

# Amanda Turner

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## RESEARCH INTERESTS

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My research interests lie at the interface of probability theory, complex analysis and mathematical physics. Specifically, I am interested in understanding the long-time behaviour of planar random growth processes which arise in physical settings, such as cell growth and polymer creation, and I am currently working on resolving some fundamental open problems in mathematical physics relating to the aggregation of diffusing particles. Random growth models which arise in this way, most notably diffusion-limited aggregation (DLA) which models mineral deposition, are complicated to analyse rigorously. I have made significant contributions to the body of work in this area. My approach uses conformal mappings to model the arrival of particles. This enables the use of techniques from complex analysis, a strategy that has been very fruitful in related areas such as Schramm–Loewner evolution (SLE). One of the most important open problems concerns identifying the mechanisms by which certain growth models appear to converge to random fractal limits. I have made notable progress towards this aim through characterising the limiting behaviour and internal structure of clusters in a general class of Laplacian growth models. By doing so, I have proved the existence of two previously conjectured phase transitions between deterministic and random limits. A detailed understanding of the mechanisms which cause deterministic limiting behavior to break down could have major impacts in disciplines as diverse as medicine and mineralogy.

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## CURRENT/PAST POSTS

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2007 – **Lecturer**, then **Senior Lecturer** from August 2015, in Mathematics and Statistics at Lancaster, UK.  
2006 – 2007 **College Teaching Fellow** at Selwyn College, University of Cambridge, UK.

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## VISITING POSITIONS

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2022 **Research Professor** at Mathematical Sciences Research Institute (MSRI), Berkeley, California, USA to participate in the program “The Analysis and Geometry of Random Spaces” (4.5 months).  
2018 – 2020 **Visiting Professor** at the University of Geneva, Switzerland, to collaborate with Stanislav Smirnov.  
2015 **Visiting Fellowship** of the Isaac Newton Institute for Mathematical Sciences, UK, to participate in the programme “Random Geometry” (3 months).  
2011 **Visitor** at the Mittag-Leffler Institute, Sweden, to participate in the programme on Complex Analysis and Integrable Systems (1 month).

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## ACADEMIC/PROFESSIONAL QUALIFICATIONS

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2015 **Senior Fellow of the Higher Education Academy**  
2002 – 2006 **PhD in Mathematics**  
Department of Pure Mathematics and Mathematical Statistics, University of Cambridge, UK  
*Title: Scaling Limits of Stochastic Processes*  
*Supervised by Professor James Norris*  
2001 – 2002 **Certificate of Advanced Study in Mathematics** (Part III) – Distinction  
St John’s College, University of Cambridge, UK  
1998 – 2001 **MA (Hons) Mathematics** - First Class  
St John’s College, University of Cambridge, UK  
*Ranked in the top 5% of approximately 250 students in all three years*

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## RESEARCH GRANTS

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2019 **Principal Investigator** on Engineering and Physical Sciences Research Council (EPSRC) Standard Grant entitled “Conformal Approach to Modelling Random Aggregation”.  
2015 **Principal Investigator** on EPSRC New Ideas and Networking Grant entitled “Random structures arising in Physics and Analysis”.  
2015 **Principal Investigator** on London Mathematical Society (LMS) Conference Grant.  
2013 **Principal Investigator** on Industrial Mathematics Knowledge Transfer Partnership collaboration between Lancaster University, UK, and BT (one of the largest telecommunications services companies in the world), entitled “TV Whitespace Interference Modelling”.  
2011 **Principal Investigator** on LMS Research in Pairs grant.

## ORGANISATION OF SCIENTIFIC MEETINGS

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- 2022 **Member of the organising committee** for workshop on The Analysis and Geometry of Random Spaces to be held at Mathematical Sciences Research Institute (MSRI), Berkeley, USA.
- 2022 **Member of the organising committee** for workshop on Scaling Limits: from Statistical Mechanics to Manifolds, to be held at the University of Cambridge, UK (funded by EPSRC, LMS and the Whittle Fund).
- 2017, 2018 **Member of the organising committee** for the Lancaster Probability Days meetings, attended by 40 participants, held at Lancaster University, UK (funded by LMS and Bank of England).
- 2015 **Chair of the organising committee** for the UK Easter Probability Meeting, attended by 80 participants, held at Lancaster University, UK (funded by EPSRC, LMS and Bank of England).
- 2012, 2015 **Organiser** of the Royal Statistical Society Applied Probability Section meetings, attended by 40 participants, held at the Royal Statistical Society, UK.
- 2011 **Member of the international organising committee** for the European Young Statisticians Meeting, attended by 50 participants, held in Lisbon, Portugal.
- 2005 **Chair of the organising committee** for the Research Students Conference in Probability and Statistics, attended by 160 participants, held at the University of Cambridge, UK.

## INVOLVEMENT IN SCIENTIFIC SOCIETIES AND NETWORKS

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- 2021 Chair of the **One World Probability Seminar** (2021).
- 2020 – **Probability in the North East (PiNE)** contact for Lancaster University (since 2020).
- 2012 – 2016 Founding member of the Applied Probability Section of the **Royal Statistical Society**, UK (Vice Chair 2012-2014 and Chair 2014-2016).
- 2002 – Member of the **London Mathematical Society**, UK (Member of Council since 2021, of Publications Committee since 2018 and of Research Grants Committee since 2017).
- 2002 – Member of the **Institute of Mathematical Statistics**, USA (Member of Nominations Committee 2018-2020).

## REVIEWING ACTIVITIES

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- 2016 – **Editorial Adviser (Associate Editor)** for the Bulletin, Journal, Proceedings and Transactions of the London Mathematical Society, UK.
- 2016 – **Assessor** for Advancing Teaching: Lancaster Accreditation Scheme (ATLAS) for HEA fellowships.
- 2015 **Member of the Periodic Quality Review (PQR) panel** for Lancaster Institute of Contemporary Arts.
- 2008 – **Peer Reviewer** for Advances in Applied Probability, Annals of Probability, Electronic Journal of Probability, Latin American Journal of Probability and Mathematical Sciences, Mathematical Programming, Mathematical Reviews, Stochastic Processes and their Applications, Stochastics.
- 2008 – **Grant Proposal Reviewer** for Engineering and Physical Sciences Research Council (EPSRC), European Research Council (ERC), and International Congress of Mathematicians (ICM).

## TEACHING ACTIVITIES

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- 2021 Contract with **Cambridge University Press (CUP)** to write textbook on Stochastic Finance: An Introduction with Examples.
- 2020 – **External Examiner** for Loughborough University, UK.
- 2018 – 2020 **Visiting Professor, University of Geneva, Switzerland**  
Teaching advanced course on stochastic calculus with applications to finance, and co-teaching (with Stanislav Smirnov) masterclass on random growth and Loewner evolution, based on my research.
- 2007 – **Lecturer / Senior Lecturer in Mathematics and Statistics, Lancaster University, UK**  
Lecturing first year probability, second year probability and computational mathematics, third and fourth year probability and measure, third and fourth year stochastic processes, fourth year and masters level stochastic calculus for finance, and masters level stochastic processes for finance; coordinating first year computer laboratory sessions; providing small group tutorials for first year problem solving; supervising second and third year group projects, masters dissertations, and PhD students.
- 2006 – 2007 **College Teaching Fellow, Selwyn College, University of Cambridge, UK**  
Providing supervisions to pairs of students in first year algebra and geometry, analysis and probability, and second year linear algebra, analysis and complex analysis.
- 2002 – 2006 **Supervisor, St John's College, University of Cambridge, UK**  
Providing supervisions to pairs of students in first year probability and analysis, second year Markov chains, analysis, linear algebra, and complex analysis and Part III (masters level) stochastic calculus.

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**SUPERVISION AND EXAMINATION OF GRADUATE STUDENTS**


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- 2007 – **Supervisor** of 1 postdoctoral research associate (Larissa Richards), 5 PhD students: 3 completed (Jamie Fairbrother, Shane Turnbull, George Liddle), 2 current (Frankie Higgs, Daniel Hodgson), and 9 Masters-level students at Lancaster University, UK.
- 2007 – 2019 **Internal examiner** for 3 PhD students at Lancaster University, UK.
- 2019 **External examiner** for PhD at Cambridge University, UK.
- 2016 **External examiner** for PhD at University of Warwick, UK.

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**INSTITUTIONAL RESPONSIBILITIES**


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- 2009 – 2015 **Head of Undergraduate Teaching for Mathematics** at Lancaster University, UK.  
In this role I was responsible for directing the teaching activities of 30 academic staff and 50 graduate teaching assistants across 14 degree programmes which were attended by over 500 students.
- 2007 – A broad range of duties and responsibilities, including **Part II Director of Studies, MSc Quantitative Finance Coordinator, STOR-i Executive, Academic Tutor, Officer for Computing, Disability, Equality and Diversity, Plagiarism, and Safety, Health and Wellbeing** at Lancaster University, UK.
- 2006 – 2007 **Director of Studies for Mathematics** at Selwyn College, University of Cambridge, UK.

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**PUBLICATIONS**


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- Liddle G. and Turner A.** *Scaling limits and fluctuations for random growth under capacity rescaling*. Annales de l'Institut Henri Poincaré - Probabilités et Statistiques **57** (2) 980-1015, 2021.
- Turnbull, S. and Turner, A.** *Coexistence in a random growth model with competition*. Electronic Communications in Probability **25** (26) 1-14, 2020.
- Fairbrother, J., Turner, A. and Wallace, S.** *Problem-driven scenario generation: an analytical approach for stochastic programs with tail risk measure*. Mathematical Programming, 2019 (42 pages).
- Sola, A., Turner, A., Viklund, F.** *One-dimensional scaling limits in a planar Laplacian random growth model*. Communications in Mathematical Physics **371** (1) 285-329, 2019.
- Turner, A.** *From Lichen to Lightning: Understanding Random Growth*. Newsletter of the London Mathematical Society **482** 14-19, 2019. (Front cover article).
- Turner, A.** *Singular scaling limits in a planar random growth model*. Strongly Correlated Random Interacting Processes, Oberwolfach Report **15** (1) 235-238, 2019.
- Fairbrother, J., Turner, A. and Wallace, S.** *Scenario generation for single-period portfolio selection problems with tail risk measures: coping with high dimensions and integer variables*. INFORMS Journal on Computing **30** (3) 472-491, 2018.
- Johansson Viklund, F., Sola, A. and Turner, A.** *Small-particle limits in a regularized Laplacian random growth model*. Communications in Mathematical Physics **334** (1) 331-366, 2015.
- Whitehead, J., Cleary, F. and Turner, A.** *Bayesian sample sizes for exploratory clinical trials comparing multiple experimental treatments with a control*. Statistics in Medicine **34** (12) 2048-2061, 2015.
- Turner, A. and Whitehead, J.** *Partial stochastic dominance for the multivariate Gaussian distribution*. Statistics and Probability Letters **103** 80-85, 2015.
- Norris, J. and Turner, A.** *Weak convergence of the localized disturbance flow to the coalescing Brownian flow*. Annals of Probability **43** (3) 935-970, 2015.
- Norris, J. and Turner, A.** *Hastings-Levitov aggregation in the small-particle limit*. Communications in Mathematical Physics **316** 809-841, 2012.
- Johansson Viklund, F., Sola, A. and Turner, A.** *Scaling limits of anisotropic Hastings-Levitov clusters*. Annales de l'Institut Henri Poincaré - Probabilités et Statistiques **48** (1) 235-257, 2012.
- Mosbach, S. and Turner, A.** *A quantitative investigation into the accumulation of rounding errors when solving ODEs numerically*. Computers and Mathematics with Applications **57** (7) 1157-1167, 2009.
- Turner, A.** *Planar aggregation and the Brownian web*. Proceedings of the 16<sup>th</sup> European Young Statisticians Meeting 93-97, 2009.
- Turner, A.** *Convergence of Markov processes near saddle fixed points*. Annals of Probability **35** 1141-1171, 2007.

## PREPRINTS

**Norris, J., Silvestri, V. and Turner, A.** *Stability of Hastings-Levitov aggregation in the subcritical regime.* arXiv:2105.09185 [math.PR], 2021 (81 pages).

**Berger, N., Procaccia, E. and Turner, A.** *Growth of stationary Hastings-Levitov.* arXiv:2008.05792 [math.PR], 2020 (32 pages).

**Norris, J., Silvestri, V. and Turner, A.** *Scaling limits for planar aggregation with subcritical fluctuations.* arXiv:1902.01376 [math.PR], 2020 (62 pages).

**Norris, J. and Turner, A.** *Planar aggregation and the coalescing Brownian flow.* arXiv:0810.0211 [math.PR], 2009 (39 pages).

## INVITED CONFERENCE PRESENTATIONS

Oct 2020	<b>Ada Lovelace Conference</b> , University of Warwick (online), UK.
Sept 2020	<b>LMS Prospects in Mathematics</b> , University of Bath (online), UK.
Dec 2019	<b>Workshop on Probabilistic Coupling and Geometry</b> , University of Warwick, UK.
Feb 2019	<b>Workshop on Statistical Mechanics</b> , Les Diablerets, Switzerland.
Jan 2019	<b>IPAM program on Analysis and Geometry of Random Shapes</b> , UCLA, Los Angeles, USA.
Sept 2018	<b>9th International Conference on Stochastic Analysis and its Applications</b> , Bielefeld, Germany.
June 2018	<b>SAMBa Summer Conference</b> , University of Bath, UK.
June 2018	<b>Workshop on Stochastic Analysis, Geometry and Statistics</b> , Imperial College, London, UK.
Jan 2018	<b>Strongly correlated random interacting processes</b> , MFO, Oberwolfach, Germany.
Sept 2017	<b>LMS Prospects in Mathematics</b> , University of Reading, UK.
Aug 2017	<b>LMS-EPSRC Durham Symposium on Markov Processes, Mixing Times and Cutoff</b> , Durham, UK.
July 2017	<b>LMS-EPSRC Durham Symposium on Stochastic Analysis</b> , University of Durham, UK.
Sept 2016	<b>Random growth problems and random matrices</b> , CRM, Montreal, Canada.
July 2016	<b>World congress in Probability and Statistics</b> , Fields Institute, Toronto, Canada.
April 2015	<b>ICERM workshop on Limit Shapes</b> , Brown University, Providence, Rhode Island, USA.
March 2015	<b>Random Graphs, Random Trees and Applications</b> , Isaac Newton Institute, Cambridge, UK.
June 2014	<b>44<sup>th</sup> Annual John H. Barrett Memorial Lectures</b> , University of Tennessee, Knoxville, USA.
July 2013	<b>Women in Probability Workshop</b> , Technische Universität München, Germany.
March 2013	<b>BMC (British Mathematical Colloquium)</b> , University of Sheffield, UK.
March 2012	<b>UK Easter Probability Meeting</b> , University of Warwick, UK.
April 2011	<b>LMS Short Course</b> , University of Oxford, UK.
Aug 2009	<b>European Young Statisticians Meeting (EYSM)</b> , Bucharest, Romania.
June 2009	<b>Annual Meeting of the Statistical Society of Canada</b> , Vancouver, Canada.
Feb 2009	<b>Aggregation, condensation and coagulation in particle systems</b> , University of Warwick, UK.
Jan 2009	<b>Potential Theory and Analysis of Growth Processes</b> , Université d'Orléans, France.
April 2008	<b>SPINADA (Systemes de Particules en Interactions Non réversibles – Approches Déterministes et Aléatoires) Workshop</b> , Paris, France.
April 2008	<b>Probability 2008</b> , University of Warwick, UK.
April 2007	<b>BMC (British Mathematical Colloquium)</b> , University of Swansea, UK.

## RECENT INVITED SEMINAR PRESENTATIONS

June 2021	<b>Statistical Science Seminar</b> , UCL (online), UK.
May 2021	<b>Probability Seminar</b> , Warwick, Bristol and Queen Mary (online), UK.
April 2020	<b>One World Probability Seminar</b> , online via Zoom (international audience of over 200).
March 2020	<b>Probability Seminar</b> , University College Dublin, Ireland.
Jan 2020	<b>Statistics Seminar</b> , Durham University, UK.
Nov 2019	<b>Stochastic Analysis and Maths Finance Seminar</b> , University of Oxford, UK.
Sept 2019	<b>Probability Seminar</b> , University of Toronto, Canada.
Jan 2019	<b>Séminaire Probabilités</b> , Institut Fourier, Grenoble, France.
Jan 2019	<b>Probability Seminar</b> , University of Cambridge, UK.
Dec 2018	<b>Mathematics and Applications Seminar</b> , University of Sussex, UK.
Jan 2018	<b>Probability Seminar</b> , University of Bristol, UK.
May 2017	<b>Maxwell Institute Probability and Statistics Day</b> , ICMS, Edinburgh, UK.
Feb 2017	<b>Stochastic Analysis and Mathematical Finance Seminar</b> , University of York, UK.
Jan 2017	<b>Stochastics Seminar</b> , University of Bonn, Germany.
Jan 2017	<b>Statistics Seminar</b> , University of Durham, UK.