

Sascha Troscheit

— Curriculum Vitæ —

Address

Research Unit of Mathematical Sciences
 P.O. Box 8000
 90014 University of Oulu
 Finland

Contact

sascha.troscheit@oulu.fi
maths@troscheit.eu
<https://www.troscheit.eu>

Year of Birth: 1988
 Nationality: German

Employment

- > European Fellowship, *University of Oulu*, Oulu, Finland. 1 Sep 2022 – 31 Aug 2024
 Principle Investigator, EU Horizon Fund, Marie Skłodowska-Curie Individual Fellowship.
 Project title: *Dimension and Dynamics*.
- > Lise Meitner Senior Research Fellow, *Universität Wien*, Vienna, Austria. 17 June 2020 – 31 July 2022
 Principle Investigator, FWF (Austrian Science Fund) Project M-2813:
Regularity and embeddability of self-similar processes.
- > Universitätsassistent (postdoc. fellow), *Universität Wien*, Vienna, Austria. 1 Jan. 2019 – 16 June 2020
- > Postdoctoral Fellowship, *University of Waterloo*, Waterloo, Canada. 1 May 2017 – 31 Dec. 2018

Education

- > Ph.D. in Pure Mathematics, University of St Andrews. April 2017
 Thesis Title: “*Dimension Theory of Random Self-similar and Self-affine Constructions*”.
 Supervisors: Kenneth Falconer and Mike Todd.
- > MSc Mathematical Sciences, University of Bristol. September 2012
 Dissertation Title: “*Non-differentiability of self-similar and self-conformal devil’s staircases*”.
 Supervisor: Thomas Jordan.
- > BSc (Hons) Mathematics, The Open University. December 2010
- > Certificate in Physics, The Open University. December 2008
- > Programme participant: “*Studieren ab 16*”, Universität Bielefeld. September 2005 – June 2006
 University studies in physics parallel to high school.

Publications*Submitted*

- 24. On the Minkowski content of self-similar random homogeneous iterated function systems.
<https://arxiv.org/abs/2103.04664>, (2021), 15pp.
- 23. Box-counting dimension in one-dimensional random geometry of multiplicative cascades.
 Joint with Kenneth J. Falconer.
<https://arxiv.org/abs/2203.15315>, (2022).

In Print

- 22. Dynamically defined subsets of generic self-affine sets.
 Joint with Balázs Bárány.
Nonlinearity, **35**, 4986–5013, (2022).
<https://doi.org/10.1088/1361-6544/ac8219>.
- 21. Analogues of Khintchine’s theorem for random attractors.
 Joint with Simon Baker.
Transactions of the American Mathematical Society, **375**(2), (2022), 1411–1441.
<https://doi.org/10.1090/tran/8537>.
- 20. Regularity versus smoothness of measures.
 Joint with Jonathan M. Fraser.
Pacific Journal of Mathematics, **311**(2), (2021), 257–275.
<http://doi.org/10.2140/pjm.2021.311.257>.

19. On quasisymmetric embeddings of the Brownian map and continuum trees.
Probability Theory and Related Fields, **179**(3), (2021), 1023–1046.
<https://doi.org/10.1007/s00440-020-01024-2>.
18. Exact Hausdorff and packing measures for random self-similar code-trees with necks.
Studia Mathematica, **257**(3), (2021), 253–285.
<http://doi.org/10.4064/sm190327-26-8>.
17. Lower Assouad dimension of measures and regularity.
Joint with Kathryn Hare.
Mathematical Proceedings of the Cambridge Philosophical Society, **170**(2), (2021), 379–416.
<https://doi.org/10.1017/S0305004119000458>.
16. The Assouad spectrum of random self-affine carpets.
Joint with Jonathan M. Fraser.
Ergodic Theory and Dynamical Systems, **41**(10), (2021), 2927–2945.
<https://doi.org/10.1017/etds.2020.93>
15. Quasi-doubling of self-similar measures with overlaps.
Joint with Kathryn E. Hare and Kevin G. Hare.
Journal of Fractal Geometry, **7**(3), (2020), 233–270.
<https://doi.org/10.4171/JFG/91>.
14. Self-conformal sets with positive Hausdorff measure.
Joint with Jasmina Angelevska and Antti Käenmäki.
Bulletin of the London Mathematical Society, **52**(1), (2020), 200–223.
<https://doi.org/10.1112/blms.12320>
13. Assouad spectrum thresholds for some random constructions.
Canadian Mathematical Bulletin, **63**(2), (2020), 434–453.
<https://doi.org/10.4153/S0008439519000547>.
12. The Mass Transference Principle: Ten years on.
Joint with Demi Allen.
Horizons of Fractal Geometry and Complex Dimensions, AMS Contemp. Math. Ser., **731**, (2019), 1–37.
<https://doi.org/10.1090/conm/731>.
11. The Assouad spectrum and the quasi-Assouad dimension: a tale of two spectra.
Joint with Jonathan M. Fraser, Kathryn E. Hare, Kevin G. Hare, Han Yu.
Annales Academiæ Scientiarum Fennicæ, **44**(1), (2019), 379–387.
<https://doi.org/10.5186/aasfm.2019.4419>
10. The quasi-Assouad dimension of stochastically self-similar sets.
Proceedings A of the Royal Society of Edinburgh, **150**(1), (2020), 261–275.
<https://doi.org/10.1017/prm.2018.112>
9. Random ubiquitous transformation semigroups.
Joint with Julius Jonušas.
Semigroup Forum, **99**(3), (2019), 655–678.
<https://doi.org/10.1007/s00233-018-09992-7>
8. Local dimensions of random homogeneous self-similar measures: strong separation and finite type.
Joint with Kathryn E. Hare and Kevin G. Hare.
Mathematische Nachrichten, **291**(16), (2018), 2397–2426.
<https://doi.org/10.1002/mana.201700466>
7. On the inverse problem for Channell collisionless plasma equilibria.
Joint with Oliver Allanson and Thomas Neukirch. (Second author)
IMA Journal of Applied Mathematics, **83**(5), (2018), 849–873.
<http://dx.doi.org/10.1093/imamat/hxy026>
6. The Assouad dimension of randomly generated fractals.
Joint with Jonathan M. Fraser and Jun Jie Miao.
Ergodic Theory and Dynamical Systems, **38**(3), (2018), 982–1011.
<http://dx.doi.org/10.1017/etds.2016.64>
5. The box dimension of random box-like self-affine sets.
Indiana University Mathematics Journal, **67**(2), (2018), 495–535.
<http://dx.doi.org/10.1512/iumj.2018.67.7295>
4. On the dimensions of attractors of random self-similar graph directed iterated function systems.
Journal of Fractal Geometry, **4**(3), (2017), 257–303.
<http://dx.doi.org/10.4171/JFG/51>

3. From one-dimensional fields to Vlasov equilibria: theory and application of Hermite polynomials.
Joint with Oliver Allanson, Thomas Neukirch and Fiona Wilson. (Third author)
Journal of Plasma Physics, **82**, (2016).
<http://dx.doi.org/10.1017/S0022377816000519>
2. An exact collisionless equilibrium for the Force-Free Harris Sheet with low plasma beta.
Joint with Oliver Allanson, Thomas Neukirch and Fiona Wilson. (Fourth author)
Physics of Plasmas, **22**, 102116 (2015).
<http://dx.doi.org/10.1063/1.4934611>
1. Hölder differentiability of self-conformal devil's staircases.
Mathematical Proceedings of the Cambridge Philosophical Society, **156**(2), (2014), 295–311.
<http://dx.doi.org/10.1017/S0305004113000698>

Other Publications

- Report in *London Mathematical Society Newsletter*, **462**, (2016).
Title: “Young Researchers in Mathematics Conference”

Theses

- Doctoral thesis. “*Dimension Theory of Random Self-similar and Self-affine Constructions*”.
University of St Andrews, 2017, <http://hdl.handle.net/10023/11033>.
- Master thesis. “*Non-differentiability of self-similar and self-conformal devil's staircases*”.
University of Bristol, 2013.

Selected Academic Visits and Programme Fellowships

- Simons Semester 1 – 30 May 2023
Topological, smooth and holomorphic dynamics, ergodic theory, fractals, Banach Center, University of Warsaw, Warsaw, Poland.
- Programme Workshop 28 May – 3 April 2022
Mathematical Sciences Research Institute, Berkeley CA, USA.
(Attended online only, due to an acute infection with SARS-CoV-2.)
- Academic Visit 20 – 27 August 2021
Jagiellonian University in Krakow, Krakow, Poland.
Host: Maik Gröger.
- Academic Visit 31 January – 7 February 2020
Budapest Institute of Technology and Economics, Budapest, Hungary.
Host: Balázs Bárány.
- Academic Visit 19 October – 2 November 2018
Acadia University, Wolfville, Nova Scotia, Canada.
Host: Franklin Mendivil.
- Programme Fellowship 10 November 2017 – 15 December 2017
Institut Mittag-Leffler, Stockholm, Sweden.
Event: *Fractal Geometry and Dynamics*.
- Postgraduate Programme Fellowship 1 February 2016 – 19 March 2016
ICERM, Brown University, Providence RI, USA.
Event: *Dimension and Dynamics*.

Invited Talks (last ~5 years)

Invited Conference Talks

- *Workshop on Fractal Geometry*. 3 – 7 July 2023
International Centre for Mathematics (ICMS), Edinburgh, Scotland.
Title: TBC.
- *Thermodynamic Formalism: Non-additive Aspects and Related Topics*. 14 – 19 May 2023
Mathematical Research and Conference Center (MRCC), Będlewo, Poland.
Title: TBC.
- *Amer. Math. Soc. Spring Western Sectional Meeting. (online)* 14 – 15 May 2022
University of Denver, Denver CO, USA.
Title: “The box-counting dimension in one-dimensional random geometry of multiplicative cascades”.

- *German Probability and Statistics Days Mannheim. (online)* 27 September – 1 October 2021
 Mannheim, Germany.
 Title: “Dimension theory and quasi-symmetric embeddability in random geometry”.
- *Geometric measure theory and applications.* 30 August – 3 September 2021
 Cortona, Italy.
 Title: “Quasi-self-similar sets with positive Hausdorff measure.”
- *First Dynamical Systems Summer Meeting.* 16–20 August 2021
 Mathematical Research and Conference Center (MRCC), Będlewo, Poland.
 Title: “The shrinking target problem and recurrence for generic self-affine sets.”
- *Ergodic Theory and Related Fields.* 8 October 2019
 Institute of Mathematics of the Romanian Academy, Bucharest, Romania.
 Title: “Self-conformal sets with positive Hausdorff measure”.
- *Canadian Mathematical Society Meeting.* 3 June 2018
 University of New Brunswick, Fredericton, Canada.
 Title: “Self-conformal sets with positive Hausdorff measure”.

Invited Colloquium/Lecture Talks

- Mathematical Colloquium, University of North Texas, Denton TX, USA. November 2022
 Title: TBA
- Rainwater Seminar, University of Washington, Seattle WA, USA. November 2022
 Title: TBA
- London Mathematical Society Scheme 2 funded lecture tour of the United Kingdom. The visit (11–29 July 2022) entailed the Universities of Bristol, Birmingham, and Glasgow at which special lectures were given.
- Mathematics Colloquium, *Dalhousie University*, Halifax, Nova Scotia, Canada. 5 November 2018
 Title: Galton-Watson trees: Big, small, and sometimes continuous.

Invited Seminar Talks

- *Harmonic Analysis and Fractal Geometry Seminar.* 15 November 2022.
 University of British Columbia, Vancouver BC, Canada.
 Title: TBA.
- *University of Bristol, Dynamical Systems Seminar.* 5 May 2022.
 University of Bristol, Bristol, UK.
 Title: “The box-counting dimension in one-dimensional random geometry of multiplicative cascades”.
- *(Not So) Informal Probability Seminar.* 3 March 2022.
 University of Vienna, Vienna, Austria.
 Title: “On quasisymmetric embeddings of the Brownian map and continuum trees”.
- *One World Numerations Seminar (online).* 27 November 2021.
 Title: “Analogues of Khintchine’s theorem for random attractors”.
- *Oulu Dynamical Systems Seminar.* 3 November 2021.
 University of Oulu, Oulu, Finland.
 Title: “Assouad-type dimensions and embeddability of random spaces”.
- *St Andrews Analysis Seminar (online).* 23 September 2021.
 St Andrews University, Scotland.
 Title: Random geometry and dimension theory.
- *Informal Probability, Operations Research, and Dynam. Systems seminar (online).* 11 June 2021
 Leiden University, The Netherlands.
 Title: Studying random metric spaces with dimension theory.
- *Jagiellonian University in Kraków, Karków, Poland (online).* 5 March 2021
 Title: A dimension theory approach to embeddings in random geometry.
- *University of Bristol (online),* 18 February 2021
 Title: A dimension theory approach to embeddings in random geometry.
- *University of St Andrews, St Andrews, Scotland.* 16 April 2019
 Title: “Lower Regularity of Measures”.
- *Budapest – Wien Dynamics seminar, Vienna, Austria.* 25 January 2019
 Title: “Self-conformal sets with positive Hausdorff measure”.

- *University of Toronto*, Toronto, Canada.
19 November 2018
 Title: “Assouad-type dimensions and their role in embedding metric spaces”.
- *Universität Wien*, Vienna, Austria.
11 October 2018
 Title: “Quasi-doubling of self-similar measures with overlap”.
- *University of St Andrews*, St Andrews, UK.
25 September 2018
 Title: “Random trees—Big and small”.
- *University of Washington*, Seattle WA, USA.
23 April 2018
 Title: “Assouad-type dimensions and their role in embedding metric spaces”.
- *Institut Mittag-Leffler*, Stockholm, Sweden.
28 November 2017
 Title: “Exact Hausdorff measure of random self-similar code-trees with necks”.

Organised Academic Events

- May 2022: Organiser of the “Affine and overlapping iterated function systems” workshop at the University of Bristol with Thomas Jordan and Henna Koivusalo.
- April 2020 to now: Organiser for the online version of the Vienna Ergodic Theory Seminar.
- Summer 2016: Organising and scientific committee member for the annual, international *Young Researchers in Mathematics 2016* Conference hosted by St Andrews, responsible for the “Pure Mathematics” streams.
- February 2014 to January 2017: Organiser of the University of St Andrews’ *Pure Postgraduate Seminars*.
- May 2015: Local Organiser (St Andrews) for *Joint PG Colloquium 2015*, a joint venture with University of Edinburgh, Herriot–Watt University and University of Glasgow.

Academic responsibilities and achievements, memberships

- Acted as referee for the following journals:
 - ※ *Acta Scientiarum Mathematicarum*,
 - ※ *Advances in Mathematics*,
 - ※ *Annales Academiæ Scientiarum Fennicæ*,
 - ※ *Applied Probability Trust (Journal of Applied Probability & Advances in Applied Probability)*,
 - ※ *Asian Journal of Mathematics*,
 - ※ *Bulletin of the London Mathematical Society*,
 - ※ *Discrete and Continuous Dynamical Systems — Series A*,
 - ※ *Electronic Research Archives*,
 - ※ *Fractals*,
 - ※ *Indiana University Mathematics Journal*,
 - ※ *Involve – A journal of Mathematics*,
 - ※ *Journal of Fractal Geometry*,
 - ※ *Journal of Mathematical Analysis and Applications*,
 - ※ *Journal of Statistical Physics*,
 - ※ *Kyungpook Mathematical Journal*,
 - ※ *Mathematica Pannonica*,
 - ※ *Mathematical Proceedings of the Cambridge Philosophical Society*,
 - ※ *Monatshefte für Mathematik*,
 - ※ *Nonlinearity*,
 - ※ *Portugalix Mathematica*
 - ※ *Proceedings of the American Mathematical Society*,
 - ※ *Real Analysis Exchange*,
 - ※ *Stochastics and Dynamics*,
 - ※ *The Royal Society of Edinburgh: Proceedings A*.
- Reviewer for American Mathematical Society’s Mathematical Reviews (MathSciNet) since 2014.
- Reviewer for Zentralblatt MATH (zbMATH) since 2021.
- My paper (14) with J. Angelevska and A. Käenmäki was the top cited paper of Bull. London Math. Soc. for the period 2020–2021.
- 2017 *IMA Lighthill-Thwaites Prize finalist* for paper (7).
- Member of the following learned societies:
 - ※ American Mathematical Society (since 2020)
 - ※ London Mathematical Society (since 2015)

Grants and Stipends Awarded

In total, I have obtained approximately EUR 500 000 in research project funding (Marie Skłodowska-Curie Action European Fellowship, Senior Meitner Research Fellowship & PhD Funding); EUR 15 000 towards travel, accommodation, and to facilitate collaborative visits; and EUR 30 000 in conference funding. A selection of which can be found below.

- (March 2022) European Union HORIZON EUROPE Marie Skłodowska-Curie Action European Fellowship (MSCA-EF) (pending finalisation) “*Dimension and Dynamics*”. Principle investigator of the two year individual research grant (EUR 215 294.40) investigating random and deterministic self-similar structures and their measure theoretic properties. **(Principal Investigator, Total: EUR 215 294.40)**
- (December 2021) For the *Affine and overlapping iterated function systems* workshop in May 2022 we received: GBP 3 400.00 from the Heilbronn Institute, GBP 4 000.00 and GBP 500.00 from the London Mathematical Society (Scheme 6 and 9, respectively), as well as EUR 1 725.00 from Foundation Compositio Mathematica. **(Conference funding, Total: EUR 11 104.86)**
- (February 2020) London Mathematical Society Scheme 2 (Visits to UK) Grant (GBP 980.00) to fund a lecture tour and visit for collaboration in the UK. In particular, to visit Universities of Birmingham, Bristol, and Glasgow in Summer 2020. Principal host: Simon Baker (Birmingham). **(Co-Applicant, Total: EUR 1 166.20)**
- (December 2019) Austrian Science Fund (FWF) Lise Meitner Senior Research Fellowship M-2813. Principle investigator of two year individual research grant (EUR 172 760.00). Project Title: “*Regularity and embeddability of self-similar processes*”. **(Principal Investigator, Total: EUR 172 760.00)**
- (July 2019) Aktion Österreich Ungarn Collaboration Grant 103öu6 (EUR 3 330.00 and HUF 1 224 000.00) from *Aktion Österreich Ungarn* to facilitate collaborative visits between members of University of Vienna and Budapest Institute of Technology. **(Co-Applicant, Total: EUR 7 079.11)**
- (November 2017) Institut Mittag-Leffler Stipend (SEK 30 386.00) to attend the *Fractal Geometry and Dynamics* thematic semester. **(Programme Fellowship, Total: EUR 3 121.37)**
- (August 2016) For the Young Researches in Mathematics conference we successfully applied for several grants and sponsorships, most notably we were funded by the Heilbronn Institute (GBP 5 208.33), London Mathematical Society (GBP 3 154.09), and the Institute of Mathematics and its Applications (GBP 1 000.00). The grants totalled at GBP 16 379.07. **(Conference Funding, Total: EUR 19 181.38)**
- (February 2016) The academic visit to ICERM, Brown University, Providence, USA in 2016 was financially supported by ICERM. **(Programme Fellowship, Total: EUR 2 315.70)**
- (April 2015) Edinburgh Mathematical Society’s *Research Support Fund* grant to enable a a short research visit by J. Angelevska in 2015, GBP 303.00. **(Principal Investigator, Total: EUR 404.81)**
- (September 2013) *EPSRC Doctoral Training Grant* (EP/K503162/1) for doctoral studies at the University of St Andrews, GBP 56 694.37. **(Principal Investigator, Total: EUR 67,348.22)**

Teaching

Teaching Engagements (last ~5 years):

- Sommersemester 2022: *Special Topics Course in Dynamical Systems: Geometric measure theory and dynamics*, University of Vienna.
- Sommersemester 2020: *Special Topics Course in Dynamical Systems: Fractal Geometry*, University of Vienna.
- Wintersemester 2019: 2 Proseminars for *Grundbegriffe der Topologie (Fundamental Concepts in Topology)*, University of Vienna.
- Sommersemester 2019: Proseminar for *Wahrscheinlichkeitstheorie und Statistik (Prob. Theo. & Statistics)*, University of Vienna.
- Spring Term 2018: Course Coordinator for *MATH128: Calculus 2 for the Sciences*, University of Waterloo.
- Winter Term 2018: Course Instructor for *MATH128: Calculus 2 for the Sciences*, University of Waterloo.
- Fall Term 2017: Organiser of *Branching processes learning seminar*, University of Waterloo.
- Spring Term 2017: Course Instructor for *MATH136: Linear algebra*, University of Waterloo.

Supervision:

- MSc project (2nd advisor/examiner): *Cellular automata in Hydrodynamics*, Grisela Zeka, February 2020.
- BSc project (supervisor): *Der Galton-Watson Prozess*, Cédrine Nilles, August 2020.

- BSc project (supervisor): *Die Topologische Dimension*, Tatjana Punz, September 2020.
- BSc project, teaching stream (supervisor): *Die Mandelbrotmenge*, Julian Malek, September 2020.
- BSc project, teaching stream (supervisor): *Diophantische Gleichungen im historischen Vergleich, (Diophantine equations, a historical comparison)*, Barbara Kleinmaier, June 2019.

Teaching Qualifications:

- November 2017: Attended the week-long *Teaching Development Series* organised by the Centre for Teaching Excellence at the University of Waterloo consisting of: CTE501 How Students Learn, CTE504 Interactive Teaching, CTE196 Teaching Philosophy, CTE502 Motivating Students, CTE503 Assessing Students, CTE505 Introduction to Course Design.
- September 2013: Attended the day-long courses *Tutoring & Demonstrating in the Sciences* and *Assessment and Academic Misconduct* organised by the Centre for Academic, Professional and Organisational Development (CAPOD) at the University of St Andrews.

Selected Contributed Talks at Conferences and Workshops (last ~5 years)

- *Fractals and Related Fields (Isle de Porquerolles, France)*. 6 September 2022
Title: “The box-counting dimension in one-dimensional random geometry of multiplicative cascades”.
- *Chapel Hill Ergodic Theory Workshop (online)*. 28 June 2021
Title: “Recurrence to shrinking targets on generic self-affine sets”.
- *8th Visegrad Conference on Dynamical Systems (Budapest, Hungary)*. 27 June 2019
Title: “The Assouad spectrum and fine information on extremal scaling”.
- *Topology of planar and higher dimensional self-replicating tiles (Salzburg, Austria)*. 19 February 2019
Title: “Structures of self-similar sets and measures with overlaps”.
- *Fractal Geometry and Stochastics 6 (Bad Herrenalb, Germany)*. 1 October 2018
Title: “Self-conformal sets with positive Hausdorff measure”.
- *6th Cornell Conference on Analysis, Probability, and Mathematical Physics on Fractals*. 17 June 2017
Cornell University, Ithaca (NY), USA.
Title: “Exact Hausdorff and packing measure of random attractors”.

Other Talks (last ~5 years)

- I have given the following talks at the University of Vienna Ergodic Theory seminar (while at Vienna):
 - ※ “Dynamically defined subsets of generic self-affine sets” 7 October 2021
 - ※ “On the embeddability of the Brownian map and the Brownian continuum tree” 31 October 2019
- I have given the following talks at the Waterloo Analysis seminar:
 - ※ “Quasi self-similarity and the dimension drop conjecture for self-conformal sets” 30 November 2017
 - ※ “Random fractals, their dimensions and measures” 15 September 2017

References

The following have agreed to provide references.

Prof Henk Bruin
Faculty of Mathematics
University of Vienna
1090 Wien
Austria
henk.bruin@univie.ac.at

Prof Kenneth J Falconer
Mathematical Institute
University of St Andrews
St Andrews, KY16 9SS
Scotland
kjf@st-andrews.ac.uk

Prof Antti Käenmäki
Dept. of Mathematical Sciences
University of Oulu
Oulu, FI-90014
Finland
antti.kaenmaki@oulu.fi