

Education

- August 2017 **Ph.D. Mathematics, University of Nebraska-Lincoln.**
Advisors: Luchezar L. Avramov and Srikanth B. Iyengar
Thesis: *Stable cohomology of local rings and Castelnuovo-Mumford regularity of graded modules*
- July 2011 **M.S. Mathematics, University of Pisa.**
Advisor: Aldo Conca
Thesis: *Homological properties of Noetherian rings*
- July 2009 **B.S. Mathematics, University of Pisa.**
Advisor: Ilaria del Corso
Thesis: *Regular local rings are UFD*

Academic Appointments

- 2020 – 2023 **Postdoctoral Teaching Scholar.**
Texas Tech University
- 2017 – 2020 **Teacher-Scholar Postdoctoral Fellow.**
Wake Forest University
- 2011 – 2017 **Graduate Teaching Assistant.**
University of Nebraska-Lincoln

Research Interests

Commutative algebra and homological algebra. My research has focused mainly on the structure of the stable cohomology of a local ring and on the Castelnuovo-Mumford regularity of graded modules.

Non-commutative algebra. My research has focused on studying actions of groups and, more generally, actions of Hopf algebras on noncommutative rings. My research has also focused on the study of the homological properties of quotients of skew polynomial rings by ideals generated by normal elements, through the use of DG algebra resolutions.

Papers and Preprints

- [13] *The homotopy Lie algebra of a Tor-independent tensor product*, joint with M. Gheibi, D. Jorgensen, N. Packauskas and J. Pollitz. Submitted. [arXiv:2109.01003](https://arxiv.org/abs/2109.01003)
- [12] *The Taylor resolution over a skew polynomial ring*, joint with D. Martin and F. Moore. Submitted. [arXiv:2109.00111](https://arxiv.org/abs/2109.00111)
- [11] *The Eliahou-Kervaire resolution over a skew polynomial ring*, joint with A. Hardesty. Submitted. [arXiv:2108.05812](https://arxiv.org/abs/2108.05812)
- [10] *Support varieties over skew complete intersections via derived braided Hochschild cohomology*, joint with W. F. Moore and J. Pollitz. Submitted. [arXiv:2101.12287](https://arxiv.org/abs/2101.12287)
- [9] *The InvariantRing package for Macaulay2*, joint with F. Galetto, F. Gandini, H. Huang, M. Mastroeni, X. Ni. Submitted. [arXiv:2010.15331](https://arxiv.org/abs/2010.15331)
- [8] *Semisimple reflection Hopf algebras of dimension sixteen*, joint with E. Kirkman, W. F. Moore and R. Won. *Algebras and Representation Theory* (to appear). [arXiv:1907.06763](https://arxiv.org/abs/1907.06763).
- [7] *On the Noether bound for noncommutative rings*, joint with E. Kirkman, W. F. Moore and K. Peng. *Proc. Amer. Math. Soc.* **149** (2021), no. 7, 2711–2725.

- [6] *Differential graded algebra over quotients of skew polynomial rings by normal elements*, joint with W. F. Moore. *Trans. Amer. Math. Soc.* **373** (2020), no. 11, 7755–7784.
- [5] *Simple \mathbb{Z} -graded domains of Gelfand-Kirillov dimension two*, joint with J. Gaddis and R. Won. *J. Algebra* **562** (2020), 433–465.
- [4] *Three infinite families of reflection Hopf algebras*, joint with E. Kirkman, W. F. Moore and R. Won. *J. Pure Appl. Algebra* **224** (2020), no. 8, 106315.
- [3] *A bimodule structure for the bounded cohomology of commutative local rings*. *J. Algebra* **537** (2019), 297–315.
- [2] *Modules of infinite regularity over commutative graded rings*. *Proc. Amer. Math. Soc.* **147** (2019), no. 5, 1929–1939.
- [1] *Regularity of Tor for weakly stable ideals*, joint with K. Ansaldi and N. Clarke. *Le Matematiche* **70** N. 1 (2015), 301–310.

Conferences Organized

- November 2019 **AMS Special Session on Homological methods in Algebra**, *University of Florida, Gainesville, FL*.
- April 2017 **KUMUNUjr**, *University of Nebraska-Lincoln, NE*, I served as a Co-PI for this annual NSF-funded conference for graduate students and post-docs in commutative algebra in the Midwest that is held each Spring at UNL..
- April 2016 **KUMUNUjr**, *University of Nebraska-Lincoln, NE*.

Presentations

Conference Talks

- January 2022 **Rigidity of Ext and Tor via flat-cotorsion theory**, *AMS Special Session on Commutative Algebra. Joint Math Meetings, Seattle, WA*.
- September 2021 **The homotopy Lie algebra of a Tor-independent tensor product**, *Commutative and Homological Algebra Market Presentations*, a virtual seminar series in commutative algebra.
- March 2021 **Homological algebra over minimal intersections**, *Special Session on Commutative Algebra, AMS, Providence, RI. (Held online because of Covid-19)*.
- January 2021 **Support varieties and symmetry of complexity for quotients of skew polynomial rings**, *AMS Special Session on Homological Aspects of Quantum Symmetries and Related Topics, Joint Math Meetings. (Held online because of Covid-19)*.
- October 2020 **The Taylor resolution over a skew polynomial ring**, *Special Session on Commutative Algebra, AMS, Chattanooga, TN. (Held online because of Covid-19)*.
- October 2020 **The Taylor resolution over a skew polynomial ring**, *Special Session on Homological Methods in Algebra, AMS, University Park, PA. (Held online because of Covid-19)*.
- May 2020 **The Taylor resolution over a skew polynomial ring**, *Special Session on DG Methods in Commutative Algebra and Representation Theory, AMS, Fresno, CA. (Held online because of Covid-19)*.
- March 2020 **The Taylor resolution over a skew polynomial ring**, *Special Session on Homological Methods in Commutative Algebra, AMS, Medford, MA. (Canceled because of Covid-19)*.
- January 2020 **Differential graded algebra over quotients of skew polynomial rings by normal elements**, *AMS Contributed Paper Session on Algebra and Algebraic Geometry, Joint Math Meetings, Denver, CO*.
- March 2019 **A color Hopf algebra structure on the Ext algebra of quotients of skew polynomial rings**, *Special Session on Hopf Algebras and Their Applications, AMS, Auburn, AL*.
- November 2018 **Hopf algebra actions on some AS regular algebras of small GK dimension**, *Special Session on Commutative Algebra, AMS, Fayetteville, AR*.
- September 2018 **Hopf algebra actions on some AS regular algebras of small GK dimension**, *Special Session on Commutative Algebra, AMS, Newark, DE*.
- May 2018 **A bimodule structure for the bounded cohomology of commutative local rings**, *"Stable cohomology: foundations and applications", Snowbird, UT*.

- September 2017 **Modules of infinite regularity over graded commutative rings**, *Special Session on Commutative Algebra: Interactions with Algebraic Geometry and Algebraic Topology*, AMS, Orlando, FL.
- April 2017 **Modules of infinite regularity over graded commutative rings**, *Special Session on Commutative Algebra*, AMS, Pullman, WA.
- January 2017 **Modules of infinite regularity over graded commutative rings**, *AMS Contributed Paper Session on Commutative Algebra, Linear and Multilinear Algebra and Matrix Theory*, Joint Mathematics Meetings, Atlanta, GA.
- September 2016 **Modules of infinite regularity over graded commutative rings**, *Route 81 Conference*, Syracuse, NY.
- January 2016 **On the bimodule structure of bounded cohomology**, *AMS Special Session on Commutative Algebra*, Joint Mathematics Meetings, Seattle, WA.
- October 2015 **On the bimodule structure of bounded cohomology**, *Commutative Algebra*, AMS, Loyola, IL.
- April 2015 **Regularity of Tor for weakly stable ideals**, *KUMUNUjr*, University of Nebraska-Lincoln.
- April 2014 **Non-vanishing of Exts**, *KUMUNUjr*, University of Nebraska-Lincoln.

Seminar Talks

- November 2021 **The homotopy Lie algebra of a Tor-independent tensor product**, *Texas Tech University, TX*.
- February 2021 **Support varieties over skew complete intersections via derived braided Hochschild cohomology**, *Texas Tech University, TX*.
- December 2019 **Differential graded algebra over quotients of skew polynomial rings by normal elements**, *UC San Diego, CA*.
- November 2019 **Differential graded algebra over quotients of skew polynomial rings by normal elements**, *Syracuse University, NY*.
- October 2019 **Differential graded algebra over quotients of skew polynomial rings by normal elements**, *University of Texas at Arlington, TX*.
- September 2019 **Differential graded algebra over quotients of skew polynomial rings by normal elements**, *University of Utah, UT*.
- August 2018 **Hopf algebra actions on some AS regular algebras of small GK dimension**, *University of South Carolina, SC*.
- March 2018 **Hopf algebra actions on some AS regular algebras of small GK dimension**, *Clemson University, SC*.
- September 2016 **On the bimodule structure of the bounded cohomology of local rings**, *Syracuse University, NY*.
- September 2016 **Modules with infinite regularity**, *University of Nebraska-Lincoln, NE*.
- July 2016 **On the bimodule structure of the bounded cohomology of local rings**, *University of Bologna, Italy*.
- May 2016 **On the bimodule structure of the bounded cohomology of local rings**, *University of Genova, Italy*.
- May 2016 **Nuovi teoremi sulla coomologia stabile degli anelli locali**, *University of Pisa, Italy*.
- February 2016 **On the bimodule structure of the bounded cohomology of local rings**, *University of Lubbock, TX*.
- February 2016 **On the bimodule structure of the bounded cohomology of local rings**, *University of Nebraska-Lincoln*.
- April 2015 **Regularity of Tor for weakly stable ideals**, *University of Nebraska-Lincoln, NE*.
- June 2014 **Non-vanishing of Exts**, *Università di Genova, Italy*.
- May 2014 **A characterization of Gorenstein rings**, *Università di Bologna, Italy*.
- February 2014 **Non-vanishing of Exts**, *University of Nebraska-Lincoln*.

Colloquia

- September 2019 **Noncommutative invariant theory**, *Wake Forest University, NC*.

Posters

April 2014 **Non-vanishing of Exts**, *University of Nebraska-Lincoln, Graduate Research Fair.*

Funded Conferences, Workshops and Summer Schools

- November 2020 **"Workshop and International Conference on Representations of Algebras (ICRA 2020)"**, *ICTP, Trieste, Italy. (Held online because of COVID-19).*
- August 2020 **"Free Resolutions and Representation Theory"**, *ICERM, Providence, RI. (Held online because of COVID-19).*
- May 2020 **"Macaulay2 Workshop and Conference at Cleveland State University"**, *Cleveland, OH. (Held online because of COVID-19).*
- August 2019 **"Structure of length 3 resolutions"**, *San Diego, CA.*
- May 2018 **"Stable cohomology: foundations and applications"**, *Snowbird, UT.*
- March 2018 **"Hot topics: the homological conjectures"**, *MSRI, Berkeley, CA.*
- October 2017 **"Structures on Free Resolutions"**, *Lubbock, TX.*
- May 2016 **"Homological and computational methods in commutative algebra"**, *INdAM meeting, Cortona, Italy.*
- June 2015 **Mathematics Research Communities**, *Snowbird, Utah.*
- February 2015 **"Homological bonds between Commutative Algebra and Representation Theory"**, *Universitat de Barcelona, Barcelona, Spain.*
- February 2015 **"(Re)emerging methods in Commutative Algebra and Representation Theory"**, *Centre de Recerca Matemàtica, Bellaterra, Spain.*
- June 2014 **Pragmatic 2014, Research school in Algebraic Geometry and Commutative Algebra, "Local cohomology and syzygies of affine algebras"**, *Catania, Italy.*
- May 2012 **Pan American Advanced Studies Institute, "Commutative algebra and its interactions with Algebraic Geometry, Representation Theory, and Physics"**, *Guanajuato, Mexico.*

Grants and Awards

- 2017 **KUMUNU jr**, I served as a Co-PI for this annual NSF-funded conference for graduate students and post-docs in commutative algebra in the Midwest that is held each Spring at UNL.
- 2016 **KUMUNU jr**, Co-PI.
- 2016 **AMS Graduate Student Travel Grant.**
- 2012 **INdAM final prize**, winner of the final prize for the scholarship of the National Institute of Advanced Mathematics (INdAM) Francesco Severi, for obtaining a Master's Degree with a high GPA.
- 2010 **INdAM Scholarship**, scholarship for ranking second place in the contest for 6 scholarships for the students of Master's Degree awarded by the National Institute of Advanced Mathematics Francesco Severi. The contest was open to all the students in Italy at the beginning of their Master's Degree and consisted in two sets of problems (abstract algebra and real analysis) to be solved in 6 hours.
- 2006 **International Pythagoras Prize**, third place, for writing the essay "The curvature: from geometry to the Einsteinian relativity going through non-Euclidean geometries up to the definition of the characteristics of a real time machine". This prize is awarded annually in the Italian city of Crotona, where Pythagoras lived. There are four prizes, one for a University professor and one for three high school students.

Research with Students

Graduate Students

- Aug. '20 – present **Alexis Hardesty**, *TTU*, worked on the paper *The Eliahou-Kervaire resolution over a skew polynomial ring*, Submitted. arXiv:2108.05812.
- Jan. '19 – Sept. '21 **Desiree Martin**, *WFU*, worked on the paper *The Taylor resolution over a skew polynomial ring*, Submitted. arXiv:2109.00111.

Undergraduate Students

May '18– May '19 **Kewen Peng**, *WFU*, worked on the paper *On the Noether bound for noncommutative rings*, Proc. Amer. Math. Soc. **149** (2021), no. 7, 2711–2725.

Software

Macaulay2 is a software system devoted to supporting research in algebraic geometry and commutative algebra. Here is a list of packages I co-wrote, the documentations can be found at <http://www2.macaulay2.com/Macaulay2/>

- `InvariantRing`
(with F. Galetto, F. Gandini, H. Huang, T. Hawes, M. Mastroeni and X. Ni).
A package to compute invariants of group actions.
- `ResLengthThree`
(with L. W. Christensen, F. Gandini, F. Moore and O. Veliche).
A package to compute multiplicative structures on free resolutions of length three.

Teaching

Instructor of Record, Graduate Courses

Spring 2019	MST 722: Abstract Algebra II	<i>Wake Forest University</i>
Fall 2018	MST 721: Abstract Algebra I	<i>Wake Forest University</i>

Instructor of Record, Undergraduate Courses

Fall 2021	MATH 2450: Calculus III with Applications	<i>Texas Tech University</i>
Summer 2021	MATH 3310: Introduction to Mathematical Reasoning and Proof	<i>Texas Tech University</i>
Spring 2021	MATH 3351: Higher Mathematics for Engineers and Scientists II	<i>Texas Tech University</i>
Spring 2021	MATH 3354: Differential Equations I	<i>Texas Tech University</i>
Fall 2020	MATH 1452: Calculus II with Applications	<i>Texas Tech University</i>
Summer 2020	STA 111: Elementary Probability and Statistics	<i>Wake Forest University</i>
Summer 2020	MST 113: Multivariable Calculus	<i>Wake Forest University</i>
Spring 2020	MST 113: Multivariable Calculus	<i>Wake Forest University</i>
Spring 2020	MST 225: Linear Algebra II	<i>Wake Forest University</i>
Fall 2019	MST 251: Ordinary Differential Equations	<i>Wake Forest University</i>
Summer 2019	MST 251: Ordinary Differential Equations	<i>Wake Forest University</i>
Summer 2019	MST 121: Linear Algebra I	<i>Wake Forest University</i>
Spring 2019	MST 112: Calculus with Analytic Geometry II	<i>Wake Forest University</i>
Fall 2018	MST 251: Ordinary Differential Equations	<i>Wake Forest University</i>
Summer 2018	MST 251: Ordinary Differential Equations	<i>Wake Forest University</i>
Summer 2018	MST 112: Calculus with Analytic Geometry II	<i>Wake Forest University</i>
Spring 2018	MST 321: Modern Algebra I	<i>Wake Forest University</i>
Spring 2018	MST 121: Linear Algebra I	<i>Wake Forest University</i>
Fall 2017	MST 111: Calculus with Analytic Geometry I	<i>Wake Forest University</i>
Summer 2017	Math 221: Differential Equations	<i>University of Nebraska-Lincoln</i>
Spring 2017	Math 221: Differential Equations	<i>University of Nebraska-Lincoln</i>
Fall 2016	Math 103: College Algebra and Trigonometry	<i>University of Nebraska-Lincoln</i>
Spring 2016	Math 221: Differential Equations	<i>University of Nebraska-Lincoln</i>
Fall 2015	Math 103: College Algebra and Trigonometry	<i>University of Nebraska-Lincoln</i>
Fall 2014	Math 203: Contemporary Mathematics	<i>University of Nebraska-Lincoln</i>

Instructor of Record, Online Graduate Certificate Courses

Fall 2020	MATH 5368: Abstract Algebra Applied I	<i>Texas Tech University</i>
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Recitations

Spring 2014	Math 107: Analytic Geometry and Calculus II	<i>University of Nebraska-Lincoln</i>
Fall 2013	Math 107: Analytic Geometry and Calculus II	<i>University of Nebraska-Lincoln</i>
Spring 2013	Math 106: Analytic Geometry and Calculus I	<i>University of Nebraska-Lincoln</i>
Fall 2012	Math 106: Analytic Geometry and Calculus I	<i>University of Nebraska-Lincoln</i>

Tutoring

Aug. '11 – May '17	The Mathematics Resource Center	<i>University of Nebraska-Lincoln</i>
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Service

Aug. '19 – July '20	Member of the Colloquia and Gentry Lectures Committee at Wake Forest University.
Aug. '17 – present	Reviewer for zbMATH.
Aug. '17 – Aug. '18	Member of the Undergraduate Committee at Wake Forest University.
Aug. '11 – May '17	Volunteer for Math Day, University of Nebraska-Lincoln , Math Day is a competition that recognizes high school students and exceptional middle school students who are interested in mathematics.

Professional Memberships

American Mathematical Society.

Gruppo Nazionale per le Strutture Algebriche, Geometriche e le loro Applicazioni, *National Group for the Geometric, Algebraic Structures and their Applications*, This is a group of the National Institute of Advanced Mathematics Francesco Severi (INdAM).

Computer Skills

Macaulay2, an open source computer algebra system for research in commutative algebra and algebraic geometry.

R, taught a class on Statistics and Probability at Wake Forest University with an R lab.

L^AT_EX.

C, attended a course on Programming at the University of Pisa. The course content included: programming in C, automaton theory, computational complexity theory, cryptography, dynamic programming.

HTML.

Languages Known

Italian, fluent.

English, fluent.

French, basic knowledge.