Amlan Banaji

Curriculum Vitae

Marie Skłodowska-Curie Actions (MSCA) postdoctoral fellow in mathematics at the University of Jyväskylä, Finland

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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, and my MSCA fellowship is titled 'Fourier decay for nonlinear fractal measures.' 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

Submitted preprints:

12. A. Banaji and H. Yu. Fourier transform of nonlinear images of self-similar measures: quantitative aspects, arXiv

11. A. Banaji and A. Rutar. Lower box dimension of infinitely generated self-conformal sets, arXiv

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

Published:

9. S. Baker and A. Banaji. *Polynomial Fourier decay for fractal measures and their pushforwards,* **Mathematische Annalen** 392 (2025), 209–261. arXiv

8. A. Banaji, A. Rutar and S. Troscheit. *Interpolating with generalized Assouad dimensions,* **Journal of Geometric Analysis** 35 (2025), 270, 57pp. arXiv

7. A. Banaji and I. Kolossváry. *Intermediate dimensions of Bedford–McMullen carpets with applications to Lipschitz equivalence,* **Advances in Mathematics** 449 (2024), 109735, 69pp arXiv

6. A. Banaji and J. M. Fraser. *Assouad type dimensions of infinitely generated self-conformal sets,* **Nonlinearity** 37 (2024), 045004, 31pp. 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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EMPLOYMENT HISTORY AND EDUCATION

University of Jyväskylä *2025–present*	**Postdoctoral Researcher in Mathematics** Working with Tuomas Orponen, on fractal geometry and Fourier decay, with an MSCA postdoctoral fellowship since September 2025
Loughborough University 2023–2025	**Research Associate in Mathematics** Working with Simon Baker, on fractal geometry and Fourier decay
University of St Andrews *2019–2023*	**PhD Mathematics** **Thesis:** "Interpolating between Hausdorff and box dimension" (defended May 2023) **Topic:** Fractal geometry and dimension theory, with the Analysis Research Group **Supervisors:** Jonathan Fraser (primary), Kenneth Falconer

University of St Andrews	**MSc Mathematics, Distinction**
2018–2019	**GPA**: 19.5/20. Ranked 1st in the Faculty of Science and Medicine
	Dissertation: <u>Solvability of Partial Differential Equations on Fractal Domains</u>
	(Score: 19.1/20, supervised by <u>Professor Kenneth Falconer</u>)
University of Cambridge,	**BA (Hons) Mathematics**
King's College	
2015–2018	**Selected Part II courses:** Linear Analysis, Analysis of Functions, Topics in Analysis, Differential Geometry, Riemann Surfaces, Logic and Set Theory

PRIZES AND GRANTS

- 2025: Awarded **€226,000 Marie Skłodowska-Curie Actions Postdoctoral Fellowship** with 100% score, titled "Fourier decay for nonlinear fractal measures," University of Jyväskylä.
- *2023–4:* Awarded **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 AND MINICOURSES

I have given more than 50 talks (see https://amlan-banaji.github.io/files/BanajiTalks.pdf) at conferences and seminar series including:

- Invited minicourse, Shenzhen Technology University, China, 25/6/25–27/6/25
- Invited minicourse, <u>Focused workshop on Harmonic analysis methods in fractal geometry</u>, Budapest, 4/11/24–8/11/24
- <u>Fractal Geometry and Stochastics 7</u> (Chemnitz, 26/9/24)
- <u>Afternoon workshop on Fourier analysis, fractals, and finite fields</u> (invited talk, St Andrews, 18/9/24)
- <u>Geometry and fractals under the midnight Sun</u> (Oulu, 27/6/24)
- <u>British Early Career Mathematicians' Colloquium</u> (keynote talk, Birmingham, 14/6/24)
- <u>British Mathematical Colloquium (BMC)</u> (Manchester, 19/6/24)
- <u>Fractal Geometry</u> (celebrating Prof. Kenneth Falconer's 70th birthday, ICMS, Edinburgh, 4/7/23)
- <u>Multifractal analysis and self-similarity</u> (CIRM, Marseille, 30/6/23)
- <u>Thermodynamic Formalism: Non-additive Aspects and Related Topics</u> (Będlewo, 16/5/23)
- <u>One World Fractals</u> (online talks by myself and Hong Wang, 18/1/23)
- <u>Szenzhen Technology University Mathematics Colloquium</u> (inaugural talk, China (online), 22/10/22)
- <u>Fractals and Related Fields IV</u> (Porquerolles, 5/9/22)
- <u>Geometry of Deterministic and Random Fractals</u> (Budapest, 30/6/22 and 2/9/24)

EXPERIENCE

- 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.

SERVICE AND MEMBERSHIPS

- *2022–present*: **Referee** for *Math. Ann.; Int. Math. Res. Not. IMRN; Adv. Math.; J. Lond. Math. Soc.; Ergodic Theory Dynam. Systems; Proc. Roy. Soc. Edinburgh Sect. A; Nonlinearity; Colloq. Math.; Amer. Math. Monthly; J. Math. Anal. Appl.; Real Anal. Exchange; MathSciNet*
- *2023–2025:* **Co-organiser** of the <u>Loughborough University Dynamical Systems Seminar</u>
- *2024:* **Co-organiser** of <u>Workshop on Ergodic Theory and Fractal Geometry</u> 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 professional bodies: <u>LMS</u>, <u>IMA</u>, <u>EMS</u>.