Debanjana Kundu

Curriculum Vitae

Last Updated: August 25, 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
Indian Institute of Science Education and Research, Mohali, India
CGPA 9.7

MA PhD 2015–2020
University of Toronto, Toronto, Canada

EMPLOYMENT

Université de Montréal Fall 2020
CRM-ISM PostDoc, Thematic Program: Cohomology in Arithmetic

University of British Columbia, Vancouver January 2021–December 2022
PIMS PostDoc Fellow

Fields Institute, Toronto January– June 2023
Visiting Researcher

University of Texas Rio Grande Valley September 2023–present
Assistant Professor

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)
Osaka J. Math. 61(1): 121-146 (January 2024).

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)
Proceedings of the American Math Society 152 (2024), 521-535

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)
Int. J. Number Theory (2024), Volume No. 20, Issue No. 04, pp. 1099 – 1124

20. Studying Hilbert's 10^{th} problem via explicit elliptic curves (with A. Lei and F. Sprung)
accepted for publication in Math Ann.

21. Statistics for anti-cyclotomic Iwasawa invariants of elliptic curves (with J. Hatley and A. Ray)
accepted for publication in Math Z.

PREPRINTS

1. Murmurations of symmetric square of modular forms (with K. Müller) *pre-print available upon request, submitted*

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. Mazur's Growth Number Conjecture in the Rank One Case (with A. Lei) *submitted*

5. Beyond Endoscopy via Trace Formula for $\mathrm{GL}(2, F)$ (with M. Emory, M. Espinosa Lara, T.A. Wong) *available on the arXiv, submitted*

6. On the p-ranks of class groups of certain Galois extensions (with U. Asarhasa, R. Gambheera, E. Nunez Lon-wo, A. Sheth) *available on the arXiv, submitted*

7. Class groups and Selmer groups (with Abhishek) *preprint available upon request*

AWARDS/ GRANTS/ DISTINCTIONS/ PRIZES

Academic Excellence Award (three times) 2010-2015
IISER Mohali (for SGPA 10 in three semesters)
Vivekananda Graduate Award for International Students 2018–2019
University of Toronto
General Motors Women in Mathematics and Science Award 2019–2020
University of Toronto
Malcolm Slingsby Robertson Prize in Mathematics 2020
University of Toronto (best thesis award)
AMS–Simons Travel Grant 2024-26
Early career travel grant ($2500/year)

FELLOWSHIPS

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

SEMINARS

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

Fun with Tilings Fall 2018
Graduate Seminar, Department of Math, University of Toronto

Möbius Functions and Number Theory Summer 2019
Math Camp, Department of Math, University of Toronto

Pigeonhole Principle and its Applications January 2020
Graduate Seminar, Department of Math, University of Toronto

Iwasawa Theory and Pseudo-nullity Conjectures January 2020
Invited talk, Algebra & Number Theory Seminar, Université Laval

Iwasawa Theory of Fine Selmer Groups January 2020
Invited talk, QVNTS, Montreal

Overview of Iwasawa Theory October 2020
Invited talk, Junior Number Theory Seminar, University of Toronto

Iwasawa Theory of Fine Selmer Groups November 2020
Invited talk, Fields Institute Number Theory Seminar video

Iwasawa Theory of Fine Selmer Groups February 2021
Invited talk, PIMS Online Colloquium

Iwasawa Theory of Fine Selmer Groups March 2021
Invited talk, Number Theory Seminar, University of Toronto

Iwasawa Theory Summer 2021
Invited lecture series (3 lectures), Seoul National University

Iwasawa Theory and Arithmetic Statistics June 2021
Invited talk, University of Göttingen

Iwasawa Theory and Arithmetic Statistics October 2021
Invited talk, Ohio State University

Iwasawa Theory and Arithmetic Statistics November 2021
Invited talk, Möbius ANT, CRM Montreal

Iwasawa Theory and Arithmetic Statistics November 2021
Invited talk, IISER Mohali Online Colloquium video

Iwasawa Theory and Arithmetic Statistics January 2022
Invited talk, Fields Institute Number Theory Seminar video

Fine Selmer Groups, Modular Forms, and Duality February 2022
Invited talk, Iwasawa Theory Virtual Seminar video(use passcode: upUiJL8%)

Studying Hilbert's 10th Problem via Explicit Elliptic Curves August 2022
Invited talk, IMSc Chennai, India

Studying Hilbert's 10th Problem via Explicit Elliptic Curves September 2022
Invited talk, HRI Allahabad, India

Studying Hilbert's 10th Problem via Explicit Elliptic Curves October 2022
Invited talk, University of Lethbridge

Iwasawa Theory and Arithmetic Statistics October 2022
Invited colloquium talk, HRI Allahabad, India

Studying Hilbert's 10th Problem via Explicit Elliptic Curves October 2022
Invited talk, University of Washington, Seattle

Studying Hilbert's 10th Problem via Explicit Elliptic Curves October 2022
Invited talk, IIT Bombay, India

Heuristics for Iwasawa invariants in anti-cyclotomic $\mathbb{Z}_p$-extensions November 2022
Invited talk, Philadelphia Area Number Theory Seminar, Bryn Mawr

Iwasawa Theory and Arithmetic Statistics November 2022
Invited colloquium talk, Fordham University

Heuristics for Iwasawa invariants in anti-cyclotomic $\mathbb{Z}_p$-extensions November 2022
Invited talk, Arizona State University, Tempe

Heuristics for Iwasawa invariants in anti-cyclotomic $\mathbb{Z}_p$-extensions January 2023
Invited talk, University of Waterloo

$p \neq q$ Iwasawa Theory March 2023
Invited talk, ISI Bangalore

$p \neq q$ Iwasawa Theory March 2023
Invited talk, IISc Bangalore

Iwasawa Theory and Arithmetic Statistics April 2023
Invited talk, Ashoka University

Iwasawa Theory and Arithmetic Statistics April 2023
Invited talk, IIT Gandhinagar
Growth of Mordell–Weil ranks in $\mathbb{Z}_p$-extensions November 2023
Invited talk, UC Santa Barbara
Growth of Mordell–Weil ranks in $\mathbb{Z}_p$-extensions February 2024
Invited talk, UBC Vancouver
Growth of Mordell–Weil ranks in $\mathbb{Z}_p$-extensions February 2024
Invited talk, University of Georgia
Beyond Endoscopy via Poisson Summation for $\mathbf{GL}(2, K)$ March 2024
Invited talk, University of Toronto
Studying Hilbert's 10th Problem via Explicit Elliptic Curves April 2024
Invited talk (pure math seminar), UTRGV (Brownsville campus)
Studying Hilbert's 10th Problem via Explicit Elliptic Curves April 2024
Invited talk, University of Texas Tyler
p-ranks of class groups via Galois cohomology October 2024
Invited talk, Michigan State University

CONFERENCES, WORKSHOPS AND SUMMER SCHOOLS

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

MAAIM, Emory University November 2019
Contributed talk

CTNT Conference, University of Connecticut June 2020
Contributed talk slides

Maine-Quebec Number Theory Conference Fall 2020
Contributed talk slides video

John's Hopkins Junior Number Theory Days December 2020
Invited Talk notes video

AIM Workshop, Online January 2021
Workshop on Arithmetic Intersection Theory on Shimura Varieties

CMS Summer Meeting June 2021
Invited talk, Session: Algebraic Number Theory

Workshop on Arithmetic Statistics Problems July 2021
Invitation-only Conference

Maine-Quebec Number Theory Conference October 2021
Contributed talk

Women in Maths: Progress and Challenges, IIT Jodhpur May 2022
Invited talk

Pair of Automorphic Workshops August 2022
part of Castella–Liu research group

CMS Winter Meeting December 2022
Invited talk, Session: Diophantine Arithmetic Geometry and Number Theory

PRIMA Congress December 2022
Invited talk, Session: Arithmetic geometry: theory and computation

5 Day Workshops at BIRS, Banff January 2023
Workshop on Arithmetic Aspects of Deformation Theory

Special values of L-functions, Paderborn University (Germany) March 2023
Invited talk

CMS Summer Meeting June 2023
Invited talk, Session: Arithmetic aspects of automorphic forms

Rethinking Number Theory June 2023
Project Leader

Texas-Oklahoma Representations and Automorphic forms (TORA) October 2023
Invited talk

Brin MRC Workshop - Vistas in Number Theory June 2024
Invited talk

Canadian Number Theory Association (CNTA) Conference XVI June 2024
Invited talk video

AMS Fall Central Sectional Meeting September 2024
Invited talk (session: L-Functions and Automorphic Forms)

Automorphic Forms and the Bloch–Kato Conjecture Summer 2025
Invited talk

ORGANIZATION: SEMINARS AND MINI-COURSES

Summer Learning Seminar on Modular Forms Summer 2017
Graduate Seminar, Department of Math, University of Toronto

Summer Learning Seminar on Galois Cohomology Summer 2017
Graduate Seminar, Department of Math, University of Toronto

Introduction to Automorphic Forms and Langlands Program Fall 2017
Graduate Seminar, Department of Math, University of Toronto

Learning Seminar on Classical Iwasawa Theory Fall 2017
Graduate Seminar, Department of Math, University of Toronto

Learning Seminar on Beyond Endoscopy 2017–18
Graduate Seminar, Department of Math, University of Toronto

Learning Seminar on Etale Cohomology Winter 2018
Graduate Seminar, Department of Math, University of Toronto

Learning Seminar on Complex Multiplication Fall 2018
Graduate Seminar, Department of Math, University of Toronto
Learning Seminar on p-adic Lie Groups Summer 2019
Graduate Seminar, Department of Math, University of Toronto
Learning Seminar on Tate Conjectures Fall 2019
Graduate Seminar, Department of Math, University of Toronto
CMS Mini-Course on Iwasawa Theory December 2019
Co-organizer with R. Sujatha
Learning Seminar on Abelian ℓ-Adic Representations Summer 2020
Graduate Seminar, Department of Math, University of Toronto
Learning Seminar on Euler system and Eisenstein congruences Fall 2020
Iwasawa Seminar, Department of Math, UBC Vancouver
CRM Women's Seminar Fall 2020
Part of the thematic program at CRM
Learning Seminar on Coleman Families of Modular Forms Fall 2020
Part of the thematic program at CRM
Learning Seminar on Eigenvarieties Winter 2021
Iwasawa Seminar, Department of Math, UBC Vancouver notes
Learning Seminar on Quadratic Twists Winter 2021
Iwasawa Seminar, online
UBC Number Theory Seminar 2021- 2022
Department of Mathematics, UBC Vancouver
Beyond Endoscopy Mini Conference April 2023
Lead Organizer
UTRGV Algebra/Number Theory Seminar 2023 – present
SMSS, UTRGV
AMS Special Session on Additive Number Theory and Modular Forms Fall 2024
Fall Central Sectional Meeting
CMS Session on Arithmetic Aspects of Galois representations Fall 2024
Winter CMS Meeting
Automorphic Forms Workshop Spring 2025
co-organizer

TEACHING ASSISTANCE EXPERIENCE (UNIVERSITY OF TORONTO)

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

TEACHING EXPERIENCE

University of Toronto:

MAT188 (Linear Algebra) Fall 2018
Course Coordinator: Dr. D. Burbulla

MAT136 (Calculus II) Winter 2019
Course Coordinator: Dr. S. Mayes-Tang

MAT136 (Calculus II) Summer 2019
Course Coordinator with Dr. D. Le and A. Oswal

MAT237 (Multivariable Calculus) Summer 2020
Course Coordinator with Dr. T. Ens, A. Pannu, and Dr. R. Zhu

University of British Columbia (Vancouver):

MAT105 (Integral Calculus for Social Sciences and Commerce) Winter 2021
Course Coordinator: Prof. K. Liu

MAT152 (Linear Systems) Winter 2022
Course Coordinator: Prof. K. Karu

UTRGV:

MATH2413 (Calculus I) Fall 2023

MATH3363 (Algebra I) Spring 2024

MATH2318 (Linear Algebra) Fall 2024

ACADEMIC SERVICES

Refereed for	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.
Reviewer for	Mathematics Reviews
Examiner for	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)

BACHELORS THESIS/PROJECT SUPERVISION

Adithya Chakravarthy (University of Toronto) 2021 – 2023
research on the Iwasawa theory of fine Selmer groups (thesis)

Vitthal Yellambalse (BITS Pilani, Goa campus) Jan – May 2022
Bachelors project on theory of cyclotomic fields

Alejandro Delgado (UTRGV) Fall 2024
Bachelors project

Raul Marquez (UTRGV) Fall 2024
Bachelors project

MASTERS THESIS/PROJECT SUPERVISION

Ama Quansah (UTRGV) Fall 2024
Masters project

Dawson Strong (UTRGV) Fall 2024
Masters project

MENTORSHIP

Math Outreach, UofT 2018–2020
Anna Krokhine *(2018): research project on graph theory and combinatorics.*
Maya Bozzo-Rey *(2019): project on Benford's Law.*
Jennifer Wang *(2020): reading project in number theory.*

Undergraduate Mentorship 2021–present
Shubrojyoti Dhara; *ISI Bangalore (May–July 2023): Theory of ellitic curves*
Léonie Chipot; *University of Ottawa (May–June 2023): Proof writing.*
Raul Marquez; *UTRGV (Sep 2023–Apr 2024): Theory elliptic curves & topics in number theory.*
Samyak Jha; *IIT Bombay (Sep–Dec 2023): Project on p-adic L-functions.*
Aniruddha Mondal; *IISER Mohali (May–July 2024): p-adic numbers.*
Parkhi Nandini Mandar; *IISER Bhopal (May–July 2024): p-adic numbers.*

OTHER SERVICES

Women in Math, Toronto Chapter 2019–2020
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.

Outreach, UBC 2021
I was an adjudicator for MURC 2021. This is an undergraduate level multi-disciplinary research conference organized at UBC every year.

Panelist at MathPath July 2021
I was a panelist at the MathPath Summer Camp for middle school students talking about hardships faced as a female mathematician.

EDI Committee, UBC 2021-2022
I was a member of the UBC Math Department Equity, Diversity and Inclusion Committee.

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