

Curriculum Vitae

Tuomas Sahlsten

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General information

Personal information

Family name and first names: Sahlsten, Tuomas Valtteri Aleksis
Date and place of birth: 25 May 1987 in Vantaa, Finland
Nationality: Finnish national, UK permanent resident
Website: <https://personalpages.manchester.ac.uk/staff/tuomas.sahlsten/>

Education

2009 – 2012 *PhD in Mathematics*, University of Helsinki, Finland
Supervisor: Prof Pertti Mattila. Awarded: November 2012.
2006 – 2009 *BSc and MSc in Mathematics*, University of Helsinki, Finland
Supervisor: Prof Pertti Mattila. Awarded: June 2009.

Work experience

Sep 2017 – present *Lecturer in Pure Mathematics*, Department of Mathematics, University of Manchester, UK, permanent contract, Research and Teaching Track
Sep 2015 – Aug 2017 *Marie Curie Research Fellow*, School of Mathematics, University of Bristol, UK (funded by the EU through MSCA-IF grant, Horizon 2020)
Jan 2014 – Aug 2015 *Research Fellow*, Einstein Institute of Mathematics, The Hebrew University of Jerusalem, Israel (fellowship in an ERC starting grant, FP7)
Jan 2013 – Dec 2013 *Research Associate*, School of Mathematics, University of Bristol, UK (funded by an Emil Aaltonen foundation grant and Academy of Finland)
Sep 2012 – Dec 2012 *Project Researcher*, Department of Mathematical Sciences, University of Oulu, Finland (fellowship in an Academy of Finland grant)

Research experience

Summary

- In total 22 articles with many appeared in leading international mathematical journals such as Duke Math. J., Math. Ann., Proc. LMS, Analysis & PDE, IMRN, Adv. Math. and others. Detailed list of the publications below.
- Current research focuses on **quantum chaos on random surfaces**, where we are working on resolutions to problems in quantum chaos using the modern techniques of computing Weil-Petersson probabilities for random surfaces developed by M. Mirzakhani *et al.* The project provides a continuous analogue of the well-developed large random network theory. Research highlights include solution to a problem of Salem (1943) with T. Jordan (2016), solution to a problem of Kahane (1993) with J. Fraser and T. Orponen (2014) and recently (2019) to Shub's conjectural inequality on manifolds supporting uniformly quasiregular dynamics.
- Advised/advising 4 PhD students and 1 postdoc and the research has been supported by an EU Marie Curie fellowship grant and currently, EPSRC for PhD students and Finnish Magnus Ehrnrooth foundation grant.

List of publications

- (1) **Fourier transform and expanding maps on Cantor sets**
with *Connor Stevens*
Submitted (2020), <https://arxiv.org/abs/2009.01703>
- (2) **Quantum ergodicity for Eisenstein series on hyperbolic surfaces of large genus**
with *Etienne Le Masson*
Submitted (2020), <https://arxiv.org/abs/2006.14935>
- (3) **Short geodesic loops and L^p norms of eigenfunctions on large genus random surfaces**
with *Clifford Gilmore, Etienne Le Masson* and *Joe Thomas*
Submitted (2019), <https://arxiv.org/abs/1912.09961>
- (4) **Random walks associated to beta-shifts**
with *Bing Li* and *Yao-Qiang Li*
Submitted (2019), <https://arxiv.org/abs/1910.13006>
- (5) **Trigonometric series and self-similar sets**
with *Jialun Li*
Submitted (2019), <https://arxiv.org/abs/1902.00426>
- (6) **Fourier decay in nonlinear dynamics**
with *Connor Stevens*
Submitted (2018), <https://arxiv.org/abs/1810.01378>
- (7) **Fourier transform of self-affine measures**
with *Jialun Li*
Advances in Mathematics (2020), to appear
- (8) **Entropy in uniformly quasiregular dynamics**
with *Ilmari Kangasniemi, Yusuke Okuyama* and *Pekka Pankka*
Ergodic Theory and Dynamical Systems (2020), to appear
- (9) **Denseness of intermediate β -shifts of finite type**
with *Bing Li, Tony Samuel* and *Wolfgang Steiner*
Proceedings of the American Mathematical Society (2019), 147, 2045-2055
- (10) **On the Fourier analytic structure of the Brownian graph**
with *Jonathan Fraser*
Analysis & PDE (2018), 11, 115-132
- (11) **Pointwise perturbations of countable Markov maps**
with *Thomas Jordan* and *Sara Munday*
Nonlinearity (2018), 31, No. 4, 1351-1377.
- (12) **Quantum ergodicity and Benjamini-Schramm convergence of hyperbolic surfaces**
with *Etienne Le Masson*
Duke Mathematical Journal (2017), 166, no. 18, 3425-3460.
- (13) **Fourier transforms of Gibbs measures for the Gauss map**
with *Thomas Jordan*

Mathematische Annalen (2016), 364, 3–4, pp 983–1023

- (14) **Intermediate β -shifts of finite type**
with *Bing Li* and *Tony Samuel*
Discrete and Continuous Dynamical Systems Series S (2016), 36(1), 323-344.
- (15) **Dynamics of the scenery flow and geometry of measures**
with *Antti Käenmäki* and *Pablo Shmerkin*
Proceedings of the London Mathematical Society (2015) 110, no. 5, 1248-1280
- (16) **Scaling scenery of $(\times m, \times n)$ invariant measures**
with *Andrew Ferguson* and *Jonathan Fraser*
Advances in Mathematics (2015), 268, 564-602
- (17) **Structure of distributions generated by the scenery flow**
with *Antti Käenmäki* and *Pablo Shmerkin*
Journal of the London Mathematical Society (2015) 91, no. 2, 464-494
- (18) **Tangent measures of typical measures**
Real Analysis Exchange (2015), 40, no. 1, pp. 53-80.
- (19) **On Fourier analytic properties of graphs**
with *Jonathan Fraser* and *Tuomas Orponen*
International Mathematics Research Notices (2014): 2730-2745
- (20) **Dimension, entropy, and the local distribution of measures**
with *Pablo Shmerkin* and *Ville Suomala*
Journal of the London Mathematical Society (2013) 87 (1): 247-268
- (21) **Tangent measures of non-doubling measures**
with *Tuomas Orponen*
Mathematical Proceedings of the Cambridge Philosophical Society (2012) 152: 555-569
- (22) **Radial projections of rectifiable sets**
with *Tuomas Orponen*
Annales Academiæ Scientiarum Fennicæ Mathematica (2011) 36: 677-681

Grants (as a P.I.)

- 1.9.2015 – 31.8.2017 *Marie Skłodowska-Curie Actions*, European Union, awarded a €183,455 MSCA-IF Grant “*Large Deviations and Measure Rigidity in Dynamics*” (LDMRD), nr. 655310, under the Horizon 2020 Programme. Hosted by University of Bristol, UK.
- 1.1.2010 – 31.12.2013 *Emil Aaltonen Foundation*, Finland, awarded three (€22,300, €23,000 and €23,000) research grants. Hosted by the University of Helsinki, Finland (1.1.2010 - 30.8.2012), and University of Bristol, UK (1.1.2013 – 31.12.2013)

Grants (as a host)

- 1.7.2018 – 31.12.2018 Hosted Dr Clifford Gilmore’s project on “*Applications of Linear Dynamics in Ergodicity and Quantum Ergodicity*” in the University of Manchester, UK. Funded by a postdoctoral grant (€13,000) obtained by Clifford from *Magnus Ehrnrooth Foundation*, Finland.

Smaller grants

- 2017 *LMS Scheme 1 and Imperial College London* conference grants (total £8,000) with Davoud Cheraghi
 2017 *Finnish Academy of Science and Letters* travel grant (€1174)
 2014 *LMS Scheme 1* grant (£4,000) and *Heilbronn Institute* grant (£4,000) with Thomas Jordan
 2013 *Chancellor’s travel grant* (€772), University of Helsinki, Finland

Research supervision/examination

- Postdocs In 2018 Hosted Magnus Ehrnrooth Research Fellowship for Dr Clifford Gilmore in the University of Manchester on quantum chaos.
- PhD students Supervised 4 PhD students in the University of Manchester.
- Main supervisor for Mr Connor Stevens (2017–) and Mr Joe Thomas (2018–) working on dynamical systems, quantum chaos, number theory and additive combinatorics.
 - Co-supervising Mr Borys Kuca (2019–) with Donald Robertson on additive combinatorics and Mr Clément Hege (2018–) with Nikita Sidorov on open dynamical systems.
- PhD examination Examined Dr Eino Rossi’s PhD thesis in 2017 on dynamical systems and fractal geometry at the University of Helsinki, Finland

Professional and organisational activities

- Co-organised (with Davoud Cheraghi) the international conference *Analysis Aspects of Dynamics I*, held in 16 – 18. May 2018 at the Imperial College London, UK.
- Co-organised (with Thomas Jordan) the international conference *Projection and Slicing Theorems in Fractal Geometry*, held in 17 – 18. July 2014 at the University of Bristol, UK.
- Local organiser in Michael Hochman’s *Workshop on Fractals*, held in 8 – 12. June 2014 at the Hebrew University of Jerusalem, Israel.
- Reviewer for major international journals such as *GAFSA*, *Proc. London Math. Soc.*, *Adv. Math.* and various others

Research visits

- Dec 2019 *University of Chicago*, Chicago, Illinois, USA
 Sep 2019 *Princeton University*, Princeton, New Jersey, USA
 Jan 2019 *Institute Mathematics De Bordeaux*, Bordeaux, France
 Nov 2018 *Alfréd Rényi Institute of Mathematics*, Budapest, Hungary
 Sep 2018 *University of Warwick*, England
 Apr 2018 *University of Bristol*, England
 May 2017 *Torcuato di Tella University*, Buenos Aires, Argentina

May 2017 *Pontifical Catholic University of Chile*, Santiago de Chile, Chile
 May 2016 *Princeton University*, New Jersey, USA
 Feb 2016 *Brown University*, Rhode Island, USA
 Apr 2015 *University of Manchester*, England
 Sep 2014 *The Chinese University of Hong Kong*, China (SAR)
 Aug 2014 *South China University of Technology*, Guangzhou, China
 Dec 2013 *University of York*, England
 Oct 2013 *University of Warwick*, England
 May 2013 *Université Paris Diderot*, France
 May 2013 *Leiden University*, Netherlands
 Apr 2013 *University of Surrey*, England
 Jan 2010 *University of St. Andrews*, Scotland

Invited talks in international conferences

June 2020 *Fractals and Related Fields IV*, Porquerolles, France
 September 2017 *Fractal Geometry and Dynamics*, Mittag-Leffler Institute, Sweden
 March 2016 *27th Nordic Congress of Mathematicians*, Stockholm University, Sweden
 January 2016 *Finnish Mathematical Days*, University of Turku, Finland
 June 2015 *Workshop on Fractals*, The Hebrew University of Jerusalem, Israel
 July 2014 *Dynamics and Numbers*, The Max Planck Institute, Bonn, Germany
 August 2013 *XXII Rolf Nevanlinna Colloquium*, University of Helsinki, Finland

Invited seminars/colloquia

University of Chicago, USA (2019), University College London (2018), University of Bristol (2019), University of Edinburgh (2018), Pontifical Catholic University of Chile (2017), Princeton University, USA (2016), Imperial College London (2016, 2018), University of St Andrews (2010, 2015, 2019), University of Helsinki (2015), South China University of Technology (2014), Chinese University of Hong Kong (2014), Technion, Israel (2014), The Hebrew University of Jerusalem (2014), University of York (2013), University of Warwick (2013), Université Paris Diderot-Paris 7 (2013), Leiden University (2013).

Social responsibility

Public engagement

- Since Summer 2018 I have been running an active series of YouTube videos (vlog) on being a researcher and a mathematician, channel link:

<https://tinyurl.com/TuomasSahlstenYouTube>

Done in collaboration with an expert video designer in the Manchester area and with current PhD students and postdocs in our group.

Administrative/organisational experience

Official duties

- Since 2019 the Programme Tutor of the MSc in Pure Mathematics in the University of Manchester, which involves managing the Pure Mathematics MSc programme and providing administrative and pastoral advice for the students/staff.

- Elected as a vice member of the Board of the Department of Mathematics and Statistics at University of Helsinki during the period Jan 2010 - Jun 2012 (consisting of around 10 people from different levels). Was present in several meetings which involved professorial/lecture appointment decisions, reviewing job applications for these posts, approving theses and various matters in the Department of Mathematics.

Seminar organisation

- 2017– co-organising the Analysis and Dynamical Systems seminar in the University of Manchester
- 2018-2019 co-organised the Pure Mathematics Colloquium in the University of Manchester
- Co-organised the Ergodic theory and dynamical systems seminar in University of Bristol (2015-2016)
- Organised the Fractal Seminar in the Hebrew University of Jerusalem (2014-2015)

Teaching experience

Supervisions and examination

- Sep 2017 – Academic advisor for a number of under- and postgraduate students in University of Manchester, UK
- Sep 2017 – Supervisor and examiner for MSc and MMath projects and dissertations on mathematical analysis, number theory and dynamics, University of Manchester, UK. Examined several such projects and dissertations.

Lecturing experience

- 2019-2020 *Analysis, Random Walks and Groups*, designing and delivering a new 4th year undergraduate course University of Manchester, UK
- 2018-2020 *Mathematics 0C2*, foundation year course on calculus, University of Manchester, UK. Revised the syllabus in 2018 according to FSE changes. UEQ average feedback 4.62, rated 5th in the School in 2018.
- 2016 *Additive Combinatorics and Ergodic Methods in Fractals*, graduate course, University of Bristol, UK

Teaching experience in schools

- Fall 2007 *Mathematical analysis*, course teacher, Jokela high school, Finland
- Fall 2007 *Geometry*, course teacher, Jokela high school, Finland
- Fall 2007 *A-level preparation course*, course teacher, Jokela high school, Finland
- Fall 2007 *Basic mathematics*, course teacher, Mantsälä upper secondary school, Finland.

Small group tutorials

- Sep 2017 – Leading first year supervision groups for undergraduate students, University of Manchester, UK

Sep 2009 – Dec 2012 Leading various undergraduate supervision groups, University of Helsinki, Finland

Pedagogical studies

2017 – 2019 New Academics Programme training courses on University Pedagogics, University of Manchester, UK.

2011 Completed successfully a University Pedagogics training course (5 ETSC), University of Helsinki, Finland, as a part of PhD training.