Pollitz

Curriculum Vitae

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Research Interests

My research interests are primarily in the homological aspects of commutative algebra. I have a particular interest in studying properties of commutative rings using theories of cohomological support and structures on resolutions. I often work with triangulated categories as they are well-suited to study such data, and it allows me to draw on ideas from a variety of other areas such as homotopy theory and representation theory.

Academic Appointments

- 2023–current **Assistant Professor (Tenure Track)**, *Syracuse University*.
- 2020–2023 **NSF Postdoctoral Research Fellow**, *University of Utah*.
Postdoc Mentor: Srikanth B. Iyengar
- 2019–2020 **Research Assistant Professor (RTG Postdoc)**, *University of Utah*.
Postdoc Mentor: Srikanth B. Iyengar

Honors

- Fall 2022 **Hausdorff Research Institute for Mathematics: Special Trimester**.
I was invited to spend two (funded) months at the Hausdorff Research Institute in Bonn, Germany during their special trimester on Spectral Methods in Algebra, Geometry, and Topology.

Education

- August 2019 **Ph.D. Mathematics, University of Nebraska, Lincoln**.
Advisors: Luchezar L. Avramov and Mark E. Walker
Thesis: The derived category of a locally complete intersection ring
- May 2015 **M.S. Mathematics, University of Nebraska, Lincoln**.
- June 2013 **M.S. Mathematics, Oregon State University**.
- December 2010 **B.S. Mathematics, California Polytechnic State University, San Luis Obispo**.

Grants and Awards

- 2023 **NSF standard grant (3 years)**, *PI on Grant # 2302567*.
- 2022 **Don H. Tucker Postdoctoral Fellowship, University of Utah**, *This award is given to a postdoc for excellence in research*.
- 2021 **Outstanding Postdoc Award, University of Utah**, *This award is annually given to a postdoctoral scholar in recognition of their exceptional research and teaching*.
- 2020 **NSF Postdoctoral Research Fellowship (3 years)**, *Grant #2002173*.
- 2018 **NSF grant funding *Conferences on Commutative Algebra for Early Career Researchers* (2 years)**, *Co-P.I. on Grant #1802088*.
- 2018 **AMS Graduate Student Travel Grant**, *Used for the Fall 2018 AMS Sectional in Fayetteville, AR*.
- 2017 **Bill Leavitt Award, University of Nebraska, Lincoln**, *This award is given each academic year to support graduate student research based on academic success*.

- 2015 **Steven Haataja Award, University of Nebraska, Lincoln**, *This award is for outstanding exposition by a graduate student.*
- 2010 **Charles J. Hanks Excellence in Math Award, California Polytechnic State University**, *This award is given to a student who demonstrated excellence and outstanding ability.*
- 2009 **Robert P. Balles Mathematics Scholarship, California Polytechnic State University**, *A scholarship awarded to a student for excellence in undergraduate math courses.*

Published Papers, Preprints and Packages

Submitted preprints

- (20) **Classifying thick subcategories over a Koszul complex via the curved BGG correspondence** joint with Jian Liu. arXiv:2502.13806
- (19) **Lower bounds on Loewy lengths of modules of finite projective dimension** joint with Nawaj KC. arXiv:2404.18368
- (18) **High Frobenius pushforwards generate the bounded derived category** joint with Matthew Ballard, Srikanth Iyengar, Patrick Lank, and Alapan Mukhopadhyay. arXiv:2303.18085

Published or accepted papers

- (17) **Koszul homomorphisms and universal resolutions in local algebra** joint with Benjamin Briggs, James Cameron, and Janina Letz. *Forum of Mathematics, Sigma* (to appear)
- (16) **Resolutions of differential operators of low order for an isolated hypersurface singularity** joint with Rachel Diethorn, Jack Jeffries, Claudia Miller, Nick Packauskas, Hamid Rahmati, and Sophia Vassiliadou. *Michigan Mathematical Journal* (to appear)
- (15) **Relations on Poincaré series for quasi-complete intersection homomorphisms** joint with Liana Şega. *Proceedings of the American Mathematical Society* (2025)
- (14) **Bounds on cohomological support varieties** joint with Benjamin Briggs and Eloísa Grifo. *Transactions of the American Mathematical Society, Series B* (2024)
- (13) **Cohomological jump loci and duality in local algebra** joint with Ben Briggs and Daniel McCormick. *Mathematische Zeitschrift* (2023)
- (12) **The homotopy Lie algebra of a Tor-independent tensor product** joint with Luigi Ferraro, Mohsen Gheibi, Dave Jorgensen and Nicholas Packauskas. *Illinois Journal of Mathematics* (2023)
- (11) **A comparison of dg algebra resolutions with prime residual characteristic** joint with Michael DeBellevue. *Quarterly Journal of Mathematics* (2023)
- (10) **A partial converse ghost lemma for the derived category of a commutative noetherian ring**, joint with Jian Liu. *Proceedings of the American Mathematical Society* (2023)
- (9) **Exceptional complete intersection maps of local rings** joint with Srikanth Iyengar, Janina Letz, and Jian Liu. *Pacific Journal of Mathematics* (2022)
- (8) **Locally complete intersection maps and the proxy small property**, joint with Benjamin Briggs, Srikanth Iyengar, and Janina Letz. *International Mathematics Research Notices IMRN* (2022)
- (7) **Constructing non-proxy small test modules**, joint with Benjamin Briggs and Eloísa Grifo. *Nagoya Mathematical Journal* (2022)
- (6) **Cohomological supports of tensor products of modules over commutative rings** joint with Srikanth Iyengar and William Sanders. *Research in the Mathematical Sciences* (2022)
- (5) **Support varieties over skew complete intersections via derived braided Hochschild cohomology**, joint with Luigi Ferraro and W. Frank Moore. *Journal of Algebra* (2022)
- (4) **Cohomological support over derived complete intersections and local rings**. *Mathematische Zeitschrift* (2021)
- (3) **Duality and symmetry of complexity over complete intersections via exterior homology**, joint with Jian Liu. *Proceedings of the American Mathematical Society* (2021)
- (2) **Equivariant isomorphisms of Ext and Tor modules**. *Journal of Algebra* (2020)
- (1) **The derived category of a locally complete intersection ring**. *Advances in Mathematics* (2019)

Software: I am a co-author of the ThickSubcategories package for the software system Macaulay2 with Eloísa Grifo and Janina Letz. This is available for use at <https://github.com/eloisagrifo/levels>. (This package is still under construction)

Teaching & Mentorship

Instructor of Record

Spring 2024	Math 732: Homological Algebra	Syracuse University
Fall 2024	Math 534: Introduction to Abstract Algebra	Syracuse University
	Math 830: Topics in Algebra	Syracuse University
Fall 2023	Math 331: Linear Algebra	Syracuse University
Spring 2023	Math 3210: Foundations of Analysis	University of Utah
Fall 2021	Math 4400: Introduction to Number Theory	University of Utah
Spring 2020	Math 3210: Foundations of Analysis	University of Utah
Fall 2019	Math 2200: Discrete Mathematics	University of Utah
Spring 2019	Math 314: Linear Algebra	University of Nebraska
Fall 2018	Math 208: Calculus III	University of Nebraska
Fall 2017	Math 208: Calculus III	University of Nebraska
Summer 2017	Math 802P: Numbers, Geometry and Algebraic Thinking II*	University of Nebraska
Spring 2017	Math 302: Mathematical Modeling*	University of Nebraska
Fall 2016	Math 301: Mathematics Matters*	University of Nebraska
Spring 2016	Math 104: Applied Calculus (Thompson Scholars)	University of Nebraska
Fall 2015	Math 203: Contemporary Mathematics	University of Nebraska
Summer 2015	Math 104: Applied Calculus	University of Nebraska
Spring 2015	Math 101: College Algebra	University of Nebraska
Fall 2014	Math 101: College Algebra	University of Nebraska
Spring 2012	Math 111: College Algebra	Oregon State University
Summer 2012	Math 111: College Algebra	Oregon State University
Spring 2012	Math 251: Differential Calculus	Oregon State University

*: These courses were for current and future K-12 educators in the Lincoln and Omaha area.

Doctoral Students

Dorian Kalir (2024-present)
Kory Pollicove (2024-present)

Undergraduate Reading Courses

Fall 2020	"Cohen-Macaulay Rings" by Bruns and Herzog and "Infinite Free Resolutions" by Avramov , mentored undergraduate Taylor Murray at the University of Utah: currently a grad student at University of Nebraska-Lincoln.
Fall 2020–Spring 2022	"Introduction to Commutative Algebra" by Atiyah and MacDonald, "Cohen-Macaulay Rings" by Bruns and Herzog, "Infinite Free Resolutions" by Avramov, and various research articles , mentored undergraduate Mason Hart at the University of Utah. I was Mason's honor's thesis advisor; currently a grad student at University of Virginia.
Spring 2021–Summer 2022	"Introduction to Commutative Algebra" by Atiyah and MacDonald , mentored undergraduate Annie Giokas at the University of Utah; currently a grad student at Purdue University.

- Summer 2021-Fall 2022 **"Introduction to Commutative Algebra"** by Atiyah and MacDonald, mentored undergraduate Ben Huenemann at the University of Utah; currently a grad student at University of Nebraska-Lincoln.
- Fall 2022 **"Infinite Free Resolutions"** by Avramov, mentored master's student Jorge Eduardo Gasper Lara at the Centro de Investigación en Matemáticas; currently a grad student at University of Utah.

Research talks

Invited Talks

May 2025	TBA	AMS Sectional, Cal Poly-SLO
April 2025	TBA	Alg and Top Seminar, SUNY-Albany
January 2025	Loewy lengths of modules of finite projective dimension	JMM AMS Sectional, Seattle
December 2024	Lower bounds on Loewy lengths of modules...	FARM: Algebra 2024 Conference
November 2024	Lower bounds on Loewy lengths of modules...	Route 81 Conference, Cornell University
October 2024	Koszul homomorphisms and universal resolutions	AMS Sectional, Georgia Southern Univ
October 2024	Lower bounds on Loewy length Pt I	AMS Sectional, Georgia Southern Univ
May 2024	Koszul homomorphisms and universal resolutions	AMS Sectional, San Francisco
May 2024	Modules of finite Loewy length and finite projective...	AMS Sectional, San Francisco
April 2024	Frobenius pushforwards and generators...	Comm. Alg. Seminar, University of Illinois-Chicago
March 2023	Frobenius pushforwards and the derived category	Fairfax Algebra Days Conference
February 2024	dg tricks in local algebra III	Special topics seminar, SLMath
February 2024	dg tricks in local algebra II	Special topics seminar, SLMath
January 2024	Koszul homomorphisms and universal resolutions	JMM AMS Sectional, San Francisco
January 2024	Frobenius pushforwards generate the derived category	JMM AMS Sectional, San Francisco
November 2023	Frobenius pushforwards in the derived category	Alg. Geom. Seminar, Cornell University
October 2023	Frobenius pushforwards and generators...	AMS Sectional, Creighton University
September 2023	Frobenius pushforwards and the bounded derived category	Oberwolfach: TTG Workshop
April 2023	Structural results in commutative algebra	Math 125, University of Nebraska
April 2023	Frobenius pushforwards in the derived category	Comm. Alg. Seminar, University of Nebraska
March 2023	High Frobenius pushforwards ...	Alg. Geom. and Comm. Alg. Seminar, Notre Dame Univ
January 2023	Applications of support varieties in local algebra	Algebra and Topology Seminar, Copenhagen
December 2022	Cohomological support varieties in local algebra	Seminar, Hausdorff Institute of Mathematics
November 2022	Generation in derived categories and singularities	Colloquium, Syracuse University
October 2022	Cohomological support varieties and their applications	Fellowship of the Ring Seminar, MRSI
September 2022	Bounds on cohomological support varieties	Seminar, Syracuse University
August 2022	Cohomological jump loci in local algebra	Conference, ICRA 2022
April 2022	Bass and Betti numbers, and cohomological jump loci	Seminar, University of Minnesota
April 2022	Cohomological jump loci and duality	Seminar, Syracuse University
February 2022	Homotopy lie algebras of quasi-complete intersection maps	Seminar, UC Berkeley/MSRI
January 2022	Cohomological supports in local algebra	JMM AMS Special Session, Seattle
October 2021	Symmetries in Bass and Betti sequences over a c.i. ring	Seminar, University of Arkansas
October 2021	Symmetries in Bass and Betti sequences over a c.i. ring	IIT Bombay Virtual Seminar
October 2021	Cohomological support in local algebra	Comm. Algebra Seminar, University of Nebraska
October 2021	A comparison of dg algebra resolutions with prime...	AMS Sectional, Creighton University

May 2021	The derived category of a complete intersection ring	<i>Comm. Algebra Seminar, UC Riverside</i>
March 2021	Homological algebra of exceptional c.i. maps	<i>AMS Sectional, Georgia Tech University</i>
March 2021	Homological algebra of exceptional complete intersections	<i>Seminar, Texas Tech University</i>
October 2020	A characterization of relative complete intersections	<i>AMS Sectional, Univ of Tennessee</i>
November 2019	Cohomological support of a local ring	<i>AMS Sectional, University of Florida</i>
July 2019	The derived category of a complete intersection	<i>Seminar, University of Genova (Italy)</i>
March 2019	Cohomological support over derived complete int...	<i>AMS Sectional, Auburn University</i>
November 2018	The derived category of a complete intersection	<i>Seminar, University of Michigan</i>
November 2018	The derived category of a complete intersection	<i>AMS Sectional, University of Arkansas</i>
October 2018	The derived category of a complete intersection	<i>AMS Sectional, SF State University</i>
February 2018	A characterization of complete intersections...	<i>Algebra Seminar, University of Utah</i>

Local Talks

September 2023	<i>Homological methods in commutative algebra</i>	<i>MGO Colloquium, Syracuse University</i>
September 2023	<i>Frobenius pushforwards and generators for the...</i>	<i>Algebra Seminar, Syracuse University</i>
September 2019	<i>Cohomological support of a local ring</i>	<i>Algebra Seminar, University of Utah</i>
October 2018	The derived category of a complete intersection	<i>Algebra Seminar, University of Nebraska</i>
February 2018	A characterization of complete intersections...	<i>Algebra Seminar, University of Nebraska</i>
October 2017	Koszul varieties and a derived category application	<i>Algebra Seminar, University of Nebraska</i>
October 2017	Cohomological properties of the Koszul DGA	<i>Algebra Seminar, University of Nebraska</i>
March 2015	Hilbert's third problem and the Dehn invariant	<i>Graduate Student Seminar, Univ of Nebraska</i>

Funded Conferences, Workshops and Summer Schools

- 2025 **Collaborate!ICERM.**
A week-long collaborative research program at ICERM January 20 - 24.
- 2024 **Betti numbers in commutative algebra and equivariant homotopy theory.**
A week-long workshop at Bielefeld University September 23 - 27.
- 2024 **Institute for Advanced Study: Summer collaborators program.**
Received travel, lodging and per diem to participate in the IAS's summer collaborator program for 2 weeks in July 2024.
- 2024 **Commutative Algebra and Non-Commutative Algebraic Geometry programs.**
I received funding to attend the introductory workshops and recent development conferences in each of the aforementioned programs during Spring 2024 at SLMATH.
- 2023 **Tensor-Triangular Geometry and Interactions.**
An Oberwolfach workshop in September 2023.
- 2022 **Spectral Methods in Algebra, Geometry, and Topology.**
I spent October-December at the Hausdorff Research Institute for Mathematics (HIM) in Bonn, Germany during this special trimester.
- 2022 **Rank Conjectures in Algebraic Topology and Commutative Algebra.**
A workshop at the Banff International Research Station September 11 - 16.
- 2022 **ICRA 2022.**
Attended, and spoke in this biannual conference in Buenos Aires August 3-12.
- 2019 **Recent Developments in Commutative Algebra.**
A workshop for graduate students and postdocs in commutative algebra. There were four lecture series that ran July 1-5 in Levico Terme, Trento, Italy.

- 2019 **Morgantown Algebra Days.**
A two-day Commutative Algebra conference which was held at the West Virginia University in Morgantown, WV April 13-14.
- 2018 **Derived Categories, MSRI Summer School.**
MSRI 2018 A two week summer school held at the MSRI June 25-July 6. This consisted of four week long courses building towards Orlov's theorem.
- 2018 **Stable Cohomology: Foundations and Applications.**
The workshop was supported by the National Science Foundation and the Department of Mathematics at the University of Nebraska. Took place in Snowbird, Utah May 28-June 1.
- 2018 **RTG Graduate Summer School: Topics in commutative algebra.**
Took place at the University of Utah May 7-11. There were fourteen lectures and problems sessions.
- 2017 **Structures on Free Resolutions.**
A workshop-style conference on "Structures on Free Resolutions" held at Texas Tech University October 26-28.
- 2017 **Local Cohomology in Commutative Algebra and Algebraic Geometry, Minnesota.**
A week long conference focused on recent advances in commutative algebra centered around topics influenced by the contributions of Gennady Lyubeznik.
- 2017 **Commutative Algebra and Related Topics, MSRI Summer School, OIST.**
A two week summer school held at the Okinawa Institute of Science and Technology May 22-June 2.
- 2017 **Stillman's Conjecture and other Progress on Free Resolutions.**
A conference and workshop at UC Berkeley, July 17-21, on regularity and Stillman's problem.
- 2016 **RTG Workshop on the Homological Conjectures in Commutative Algebra.**
The University of Illinois at Chicago hosted an RTG Workshop, November 18-20, consisting of three mini-courses on the Homological Conjectures.

Other Conferences

- 2023 **Route 81.**
An annual conference on commutative algebra and algebraic geometry. The location rotates between Cornell University, Queen's University, and Syracuse University.
- 2015-2019, 2022 **KUMUNU.**
An annual NSF-funded conference for commutative algebraists in the Great Plains region since 1999.
- 2015-2019 **KUMUNU JR.**
An annual NSF-funded conference for graduate students and postdocs in commutative algebra in the Midwest that is held each Spring at UNL.

Leadership and Service

- 2024 **NSF panelist.**
- October 2024 **Co-organizer, AMS Special Session.**
Co-organizing *Singularities in commutative algebra* at the University of Albany-SUNY in October 2024 with Jason Howell and Claudia Miller.
- Fall 2023 **Co-organizer, Route 81 Commutative Algebra and Algebraic Geometry Conference.**
- Fall 2023-currently **Co-organizer, Syracuse University Algebra Seminar.**
- April 2023 **Co-organizer, AMS Special Session.**
Co-organizing *Homological methods in commutative algebra* at the University of Cincinnati in April 2023 with Michael DeBellevue.
- Summer 2020 **Online course.**
I organized a virtual course on Zoom where I lectured on the singularity category of Gorenstein rings for twelve weeks; there were two hour-long lectures a week. There were twelve other participants from universities such as: Utah, Nebraska, Wake Forest, University of Texas-Arlington, UC Riverside.
- May 2020 **Online Conference Organizer.**
Organized *Dg Methods in Commutative Algebra and Representation Theory* with Benjamin Briggs and Janina Letz.

2017-2019 **Conference Co-Organizer (Co-P.I.), KUMUNU JR.**

Served as a co-organizer and co-P.I. for this annual conference for graduate students and postdocs.

2017-2018 **Commutative Algebra Reading Seminar Organizer.**

I organized this graduate student seminar devoted to a wide range of talks in commutative algebra and related areas.

2017-2020 **Panelist for graduate students.**

I have served on several panels for graduate students at both the University of Nebraska and the University of Utah for topics including: choosing a research area and advisor, applying for academic jobs, applying for the NSF postdoc, and teaching.

Summer 2016 **WebWork development.**

I wrote 80 hours of WebWork code for the math department at the University of Nebraska during the Summer of 2016; these are homework problems for Math 106 and 107 (calculus I & II).

2013-2019 **Math Day Volunteer.**

For Math Day, held annually at the University of Nebraska Lincoln, I held positions such as proctor, head proctor, local command center leader, and score keeper.