Akash Singha Roy

Curriculum Vitae

Contact information

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Education

August 2022–present: University of Georgia, PhD program in mathematics.
September 2021–April 2022: Université de Montréal, PhD program in mathematics.
August 2018–April 2021: Chennai Mathematical Institute, Bachelor of Science in Mathematics and Computer Science.

Completed milestones in UGA doctoral program:

- Passed written comprehensive exams (Complex analysis, Real analysis, Algebra): August 2022.
- Passed oral comprehensive exam: November 2022.

Expected thesis defense: April 2025.

Research interests

Elementary, analytic, combinatorial and algebraic number theory; anatomy of integers; multiplicative number theory with focus on value distributions and mean values of arithmetic functions and questions on uniform distribution.

Publications (See website for most recent versions of papers)

Accepted/Published works

1. Steps into analytic number theory: A problem-based introduction (with P. Pollack), *Springer, Problem Books in Mathematics.*
2. Distribution mod p of Euler's totient and the sum of proper divisors (with N. Lebowitz-Lockard and P. Pollack), *Michigan Math. J.* **74** (2024), 143–166.
3. Joint distribution in residue classes of polynomial-like multiplicative functions (with P. Pollack), *Acta Arith.* **202** (2022), 89–104.
4. Powerfree sums of proper divisors (with P. Pollack), *Colloq. Math* **168** (2022), 287–295.
5. Dirichlet, Sierpiński, and Benford (with P. Pollack), *J.Number Theory* **239** (2022), 352–364.
6. On Benford's Law for multiplicative functions (with V. Chandee, X. Li and P. Pollack), *Proc. Amer. Math. Soc.* **151** (2023), 4607–4619.
7. Benford behavior and distribution in residue classes of large prime factors (with P. Pollack), Canad. Math. Bull. **66** (2023), 626–642.
8. Distribution in coprime residue classes of polynomially-defined multiplicative functions (with P. Pollack), Math. Z. **303** (2023), no. 4, paper 93, 20 pages.
9. Intermediate prime factors in specified subsets (with N. McNew and P. Pollack), Monatsh. Math. **202** (2023), 837–855.
10. The distribution of intermediate prime factors (with N. McNew and P. Pollack), Illinois J. Math. **68** (2024), no. 3, 537–576.
11. Mean values of multiplicative functions and applications to residue-class distribution (with P. Pollack), 14 pages, *Proc. Edinb. Math. Soc.*, recommended for acceptance subject to minor revisions

Submitted Papers

12. Joint distribution in residue classes of families of polynomially-defined multiplicative functions I, 53 pages, *submitted to J. London Math. Soc.*
13. Joint distribution in residue classes of families of polynomially-defined multiplicative functions II, 31 pages, *submitted to Acta. Arith.*
14. Joint distribution in residue classes of families of polynomially-defined additive functions, 34 pages, *submitted to Math Z.*
15. Anatomical mean value bounds on multiplicative functions and the distribution of the sum of divisors, 34 pages, *submitted to Michigan Math. J.*

Manuscripts under preparation

16. The Landau–Selberg–Delange method for products of Dirichlet L-functions and applications.

17. Distribution in residue classes of hybrid families of polynomially–defined additive and multiplicative functions.

18. Weighted equidistribution and mean values of multiplicative functions in twisted progressions.

Recent and upcoming talks

- PAlmetto Number Theory Series (PANTS) XXXVII: December 2023
  "Distribution in coprime residue classes of Euler's totient and the sum of divisors"
- University of Georgia Number Theory Seminar: April 2024
  "Joint distribution in residue classes of families of arithmetic functions"
- Dartmouth College Algebra and Number Theory Seminar: November 2024 (upcoming)
  "Equidistribution and mean values of families of multiplicative functions"

Awards and Scholarships

- William Armor Wills Memorial Scholarship Award 2024:
  presented by the Department of Mathematics at the University of Georgia, "in recognition of excellence in research".
- University of Georgia Graduate School Dean's Award: April 2023.
- Teaching assistantship awarded by the Department of Mathematics at UGA: August 2023 to May 2025.
- University of Georgia Graduate School Research Assistantship: August 2022 to May 2023.
- Exemplary Counselor Award at Ross/Asia Mathematics Program 2019:
  "in recognition of outstanding work at the 2019 Ross/Asia Mathematics Program" and "showing exemplary dedication to the spirit of the Ross program".
- Full scholarship and monthly stipend during undergraduate studies at the Chennai Mathematical Institute: 2018–2021.
- Stipend and travel grant from the Ross/Asia Mathematics program for Counselor duties: 2019.
- Full scholarship and travel grant from the Ross Mathematics program for attending as Junior Counselor: 2018.
- Mehta Fellowship for attending the Ross Mathematics Program: 2017.
  Highly competitive scholarship for students from India for attending mathematics programs abroad. Pays the full tuition and also provides support for travel and lodging expenses.
- Qualified to top quartile in the Simon Marais Mathematics Competition (SMMC) 2019, overall second from Chennai Mathematical Institute in Individual Category. International rank according to score: 15.
- Madhava Mathematics Competition (MMC) 2020 Prize Winner (national ranking: 11). Also accepted into MMC camp 2019. O

- Indian National Mathematical Olympiad (INMO) 2017 Merit Certificate awardee. Regional Mathematical Olympiad (RMO) 2016 and 2017 awardee.
- Enumeration 2020 organized by the Indian Institute of Science (IISc) Bangalore: second prize.
- Scholarship from Camp Euclid: 2016.

Selected list of conferences, summer schools and seminars participated in:

1. Regular participant in UGA Number Theory Seminars, Oberseminars, and Math Department Colloquia from August 2022 onwards. Also multiple participations in UGA Analysis Seminar and Graduate Student Seminar (GSS).
2. Number Theory Web Seminar series: participant from May 2020 onwards.
3. University of Georgia Cantrell Lectures 2024 by Melanie Matchett Wood: March 2024.
4. PAlmetto Number Theory Series XXXVII 2023 at UGA: December 2023.
5. Combinatorial and Additive Number Theory (CANT): May 2022.
6. Quebec-Vermont Number Theory Seminar (QVNTS) and Montréal Online Biweekly Inter-University Seminar on Analytic Number Theory (MOBIUS ANT) conducted by the Centre Interuniversitaire en Calcul Mathématique Algébrique (CICMA): regular participant from 2021 to 2022.
7. Summer school on 'Applications of Expander Graphs to Number Theory and Computer Science' conducted by the UNC Greensboro: May 2021.
8. Conference on Analytic and Probabilistic Number Theory commemorating Prof. Ramachandran Balasubramanian's 70th Birthday, conducted by the Institute of Mathematical Sciences (IMSc) Chennai: March 2021.
9. Symposium on Number Theory in honor of Prof. M.V. Subbarao on his birth centenary, conducted by the Indian Institute of Science Education and Research (IISER) Pune: July 2021.
10. Maine-Quebec Number Theory Conference conducted by the Centre de recherches mathématiques (CRM): October 2021.
11. Third Chennai-Tirupati Number Theory Conference, a joint initiative of the Chennai Mathematical Institute (CMI), IMSc, IISER Tirupati, Indian Institute of Technology (IIT) Madras, IIT Tirupati: August, 2020.
12. SPARC Lecture series on "Algebraic numbers of small height" (work of Vesselin Dimitrov on the Schinzel-Zassenhaus conjecture), instructed by Prof. Yuri Bilu: March 2021.
13. Lecture series on "p-adic numbers and Diophantine Equations" in IMSc (Jan 2020) and "Effective Andre-Oort on products of modular curves", in IIT Madras (Feb 2020), both instructed by Prof. Yuri Bilu.
14. Number Theory seminar series conducted by the Institute of Mathematical Sciences (IMSc): regular participant from 2019 to 2021.

Selected list of research projects prior to UGA:

- Research under Prof. Andrew Granville and Prof. Dimitris Koukoulopoulos in the Université de Montréal (August 2021 to April 2022): Worked on mean values of multiplicative functions in arithmetic progressions, residue races and antiequidistribution phenomena.
- Research projects under the guidance of Prof. Sinnou David (IMJ-PRG) from May to September 2020 (`https://projects.lsv.ens-cachan.fr/relax/people/short-term/`): Worked on Mahler measures, Lehmer's problem and the Schinzel-Zassenhaus conjecture. Based on several papers, some of them being Smyth's "On the product of conjugates outside the unit circle of an algebraic integer", Amoroso-Dvornicich's "A lower bound for the height in abelian extensions", and Dimitrov's "A proof of the Schinzel-Zassenhaus conjecture on polynomials".

Selected list of talks and directed reading prior to UGA:

1. Expander graphs, under Prof. Dimitris Koukoulopoulos at the Université de Montréal (April to June 2021): based on parts of Davidoff-Sarnak-Valette's "Elementary Number Theory, Group Theory, and Ramanujan Graphs", Kowalski's "An introduction to expander graphs", and Helfgott–Radziwill's "Expansion, Divisibility and Parity".
2. Projects on regular and Frobenian densities, Fourier coefficients of modular forms, and improvements and applications of the Chebotarev density theorem; under Prof. Purusottam Rath at CMI (April–November 2020): based on Serre's "Divisibilité de certaines fonctions arithmétiques" and "Quelques applications du théorème de densité de Chebotarev".
3. Mertens' estimates, applications and improvements (October 2020): based on parts of Tenenbaum's "Introduction to Analytic and Probabilistic Number Theory", Montgomery and Vaughan's "Multiplicative Number Theory I", and Landau's "Handbuch der Lehre von der Verteilung der Primzahlen".
4. Binary quadratic forms, composition laws, genus theory and the correspondence between the form class group and ideal class group; under Prof. Chantal David at the Concordia University (November 2021): based on parts of Cox's "Primes of the form $x^2 + ny^2$ " and Harcos' "Equidistribution on the modular surface and L-functions".
5. p-adic numbers, under Prof. Purusottam Rath in CMI (September to December 2019): based on Artin–Whaples' "Axiomatic characterization of fields by the product formula for valuations".
6. Quiver Representations and Gabriel's Theorem, under Prof. Upendra Kulkarni in CMI (March 2020): based on parts of Schiffler's "Quiver Representations" and Brion's "Representations of quivers".
7. Hilbert's Syzygy Theorem (April 2021): based on parts of Rotman's "An Introduction to Homological Algebra".
8. $\mathcal{D}$-module theory (April 2021): based on Lyubeznik's "A characteristic-free proof of a basic result on $\mathcal{D}$-modules".
9. Associated primes and regular sequences (February 2021): based on parts of Matsumura's "Commutative Ring Theory".
10. Artinianness of local cohomology modules (March 2021): based on parts of Brodmann and Sharp's "Local Cohomology".

11. Twisted, cuspidal and nodal cubic curves and rational curves (December 2020): based on part of Hartshorne's "Algebraic Geometry".
12. Weyl Chambers and simple roots (November 2020): based on parts of Humphreys' "Introduction to Lie Algebras and Representation Theory".
13. Separability of transcendental extensions, under Prof. Upendra Kulkarni at CMI (December 2019-January 2020): based on parts of Lang's "Algebra".
14. Commutative algebra, under Prof. Balwant Singh at the University of Mumbai-DAE Centre for Excellence in Basic Sciences (May 2019): based on Singh's "Basic Commutative Algebra".

Teaching and Service Work

Refereeing

Have refereed for

- "Women in Numbers Europe 4 – Research Directions in Number Theory", Springer, Association for Women in Mathematics Series.
- Rose–Hulman Undergraduate Mathematics Journal.

Teaching and service at UGA

- Committee for UGA High School Math Tournament 2024
  Contributed several questions and was involved in the design of the contest.
- Instructor of MATH 2250 (Calculus I) at UGA: Spring 2025, Fall 2024, Spring 2024.
  Flipped/hybrid classroom structure.
- Committee for design of MATH 2250 final exam at UGA: Spring 2024.
- UGA MATH 2250 Active Learning Working Group: Spring 2024.
- Instructor for MATH 1113 (Precalculus) at UGA: Fall 2023.
  Flipped classroom structure.
- Grader for MATH 3100 (Sequences and series): Fall 2023.
  Instructed by Prof. Paul Pollack
- UGA Math Study Hall tutor: Spring 2024, Fall 2024.

Teaching and service prior to UGA

- Counselor in the Ross/Asia Mathematics program 2019.
  The Ross Program is a residential summer math camp for high school students, primarily focused on algebra and number theory, where students are immersed in the process of mathematical discovery for six weeks. As a Counselor, my responsibility was to mentor the students by guiding their thinking and providing detailed feedback on their work; in addition, I also discussed several interesting mathematical problems with students and gave several informal lectures.

  Received Exemplary Counselor Award "in recognition of outstanding work at the 2019 Ross/Asia Mathematics Program" and "showing exemplary dedication to the spirit of the Ross program".

- Served on committee for evaluating applications to the Ross Mathematics Program: 2020–2021.
- Teaching assistant in the courses Algebra III and Algebra IV at the Chennai Mathematical Institute: 2020–2021.
- Contributed questions to and served as grader for the Scholastic Test for Excellence in Mathematical Sciences (STEMS) conducted by the Chennai Mathematical Institute: 2019.
- Junior Counselor in the Ross Mathematics Program at the Ohio State University: 2018.