

# Amlan Banaji

Curriculum Vitae

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

Nationality: UK

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## RESEARCH INTERESTS

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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.

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## PUBLICATIONS AND PREPRINTS

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Submitted preprints:

11. A. Banaji and A. Rutar. *Lower box dimension of infinitely generated self-conformal sets*. [arXiv](#)
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*. [arXiv](#)

Published:

7. A. Banaji and I. Kolossváry. *Intermediate dimensions of Bedford–McMullen carpets with applications to Lipschitz equivalence*, **Advances in Mathematics** 449 (2024), 109735. [arXiv](#)
6. A. Banaji and J. M. Fraser. *Assouad type dimensions of infinitely generated self-conformal sets*, **Nonlinearity** 37 (2024), 045004. [arXiv](#)
5. A. Banaji. *Generalised intermediate dimensions*, **Monatshefte für Mathematik** 202 (2023), 465–506. [arXiv](#)
4. A. Banaji. *Metric spaces where geodesics are never unique*, **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](#)

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## EDUCATION

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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 1<sup>st</sup> 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

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**PRIZES AND GRANTS**

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- 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.

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**TALKS**

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I have given at least 40 talks (see <https://amlan-banaji.github.io/files/BanajiTalks.pdf>) at conferences and seminar series including:

- Invited minicourse, Focused workshop on Harmonic analysis methods in fractal geometry, Budapest, 4/11/24–8/11/24
- Fractal Geometry and Stochastics 7 (Chemnitz, 26/9/24)
- Afternoon workshop on Fourier analysis, fractals, and finite fields (invited talk, St Andrews, 18/9/24)
- Geometry and fractals under the midnight Sun (Oulu, 27/6/24)
- British Early Career Mathematicians' Colloquium (keynote talk, Birmingham, 14/6/24)
- British Mathematical Colloquium (BMC) (Manchester, 19/6/24)
- Geometric Analysis Seminar (Jyväskylä, 1/2/24)
- 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)
- One World Fractals (online, 18/1/23)
- Szenzhen Technology University Mathematics Colloquium (inaugural talk, China (online), 22/10/22)
- Fractals and Related Fields IV (Porquerolles, 5/9/22)
- Geometry of Deterministic and Random Fractals (Budapest, 30/6/22 and 2/9/24)

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**EXPERIENCE**

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- March–May 2024: **lectured** second-year course “Elements of Topology” at Loughborough to 90 students
- 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.

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**SERVICE AND MEMBERSHIPS**

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- 2023–present: **Co-organiser** of the Loughborough University Dynamical Systems Seminar
- 2022–present: **Referee** for *Math. Ann.*; *Adv. Math.*; *Ergodic Theory Dynam. Systems*; *Proc. Roy. Soc. Edinburgh Sect. A*; *Colloq. Math.*; *Amer. Math. Monthly*; *J. Math. Anal. Appl.*; *Real Anal. Exchange*; *MathSciNet*
- 2024: **Co-organiser** of Workshop on Ergodic Theory and Fractal Geometry at Loughborough University
- 2022: **Organiser** of St Andrews Analysis Reading Group
- 2021: **Co-organiser** of the Postgraduate Interdisciplinary Mathematics Symposium (PIMS), St Andrews.
- Member of London Mathematical Society, Institute of Mathematics and its Applications