

# Jonathan Montaña

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## INTERESTS

Commutative algebra and its interactions with combinatorics and algebraic geometry.

## EXPERIENCE

Assistant Professor	Arizona State University	August 2022-
Assistant Professor*	New Mexico State University	August 2018-July 2022
*Granted tenure and promoted to Associate Professor in the spring of 2022		
Oberwolfach Leibniz Fellow	MFO, Oberwolfach Res. Inst. for Math.	Summer 2018
Visiting Assistant Professor	University of Kansas	August 2015-May 2018
Graduate Assistant	Purdue University	August 2009-July 2015
Program Associate	MSRI, Berkeley, CA	August 2012-December 2012
Graduate Assistant	Universidad Nacional de Colombia, Bogotá	August 2008-August 2009

## EDUCATION

### **Purdue University**, West Lafayette, IN

Ph.D. in Mathematics, August 2015

Thesis: *Generalized multiplicities, reductions of ideals, and depth of blowup algebras.*

Advisor: Prof. Bernd Ulrich

M.Sc. in Mathematics, August 2011

### **Universidad Nacional de Colombia**, Bogotá

M.Sc. in Mathematics, August 2009

Thesis: *Idempotents, adjoining an identity, and connectedness.* (in Spanish)

Advisor: Prof. Lorenzo Acosta

B.Sc. in Mathematics, August 2008

Thesis: *Applications of the algorithmic proofs of the Quillen-Suslin theorem in algebraic geometry.* (in Spanish)

Advisor: Prof. José Oswaldo Lezama

## PUBLICATIONS

### **Mathematics:**

22. *K-polynomials of multiplicity-free varieties*, with Federico Castillo, Yairon Cid-Ruiz, and Fatemeh Mohammadi, **arXiv:** 2212.13091, submitted.
21. *Purity of monoids and characteristic-free splittings in semigroup rings*, with Alessandro De Stefani and Luis Núñez-Betancourt, **arXiv:** 2210.03358, submitted.
20. *Double Schubert polynomials do have saturated Newton polytopes*, with Federico Castillo, Yairon Cid-Ruiz, and Fatemeh Mohammadi, **arXiv:** 2109.10299, submitted.
19. *Blowup algebras of determinantal ideals in prime characteristic*, with Alessandro De Stefani and Luis Núñez-Betancourt, **arXiv:** 2109.00592, submitted.
18. *Computing multiplicity sequences*, with Justin Chen and Youngsu Kim, **arXiv:** 2103.14175, submitted.

17. *Frobenius methods in combinatorics*, with Alessandro De Stefani and Luis Núñez-Betancourt, [arXiv: 2203.09902](#), to appear in São Paulo J. Math. Sci.
16. *Convex bodies and graded families of monomial ideals*, with Yairon Cid-Ruiz, [arXiv: 2010.07918](#), to appear in Rev. Mat. Iberoam.
15. *Mixed multiplicities of graded families of ideals*, with Yairon Cid-Ruiz, J. Algebra **590** (2022), 394-412.
14. *Exterior powers and Tor-persistence*, with Justin Lyle and Keri Sather-Wagstaff, J. Pure Appl. Algebra. **226** (2022), 106890.
13. *When are multidegrees positive?*, with Federico Castillo, Yairon Cid-Ruiz, Binglin Li, and Naizhen Zhang, Adv. Math. **374** (2020), 107382.
12. *Analytic spread and integral closure of integrally decomposable modules*, with Carles Bivià-Ausina, Nagoya Math. J. **245** (2022), 166–191.
11. *Symbolic analytic spread: upper bounds and applications*, with Hailong Dao, J. Inst. Math. Jussieu. **20** (2021), 1969-1981.
10. *Extremal growth of Betti numbers and trivial vanishing of (co)homology*, with Justin Lyle, Trans. Amer. Math. Soc. **373** (2020), 7937-7958.
9. *Splittings and symbolic powers of square-free monomial Ideals*, with Luis Núñez-Betancourt, Int. Math. Res. Not. IMRN **2021** (2021), 2304–2320.
8. *On asymptotic vanishing behavior of local cohomology*, with Hailong Dao, Math. Z. **295** (2020), 73-86.
7. *Length of local cohomology of powers of ideals*, with Hailong Dao, Trans. Amer. Math. Soc. **371** (2019), 3483-3503.
6. *Lower bounds on projective levels of complexes*, with Hannah Altmann, Eloísa Grifo, William Sanders, and Thanh Vu, J. Algebra **491** (2017), 343-356.
5. *On the growth of deviations*, with Adam Boocher, Alessio D'Alì, Eloísa Grifo, and Alessio Sammartano, Proc. Amer. Math. Soc. **144** (2016), 5049-5060.
4. *Edge ideals and DG algebra resolutions*, with Adam Boocher, Alessio D'Alì, Eloísa Grifo, and Alessio Sammartano, Le Matematiche **70** (2015), no.1, 215-237.
3. *Artin-Nagata properties, minimal multiplicities, and depth of fiber cones*, J. Algebra **425** (2015), 423-449.
2. *Multiplicities of classical varieties*, with Jack Jeffries and Matteo Varbaro, Proc. London Math. Soc. **110** (2015), 1033-1055.
1. *The  $j$ -multiplicity of monomial ideals*, with Jack Jeffries, Math. Res. Lett. **20** (2013), 729-744.

## Computer Science:

3. *Improving Locality Sensitive Hashing by Efficiently Finding Projected Nearest Neighbors*, with Omid Jafari and Parth Nagarkar, 13<sup>th</sup> International Conference on Similarity Search and Applications (SISAP) 2020.
2. *mmLSH: A Practical and Efficient Technique for Processing Approximate Nearest Neighbor Queries on Multimedia Data*, with Omid Jafari and Parth Nagarkar, 13<sup>th</sup> International Conference on Similarity Search and Applications (SISAP) 2020.
1. *Efficient Bitmap-based Indexing and Retrieval of Similarity Search Image Queries*, with Omid Jafari and Parth Nagarkar, IEEE Southwest Symposium on Image Analysis and Interpretation (SSIAI) 2020.

## CODES

*MultiplicitySequence* package in Macaulay2, with Justin Chen and Youngsu Kim.

## FELLOWSHIPS, HONORS, AND GRANTS

Oberwolfach Research Fellow	MFO, Oberwolfach Res. Inst. for Math.	November-December 2022
NSF Conference Grant, DMS #2220824	PASCA 2022	June 2022
NSF Standard Grant, DMS #2001645/2303605	NSF	2020-2023

Oberwolfach Leibniz Fellow  
 NSF Conference Grant, DMS #1745772  
 AMS - Simons Travel Grant  
 Bilsland Dissertation Fellowship  
 Ross Fellowship  
 Outstanding Graduate Students Fellowship  
 Second place (nationwide)

MFO, Oberwolfach Res. Inst. for Math.  
 KUMUNU 2017  
 AMS & Simons Foundation  
 Purdue University, College of Science  
 Purdue University  
 Universidad Nacional de Colombia, Bogotá  
 ECAES in Mathematics, Colombia

Summer 2018  
 October 2017  
 July 2017-June 2019  
 June 2014-May 2015  
 August 2009-July 2010  
 August 2008- July 2009  
 2008

## **INVITED TALKS**

MSRI summer school Colloquium  
 AMS Sectional Meeting  
 Tulane Mathematics Colloquium  
 XII School of Mathematics  
 Algebra&Geometry seminar  
 Dept. of Mathematical Sciences Colloquium  
 AMS Sectional Meeting  
 Comb. and Commalg. Seminar  
 2022 JMM  
 AMS Sectional Meeting  
 AMS Sectional Meeting  
 Southwest Local Alg. Mtg. (SLAM)  
 Sch. Math and Stat. Sc. Colloquium  
 Dept. of Mathematics Millican Colloquium  
 Dept. of Math., Stat., Comp. Sc. Colloquium  
 AG-CA Seminar  
 Commutative Algebra Seminar  
 AMS Sectional Meeting  
 Nat. Congress Mexican Math Soc.  
 Algebra and Alg. Geometry Seminar  
 Virtual CA seminar  
 Fellowship of the Ring  
 AMS Sectional Meeting  
 Dept. of Math. Colloquium  
 Algebra and Geometry Seminar  
 Dept. of Math. Colloquium  
 Combinatorics Seminar  
 Dept. of Math. Colloquium  
 Dept. of Math. Colloquium  
 AMS Sectional Meeting  
 AG and CA seminar  
 eCARs conference  
 Algebra Seminar  
 AMS Sectional Meeting (meeting canceled)  
 Algebra and Algebraic Geometry Seminar  
 Commutative Algebra Seminar  
 AMS Sectional Meeting  
 Frobenius Action in CA Workshop  
 Algebra Seminar  
 Fall School in CA  
 Algebra Seminar  
 Public Lecture at ECCO 2018

University of Notre Dame  
 University of Cincinnati  
 Tulane University  
 Fed. Univ. of Sergipe, Brazil (Online)  
 University of Genova, Italy  
 University of Texas at El Paso (Online)  
 University of Utah  
 Oklahoma State University (Online)  
 Online  
 Online  
 Online  
 Baylor University  
 Arizona State University  
 University of North Texas  
 University of Illinois Chicago (Online)  
 University of Notre Dame (Online)  
 U. of Illinois at Chicago (Online)  
 Online  
 Online  
 McMaster University, Canada (Online)  
 IIT Bombay, India (Online)  
 MSRI (Online)  
 Online  
 New Mexico State University (Online)  
 Iowa State University (Online)  
 U. of California, Riverside (Online)  
 University of Kansas (Online)  
 U. de los Andes, Colombia (Online)  
 University of New Mexico (Online)  
 Online  
 NU/UIC/UofC (Online)  
 Online  
 U./Neu./Frib./Bern, Switzerland (Online)  
 Purdue University  
 University of Wisconsin, Madison  
 Purdue University  
 Auburn University  
 Barcelona, Spain  
 Universitat Pol. València, Spain  
 CIMAT, Mexico  
 Georgia State University  
 Barranquilla, Colombia

May 26, 2023  
 April 15, 2023  
 March 30, 2023  
 January-February, 2023  
 December 21, 2022.  
 November 4, 2022  
 October 23, 2022  
 April 20, 2022  
 April 7, 2022  
 March 26, 2022  
 March 19, 2022  
 February 26, 2022  
 February 22, 2022  
 February 8, 2022  
 December 7, 2021  
 November 16, 2021  
 November 4, 2021  
 October 23, 2021  
 October 21, 2021  
 July 19, 2021  
 July 9, 2021.  
 April 29, 2021  
 April 17, 2021  
 April 9, 2021  
 March 16, 2021  
 February 24, 2021  
 November 13, 2020  
 October 22, 2020  
 October 13, 2020  
 October 3, 2020  
 July 29, 2020  
 June 28, 2020  
 May 15, 2020  
 April 4, 2020  
 February 7, 2020  
 April 22, 2019  
 March 15, 2019  
 January 18, 2019  
 January 15, 2019  
 November 13-17, 2018  
 September 11, 2018  
 June 7, 2018

Col.-Mex. Math Soc. joint meeting	Universidad del Norte, Colombia	May 30, 2018
AMS Sectional Meeting	Portland State University	April 14, 2018
CA-AG Seminar	CIMAT, Mexico	March 22, 2018
Geometry and Topology Seminar	San Francisco State University	March 12, 2018
Commutative Algebra Seminar	University of Michigan	November 2, 2017
Commutative Algebra Seminar	University of Utah	October 19, 2017
PRIMA 2017	Oaxaca, Mexico	August 14, 2017
Combinatorial and CA Seminar	Oklahoma State University	April 20, 2017
Commutative Algebra Seminar	University of Nebraska-Lincoln	April 10, 2017
KUMUNU jr 2017	University of Nebraska-Lincoln	April 8, 2017
Algebra Seminar	University of Missouri	February 27, 2017
Department of Mathematics Colloquium	New Mexico State University	February 9, 2017
2016 CMS Winter Meeting	Niagara Falls, Canada	December 4, 2016
Algebra & Combinatorics Seminar	Tulane University	November 10, 2016
Commutative Algebra Seminar	Purdue University	October 21, 2016
KUMUNU 2016	University of Kansas	October 1, 2016
AMS Sectional Meeting	North Dakota State University	April 16, 2016
Algebra Seminar	University of Arkansas	January 29, 2016
AMS Sectional Meeting	Rutgers University	November 14, 2015
Combinatorics Seminar	University of Kansas	November 6, 2015
Commutative Algebra Seminar	Purdue University	October 7, 2015
Midwest Commutative Algebra Meeting	Purdue University	August 5, 2015
CA and related topics 2015	University of Kansas	March 22, 2015
Commutative Algebra Seminar	Purdue University	February 4, 2015
2015 Joint Mathematics Meeting	San Antonio, TX	January 13, 2015
Commutative Algebra Seminar	University of Utah	November 21, 2014
Commutative Algebra Seminar	Purdue University	November 5, 2014
Algebra Seminar	New Mexico State University	November 3, 2014
AMS Sectional Meeting	San Francisco State University	October 26, 2014
AMS Sectional Meeting	Dalhousie University	October 19, 2014
AMS Sectional Meeting	University of New Mexico	April 5, 2014
Commutative Algebra Seminar	Purdue University	February 27, 2014
Commutative Algebra Seminar	Purdue University	October 28, 2013
Commutative Ring Theory Seminar	University of Illinois at U-C	October 24, 2013
Commutative Algebra Seminar	Purdue University	October 21, 2013
AMS Sectional Meeting	University of Louisville	October 5, 2013
KUMUNU jr 2013	University of Nebraska-Lincoln	April 22, 2013
Commutative Ring Theory Seminar	University of Illinois at U-C	March 7, 2013
AG-CA Seminar	University of Notre Dame	February 26, 2013
Commutative Algebra Seminar	Purdue University	February 22, 2013

## **ORGANIZATIONAL ACTIVITIES**

<i>Co-Organizer</i> , Southwest Local Algebra Meeting		Fall 2022-
<i>Co-Organizer</i> , Number Theory&Algebra Seminar	Arizona State University	Fall 2022-
<i>Co-Organizer</i> , AMS Spe. Ses. on CA and Comb.	University of Texas, El Paso, TX	September 2022
<i>Co-Organizer</i> , Pan-American School on CA	CIMAT, Mexico	June 202
<i>Co-Organizer</i> , AMS Spe. Ses. on CA	Online	September 2020
<i>Co-Organizer</i> , Algebra Seminar	New Mexico State University	Fall 2019-Fall 2021
<i>Co-Organizer</i> , CAAG Reading Seminar	New Mexico State University	Spring 2019-
<i>Co-Organizer</i> , AMS Spe. Ses. on Multiplicities	University of Michigan, Ann Arbor, MI	October 2018
<i>Co-Organizer</i> , Algebra Seminar	University of Kansas	Fall 2015-Spring 2018
<i>Co-Organizer</i> , KUMUNU 2017	University of Kansas	October 2017

<i>Co-Organizer</i> , 2017 SACNAS, Session on CA	Salt Lake City, UT	October 2017
<i>Co-Organizer</i> , AMS Spe. Ses. on CA	University of North Texas, Denton, TX	September 2017
<i>Co-Organizer</i> , JMM - MRC Session on CA	Seattle, WA	January 2016
<i>Co-Organizer</i> , AMS Spe. Ses. on CA	Loyola University, Chicago, IL	October 2015
<i>Co-Organizer</i> , Student Comm. Alg. Seminar	Purdue University	Fall 2013-Spring 2015
<i>Co-organizer</i> , Student Colloquium	Dept. of Mathematics, Purdue University	Fall 2013-Spring 2015
<i>Co-organizer</i> , Program Associate Seminar	MSRI	Fall 2012

## **OTHER PROFESSIONAL ACTIVITIES**

*Scientific Committee member*, Colombian Combinatorics Meeting (ECCO), summer 2024  
*Teaching Assistant*, MSRI Summer Graduate School, University of Notre Dame, May 2019  
*Teaching Assistant*, MSRI Summer Graduate School, Okinawa, Japan, May 2017  
*Reviewer*, NSA-AMS Grant  
*Referee*, Contemporary Mathematics, European Journal of Combinatorics, Journal of Algebra, Journal of Algebra and its Applications, Journal of Commutative Algebra, Journal of Pure and Applied Algebra, Mathematical Research Letters, Mathematica Scandinavica, Mathematische Zeitschrift, Nagoya Mathematical Journal, Proceedings of the American Mathematical Society, Rocky Mountain Journal of Mathematics, Transactions of the American Mathematical Society.

## **ADVISING**

*Ph.D. students:*

Sudipta Das (2020 - )

*Master's Degree students:*

Emmy Lewis (2019 - 2021) - Currently a PhD Student at Cornell University

*Undergraduate students:*

Ethan Leventhal (2022 - )

Emmy Lewis (2018 - 2019) - Currently a PhD Student at Cornell University

## **SELECTED OUTREACH ACTIVITIES**

<i>Associate Editor</i> , AMS Blog on Teaching and Learning		August 2020 - July 2021
<i>Associate Editor</i> , Frontiers for Young Minds		May 2017 - May 2021
<i>Grader</i> , USAMO 2015, 2016	Cambridge, MA	April 2015, 2016
<i>Coordinator (Problem Captain)</i> , IMO 2013	Santa Marta, Colombia	July 2013
<i>Trainer</i> , AAAS Olympiad Program	Washington D.C.	2012
<i>President</i> , Colombian St. Association at Purdue	Purdue University	2011

## **SELECTED AWARDS IN MATHEMATICS AND PROGRAMMING COMPETITIONS**

International Collegiate Programming Contest, South American Final, *first place*, Bogotá, Colombia, 2008.  
Colombian Programming Contest, *first place*, 2008.  
International Mathematics Competition for University Students, *third prize*, Bulgaria, 2008; Ukraine, 2006.  
International Mathematical Olympiad, *bronze medal*, Greece, 2004.  
Colombian Mathematical Olympiad, *gold medal*, 2003.  
Colombian Olympiad in Informatics, *first place*, 2002, 2001, *third place*, 2003.

## **TEACHING EXPERIENCE**

**Arizona State University**, August 2022 -

Ring Theory

Advanced Linear Algebra

Instructor

Instructor

Spring 2023

Fall 2022

**New Mexico State University**, August 2018 - July 2022

Abstract Algebra I: Groups and Rings	Instructor	Spring 2022
Calculus and Analytic Geometry II	Instructor	Spring 2022
Introduction to Modern Algebra	Instructor	Fall 2021
Calculus and Analytic Geometry II	Instructor	Fall 2021
Introduction to Algebraic Statistics	Instructor	Spring 2021
Introduction to Higher Mathematics	Instructor	Spring 2021
Advanced Linear Algebra	Instructor	Fall 2020
Calculus and Analytic Geometry II	Instructor	Fall 2020
Introduction to Algebraic Geometry	Instructor	Spring 2020
Matrix Theory and Applied Linear Algebra	Instructor	Fall 2019
Calculus and Analytic Geometry III	Instructor	Fall 2019
Calculus and Analytic Geometry II	Instructor	Spring 2019
Calculus and Analytic Geometry I (two sections)	Instructor	Fall 2018

**University of Kansas**, August 2015 - May 2018

Calculus III (Honors)	Instructor	Spring 2018
Introductory Modern Algebra	Instructor	Fall 2017
Elementary Linear Algebra	Instructor	Fall 2017
Linear Algebra	Instructor	Summer 2017
Linear Algebra	Instructor	Spring 2017
Elementary Linear Algebra	Instructor	Fall 2016
Calculus III (Honors)	Instructor	Fall 2016
Elementary Linear Algebra	Instructor	Spring 2016
Vector Calculus	Instructor	Spring 2016
Linear Algebra	Instructor	Fall 2015

**Purdue University**, August 2009 - July 2015

Introductory Analysis I	Instructor	Spring 2014
Introductory Analysis II	Instructor	Fall 2013
Calculus I	Recitation Instructor	Spring 2013
Calculus II	Recitation Instructor	Spring 2012
Multivariable Calculus	Recitation Instructor	Fall 2011
Multivariable Calculus	Recitation Instructor	Fall 2010

**Universidad Nacional de Colombia**, Bogotá, August 2008 - August 2009

Linear Algebra	Instructor	Spring 2009
Calculus I	Instructor	Fall 2008

**LANGUAGES**

English (fluent), Spanish (native).

**MEMBERSHIP**

American Mathematical Society, 2010-