

Thomas Mark (Tom) Hutchcroft

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EMPLOYMENT

- 2021- **Professor of Mathematics.** California Institute of Technology.
- 2021-2021 **Senior Research Associate.** University of Cambridge.
- 2017-2020 **Herchel Smith Postdoctoral Fellowship.** University of Cambridge.
- 2017-2021 **Junior Research Fellow.** Trinity College, Cambridge.

EDUCATION

- 2013-2017 **PhD** in mathematics, co-supervised by Omer Angel and Asaf Nachmias, University of British Columbia (UBC), Canada.
- 2015, 2016, and 2017 Research intern in the Microsoft Research Theory Group, Redmond, USA.
- 2009-2013 **BA and MMath** in mathematics, University of Cambridge.

GRADUATE STUDENTS

- 2020- Philip Easo. PhD student. Cambridge 2020-2021, Caltech 2021-.
- 2019- Noah Halberstam. PhD student. Cambridge. Co-supervised by Sebastian Andres.

PRIZES, SCHOLARSHIPS AND OTHER HONOURS

- 2019 **Rollo Davidson Prize.**
An international prize awarded annually to early-career probabilists by the Rollo Davidson trust.
- 2018 **Governor General's Gold Medal, UBC**
Awarded annually to one graduating doctoral student in the university across all departments.
- Canadian Mathematical Society Doctoral Prize**
Awarded annually to one doctoral student in mathematics graduating from a Canadian university.
- 2017 **Lorraine Schwartz Prize**
Awarded annually to a graduate or undergraduate student in probability or statistics at UBC.
- 2016 **Microsoft Research PhD Fellowship**
A scholarship for PhD students in mathematics and computer science in the US and Canada, awarded to around ten students annually.
- Li Tze Fong Memorial Fellowship** (declined)
A scholarship for PhD students in memory of Hong Kong entrepreneur and politician Li Tze Fong.
- 2015 **UBC Graduate Research Award**
Awarded annually to one graduate student in pure and applied mathematics in recognition of research achievements.

SELECTED PUBLICATIONS

- Supercritical percolation on nonamenable graphs: Isoperimetry, analyticity, and exponential decay of the cluster size distribution*, with Jonathan Hermon. **Inventiones Mathematicae**, 2020.
- Kazhdan groups have cost 1*, with Gábor Pete. **Inventiones Mathematicae**, 221, 873–891 (2020).
- Percolation on hyperbolic graphs*. **Geometric and Functional Analysis**, 29(3):766–810, 2019.
- Universality of high-dimensional spanning forests and sandpiles*. **Probability Theory and Related Fields**, 176(1-2):533–597, 2020.
- Geometric and spectral properties of causal maps*, with N. Curien and A. Nachmias. **Journal of the European Mathematical Society**, 2020.
- Non-uniqueness and mean-field criticality for percolation on nonunimodular transitive graphs*. **Journal of the American Mathematical Society**, 33 (2020), 1101-1165.
- Hyperbolic and Parabolic Unimodular Random Maps*, with O. Angel, A. Nachmias, and G. Ray. **Geometric and Functional Analysis**, 28(4):879– 942, 2018.
- Critical percolation on any quasi-transitive graph of exponential growth has no infinite clusters*, **Comptes Rendus Mathématique**, 354(9):944–947, 2016.
- Unimodular Hyperbolic Triangulations: Circle Packing and Random Walk*, with O. Angel, A. Nachmias and G. Ray. **Inventiones Mathematicae**, 206 (2016), no. 1, 229–268.

SERVICE

- Co-organizer of the *Percolation Today* webinar jointly with Hugo Duminil-Copin (2020-2021), Vincent Tassion (2020-), and Christophe Garban (2022-). Starting in April 2020, the seminar has now had over fifty two-hour sessions with a typical attendance of around forty-fifty people from around the world. 2020-
- Creator and co-organizer of the Los Angeles Probability Forum, a new monthly event for the LA probability community. 2022-
- Caltech Math Graduate Admissions Committee. 2022
- Associate Editor, *Annales de l'Institut Henri Poincaré*. 2021-
- Undergraduate admissions interviewer, Trinity College Cambridge. 2017-2020

TEACHING

- Random walks and uniform spanning trees*, graduate topics course, Caltech. 2022
- Percolation on Nonamenable Groups, Old and New*, four lecture mini-course, International Centre for Theoretical Sciences, India. 2021
- Random walks and uniform spanning trees*, Part III Master's course, Cambridge. 2020
- Percolation and the cost of groups*, two lecture mini-course, Swiss Doctoral Program in Mathematics Kervaire Seminar: Groups and dynamics, Les Diablerets, Switzerland.
- Three lecture mini-course, Online Open Probability School.
- Scaling exponents in high-dimensional spanning forests and the interlacement Aldous-Broder algorithm*, four lecture mini-course, Fondation des Treilles, France. 2019
- Supervisor for Cambridge undergraduate courses including Analysis 1, Linear Analysis, Analysis of Functions, Applied Probability, Markov Chains, and Topics in Analysis. 2017-2021
- Instructor, MATH 110, UBC. 2015
- MATH 110 Workshop Facilitator, UBC. 2014
- Math Learning Centre Tutor, UBC. 2013-2016

PUBLICATIONS AND PREPRINTS: FULL LIST

(Listed in reverse chronological order by appearance on the arXiv.)

- 2022 *Most transient random walks have infinitely many cut times*, with Noah Halberstam. Submitted.
Sharp hierarchical upper bounds on the critical two-point function for long-range percolation on \mathbb{Z}^d . Submitted.
- 2021 *Supercritical percolation on finite transitive graphs I: Uniqueness of the giant component*, with Philip Easo. Submitted.
The bunkbed conjecture holds in the $p \uparrow 1$ limit, with Alexander Kent and Petar Nizic-Nikolac. Submitted.
High-dimensional near-critical percolation and the torus plateau, with Emmanuel Michta and Gordon Slade. Submitted.
What are the limits of universality? with Noah Halberstam. **Proceedings of the Royal Society A**, 2022.
On the derivation of mean-field percolation critical exponents from the triangle condition. **Journal of Statistical Physics**, revisions requested.
Non-triviality of the phase transition for percolation on finite transitive graphs, with Matthew Tointon. Submitted.
The critical two-point function for long-range percolation on the hierarchical lattice. Submitted.
- 2020 *Transience and recurrence of sets for branching random walk via non-standard stochastic orders*. **Annales de l'Institut Henri Poincaré**, to appear.
Logarithmic corrections to scaling in the four-dimensional uniform spanning tree, with Perla Sousi. Submitted.
Collisions of Random Walks in Dynamic Random Environments, with Noah Halberstam. **Electronic Journal of Probability**, to appear.
Power-law bounds for critical long-range percolation below the upper-critical dimension. **Probability Theory and Related Fields** (special issue in memory of Harry Kesten), to appear.
Continuity of the Ising phase transition on nonamenable groups. Submitted.
On the tail of the branching random walk local time, with Omer Angel and Antal Jari. **Probability Theory and Related Fields**, 2020.
Slightly supercritical percolation on nonamenable graphs I: The distribution of finite clusters. **Proceedings of the London Mathematical Society**, revisions requested.
- 2019 *Non-intersection of transient branching random walks*. **Probability Theory and Related Fields**, 178, 1–23 (2020).
Large, lengthy graphs look locally like lines, with Itai Benjamini. **Bulletin of the London Mathematical Society**, to appear.
Supercritical percolation on nonamenable graphs: Isoperimetry, analyticity, and exponential decay of the cluster size distribution, with Jonathan Hermon. **Inventiones Mathematicae**, 2020.
The L^2 boundedness condition in nonamenable percolation. **Electronic Journal of Probability**, Volume 25, (2020).
New critical exponent inequalities for percolation and the random cluster model. **Probability and Mathematical Physics**, to appear.
- 2018 *Kazhdan groups have cost 1*, with Gabor Pete. **Inventiones Mathematicae**, 221, 873–891 (2020).
Indistinguishability of collections of trees in the uniform spanning forest. **Annales de l'Institut Henri Poincaré**, Volume 56, Number 2 (May 2020), 917–927.
No percolation at criticality on certain groups of intermediate growth, with Jonathan Hermon. **International Mathematics Research Notices**, 2019.

Locality of the critical probability for transitive graphs of exponential growth. **Annals of Probability**, Volume 48, Number 3 (2020), 1352-1371.

Anomalous diffusion of random walks on random planar maps, with Ewain Gwynne. **Probability Theory and Related Fields**, 178, 567–611(2020).

Percolation on hyperbolic graphs. **Geometric and Functional Analysis**, 29,766–810(2019).

Universality of high-dimensional spanning forests and sandpiles. **Probability Theory and Related Fields**, 176, 533–597(2020).

Coalescing random walk on unimodular graphs, with Eric Foxall and Matthew Junge. **Electronic Communications in Probability**, Volume 23 (2018), paper no. 62, 10 pp.

Mallows permutations as stable matchings, with O. Angel, A. Holroyd and A. Levy. **Canadian Journal of Mathematics**, to appear.

Statistical physics on a product of trees. **Annales de l'Institut Henri Poincaré**, Volume 55, 2017 Number 2 (May 2019), 1001-1010.

Non-uniqueness and mean-field criticality for percolation on nonunimodular transitive graphs. **Journal of the American Mathematical Society**, 33 (2020), 1101-1165.

Geometric and spectral properties of causal maps, with N. Curien and A. Nachmias. **Journal of the European Mathematical Society**, 2020.

Counterexamples for percolation on unimodular random graphs, with O. Angel. **Unimodularity in randomly generated graphs**, 11–28, Contemp. Math., 719, Amer. Math. Soc., Providence, RI, 2018.

Self-avoiding walk on nonunimodular transitive graphs. **Annals of Probability**, Volume 47, Number 5 (September 2019), 2801-2829.

The Hammersley-Welsh bound revisited. **Electronic Communications in Probability**, Volume 23, (2018).

Finitely Dependent Cycle Coloring, with A. Holroyd and A. Levy. **Electronic Communications in Probability**, Volume 23 (2018), paper no. 64, 12 pp.

Harmonic Dirichlet Functions on Planar Graphs. **Discrete and Computational Geometry**, April 2019, Volume 61, Issue 3, pp 479–506.

Mallows Permutations and Finite Dependence, with A. Holroyd and A. Levy. **Annals of Probability**, Volume 48, Number 1 (January 2020), 343-379.

The Component Graph of the Uniform Spanning Forest: Transitions in Dimensions 9, 10, 11, ..., with Y. Peres. **Probability Theory and Related Fields**, 175, 141–208(2019).

Hyperbolic and Parabolic Unimodular Random Maps, with O. Angel, A. Nachmias, and G. Ray. 2016 **Geometric and Functional Analysis**, 28, 879–942(2018).

Critical percolation on any quasi-transitive graph of exponential growth has no infinite clusters, **Comptes Rendus Mathématique**, 354(9):944–947, 2016.

Uniform Spanning Forests of Planar Graphs, with A. Nachmias. **Forum of Mathematics Sigma**, Volume 7, 2019, e29.

Interlacements and the Wired Uniform Spanning Forest, **Annals of Probability**, Volume 46, 2015 Number 2 (March 2018), 1170-1200.

Boundaries of Planar Graphs: A Unified Approach, with Y. Peres. **Electronic Journal of Probability**, Volume 22 (2017), paper no. 100, 20 pp.

Indistinguishability of Trees in Uniform Spanning Forests, with A. Nachmias. **Probability Theory and Related Fields**, June 2017, Volume 168, Issue 1–2, pp 113–152.

Collisions of Random Walks in Reversible Random Graphs, with Y. Peres. **Electronic Communications in Probability**, 20, no. 63, 1-6, 2015.

Wired Cycle-Breaking Dynamics for Uniform Spanning Forests. **Annals of Probability**, 44 (2016), no. 6, 3879–3892.

Unimodular Hyperbolic Triangulations: Circle Packing and Random Walk, with O. Angel, A. Nachmias and G. Ray. **Inventiones Mathematicae**, 206 (2016), no. 1, 229–268.

INVITED TALKS

- 2022 UCONN Math colloquium.
UCSD Group Actions Seminar.
Probability and the City seminar.
Descriptive Combinatorics, LOCAL Algorithms and Random Processes, Oberwolfach.
The Analysis and Geometry of Random Spaces, MSRI.
Chicago Mathematics Colloquium.
Chicago Probability Seminar.
- 2021 UCLA Probability Seminar.
Probability Seminar, INRIA Paris.
Stochastic Geometry Days, Dunkerque.
Stanford probability seminar.
Munich Oberseminar Wahrscheinlichkeitstheorie.
QMUL Combinatorics Study Group.
Spatial Networks and Percolation, Oberwolfach.
Progrès récents sur les marches aléatoires, CIRM.
Random Geometry and Statistical Physics webinar.
UCLA Math Colloquium.
Berkeley Math Colloquium.
Carnegie Mellon Math Colloquium.
Northwestern Math Colloquium.
- 2020 Caltech Math Colloquium.
University of Toronto Math Colloquium.
NYU Courant Colloquium.
Online Open Probability Summer School.
Oxford Discrete Mathematics and Probability Seminar.
UCLA Probability Seminar.
UBC Probability Seminar.
TU Graz Probability Seminar.
Joint Israeli Probability Seminar.
- 2019 Random walks and Polymers: Interacting and folding, Fondation des Treilles, France.
Group Theory Afternoon, ENS Paris.
Groups, Geometry, and Dynamics Seminar, ENS Lyon.
Action! Working Group, ENS Lyon.
Probability Seminar, University of Bristol.
Stochastic Analysis Seminar, Imperial College London.
Vienna Probability Seminar, Universität Wien.
Mathematical Physics Seminar, Université de Genève.
Analysis and Geometry Seminar, University of Bristol.
Probability Seminar, University of British Columbia.
Measurable, Borel, and Topological Dynamics, CIRM.
Probability Seminar, University of Warwick.
Pure Mathematics Colloquium, University of Lancaster.
Probability and Statistics Seminar, University of Sheffield.
Groups, Dynamics, and Approximation, MFO Oberwolfach, Germany.
- 2018 Scaling Limits in Models of Statistical Mechanics, Oberwolfach, Germany.
Random Walks on Symmetric Structures, IIAS, Jerusalem, Israel.
Canadian Mathematical Society Winter Meeting, Vancouver, Canada.
Geometric Group Theory Seminar, University of Cambridge.
Probability Seminar, University of Cambridge.
Probability Seminar, University of British Columbia.

Stochastic Processes and Their Applications, Gothenburg, Sweden.
 IMS Annual Meeting on Probability and Statistics, Vilnius, Lithuania.
 RGM Follow Up Workshop, Isaac Newton Institute, Cambridge, UK.
 Combinatorics Seminar, University of Birmingham.
 Combinatorics Seminar, University of Warwick.
 Probability Seminar, Columbia University.
 Probability Seminar, Courant Institute.
 Seminar on Stochastic Processes, ETH Zurich.
 Probability Seminar, Alfred Renyi Institute of Mathematics.
 Probability Seminar, BME Budapest.
 Strongly Correlated Random Interacting Processes, Oberwolfach.
 Combinatorics Seminar, University of Warwick.
 Combinatorics Seminar, University of Birmingham.
 Probability Seminar, University of Cambridge. 2017
 Dynamics on Random Graphs and Maps, CIRM.
 Elegance in Probability (Russell Lyons' 60th birthday conference), Tel Aviv University.
 Mathematical Congress of the Americas, Montreal.
 AMS Sectional Meeting, Session on Probability Theory, Indiana University.
 Probability Seminar, Universite Paris Sud.
 Probability Seminar, University of British Columbia. 2016
 Northwest Probability Seminar, Microsoft Research.
 Random Spatial Processes and Dynamics, Texas A&M.
 Probability Seminar, University of Bath.
 Probability Workshop, Oxford University.
 Probability Seminar, University of Cambridge.
 Probability Seminar, University of British Columbia.
 Probability and Statistical Physics Seminar, University of Chicago.
 MSR Talk Series, Microsoft Research. 2015
 Geometric Functional Analysis and Probability Seminar, Weizmann Institute.
 Horowitz Seminar, Tel Aviv University.
 Groups, Graphs, and Stochastic Processes, Banff International Research Centre.
 Probability Seminar, University of British Columbia. 2014
 Probability on Trees and Planar Graphs, Banff International Research Centre.