Prof. Dan M. Ciubotaru

CONTACT INFORMATION

Mathematical Institute
University of Oxford
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Radcliffe Observatory Quarter
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ACADEMIC POSITIONS

September 2017– . Professor of Mathematics, University of Oxford.

July 2019– . Diana Brown Fellow and Tutor in Pure Maths, Somerville College, Oxford.

September 2022– . Academic Lead Prelims and Part A, Mathematical Institute, Oxford.

September 2014– June 2019 . Tutorial Fellow at Somerville College, Oxford.

September 2014–August 2017. Associate Professor of Pure Mathematics, University of Oxford.

July 2011–August 2014. Associate Professor of Mathematics, University of Utah.

July 2007–June 2011. Assistant Professor of Mathematics, University of Utah.

July 2004–June 2007. C.L.E. Moore Instructor, Massachusetts Institute of Technology.

Visiting Professor/Scholar:

March 2022. Université de Lorraine, Metz;
September 2021. Université de Paris - Sorbonne Université;
March and September 2017. Aix-Marseille Université;
June 2017. Weizmann Institute, Israel;
November 2013. Hong Kong University of Science and Technology;
September 2013. Massachusetts Institute of Technology;
May 2012. Hong Kong University of Science and Technology;
August 2011. Max Planck Institute, Bonn;
June 2008. Max Planck Institute, Bonn.

EDUCATION

Cornell University, Ithaca, NY

- Ph.D., Department of Mathematics, August 2004; Thesis: Unitary representations of split p-adic exceptional groups; Advisor: Prof. Dan Barbasch.

Babeş-Bolyai University, Cluj-Napoca, Romania

- B.S. and M.A., Department of Mathematics and Computer Science, July 1998; Advisor: Prof. Andrei Mărcuş.

RESEARCH GRANTS

Engineering and Physical Sciences Research Council, UK

EPSRC EP/V046713/1, 01/2021–12/2023, "New Horizons" grant, *Unitary representations of reductive p-adic groups*, Principal Investigator, £202K.
EPSRC EP/N033922/1, 09/2016–08/2020, Standard Grant, *Dirac operators in representation theory*, Principal Investigator, £432K.

National Science Foundation, USA

NSF-DMS 1302122, 07/2013–09/2016, Standard Grant, *Unitary representations of affine Hecke algebras and reductive p-adic groups*, Principal Investigator, $135K.

NSF-DMS 0968065, 07/2010–06/2013, Standard Grant (part of the Focused Research Group *Atlas of Lie groups: Unitary representations*), Principal Investigator, $87K.

NSF-DMS 0554278, 07/2007-06/2006, FRG collaborative grant, *Atlas of Lie groups and representations*, Personnel, $40K.

NSF-DMS 0532088, 07/2005-06/2006, FRG collaborative grant, *Atlas of Lie groups and representations*, Personnel, $10K.

National Security Agency – Mathematical Sciences Program, USA

NSA-AMS 111016, 04/2013–09/2014, Young Investigator Award, *Dirac cohomology of unitary Hecke algebra modules*, Principal Investigator, $30K.

NSA-AMS 081022, 01/2010–01/2012, Young Investigator Award, *Unitary modules of affine Hecke algebras*, Principal Investigator, $30K.

Teaching Awards

MPLS Individual Teaching Award (2017), Oxford.

M.A. Oxford (2014), degree by resolution.

Faculty Undergraduate Teaching Award (2011), Department of Mathematics, University of Utah.

Graduate Student Teaching Award (2003), Department of Mathematics, Cornell University.

Papers

Preprints

1. Local character expansions via positive-depth Barbasch-Moy theory, with E. Okada, `arXiv:2307` (2023), 16 pages.
2. The wavefront sets of unipotent representations of reductive p-adic groups II, with L. Mason-Brown and E. Okada, `arXiv:2303.10713` (2023), 54 pages, submitted.
3. The wavefront sets of unipotent representations of reductive p-adic groups I, with L. Mason-Brown and E. Okada, `arXiv:2112.14354v4` (2022), 49 pages, submitted.
4. The wave front sets of unipotent supercuspidal representations, with L. Mason-Brown and E. Okada, `arXiv:2206.08628` (2022), 20 pages, submitted.
5. On the generalized Ramanujan conjecture over function fields, with M. Harris, `arXiv:2204.06053` (2022), 20 pages, submitted.
6. A nonabelian Fourier transform for tempered unipotent representations, with A.-M. Aubert and B. Romano, `arXiv:2106.13969` (2021), 52 pages, submitted.
7. Deformations of unitary Howe dual pairs, with H. De Bie, M. De Martino, R. Oste, `arXiv:2009.05412` (2020), 26 pages, submitted.
8. The nonabelian Fourier transform for elliptic unipotent representations of exceptional p-adic groups, `arXiv:2006.13540` (2020), 27 pages, submitted.
9. Hermitian forms for affine Hecke algebras, with D. Barbasch, `arXiv:1312.3316v2` (2015), 29 pages.

Published

10. Some unipotent Arthur packets for reductive p-adic groups, with L. Mason-Brown and E. Okada, `arXiv:2210.00251v2` (2023), 17 pages, to appear in *IMRN*.
11. Symplectic Dirac operators for Lie algebras and graded Hecke algebras, with M. De Martino and P. Meyer, *Transformation Groups*, online 08/2022, `doi.org/10.1007/s00031-022-09762-4`
12. Weyl groups, the Dirac inequality, and isolated unitary unramified representations, Special issue to the memory of T.A. Springer, *Indag. Math.* **33** (2022), no. 1, 1–23.
13. Cocenters of p-adic groups III: elliptic and rigid cocenters, with X. He, *Peking Math. Journal* (2021), **4**, no. 2, 159–186.
14. Dirac induction for rational Cherednik algebras, with M. De Martino, *IMRN* **17** (2020), 5155–5214.

15. The Dunkl-Cherednik defomation of a Howe duality, with M. De Martino, *J. Algebra* **560** (2020), 914–959.

16. Star operations for affine Hecke algebras, with D. Barbasch, *Representation Theory, Automorphic Forms, and Complex Geometry: A Tribute to Wilfried Schmid*, International Press Boston, 2019, 107–137.

17. On the reducibility of induced representations for classical p-adic groups and related affine Hecke algebras, with V. Heiermann, *Israel Journal Math*, **231** (2019), no. 1, 379–417.

18. An Euler-Poincaré formula for a depth zero Bernstein projector, with D. Barbasch and A. Moy, *Representation Theory* **23** (2019), 154–187.

19. Types and unitary representations of reductive p-adic groups, *Invent. Math.* **213** (2018), no. 1, 237–269.

20. One-W-type modules for rational Cherednik algebra and cuspidal two-sided cells, *Bull. Inst. Math. Acad. Sinica*, **13** (2018), no. 1, 1–29.

21. Cocenters and representations of affine Hecke algebras, with X. He, *Jour. Eur. Math. Soc.* **19** (2017), no. 10, 3143–3177.

22. A uniform classification of discrete series representations of affine Hecke algebras, with E. Opdam, *Algebra and Number Theory* **11**, no. 5 (2017), 1089–1134.

23. On the elliptic nonabelian Fourier transform for unipotent representations of p-adic groups, with E. Opdam, 18 pages, *"Representation Theory, Number Theory, and Invariant Theory: In Honor of Roger Howe on the Occasion of His 70th Birthday"*, Progr. Math. **323**, Birkhäuser (2017), 87–113.

24. Dirac cohomology for symplectic reflection algebras, *Selecta Math.* **22** (2016), no. 1, 111–144.

25. Ladder representations of $GL(n, Q_p)$, with D. Barbasch, Representations of Reductive Groups: in honor of the 60th birthday of David A. Vogan, Jr., *Progr. Math.* **312**, Birkhäuser (2016), 117–137.

26. The cocenter of graded affine Hecke algebra and the density theorem, with X. He, in *J. Pure Appl. Algebra* **220** (2016), no. 1, 382–410.

27. Green polynomials, elliptic pairings, and the extended Dirac operator, with X. He, *Adv. Math.* **283** (2015), 1–50.

28. Formal degrees of unipotent discrete series representations and the exotic Fourier transform, with E. Opdam, *Proc. London Math. Soc.* **110** (2015), no. 3, 615–646.

29. Dirac cohomology of one-W-type representations, with A. Moy, *Proc. Amer. Math. Soc.* **143** (2015), no. 3, 1001–1013.

30. Unitary Hecke modules with nonzero Dirac cohomology, with D. Barbasch, *Symmetry in Representation Theory and Its Applications: in honor of Nolan Wallach*, Progress in Mathematics, Birkhäuser **257** (2015), 1–20.

31. Special unipotent representations, with P. Trapa, in appendix (6 pages) to "Small representations, string instantons, and Fourier modes of Eisenstein series" by M. B. Green, S. D. Miller, and P. Vanhove, *J. Number Theory* **146** (2015), 187–309.

32. Algebraic and analytic Dirac induction for graded affine Hecke algebras, with E. Opdam and P. Trapa, *J. Inst. Math. Jussieu* **13** (2014), no. 3, 447–486.

33. Unitary equivalences for reductive p-adic groups, with D. Barbasch, *Amer. J. Math.* **135** (2013), no. 6, 1633–1674.

34. Characters of Springer representations on elliptic conjugacy classes, with P. Trapa, *Duke Math. J.* **162** (2013), no. 2, 201–223.

35. Dirac cohomology for graded affine Hecke algebras, with D. Barbasch and P. Trapa, *Acta Math.* **202** (2012), no. 2, 197–227.

36. Spin representations of Weyl groups and Springer's correspondence, *J. Reine Angew. Math.* **671** (2012), 199–222.

37. On characters and formal degrees for classical affine Hecke algebras, with M. Kato and S. Kato, *Invent. Math.* **187** no. 3 (2012), 589–635.

38. Duality for $GL(n,R)$, $GL(n,Q_p)$, and the degenerate affine Hecke algebra for $gl(n)$, with P. Trapa, *Amer. J. Math.* **134** (2012), 1–30.

39. Regular orbits of symmetric subgroups on partial flag varieties, with K. Nishiyama and P. Trapa, *Representation Theory, Complex Analysis, and Integral Geometry*, Birkhäuser (2012), 61–86.

40. Tempered modules in exotic Deligne-Langlands correspondence, with S. Kato, *Adv. Math.* **226**, issue 2 (2011), 1538–1590.

41. Functors for unitary representations of real classical groups and affine Hecke algebras, with P. Trapa, *Adv. Math.* **227** (2011), no. 4, 1585–1611.

42. Reducibility of generic unipotent standard modules, with D. Barbasch, *J. Lie Theory* **21** (2011), no. 4, 837–846.

43. Ramanujan bigraphs arising from p-adic $SU(3)$, with C. Ballantine, *Proc. Amer. Math. Soc.* **139** (2011), no. 6, 1939–1953.

44. Whittaker unitary dual for affine graded Hecke algebras of type E, with D. Barbasch, *Compositio Math.* **145**, issue 6 (2009), 1563–1616.

45. On unitary unipotent representations of p-adic groups and affine Hecke algebras with unequal parameters, *Represent. Theory* **12** (2008), 453–498.

46. Multiplicity matrices for the affine graded Hecke algebra, *J. Algebra* **320** (2008), 3950–3983.

47. Unitarizable minimal principal series of reductive groups, with D. Barbasch and A. Pantano, *Contemp. Math.*, **472**, Amer. Math. Soc., 2008, 63–136.

48. Unitary I-spherical representations for split p-adic E_6, *Represent. Theory* **10** (2006), 435–480.

49. Spherical unitary principal series, with D. Barbasch, *Pure Appl. Math. Q.* **1** (2005), no. 4, 755–789.

50. The unitary I-spherical dual of split p-adic F_4, *Represent. Theory* **9** (2005), 94–137.

Teaching

University of Oxford

C2.7: Category Theory: MT 2023, MT 2022, MT 2021;
C3.5: Lie groups: HT 2023;
B2.1 Introduction to Representation Theory: MT 2019, MT 2018; MT 2017;
M3 Prelims Introduction to Calculus: MT 2019, 2021;
C2.1 Lie algebras: MT 2014, MT 2015, MT 2016;
C2.3 Representations of semisimple Lie algebras (created the course in Hilary 2016): HT 2016, HT 2017, HT 2018;
Tutorials in Pure Maths (Somerville College), intercollegiate classes (Maths Institute).

University of Utah

Modern Algebra I, Modern Algebra II, Topics in Representation Theory, Graduate Complex Analysis, Foundations of Analysis I, Foundations of Analysis II, Multivariable Calculus, Discrete Mathematics, Trigonometry, Business Algebra.

Massachusetts Institute of Technology
Analysis I (published by MIT OpenCourseWare), Mathematical Methods for Engineering I, Linear Algebra (published by MIT OpenCourseWare), Seminar in Analysis (Applications to number theory), Calculus I.

Cornell University
Calculus for Engineers, Calculus I, Calculus II.

Invited Talks

Conferences, Workshops
Recent selected talks:

- Elliptic representations, "Trends in Representation Theory", Universitatea Babeş-Boyai, Cluj-Napoca, September 2023.
- Elliptic representations, LMS Northern Regional meeting, York, September 2023.
- A nonabelian Fourier transform for unipotent representations, "Representation Theory, Combinatorics and Geometry", IMS Singapore, January 2023.
- Wavefront sets of unipotent representations (zoom), "Langlands Program: Number Theory and Representation Theory", BIRS, Oaxaca, Mexico, November 2022.
- Wavefront sets of unipotent representations, "From E_6 to $\tilde{\tilde{E}}_{60}$", a conference in honour of Eric Opdam, Amsterdam, September 2022.
- Wavefront sets of unipotent representations of p-adic groups, Satellite conference of vICM 2022, Geometric Representation Theory, online, July 2022.
- Elliptic nonabelian Fourier transforms for unipotent representations, Geometry and representation theory, IHP, Paris, January 2020.
- Invariant hermitian forms, Bernstein projectives, and Jacquet functors, Recent developments in representations of p-adic groups, Oberwolfach, Germany, October 2019.
- Hermitian forms and semisimple Jacquet modules, Representation Theory XVI, Dubrovnik, Croatia, June 2019.
- Higher depth preservation of unitarity for representations of p-adic groups, Representation theory of reductive groups over local fields and applications to automorphic forms, Weizmann Institute, Israel, June 2017.
- Tutorial on affine Hecke algebras I-III, Recent developments in representation theory, graduate school and conference, Singapore, March 2016.
- Dirac cohomology for rational Cherednik algebras and two-sided cells, Representation theory of algebraic groups, a conference in honor of George Lusztig on his 70th birthday, Academia Sinica, Taipei, January 2016.
- Characters of unipotent discrete series of semisimple p-adic groups (3 talks), Summer School: Reductive groups, Franken-Akademie, Schloss Schney, Germany, August 2015.
- Formal degrees of unipotent discrete series representations, Representation theory, number theory, and invariant theory, a conference in honor of Roger Howe on his 70th birthday, Yale University, June 2015.
- Formal degrees and the nonabelian Fourier transform, Representations of reductive groups, a conference dedicated to David Vogan on his 60th birthday, M.I.T., Cambridge, MA, May 2014.
- Green polynomials and representations of the pin cover of the Weyl group, Algebraic groups and Representation theory, a conference in the memory of T. A. Springer, Hong Kong, January 2013.

Since 2004, I have given about 40 other invited talks at international conferences, including: Amsterdam, China (Hangzhou, Tianjin, Sanya), France (Luminy, Porquerolles), Germany (Bonn, Heiligkreuztal), Croatia (Dubrovnik, Zagreb), USA (Boston, Palo Alto, Salt Lake City, St Paul, Evaston, New Orleans), Japan (Tokyo, Sapporo), Canada (Banff, Windsor), Romania (Alba-Iulia, Bucharest), UK (Leeds, Oxford, Manchester).

Colloquia, Seminars
I have given many colloquia and seminar talks, including:

- UK: Oxford, Cambridge, Sheffield, Durham, Birmingham, East Anglia, York
- USA: MIT, Utah, Cornell, Princeton/IAS, Maryland, Rutgers, American Mathematical Institute (zoom), Michigan (zoom), Rutgers, Northeastern, Boston College, Notre Dame, UMass
- France: Paris (Jussieu, Dennis Diderot), Metz, Marseille, Clermont-Ferrand
- Cluj-Napoca Romania, Amsterdam, Weizmann Israel (zoom), Talca Chile (zoom), Hong Kong (HKUST, HKU), Kyoto Japan.

Mentorship

Postdoctoral researchers.

Dr. Lucas Mason-Brown (2021-22), grant EP/V046713/1.
Dr. Beth Romano (2019–2022), JRF Somerville College.
Dr. Marcelo Gonçalves de Martino (2016–2021), grants EPSRC EP/N033922/1 and EP/V046713/1.
Dr. Philippe Meyer (2019–2020), grant EPSRC EP/N033922/1.
Dr. Baiying Liu (Utah, 2013–2015), grant NSF-DMS 1302122.

Students supervision.

Max MacKie (Oxford, DPhil student, 2023–).
Mick Gielen (Oxford, DPhil student, 2022–).
Elena Collaciani (Padova, PhD student 2022–, co-supervised with Giovanna Carnovale).
Ruben La (Oxford, DPhil 2023).
Emile Okada (Oxford, DPhil 2022, co-supervised with Kevin McGerty).
Xin Zhao (Oxford, DPhil 2022, co-supervised with Kevin McGerty).
Kieran Calvert (Oxford, DPhil 2019).
Teresa Conde (Oxford, DPhil 2016, principal supervisor: Karin Erdmann).
Kei Yuen Chan (Utah, PhD 2014, principal supervisor: Peter Trapa).
Benjamin Trahan (Utah, PhD 2011, co-supervised with Peter Trapa).

Oxford Master theses: 10 students 2016–2023.

Supervised 7 undergraduate summer research projects in Oxford (2016–2022) and 3 Research Experience for Undergraduates projects in Utah (2012–2014).

DPhil Examiner

External Examiner: University of East Anglia, (2019), Rutgers University (2018), University of Amsterdam (2015).
Internal Examiner: Oxford and University of Utah (multiple times).

University Service

University of Oxford.
Academic Lead, Prelims and Part A, 2022-.
Teaching committee, 2021-.
Prelims Examiner, 2018-2022. Chair of prelims examiners, 2019-2021.
Hiring panels: Oxford, 7 times.

Somerville College, Oxford.

Member of the Governing Body, since October 2014.
Member of the Education Committee, since October 2014, Buildings Committee, 2016-17, Travel and Grants Committee 2018-20, Library Committee 2018-20, Standing Committee, 2021-.
Admissions for Somerville College, since 2014.
Personal tutor for Somerville Maths undergraduates and College adviser for graduate students.
Outreach and Access activities: open days, lectures for prospective applicants.

University of Utah.
Committee work: graduate recruitment (2009–2014); hiring (2012–2013); math circles (2008–2009, 2011–2012); undergraduate colloquium (2007–2010); library committee (2008–2009), Science Day (2012).

Organized: Representation theory seminar, 2008–2011; Math Circle for high school students (2008-2009 and 2012-2013); ACCESS session lecturer, June 2010; Early Research Directions: Representation Theory, Spring 2008; graduate reading courses.

Professional Service

Editor of *Documenta Mathematica*, since 2015 and *Quarterly Journal of Mathematics*, since 2017.

Panelist for the National Science Foundation (USA), 4 times.

Refereed grant applications for UKRI, NSF and NSA (USA), European Research Committee, funding agencies in France, Germany, Israel, Hong Kong, Chile, Mexico.

Co-organized (with J. Fintzen, X. He, Y. Sakellaridis) the conference "Anaparastaseis: Orbits, Hecke algebras, and representations", Nisyros, Greece, July 2023.
Co-organized (with C. Kriloff and P. Trapa) a special session on "Reductive groups and Hecke algebras" at the A.M.S. Sectional Meeting, Salt Lake City, UT, October 2011.

Refereed papers for many mathematical journals.

Member of the American Mathematical Society (since 2003) and London Mathematical Society (since 2014).