Amlan Banaji

Curriculum Vitae

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Research Associate in Fractal Geometry at Loughborough University's mathematics department since March 2023

Nationality: UK

RESEARCH INTERESTS

My main research interests are in geometry and analysis related to fractal sets and measures. These 'fractals' exhibit complexity over a wide range of scales, and often arise in a natural dynamical way, such as via (conformal or non-conformal) iterated function systems. Currently, I am especially interested in the rate of decay of the Fourier transform of stationary measures for such systems. I have also done a lot of work exploring different ways one can define 'dimension,' to provide refined information about the global or local scaling properties of classes of sets or measures. I enjoy finding connections between these topics and other areas of mathematics such as number theory and probability theory.

PUBLICATIONS AND PREPRINTS

Preprints:

10. S. Baker and A. Banaji. *Polynomial Fourier decay for fractal measures and their pushforwards*. arXiv

9. A. Banaji, J. M. Fraser, I. Kolossváry and A. Rutar. *Assouad spectrum of Gatzouras–Lalley carpets.* arXiv

8. A. Banaji, A. Rutar and S. Troscheit. *Interpolating with generalized Assouad dimensions*, Submitted. arXiv

7. A. Banaji and I. Kolossváry. *Intermediate dimensions of Bedford–McMullen carpets with applications to Lipschitz equivalence*, Submitted to Advances in Mathematics. arXiv

6. A. Banaji and J. M. Fraser. *Assouad type dimensions of infinitely generated self-conformal sets* Submitted to Nonlinearity. arXiv

Published:

5. A. Banaji. *Generalised intermediate dimensions*
Monatshefte für Mathematik 202 (2023), 465–506. arXiv

4. A. Banaji. *Metric spaces where geodesics are never unique*
To appear in the **American Mathematical Monthly** 130 (2023), 747–754. arXiv

3. A. Banaji and J. M. Fraser. *Intermediate dimensions of infinitely generated attractors*
Transactions of the American Mathematical Society 376 (2023), 2449–2479. arXiv

2. A. Banaji and H. Chen. *Dimensions of popcorn-like pyramid sets*
Journal of Fractal Geometry 10 (2023), 151–169. arXiv

1. A. Banaji and A. Rutar. *Attainable forms of intermediate dimensions*
Annales Fennici Mathematici 47 (2022), 939–960. arXiv

EDUCATION

University of St Andrews
2019–2023

PhD Mathematics

Thesis: "Interpolating between Hausdorff and box dimension" (defended May 2023)
With the Analysis Research Group
Topic: Fractal geometry and dimension theory
Supervisors: Prof. Jonathan Fraser (primary), Prof. Kenneth Falconer
Fully funded by the Leverhulme Trust

University of St Andrews
2018–2019

MSc Mathematics, Distinction

GPA: 19.5/20. Ranked 1st in the Faculty of Science and Medicine

Dissertation:
Solvability of Partial Differential Equations on Fractal Domains
(Score: 19.1/20, supervised by Professor Kenneth Falconer)

University of Cambridge,
King's College
2015–2018

BA (Hons) Mathematics

Selected Part II courses: Linear Analysis, Analysis of Functions, Topics in Analysis, Differential Geometry, Riemann Surfaces, Logic and Set Theory

PRIZES AND GRANTS

- *2023–4:* Awarded **£500 LMS Travel Grant** for Early Career Researchers to visit the University of Oulu
- *2019*: **Postgraduate Gray Prize** for the best MSc student in the Faculty of Science and Medicine at the University of St Andrews.

TALKS

I have given at least 35 talks (see https://amlan-banaji.github.io/files/BanajiTalks.pdf) at conferences and seminar series including:

- Topology and Dynamics Seminar (Birmingham, 8/2/24)
- Geometric Analysis Seminar (Jyväskylä, 1/2/24)
- Analysis Seminar (Oulu, 26/1/24)
- Fractal Geometry (celebrating Prof. Kenneth Falconer's 70th birthday, ICMS, Edinburgh, 4/7/23)
- Multifractal analysis and self-similarity (CIRM, Marseille, 30/6/23)
- Diophantine Approximation, Dynamics, and Fractals (Exeter, 22/6/23)
- Thermodynamic Formalism: Non-additive Aspects and Related Topics (Będlewo, 16/5/23)
- Ergodic Theory and Dynamical Systems Seminar (Bristol, 13/3/23)
- Analysis Seminar (Edinburgh, 13/3/23)
- One World Fractals (online, 18/1/23)
- Szenzhen Technology University Mathematics Colloquium (China (online), inaugural talk, 22/10/22)
- Fractals and Related Fields IV (Porquerolles, France, 5/9/22)
- Geometry of Deterministic and Random Fractals (Budapest University of Technology and Economics, 30/6/22)
- Workshop on affine and overlapping iterated function systems (Bristol, 11/5/22)
- Analysis Seminar (St Andrews, 22/3/23, 3/5/22, 12/10/21, 20/4/21, 30/6/20)

EXPERIENCE

- **Teaching undergraduate tutorials at the University of St Andrews:**
  Most recent student feedback score: 1.5 on a scale from 1 to 5 (where 1 is highest).
  2019–2022: MT2502 Analysis (10 groups total)
  2021: MT2505 Abstract Algebra (2 groups)
  2020: MT1003 Pure and Applied Mathematics (2 groups)

- *2018–2022:* **Tutoring** mathematics (undergraduate, A level and STEP) with G5 Education, Oxford Exclusif Tutorial Agency, PhD Tutors, Sishu Chinese School, and privately.

- *2018*: LMS-funded **Cambridge Summer Research in Mathematics (SRIM) project** on Leray-Schauder Topological Degree Theory and its applications to Partial Differential Equations.

SERVICE

- *2023–4:* **Co-organiser** of Workshop on Ergodic Theory and Fractal Geometry at Loughborough University
- *2023–present:* **Co-organiser** of the Loughborough University Dynamical Systems Seminar
- *2022–present*: **Referee** for *Proc. Roy. Soc. Edinburgh Sect. A* and *Colloq. Math.* and *Amer. Math. Monthly* and *J. Math. Anal. Appl.*
- *2022:* **Organiser** of St Andrews Analysis Reading Group
- *2021*: **Co-organiser** of the Postgraduate Interdisciplinary Mathematics Symposium (PIMS), St Andrews.
- *2019–2021*: **Treasurer** of St Andrews Mindfulness Society.

MEMBERSHIP OF PROFESSIONAL BODIES

London Mathematical Society, Edinburgh Mathematical Society, Institute of Mathematics and its Applications