

Arvind Kumar

Curriculum Vitae

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Dep. of Mathematical Sciences
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Research Interests

Combinatorial Commutative Algebra

Education

- July'16 - May'20 **Ph.D., Mathematics**, Indian Institute of Technology Madras, India, GPA: 9.43/10
Thesis Title: Homological properties of binomial edge ideals
Supervisor: Professor A. V. Jayanthan
- July'14 - May'16 **M.Sc., Mathematics**, Indian Institute of Technology Madras, India, GPA: 8.63/10
- July'11 - May'14 **B.Sc., Mathematics Hons.**, University of Delhi, India, Percentage: 90

Academic Appointments

- Aug'23 - July'25 **Post-Doctoral Fellow**, New Mexico State University, USA
- Mar'21 - Jul'23 **Post-Doctoral Fellow**, Chennai Mathematical Institute, India
- Sept'20 - Feb'21 **Post-Doctoral Fellow**, Indian Institute of Technology Delhi, India
- Mar'20 - Aug'20 **Pre Post-Doctoral Fellow**, Indian Institute of Technology Madras, India

External Grants

- 2024-2026 The **AMS-Simons Travel Grant**
- 2023-2028 **INSPIRE Faculty Grant (DST/INSPIRE/04/2022/001800)**: from the Department of Science and Technology India. The grant provide an early career faculty salary for five years, support to purchase equipment, support for national and international travels (declined).
- 2020-2022 **NPDF Grant (NPDF/2020/001436)**: from the Science and Engineering Research Board of India. This two year grant provides salaries for a postdoctoral fellow and support to purchase equipment and funding for national travel. This grant is obtained through a competitive process analogous to the MSPRF/NSF Postdoctoral Fellowship.

- 2016-2020 **National Board of Higher Mathematics India Graduate Fellowship:** selection through a competitive exam followed by an interview, given to on average 35 candidates every year. This fellowship support through stipend, an education allowance, and a travel allowance for doctoral studies for four years.
- 2014-2016 **Inspire Master's Scholarship:** provides stipend and covers full tuition for two-year master's study programs in India. Awarded by the Department of Science and Technology India to the top 1% of undergraduate students nationwide.
- 2011-2014 **Inspire Undergraduate Scholarship:** provides stipend and covers full tuition for a three-year undergraduate study programs in India. Awarded by the Department of Science and Technology India to the top 1% of high school students nationwide.

Travel Grants

- Spring 2024 **Arts and Sciences Spring 2024 Faculty and Postdoc Travel Award** by NMSU
- Dec 2023 **CRM Funding** from Centre de recherches mathématiques to participate in Canadian Mathematical Society Winter meeting 2023
- May 2023 **CDC Grant** from European Mathematical Society
- May 2023 National Board of Higher Mathematics India **Travel Grant**
- 2022 **Chebyshev Grant** from International Mathematical Union for International Congress of Mathematics 2022

Publications
















† denotes undergraduate student coauthor, * denotes graduate student coauthor

Preprints Under Review

- 2024
25. *Binomial edge ideals of crown graphs* (with J. Pomeroy[†], L. Tran^{*}) Submitted
24. *Generalized Hamming weights and symbolic powers of Stanley-Reisner ideals of matroids* (with M. DiPasquale, L. Fouli, and S. O. Tohăneanu) Submitted 📩
23. *Symbolic Powers of Classical Varieties* (with V. Mukundan) Submitted 📩
- 2023
22. *Resurgence number of graded families of ideals* (with H. T. Ha, H. D. Nguyen and T. T. Nguyen) Submitted 📩
21. *F-thresholds of filtrations of ideals* (with M. Koley) Submitted 📩
20. *Powers of facet ideals of simplicial trees* (with Ajay Kumar) Submitted 📩
19. *Regularity comparison of symbolic powers, integral closure of powers and powers of edge ideals* (with R. Kumar) Submitted 📩

Published

- 2023
18. *Subadditivity, strand connectivity and multigraded Betti numbers of monomial ideals* (with A. V. Jayanthan) *J. Commut. Algebra*, 15 (2023), no. 4, 519-541 📩
17. *Properties of analogues of Frobenius powers of ideals* (with S. Chanda^{*}) *Indian J. Pure Appl. Math.*, 54 (2023), no. 2, 524-531 📩

16. *Upper bounds for the regularity of symbolic powers of certain classes of edge ideals* (with S. Selvaraja) J. Algebra Appl., 22 (2023), no. 1, 2350016 
15. *Binomial expansion for saturated and symbolic powers of sums of ideals* (H. T. Ha, A.V. Jayanthan and H. D. Nguyen) J. Algebra, 620 (2023), 690–710 
- 2022 14. *On the resurgence and asymptotic resurgence of homogeneous ideals* (with A. V. Jayanthan and V. Mukundan) Math. Z., 302 (2022), no. 4, 2407–2434 
13. *Rees algebra and special fiber ring of binomial edge ideals of closed graphs*, Illinois J. Math., 66 (2022), no. 1, 79–90 
- 2021 12. *Symbolic powers of cover ideals of certain graphs* (with R. Kumar, R. Sarkar* and S. Selvaraja) Acta Math. Vietnam., 46 (2021), no. 3, 599–611 
11. *Binomial edge ideals and bounds for their regularity*, J. Algebraic Combin., 53 (2021), 729–742 
10. *Regularity of parity binomial edge ideals*, Proc. Amer. Math. Soc., 149 (2021), 2727–2737 
9. *Certain algebraic invariants of edge ideals of join of graphs* (with R. Kumar and R. Sarkar*) J. Algebra Appl., 20 (2021), no. 6, 2150099 
8. *Lovász-Saks-Schrijver ideals and parity binomial edge ideals of graphs*, European J. Combin., 93 (2021), 103274 
7. *Almost complete intersection binomial edge ideals and their Rees algebras* (with A. V. Jayanthan and R. Sarkar*) J. Pure Appl. Algebra, 225 (2021), no. 6, 106628 
- 2020 6. *Binomial edge ideals of generalized block graphs*, Internat. J. Algebra Comput., 30 (2020), no. 8, 1537–1554 
5. *Depth and extremal Betti numbers of binomial edge ideals* (with R. Sarkar*) Math. Nachr., 293 (2020), no. 9, 1746–1761 
4. *Regularity of powers of quadratic sequences with applications to binomial ideals* (with A. V. Jayanthan and R. Sarkar*) J. Algebra, 564 (2020), 98–118 
3. *Regularity bound of generalized binomial edge ideal of graphs*, J. Algebra, 546 (2020), 357–369 
- 2019 2. *Regularity of binomial edge ideals of Cohen-Macaulay bipartite graphs* (with A. V. Jayanthan) Comm. Algebra, 47 (2019), no. 11, 4797–4805 
1. *Hilbert series of binomial edge ideals* (with R. Sarkar*) Comm. Algebra, 47 (2019), no. 9, 3830–3841 

Undergraduate Research Supervised

- Summer 2024 Designed a five week undergraduate research program and mentored undergraduate student Joshua Pomeroy and graduate student Le Tran. This program led to a (recently) submitted joint article titled *Binomial edge ideals of crown graphs* (no. 25 in Publications)

Teaching Experience

As an instructor of record at New Mexico State University

<i>Calculus 1</i> (undergraduate course)	Spring 2024, Fall 2024, Spring 2025
<i>Elementary Number Theory</i> (undergraduate and graduate course)	Fall 2024
<i>Abstract Algebra I</i> (undergraduate and graduate course)	Spring 2024
<i>Applied Linear Algebra</i> (undergraduate course)	Fall 2023
<i>Special Topics in Mathematics</i> (graduate course)	Fall 2023

As an instructor of record at Chennai Mathematical Institute, India

<i>Homological Algebra</i> (graduate course)	Fall 2022
<i>Algebra III</i> (undergraduate course, co-taught with another faculty)	Fall 2021

As a course assistant at Indian Institute of Technology Delhi, India

<i>Calculus</i> (undergraduate course)	Spring 2021
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As a course assistant at Indian Institute of Technology Madras, India

<i>Series and Matrices</i> (undergraduate course)	Spring 2019, 2020
<i>Algebra II</i> (graduate course)	Fall 2018
<i>Differential Equations</i> (undergraduate course)	Spring 2018
<i>Functions of several variables</i> (undergraduate course)	Fall 2017
<i>Linear Algebra for engineers</i> (undergraduate course)	Spring 2017

Professional development

- 2024-2025 Enrolled in the NMSU-MÁS program on active learning. Collaborating with a team of four professors from diverse departments and a coach to design an active learning STEM course in Fall 2024, set to be implemented in Calculus 1 in Spring 2025, with ongoing coaching and classroom observations.
- Sep 2024 AI Tools and Faculty Work, Teaching Academy, NMSU.
- Aug 2024 Getting Started with Gradescope, Teaching Academy, NMSU.
- Aug 2024 iClicker onboarding, Teaching Academy, NMSU.

Short research visits

- Jan 20-24, 2025 Apprenticeship Program in Commutative Algebra, Fields Institute in Toronto, Ontario
- Oct 17-22, 2023 Tulane University, U.S.A. (visited Professor Huy Tai Ha).
- Jun 19-29, 2023 Institute of Mathematics Hanoi, Vietnam.
- May 24-30, 2023 University of Messina, Italy (visited Professor Giancarlo Rinaldo).
- May 13-20, 2023 University of Genova, Italy (visited Professor Francesco Strazzanti).
- Feb 17-27, 2023 Indian Institute of Technology Jammu, India (visited Professor Ajay Kumar).
- Jan 1-8, 2022 Indian Institute of Technology Jammu, India (visited Professor Rajiv Kumar).

Invited Talks

- Mar'25 *Symbolic powers and related invariants*, Southwest Local Algebra Meeting 2025, Arizona State University.
- Jan'25 *Generalized Hamming weights and symbolic powers of Stanley-Reisner ideals of matroids*, Joint Mathematics Meetings 2025, Seattle.
- Dec'24 *Generalized Hamming weights and symbolic powers of Stanley-Reisner ideals of matroids*, Joint meeting of the NZMS, AustMS and AMS, Auckland, New Zealand.
- Sep'24 *Regularity bound of generalized binomial edge ideal of graphs*, AMS Fall Central Sectional Meeting 2024, University of Texas, San Antonio.
- Feb'24 *Symbolic powers of classical varieties (poster presentation)*, Southwest Local Algebra Meeting (SLAM) 2024, University of Oklahoma, Norman, Oklahoma.
- Dec'23 *Resurgence of classical varieties*, Canadian Mathematical Society Winter Meeting, Montreal, Canada.
- Nov'23 *F-threshold of filtration of ideals*, Algebra Days in Arizona State, Arizona State University, U.S.A.
- Nov'23 *F-threshold of filtration of ideals*, Commutative Algebra Seminar, Purdue University.
- Oct'23 *Regularity Bound of Generalized Binomial Edge Ideal of Graphs*, Algebra Seminar, Tulane University, U.S.A.
- Oct'23 *Regularity Bound of Generalized Binomial Edge Ideal of Graphs*, Colloquium Talk, New Mexico State University, U.S.A.
- Sep'23 *Koszul Algebras and Subadditivity of maximal shifts*, Algebra Seminar, New Mexico State University, U.S.A.
- Aug'23 *On resurgence number of cover ideal of graphs (poster presentation)*, BrianFest Conference, University of Nebraska-Lincoln, U.S.A.
- June'23 *Resurgence numbers of graded families of ideals*, Conference on Commutative Algebra and its connection with Algebraic Geometry and Combinatorics, Vietnam Institute for Advanced Studies in Mathematics Hanoi, Vietnam.
- June'23 *Powers of facet ideals of simplicial trees*, Algebra and Number Theory Seminar, Institute of Mathematics Hanoi, Vietnam.
- May'23 *Regularity bounds of generalized binomial edge ideals (poster presentation)*, Commutative Algebra Towards Applications, Politecnico di Torino and Università di Torino, Italy.
- May'23 *F-threshold of filtration of ideals*, School on Commutative Algebra and Algebraic Geometry in prime characteristic p , ICTP, Italy.
- May'23 *F-threshold of filtration of ideals (poster presentation)*, Workshop on Commutative Algebra and Algebraic Geometry in prime characteristic, ICTP, Italy.
- Mar'23 *Linearity of resolution of powers of facet ideals of simplicial complex*, Colloquium Talk, Chennai Mathematical Institute, India.
- Feb'23 *Resurgence numbers of graded families of ideals*, Conference on Commutative Algebra and Algebraic Geometry, IIT Hyderabad, India.

- Oct'20 *Regularity of binomial edge ideals*, CATGT Webinar Series(virtual).
- Oct'19 *Almost complete intersection binomial edge ideals and their Rees algebras*, Conference on Commutative Algebra and its interactions with Algebraic Geometry, University of Tabriz, Iran.
- July'19 *Regularity bound of generalized binomial edge ideal of graphs*(poster presentation), National Conference on Commutative Algebra and Algebraic Geometry, IISER Bhopal, India.
- Oct'18 *Saeedi Madani-Kiani Conjecture*, Mathematics In house Symposium, IIT Madras.
[Algebra Seminar at IIT Madras, India](#)
- Aug'19 *Three lectures on Local Co-homology*.
- Oct'18 *Two lectures on Regular local rings*.
- Mar'18 *Three lectures on Hochster's Formula*.
- [Student Seminar at IIT Madras, India](#)
- May'19 *Stanley-Reisner rings*.
- Jan'19 *Hilbert's Nullstellensatz*.

Conferences/Workshops Attended

- Mar'25 *Southwest Local Algebra Meeting 2025*, Arizona State University.
- Jan'25 *Joint Mathematics Meetings 2025*, Seattle.
- Dec'24 *Joint meeting of the NZMS, AustMS and AMS*, Auckland, New Zealand.
- Sep'24 *AMS Fall Central Sectional Meeting*, University of Texas, San Antonio.
- May'24 *AMS Sectional Meeting*, San Francisco State University, California.
- Feb'24 *Southwest Local Algebra Meeting*, University of Oklahoma, Norman, Oklahoma.
- Jan'24 *Connections Workshop: Commutative Algebra*, SLMATH, Berkeley, California.
- Dec'23 *Canadian Mathematical Society Winter Meeting*, Montreal, Canada.
- Nov'23 *Algebra Days in Arizona State*, Arizona State University, U.S.A.
- Aug'23 *BrianFest Conference*, University of Nebraska-Lincoln, U.S.A.
- Aug'23 *Summer Camp*, University of Nebraska-Lincoln, U.S.A.
- June'23 *Conference on Commutative Algebra and its connection with Algebraic Geometry and Combinatorics*, Vietnam Institute for Advanced Studies in Mathematics Hanoi, Vietnam.
- May'23 *Commutative Algebra Towards Applications*, Politecnico di Torino and Università di Torino, Italy.
- May'23 *School on Commutative Algebra and Algebraic Geometry in prime characteristic p* , ICTP, Italy.
- May'23 *Workshop on Commutative Algebra and Algebraic Geometry in prime characteristic*, ICTP, Italy.

- Feb'23 *Conference on Commutative Algebra and Algebraic Geometry*, IIT Hyderabad, India.
- Jul'22 *Maximal Cohen-Macaulay Modules*, Chennai Mathematical Institute, India.
- Mar'21 *International GeoGebra Conference*, Institute of Mathematical Sciences, India.
- Jan'21 *The 17th (Virtual) Seminar on Commutative Algebra and Related Topics*, Institute for Research in Fundamental Sciences(IPM), Iran.
- Sep'20 *Workshop on Commutative Algebra and Related Fields*, Constanta, Romania.
- Dec'19 *Advanced commutative algebra*, IIT Kharagpur, India.
- Oct'19 *Conference on Commutative Algebra and its interactions with Algebraic Geometry*, University of Tabriz, Iran.
- July'19 *National Conference on Commutative Algebra and Algebraic Geometry*, IISER Bhopal, India.
- Jun'18 *Combinatorial Commutative Algebra*, IIT Bombay, India.
- Dec'17 *Grobner Basis and their applications*, IIIT Delhi, India.
- Jun'17 *Positive characteristic methods in Commutative Algebra*, IIT Bombay, India.
- Dec'16 *Commutative Algebra*, Bhaskarcharya Pratishthana, Pune, India.

Research Awards

- 2021 **Ganitam Research Award** conferred by Dr. K. V. Rao Scientific Society India for outstanding research as early career fellow.
- 2020 **Smt Lakshmikutty Amma and Shri A Krishnankutty Nair Prize** conferred by Indian Institute of Technology Madras for the best PhD thesis of 2020 in Mathematics.
- 2020 **Institute Research Award** conferred by Indian Institute of Technology Madras for outstanding and creative research.

Membership

since 2023 American Mathematical Society

Service to the Profession

Co-organizer (with M. DiPasquale and L. Fouli)

- Sep 14-15, 2024 Special session on "Commutative algebra and connections to combinatorics" at the AMS Sectional Meeting at University of Texas, San Antonio.
- May 4-5, 2024 Special session on "Recent Developments in Commutative Algebra" at the AMS Sectional Meeting at San Francisco State University, California.

Referee for the following journals:

Collectanea Mathematica, Electronic Journal of Combinatorics, Journal of Algebra and Its Applications, Journal of Algebraic Combinatorics, Indian Journal of pure and Applied Mathematics, Mathematische Nachrichten, Proceedings of the American Mathematical Society, Communications in Algebra.

Reviewer for Mathscinet

Outreach and Diversity Efforts

National Symposium on Mathematics and Applications, IIT Madras

In-house Symposium, IIT Madras

Foryas: a mathematical fest, IIT Madras

Alpha: a mathematical fest, Hindu College, University of Delhi

Dec'19, Dec'18

Nov'17

Mar'17, Mar'16, Mar'15

Feb'14, Feb'13, Feb'12