# Asif Zaman

Department of Mathematics University of Toronto asif.zaman@utoronto.ca math.utoronto.ca/zaman

#### A. BIOGRAPHICAL INFORMATION

#### Employment

- 2019– University of Toronto, Mathematics Assistant Professor, Teaching Stream
  2017–19 Stanford University, Mathematics
  - NSERC Postdoctoral Scholar

#### Degrees

- Ph.D. Mathematics, University of Toronto, 2017 Analytic estimates for the Chebotarev Density Theorem and their applications supervised by John Friedlander
- M.Sc. Mathematics, University of British Columbia, 2012
- B.Sc. Mathematics, Simon Fraser University, 2010

## **B. AWARDS AND GRANTS**

#### **Teaching Grants and Awards**

- 2024 Instructional Technology Innovation Fund (\$10,000) awarded \$5,000 by Vice Provost, Innovations in Undergraduate Education and matched \$5,000 by department chair for development of interactive models in multivariable calculus
- 2024 Pedagogical Innovation and Experimentation Fund, Faculty of Arts & Science (\$11,200) awarded by department chair for textbook development and for multivariable calculus models
- 2023 Pedagogical Innovation and Experimentation Fund, Faculty of Arts & Science (\$6,200) awarded by department chair for textbook development
- 2022 Pedagogical Innovation and Experimentation Fund, Faculty of Arts & Science (\$4,000) awarded by department chair for textbook development
- 2019 Teaching Stream Pedagogical Grant, Faculty of Arts & Science (\$2,000)

#### Research Grants and Awards

2022–27 NSERC Discovery Grant – Early Career Researcher (\$115,000)

- 2022 NSERC Discovery Launch Supplement (\$12,500)
- 2017–19 NSERC Postdoctoral Fellowship (\$90,000)

#### C. RESEARCH

#### **Research Interest Keywords**

Analytic number theory, *L*-functions, distribution of primes, Chebotarev density theorem, probabilistic number theory, random multiplicative functions

#### **Refereed Publications**

Authorship for publications and manuscripts are always listed in alphabetical order by last name.

The symbol **\*** indicates articles written as part of undergraduate research programs.

\*19. M. Hofmann, A. Hoganson, S. Menon, W. Verreault and A. Zaman. "Moments of random multiplicative functions over function fields." *Math. Proc. Camb. Phil. Soc.* (2025), accepted. arxiv:2408.08309

- 18. J. Thorner and A. Zaman. "An explicit version of Bombieri's log-free density estimate and Sárközy's theorem for shifted primes." *Forum Math.*. 36 (2024), no. 4, 1059–1080. doi:10.1515/forum-2023-0091
- 17. J. Thorner and A. Zaman. "Refinements to the prime number theorem for arithmetic progressions." *Math. Z.*. 306 (2024), no. 54. doi:10.1007/s00209-023-03414-3
- 16. R. J. Lemke Oliver, J. Thorner, and A. Zaman. "An approximate form of Artin's holomorphy conjecture and non-vanishing of Artin *L*-functions." *Invent. Math.*. 235 (2024), 893–971. doi:10.1007/s00222-023-01232-2
- 15. J. Thorner and A. Zaman. "A zero density estimate for Dedekind zeta functions." *Int. Math. Res. Not.*, 2023 (2023), no. 8, 6739–6761. doi:10.1093/imrn/rnac015
- \*14. D. Aggarwal, U. Subedi, W. Verreault, A. Zaman, and C. Zheng. "A conjectural asymptotic formula for multiplicative chaos in number theory." *Res. Number Theory*. 8 (2022), no. 35. doi:10.1007/s40993-022-00332-x
- \*13. D. Aggarwal, U. Subedi, W. Verreault, A. Zaman, and C. Zheng. "Sums of random multiplicative functions over function fields with few irreducible factors." *Math. Proc. Camb. Phil. Soc.*, 173 (2022), no. 3, 715–726. doi:10.1017/S030500412200010X
- 12. K. Soundararajan and A. Zaman. "A model problem for multiplicative chaos in number theory." *Enseign. Math.*, 68 (2022), no. 3, 307–340. doi:10.4171/lem/1031
- 11. F. Brumley, J. Thorner, and A. Zaman. With an appendix by C. J. Bushnell and G. Henniart. "Zeros of Rankin-Selberg *L*-functions at the edge of the critical strip." *J. Eur. Math. Soc.*, 24 (2022), no. 5, 1471–1541. doi:10.4171/jems/1134.
- 10. J. Thorner and A. Zaman. "An unconditional GL(*n*) large sieve." *Adv. Math.* 378 (2021), paper no. 107529, 24 pp. doi:10.1016/j.aim.2020.107529
- 9. J. Thorner and A. Zaman. "A unified and improved Chebotarev density theorem." *Alg. Num. Theory.* 13 (2019), no. 5, 1039–1068. doi:10.2140/ant.2019.13.1039
- 8. A. Zaman. "Primes represented by positive definite binary quadratic forms." *Q.J. Math.* 56 (2018), no. 4, 1353–1386. doi:10.1093/qmath/hay028
- 7. B. Hanson and A. Zaman. "The density of numbers represented by diagonal forms of large degree." *Mathematika*. 64 (2018), no. 2, 542–550. doi:10.1112/S0025579318000190
- 6. J. Thorner and A. Zaman. "A Chebotarev variant of the Brun–Titchmarsh theorem and bounds for the Lang–Trotter conjectures." *Int. Math. Res. Not.* 2018 (2018), no. 16, 4991–5027. doi:10.1093/imrn/rnx031
- 5. A. Zaman. "The least unramified prime which does not split completely." *Forum. Math.* 30 (2017), no. 3, 651–661. doi:10.1515/forum-2017-0081
- 4. J. Thorner and A. Zaman. "An explicit bound for the least prime ideal in the Chebotarev density theorem." *Alg. Num. Theory* 11 (2017), no. 5, 1135–1197. doi:10.2140/ant.2017.11.1135
- 3. A. Zaman. "Bounding the least prime ideal in the Chebotarev Density Theorem." *Funct. Approx. Comment. Math.* 57 (2017), no. 1, 115–142. doi:10.7169/facm/1651
- 2. A. Zaman. "On the least prime ideal and Siegel zeros." *Int. J. Number Theory.* 12 (2017), no. 8, 2201–2229. doi:10.1142/S1793042116501335
- 1. A. Zaman. "Explicit estimates for the zeros of Hecke *L*-functions." *J. Number Theory.* 162 (2016), 312–375. doi:10.1016/j.jnt.2015.10.003

## Submitted Manuscripts and Articles In Preparation

- \*24. D. Hoban, N.-C. Ismail, J. Shah, W. Verreault, A. Zaman. "Central limit theorems for random multiplicative functions over function fields." (2025), in preparation.
- 23. P. J. Cho, R. J. Lemke Oliver, A. Zaman. "The least prime with a given factorization type." (2025), in preparation.
- 22. L. B. Pierce, C. L. Turnage–Butterbaugh, A. Zaman. "A guide to Tauberian theorems for

	arithmetic applications." (2025), submitted. arxiv:2504.16233
21.	R. J. Lemke Oliver, A. Zaman. "Improving the trivial bound for $\ell$ -torsion in class groups." (2025), submitted. arxiv:2502.03464
20.	K. Benli, S. Goel, H. Twiss and A. Zaman. "Explicit Deuring–Heilbronn phenomenon for Dirichlet <i>L</i> -functions." (2024), submitted. arxiv:2410.06082
Invited	Conferences on Research
2025	Bird's Eye Conference. Toronto, ON.
	invited plenary lecture; organized by MGSA at U. Toronto.
2024	Canadian Mathematical Society Winter Meeting. Vancouver, BC.
	Computational Aspects of Arithmetic Geometry and Analytic Number Theory session
0004	Celebrating Greg Martin: A Chorus of Contributions to Analytic Number Theory session
2024	invited lecture; held at Fields Institute
2023	PIMS CRG Summer School: Inclusive Paths in Explicit Number Theory. Kelwona, BC.
	invited lectures and project leader; held at UBC Okanagan
2023	Canadian Undergraduate Mathematics Conference. Toronto, ON. invited keynote lecture
2022	Ulsan National Institute of Science and Technology. Ulsan, Korea.
2020	First International Workshop in Analytic Number Theory
2020	Arithmetic Statistics session, Probability in Number Theory session
2010	Joint Math Meetings Baltimore MD
2017	AMS Special Session. Analytic Number Theory
2019	Joint Math Meetings. Baltimore, MD.
	AMS Invited Paper Session. Counting Methods in Number Theory
2018	Canadian Mathematical Society Winter Meeting. Vancouver, BC. Analytic Number Theory session
2018	Oregon Number Theory Days. Corvalis, OR.
	Hosted by Portland State University, University of Oregon, and Oregon State University
2017	Joint Math Meetings. Atlanta, GA.
2016	AMS Special Sessions. Analytic Number Theory and Arithmetic
2016	Analytic Number Theory session
2016	Canadian Number Theory Association 14th Meeting. University of Calgary. Calgary, AB. invited lecture
2015	Canadian Mathematical Society Winter Meeting. Montréal, QC. Analytic Number Theory session
Invited	Seminars on Research
2025	Concordia University, Montréal, QC. (upcoming)
	Quebec–Vermont Number Theory seminar
2024	Number Theory Web Seminar. ntwebseminar.org
2024	University of Virginia. Charlottesville, VA.
	Ramanujan-Serre Number Theory seminar
2024	Kyushu University. Fukuoka, Japan. Algebra seminar
2023	University of Toronto. Toronto, ON. Probability seminar

2023	Pacific Institute for the Mathematical Sciences. Vancouver, BC. CRG <i>L</i> -functions in Analytic Number Theory seminar
2022	American Institute of Mathematics. San Jose, CA. FRG <i>L</i> -functions graduate seminar
2022	Rutgers University. Newark, NJ. Number Theory seminar
2021	Kansas State University. Manhattan, KS. Number Theory seminar
2021	University of Mississippi. Oxford, MS. Number Theory seminar
2021	Heilbronn Institute. Bristol, UK. Number Theory seminar
2021	Montreal number theory group. Montréal, QC. MOBIUS ANT mini-course (4 talks)
2021	Institut Elie Cartan de Lorraine. France. Nancy Metz Number Theory seminar
2021	Boise State University. Boise, ID. Department colloquium
2021	Fields Institute. Toronto, ON. Number Theory seminar
2020	University of Lethbridge. Lethbridge, AB. Number Theory and Combinatorics seminar
2019	University of Wisconsin-Madison. Madison, WI. Number Theory seminar
2019	University of New South Wales Canberra. Canberra, Australia. Number Theory seminar
2019	University of New South Wales Sydney. Sydney, Australia. Number Theory seminar
2019	Duke University. Durham, NC. Number Theory seminar
2018	Tufts University. Medford, MA. Algebra and Number Theory seminar
2018	Stanford University. Stanford, CA. Number Theory seminar
2018	University of Oregon. Eugene, OR. Number Theory seminar
2018	University of Wisconsin-Madison. Madison, WI. Number Theory seminar
2018	Boise State University. Boise, ID. Complexity Across Disciplines REU seminar
2017	University of Waterloo. Waterloo, ON. Number Theory seminar
2016	Stanford University. Stanford, CA. Number Theory seminar
2016	University of Lethbridge. Lethbridge, AB. Number Theory and Combinatorics seminar
2016	York University. Toronto, ON. Number Theory seminar

# D. LIST OF COURSES

University of Toronto	
2024–25	MAT237 Multivariable Calculus with Proofs (co-coordinator, 550 enrolled)
2024 Fall	MAT496 Independent Reading in Mathematics: Computation with L-functions
2023–24	MAT237 Multivariable Calculus with Proofs (coordinator, 550 enrolled)
2023 Winter	MAT198 Cryptology (Innis FYF)
2022–23	MAT237 Multivariable Calculus with Proofs (coordinator, 500 enrolled)
2021–22	MAT237 Multivariable Calculus with Proofs (coordinator, 500 enrolled)
2021 Fall	MAT198 Cryptology (Innis FYF)
2020–21	MAT237 Multivariable Calculus with Proofs (coordinator, 500 enrolled)
2020 Fall	MAT198 Cryptology
2020 Winter	MAT198 Cryptology
2019–20	MAT137 Calculus with Proofs (coordinator, 1500 enrolled)
Stanford University	
2019 Spring	MATH 122 Modules and Group Representations
2019 Spring	MATH 106 Functions of a Complex Variable
2018 Spring	MATH 52 Integral Calculus of Several Variables
2018 Winter	MATH 106 Functions of a Complex Variable
University of Toronto	
2017 Winter	MAT135 Calculus I(A) for Life Sciences (co-coordinator)
2016 Fall	MAT186 Calculus I for Engineers
2016 Summer	MAT136 Calculus I(B) for Life Sciences (co-coordinator)
2015 Fall	MAT186 Calculus I for Engineers
2014 Fall	MAT186 Calculus I for Engineers
2014 Summer	MAT136 Calculus I(B) for Life Sciences (co-coordinator)

## E. SUPERVISION

# Undergraduate Research Supervision

2025	Mathematics Undergraduate Summer Research Program, U. Toronto (2 students) Rick Lu (U. Toronto)
2024	Haonan (Kristopher) Zhao (U. Toronto) Fields Institute Undergraduate Summer Research Program (3 students)
	Nadya-Catherine Ismail (Smith College) Jibran Shah (U. Toronto)
2024	Mathematics Undergraduate Summer Research Program, U. Toronto (3 students) Sabek Germame (U. Toronto) – next MSc Math at U. Toronto Hanfu Gong (U. Toronto) Lucas Olmstead (U. Toronto)
2023	Fields Institute Undergraduate Summer Research Program (3 students) Max Hofmann (U. Goethe Frankfurt) – next PhD Math at Stony Brook Annemily Hoganson (Carleton College) – next PhD Math at UW Madison Siddarth Menon (Berkeley) – next MSc Cambridge; now PhD Math at Cambridge
2020	Fields Institute Undergraduate Summer Research Program (4 students) Daksh Aggarwal (Grinnell) – next PhD Math at Brown U. Unique Subedi (U. Mississippi) – next PhD Stats at U. Michigan

William Verreault (U. Laval) – next MSc Math at U. Laval, now PhD Math at U. Toronto Chenghui Zheng (U. Toronto) – next MSc Stats at U. Toronto, now PhD Stats at UW Madison

#### Undergraduate Work Supervision

- 2024–25 Work Study Program, Education Research Assistants (2 students) Yuzhe (Liz) Liu; Sydney Pinkalla
- 2024 Work Study Program, Textbook Design Assistants (4 students) Edric Liu; Katrina Sha; Grace Shang; William Young
- 2023 Work Study Program, Textbook Design Assistants (4 students) Victoria Allder; Chengyuan (Ryan) Shi; Amy Wang; Sarah Xie
- 2022 Work Study Program, Textbook Design Assistants (4 students) Sirui (Ariel) Chen (next MSc CS at Stanford); Kevin Didi (next MA Econ at U. Toronto); Sarah Verreault (next MSc CS at ETH); Amy Wang
- 2021 Work Study Program, Textbook Design Assistants (3 students) Sam De Abreu (next PhD Earth and Planetary Sciences at Yale U.); Raymond Liu; Lucas Prates

#### Postdoctoral and Graduate Supervision

- 2023– Maryam Khaqan, Teaching Postdoctoral Fellow, University of Toronto co-mentored with Cindy Blois
- 2023– Research Project, Inclusive Paths in Explicit Number Theory summer school (2 students) Shivani Goel (IIIT–Delhi PhD); Henry Twiss (Brown PhD); co-led with Kubra Benli (ULeth postdoc)
- 2023 Reading Course, University of Toronto (1 student) Matias Bruna Penaloza; studied sieve theory and binary quadratic forms

## F. PEDAGOGICAL ACTIVITIES

#### **Teaching Projects**

- 2024– Multivariable Calculus Models ongoing development of lessons with physical models (e.g. 3D printed graph, wooden wedge, styrofoam bead) for 500+ students; performed literature review, designed 5 pilot lessons, and summarizing outcomes in reports; prepared in collaboration with teaching team and education research assistants; funded by university ITIF grant and departmental PIE funds
- 2023– Multivariable Calculus Concept Videos ongoing development of MAT237 concept videos with Alexandra Logue, Phil Rudz, and A&S Digital Teaching & Learning studio team; created and distributed 7 pilot videos so far
- 2021– MAT237 Multivariable Calculus with Proofs textbook ongoing development of 1000 page textbook with 1000+ exercises and WeBWorK database; prepared in collaboration with teaching teams and textbook design assistants; funded by departmental PIE funds

#### Invited Talks on Teaching

- 2025 Arts & Science Showcase, U. Toronto (upcoming)
  - invited speaker on continuation of Digital Teaching & Learning studio project
- 2024 Arts & Science Showcase, U. Toronto
  - invited speaker on Digital Teaching & Learning studio project
- 2023 Student Writing Workshop by CMS student committee. CMS Winter Meeting, Montreal QC invited workshop leader on "How to get the most out of talks"
- 2023 Academic Job Search, Department of Mathematics, U. Toronto invited panelist; organized by Ignacio Uriarte-Tuero, Associate Chair, Graduate.
- 2023 Mathematics Education seminar. Department of Mathematics, University of Toronto invited talk on "Lifecycle of assessments in a large course"
- 2023 Arts & Science Showcase: Writing-Integrated Teaching, University of Toronto invited roundtable panelist on "Employing WIT for TA Development and Student"

2022 Arts & Science Teaching & Learning Community of Practice, U. Toronto invited talk on "Lifecycle of assessments in a large course"

#### **Teaching & Training Programs**

- 2019–22 First-Time Instructor Training, Mathematics Department, U. Toronto supported 3 to 4 new instructors with microteaching sessions, class observations, and reflections
- 2019–21 First-Time TA Training, Mathematics Department, U. Toronto supported training and led interactive sessions on grading, feedback, and consistency for 90+ TAs
- 2019–21 Math Learning Centre, U. Toronto led and redesigned drop-in TA resource for large first year courses with total enrollment 7000 per semester; both in-person and online; relocated to better space in collaboration with FAS
- 2018 Postdoctoral Instructor Training, Mathematics Department, Stanford U. led two sessions on experiences with active learning at this 3-day workshop

#### **G. PROFESSIONAL DEVELOPMENT**

#### **Professional Development Programs**

- 2023–24 CTSI Peer-to-Peer Mentorship program, University of Toronto enrolled in intensive program with biweekly meetings and 4 workshops
- 2019–20 MAA Project NExT Silver Dot enrolled in invited MAA program for teaching development of junior faculty members
- 2017 Mentors in Teaching Program, Stanford University enrolled in 3 full-day workshops and gave feedback to TAs in the Math Department

#### Attended Conferences on Teaching

2024	CMS Winter meeting. Vancouver, BC
	participant at mathematics education sessions on teaching and learning
2023	CMS Winter meeting. Montreal, QC
	participant at mathematics education sessions on teaching and learning
2023	MAA Seaway Sectional Spring meeting. Waterloo, ON
	participant at talks and workshops on teaching and learning
2023	CTSI Teaching & Learning Showcase, University of Toronto
	participant at 3-day conference organized by university's teaching centre
2022–24	Arts & Science Teaching & Learning Community of Practice, University of Toronto
	participant and speaker at monthly seminar organized by faculty
2022	CTSI Teaching & Learning Showcase, University of Toronto
	participant at 3-day conference organized by university's teaching centre
2020	MAA MathFest. online.
	participant at Project NExT program and other activities on teaching
2020	Joint Math Meetings. Denver, CO.
	participant at Project NExT program and other workshops on teaching

2019 MAA MathFest. Cincinatti, OH. participant at Project NExT program and other activities on teaching

#### **H. SERVICE**

#### Service within the University

- 2024–25 Undergraduate Special Projects Committee, Mathematics
- 2023–24 Undergraduate Committee, Mathematics
- 2023–24 Departmental Council, Mathematics
- 2023 Online Grading RFSQ Committee, University

2022–23 Teaching Stream Appointments Committee, Mathematics

- 2022–23 Departmental Council, Mathematics
- 2021–22 Teaching Stream Appointments Committee, Mathematics
- 2020–21 Workload Committee, Mathematics
- 2020–21 Undergraduate Committee, Mathematics
- 2019–20 Undergraduate Committee, Mathematics

#### Service outside the University

- 2023 Co-organizer for online conference "Around Frobenius Distributions and Related Topics IV" co-organized with Lucile Devin and Jesse Thorner.
- 2019 Co-organizer for a session of Canadian Mathematical Society Winter Meeting Analytic Number Theory session co-organized with Yu-Ru Liu and Stanley Xiao.
- 2018– Reviewer for publications on MathSciNet
- 2017– Peer reviewer for academic journals

Algebra and Number Theory Bulletin of the London Mathematical Society Bulletin de la Société Mathématique de France Duke Mathematical Journal Forum Mathematics. Pi International Mathematics Research Notices Journal of Mathematical Analysis and Applications Journal of Number Theory Mathematical Research Letters Mathematics of Computation Mathematika Proceedings of the American Mathematical Society Quarterly Journal of Mathematics Research in the Mathematical Sciences Research in Number Theory Transactions of the American Mathematical Society

2017–19 Organizer of Stanford Analytic Number Theory learning seminar

Updated April 2025