

Debanjana Kundu

Curriculum Vitae

Last Updated: April 17, 2024

PERSONAL DETAILS

Birth	January 6, 1993
Address	3.434 MAGC, 1201 W. University Drive Edinburg, TX 78539, USA
Mail	dkundu@math.toronto.edu or debanjana.kundu@utrgv.edu

EDUCATION

BS-MS Dual Degree	2010-2015
<i>Indian Institute of Science Education and Research, Mohali, India</i>	
CGPA 9.7	
MA PhD	2015-2020
<i>University of Toronto, Toronto, Canada</i>	

EMPLOYMENT

Université de Montréal	Fall 2020
<i>CRM-ISM PostDoc, Thematic Program: Cohomology in Arithmetic</i>	
University of British Columbia, Vancouver	January 2021– December 2022
<i>PIMS PostDoc Fellow</i>	
Fields Institute, Toronto	January– June 2023
<i>Visiting Researcher</i>	
University of Texas Rio Grande Valley	September 2023– present
<i>Assistant Professor</i>	

PUBLICATIONS

1. Growth of Fine Selmer Groups in Infinite Towers
Canadian Mathematics Bulletin (2020) Volume 63 / Issue 4 pp. 921-936.
2. Growth of p -Fine Selmer Groups and p -Fine Shafarevich-Tate Group in $\mathbb{Z}/p\mathbb{Z}$ -Extensions
Journal of the Ramanujan Math Society (2021) Volume 36, No. 1.
3. Growth of Fine Selmer Groups in Uniform pro- p Extensions
Annales Mathématiques du Québec (2021) Volume 45, pp. 347-362.
4. Perfect Powers that are Sums of Squares of an AP (with V. Patel)
Rocky Mountain Journal of Mathematics (2021) Volume 51 / No. 3 pp. 933-949.
5. On an Analogue of Kida's Formula for Fine Selmer Groups
Journal of Number Theory (2021) Volume 222; pp. 249-261.
6. Anticyclotomic μ -Invariants of Residually Reducible Galois Representations (with A. Ray)
Journal of Number Theory (2022) Volume 234, pp. 476-498.
7. Statistics for Iwasawa Invariants of Elliptic Curves (with A. Ray)
Transactions of the American Mathematical Society (2021) Volume 374/ Issue 11; pp. 7945-7965

8. Arithmetic Statistics and Non-Commutative Iwasawa Theory (with A. Lei and A. Ray)
Documenta Mathematica (2022) Volume 27, pp. 89–149
9. Iwasawa Invariants for elliptic curves over \mathbb{Z}_p -extensions and Kida’s Formula (with A. Ray)
Forum Math. 34 (2022), no. 4, 945–967
10. Control Theorems of Fine Selmer Groups (with M. F. Lim)
Journal de théorie des nombres de Bordeaux, Volume 34 (2022) no. 3, pp. 851–880
11. On the fine Selmer groups of modular forms and duality (with J. Hatley, A. Lei, J. Ray)
The Ramanujan Journal (2023) Volume 60, pp. 237–258
12. λ -invariant stability in Families of Modular Galois Representations (with J. Hatley)
Research in Mathematical Sciences 10 (2023), article number 33
13. Growth of p -parts of ideal class groups and fine Selmer groups in \mathbb{Z}_q -extensions with $p \neq q$ (with A. Lei)
Acta Arithmetica 207 (2023), no. 4, 297–313
14. Structure of fine Selmer Groups in p -adic Lie Extensions (with R. Sujatha and F. Nuccio)
accepted for publication in Osaka Journal of Math
15. Non-vanishing modulo p of Hecke L -values over imaginary quadratic fields (with A. Lei)
accepted for publication in Israel Journal of Math
16. Rank jumps and growth of Shafarevich–Tate groups for elliptic curves in $\mathbb{Z}/p\mathbb{Z}$ -extensions (with L. Beneish and A. Ray)
accepted for publication in Journal of the Australian Math Society
17. Cotorsion of anti-cyclotomic Selmer groups on average (with F. Sprung)
accepted for publication in Proceedings of the AMS
18. Heuristics for anti-cyclotomic \mathbb{Z}_p -extensions (with L. Washington)
accepted for publication in Experimental Math
19. Statistics for Iwasawa Invariants of Elliptic Curves II (with A. Ray)
accepted for publication in Int. J. Number Theory
20. Studying Hilbert’s 10th problem via explicit elliptic curves (with A. Lei and F. Sprung)
accepted for publication in Math Ann.

PREPRINTS

1. Statistics for anticyclotomic Iwasawa invariants of elliptic curves (with J. Hatley and A. Ray) *pre-print available on arXiv, undergoing revisions in Math Z. (submitted September 2021)*
2. Derived p -adic heights and the leading coefficient of the BDP p -adic L -function (with F. Castella, C.-Y. Hsu, Y.-S. Lee, Z. Liu) *pre-print available on arXiv, submitted*
3. On a conjecture of Mazur predicting the growth of Mordell–Weil ranks in \mathbb{Z}_p -extensions (with R. Gajek-Leonard, J. Hatley, A. Lei) *available on the arXiv, submitted*
4. Beyond Endoscopy via Trace Formula for $\mathrm{GL}(2, F)$ (with M. Emory, M. Espinosa Lara, T.A. Wong) *available on the arXiv*
5. Iwasawa Invariants of Abelian Varieties in Extensions of Number Fields (with L. Beneish) *preprint available upon request*

AWARDS/ DISTINCTIONS/ PRIZES

Academic Excellence Award (three times) <i>IISER Mohali (for SGPA 10 in three semesters)</i>	2010-2015
Vivekananda Graduate Award for International Students <i>University of Toronto</i>	2018-2019
General Motors Women in Mathematics and Science Award <i>University of Toronto</i>	2019-2020
Malcolm Slingsby Robertson Prize in Mathematics <i>University of Toronto (best thesis award)</i>	2020

FELLOWSHIPS

INSPIRE Fellowship <i>Department of Science and Technology, Government of India</i>	2010-2015
JNCASR Summer Fellowship <i>JNCASR, India</i>	2012
DAAD WISE Scholarship <i>Germany</i>	2013
IAS Summer Fellowship (not availed) <i>Indian Academy of Sciences, India</i>	2013
MITACS Globalink Research Internship <i>Canada</i>	2014
Rhodes Scholarship finalist (top 18) <i>Oxford University, UK</i>	Class of 2015
TIFR VSRP Fellowship <i>TIFR, India</i>	2015
BIGS Scholarship for Graduate Studies (not availed) <i>Hausdorff Center for Mathematics, Bonn, Germany</i>	2015-2018
MITACS Graduate Fellowship <i>Canada</i>	2015-2018
CRM-ISM Postdoctoral Fellowship <i>Université de Montréal</i>	Fall 2020
PIMS Postdoctoral Fellowship <i>University of British Columbia, Vancouver</i>	January 2021- December 2022
IAS Summer Research Fellowship <i>Institute for Advanced Study, Princeton</i>	Summer 2022

SEMINARS

Introduction to Game Theory <i>Mathematics Club, IISER Mohali</i>	Aug 2012
27 Lines on a Cubic <i>Department Colloquium, IISER Mohali</i>	November 2013
Proofs of Quadratic Reciprocity <i>Department Colloquium, IISER Mohali</i>	April 2014
Linear Groups- Malcev's Theorem and Selberg's Lemma <i>IISER Mohali</i>	April 2014
Principal L-Functions of the Linear Group <i>Department of Math, University of Toronto</i>	August 2016
Understanding the Rank Distribution Conjecture <i>Graduate Seminar, Department of Math, University of Toronto</i>	November 2016
What is an Elliptic Curve? <i>Graduate Seminar, Department of Math, University of Toronto</i>	April 2017
Fun with Tilings <i>Graduate Seminar, Department of Math, University of Toronto</i>	Fall 2018

Möbius Functions and Number Theory <i>Math Camp, Department of Math, University of Toronto</i>	Summer 2019
Pigeonhole Principle and its Applications <i>Graduate Seminar, Department of Math, University of Toronto</i>	January 2020
Iwasawa Theory and Pseudo-nullity Conjectures <i>Invited talk, Algebra & Number Theory Seminar, Université Laval</i>	January 2020
Iwasawa Theory of Fine Selmer Groups <i>Invited talk, QVNTS, Montreal</i>	January 2020
Overview of Iwasawa Theory <i>Invited talk, Junior Number Theory Seminar, University of Toronto</i>	October 2020
Iwasawa Theory of Fine Selmer Groups <i>Invited talk, Fields Institute Number Theory Seminar video</i>	November 2020
Iwasawa Theory of Fine Selmer Groups <i>Invited talk, PIMS Online Colloquium</i>	February 2021
Iwasawa Theory of Fine Selmer Groups <i>Invited talk, Number Theory Seminar, University of Toronto</i>	March 2021
Iwasawa Theory <i>Invited lecture series (3 lectures), Seoul National University</i>	Summer 2021
Iwasawa Theory and Arithmetic Statistics <i>Invited talk, University of Göttingen</i>	June 2021
Iwasawa Theory and Arithmetic Statistics <i>Invited talk, Ohio State University</i>	October 2021
Iwasawa Theory and Arithmetic Statistics <i>Invited talk, Möbius ANT, CRM Montreal</i>	November 2021
Iwasawa Theory and Arithmetic Statistics <i>Invited talk, IISER Mohali Online Colloquium video</i>	November 2021
Iwasawa Theory and Arithmetic Statistics <i>Invited talk, Fields Institute Number Theory Seminar video</i>	January 2022
Fine Selmer Groups, Modular Forms, and Duality <i>Invited talk, Iwasawa Theory Virtual Seminar video (use passcode: upUiJL8%)</i>	February 2022
Studying Hilbert's 10th Problem via Explicit Elliptic Curves <i>Invited talk, IMSc Chennai, India</i>	August 2022
Studying Hilbert's 10th Problem via Explicit Elliptic Curves <i>Invited talk, HRI Allahabad, India</i>	September 2022
Studying Hilbert's 10th Problem via Explicit Elliptic Curves <i>Invited talk, University of Lethbridge</i>	October 2022
Iwasawa Theory and Arithmetic Statistics <i>Invited colloquium talk, HRI Allahabad, India</i>	October 2022
Studying Hilbert's 10th Problem via Explicit Elliptic Curves <i>Invited talk, University of Washington, Seattle</i>	October 2022
Studying Hilbert's 10th Problem via Explicit Elliptic Curves <i>Invited talk, IIT Bombay, India</i>	October 2022
Heuristics for Iwasawa invariants in anti-cyclotomic \mathbb{Z}_p-extensions <i>Invited talk, Philadelphia Area Number Theory Seminar, Bryn Mawr</i>	November 2022
Iwasawa Theory and Arithmetic Statistics <i>Invited colloquium talk, Fordham University</i>	November 2022
Heuristics for Iwasawa invariants in anti-cyclotomic \mathbb{Z}_p-extensions <i>Invited talk, Arizona State University, Tempe</i>	November 2022
Heuristics for Iwasawa invariants in anti-cyclotomic \mathbb{Z}_p-extensions <i>Invited talk, University of Waterloo</i>	January 2023
$p \neq q$ Iwasawa Theory <i>Invited talk, ISI Bangalore</i>	March 2023
$p \neq q$ Iwasawa Theory <i>Invited talk, IISc Bangalore</i>	March 2023
Iwasawa Theory and Arithmetic Statistics <i>Invited talk, Ashoka University</i>	April 2023
Iwasawa Theory and Arithmetic Statistics <i>Invited talk, IIT Gandhinagar</i>	April 2023

Growth of Mordell–Weil ranks in \mathbb{Z}_p-extensions <i>Invited talk, UC Santa Barbara</i>	November 2023
Growth of Mordell–Weil ranks in \mathbb{Z}_p-extensions <i>Invited talk, UBC Vancouver</i>	February 2024
Growth of Mordell–Weil ranks in \mathbb{Z}_p-extensions <i>Invited talk, University of Georgia</i>	February 2023
Beyond Endoscopy via Poisson Summation for $GL(2, K)$ <i>Invited talk, University of Toronto</i>	March 2024
Studying Hilbert’s 10th Problem via Explicit Elliptic Curves <i>Invited talk (pure math seminar), UTRGV (Brownsville campus)</i>	April 2024
Studying Hilbert’s 10th Problem via Explicit Elliptic Curves <i>Invited talk, University of Texas Tyler</i>	April 2024

CONFERENCES, WORKSHOPS AND SUMMER SCHOOLS

Summer Graduate School, MSRI <i>Summer school on Introduction to Character Theory and the McKay Conjecture.</i>	July 2016
PIMS Summer School, UBC Vancouver <i>Summer School on Representation Theory of Finite Groups</i>	July 2016
Montreal-Toronto Workshop in Number Theory, CRM <i>Workshop on Mock Modular Forms</i>	December 2016
5 Day Workshops at BIRS, Banff <i>Workshop on Diophantine Approximation and Algebraic Curves</i>	July 2017
Summer Graduate School, MSRI <i>Summer school on Automorphic Forms and Langlands Program</i>	July 2017
AIM Workshop, San Jose <i>Workshop on Functoriality and the Trace Formula</i>	December 2017
Montreal-Toronto Workshop in Number Theory, CRM <i>Workshop on Unitary Shimura Varieties</i>	January 2018
Arizona Winter School, Tucson <i>Winter school on Iwasawa Theory</i>	March 2018
PIMS Focus Period, UBC Vancouver <i>Focus Period on Representations in Arithmetic</i>	March 2018
Upstate Number Theory Conference, SUNY Buffalo <i>Young Researchers Conference</i>	April 2018
Strength in Numbers, Queen’s University <i>Graduate Student Conference, Contributed talk</i>	May 2018
CTNT Summer School, University of Connecticut <i>Summer School and Conference</i>	May 2018
CNTA Conference, Universite Laval <i>Contributed talk</i>	July 2018
Montreal-Toronto Workshop in Number Theory, CRM <i>Workshop on p-adic Hodge Theory</i>	March 2019
Analytic & Combinatorial Number Theory, UIUC <i>Contributed talk</i>	June 2019
SOGMSC, University of Guelph <i>Contributed talk</i>	June 2019
Boston University-Keio University Workshop <i>Contributed talk</i>	June 2019
Palmetto Number Theory Seminar (PANTS) XXXII <i>Invited talk</i>	September 2019
Maine-Quebec Number Theory Conference <i>Contributed talk</i>	October 2019
MAAIM, Emory University <i>Contributed talk</i>	November 2019
CTNT Conference, University of Connecticut <i>Contributed talk slides</i>	June 2020

Maine-Quebec Number Theory Conference <i>Contributed talk slides video</i>	Fall 2020
John's Hopkins Junior Number Theory Days <i>Invited Talk notes video</i>	December 2020
AIM Workshop, Online <i>Workshop on Arithmetic Intersection Theory on Shimura Varieties</i>	January 2021
CMS Summer Meeting <i>Invited talk, Session: Algebraic Number Theory</i>	June 2021
Workshop on Arithmetic Statistics Problems <i>Invitation-only Conference</i>	July 2021
Maine-Quebec Number Theory Conference <i>Contributed talk</i>	October 2021
Women in Maths: Progress and Challenges, IIT Jodhpur <i>Invited talk</i>	May 2022
Pair of Automorphic Workshops <i>part of Castella-Liu research group</i>	August 2022
CMS Winter Meeting <i>Invited talk, Session: Diophantine Arithmetic Geometry and Number Theory</i>	December 2022
PRIMA Congress <i>Invited talk, Session: Arithmetic geometry: theory and computation</i>	December 2022
5 Day Workshops at BIRS, Banff <i>Workshop on Arithmetic Aspects of Deformation Theory</i>	January 2023
Special values of L-functions, Paderborn University (Germany) <i>Invited talk</i>	March 2023
CMS Summer Meeting <i>Invited talk, Session: Arithmetic aspects of automorphic forms</i>	June 2023
Rethinking Number Theory <i>Project Leader</i>	June 2023
Texas-Oklahoma Representations and Automorphic forms (TORA) <i>Invited talk</i>	October 2023
Brin MRC Workshop - Vistas in Number Theory <i>Invited talk</i>	June 2024
Canadian Number Theory Association (CNTA) Conference XVI <i>Invited talk</i>	June 2024
AMS Fall Central Sectional Meeting <i>Invited talk (session: L-Functions and Automorphic Forms)</i>	September 2024

ORGANIZATION: SEMINARS AND MINI-COURSES

Summer Learning Seminar on Modular Forms <i>Graduate Seminar, Department of Math, University of Toronto</i>	Summer 2017
Summer Learning Seminar on Galois Cohomology <i>Graduate Seminar, Department of Math, University of Toronto</i>	Summer 2017
Introduction to Automorphic Forms and Langlands Program <i>Graduate Seminar, Department of Math, University of Toronto</i>	Fall 2017
Learning Seminar on Classical Iwasawa Theory <i>Graduate Seminar, Department of Math, University of Toronto</i>	Fall 2017
Learning Seminar on Beyond Endoscopy <i>Graduate Seminar, Department of Math, University of Toronto</i>	2017–18
Learning Seminar on Etale Cohomology <i>Graduate Seminar, Department of Math, University of Toronto</i>	Winter 2018
Learning Seminar on Complex Multiplication <i>Graduate Seminar, Department of Math, University of Toronto</i>	Fall 2018
Learning Seminar on p-adic Lie Groups <i>Graduate Seminar, Department of Math, University of Toronto</i>	Summer 2019
Learning Seminar on Tate Conjectures <i>Graduate Seminar, Department of Math, University of Toronto</i>	Fall 2019

CMS Mini-Course on Iwasawa Theory <i>Co-organizer with R. Sujatha</i>	December 2019
Learning Seminar on Abelian ℓ-Adic Representations <i>Graduate Seminar, Department of Math, University of Toronto</i>	Summer 2020
Learning Seminar on Euler system and Eisenstein congruences <i>Iwasawa Seminar, Department of Math, UBC Vancouver</i>	Fall 2020
CRM Women's Seminar <i>Part of the thematic program at CRM</i>	Fall 2020
Learning Seminar on Coleman Families of Modular Forms <i>Part of the thematic program at CRM</i>	Fall 2020
Learning Seminar on Eigenvarieties <i>Iwasawa Seminar, Department of Math, UBC Vancouver notes</i>	Winter 2021
Learning Seminar on Quadratic Twists <i>Iwasawa Seminar, online</i>	Winter 2021
UBC Number Theory Seminar <i>Department of Mathematics, UBC Vancouver</i>	2021- 2022
Beyond Endoscopy Mini Conference <i>Lead Organizer</i>	April 2023
UTRGV Algebra/Number Theory Seminar <i>SMSS, UTRGV</i>	2023 – present
AMS Special Session on Additive Number Theory and Modular Forms <i>Fall Central Sectional Meeting</i>	Fall 2023

TEACHING ASSISTANCE EXPERIENCE (UNIVERSITY OF TORONTO)

MAT223 (Linear Algebra) <i>Instructor: S. Uppal</i>	multiple times
MAT235 (Multivariable Calculus) <i>Instructor: Dr. N. Jung</i>	multiple times
MAT237 (Multivariable Calculus) <i>Instructor: Dr. T. Holden, Prof. R. Gerrard</i>	multiple times
MAT240 (Linear Algebra for Math Specialists) <i>Instructor: Prof. E. Meinrenken</i>	multiple times
MAT246 (Concepts in Abstract Math) <i>Instructor: Dr. J. Korman, Dr. H. Soheil, Prof. F. Murnaghan, Dr. D. Burbulla</i>	multiple times
MAT247 (Linear Algebra II for Math Specialists) <i>Instructor: Prof. S. Kudla</i>	Winter 2018
MAT315 (Elementary Number Theory) <i>Instructor: Prof. H. Kim</i>	Winter 2020
MAT336 (Elements of Analysis) <i>Instructor: Dr. H. Soheil</i>	Winter 2017
MAT401 (Polynomial Equations and Fields) <i>Instructor: Dr. J. Korman</i>	Summer 2017

TEACHING EXPERIENCE

University of Toronto:	
MAT188 (Linear Algebra) <i>Course Coordinator: Dr. D. Burbulla</i>	Fall 2018
MAT136 (Calculus II) <i>Course Coordinator: Dr. S. Mayes-Tang</i>	Winter 2019
MAT136 (Calculus II) <i>Course Coordinator with Dr. D. Le and A. Oswal</i>	Summer 2019
MAT237 (Multivariable Calculus) <i>Course Coordinator with Dr. T. Ens, A. Pannu, and Dr. R. Zhu</i>	Summer 2020

University of British Columbia (Vancouver):	
MAT105 (Integral Calculus for Social Sciences and Commerce)	Winter 2021
<i>Course Coordinator: Prof. K. Liu</i>	
MAT152 (Linear Systems)	Winter 2022
<i>Course Coordinator: Prof. K. Karu</i>	
UTRGV:	
MATH2413 (Calculus I)	Fall 2023
MATH3363 (Algebra I)	Spring 2024

ACADEMIC SERVICES

<i>Refereed for</i>	Mathematika, The Ramanujan Journal, Nagoya Math Journal, Annales Mathématiques du Québec, Canadian Math Bulletin, Czechoslovak Mathematical Journal, Forum Mathematicum, Documenta Math, Acta Arithmetica, Abh. Math. Semin. Univ. Hambg.
<i>Reviewer for</i>	Mathematics Reviews
<i>Examiner for</i>	Christopher M. Stokes (PhD candidate, Arizona State University, 2023) Paul Marsh (Masters thesis committee, UTRGV, Fall 2023) Jacob Gutierrez (Masters thesis committee, UTRGV, Fall 2023)

MENTORSHIP

Math Outreach, UofT	2018–2020
<i>Anna Krokline (2018): research project on graph theory and combinatorics.</i>	
<i>Maya Bozzo-Rey (2019): project on Benford's Law.</i>	
<i>Jennifer Wang (2020): reading project in number theory.</i>	
Undergraduate Mentorship	2021–present
<i>Aug 2021 – Apr 2023: I supervised Adithya Chakravarty (University of Toronto) for his Bachelor's (research) thesis on Iwasawa theory.</i>	
<i>Jan–May 2022: I supervised Vitthal Yellambalse (BITS Goa, India) for his Bachelor's project.</i>	
<i>May–July 2023: I supervised Shubhrojyoti Dhara (ISI Bangalore) and Léonie Chipot (University of Ottawa) for their summer project.</i>	
<i>Sep–present 2023: I am supervising Raul Marquez (UTRGV) for his learning project on elliptic curves and other topics in number theory.</i>	
<i>Sep–present 2023: I am mentoring Samyak Jha (IIT Bombay) for his readings in number theory.</i>	

OTHER SERVICES

Women in Math, Toronto Chapter	2019–2020
<i>Female graduate students from schools in and around the Greater Toronto Area came together for WiM, Toronto Chapter in 2019. I was a part of the core team and a mentor for incoming graduate students.</i>	
Outreach, UBC	2021
<i>I was an adjudicator for MURC 2021. This is an undergraduate level multi-disciplinary research conference organized at UBC every year.</i>	
Panelist at MathPath	July 2021
<i>I was a panelist at the MathPath Summer Camp for middle school students talking about hardships faced as a female mathematician.</i>	
EDI Committee, UBC	2021–2022
<i>I was a member of the UBC Math Department Equity, Diversity and Inclusion Committee.</i>	

REFERENCES

Kumar Murty (murty@math.toronto.edu)

Professor (University of Toronto) & Director (Fields Institute)

R. Sujatha (sujatha@math.ubc.ca)

Professor (UBC Vancouver)

Henri Darmon (henri.darmon@mcgill.ca)

Professor (McGill University)

Otmar Venjakob (venjakob@mathi.uni-heidelberg.de)

Professor (University of Heidelberg)

Lawrence Washington (lcw@umd.edu)

Professor (University of Maryland)

Antonio Lei (antonio.lei@uottawa.ca)

Associate Professor (University of Ottawa)

Fok-Shuen Leung (fsl@math.ubc.ca)

Undergraduate Chair (Department of Mathematics, UBC Vancouver) – for teaching