Nina Holden

CONTACT
INFORMATION

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RESEARCH
INTERESTS

Probability theory and mathematical physics, in particular Liouville quantum gravity, Schramm-Loewner evolutions, random planar maps, and statistical mechanics

EMPLOYMENT

Courant Institute of Mathematical Sciences, New York University, USA.

Associate Professor, from 9/2022

Department of Mathematics, ETH Zürich, Switzerland.

Postdoc, 1/2021-8/2022

Institute for Theoretical Studies, ETH Zürich, Switzerland.

Junior Fellow, 9/2018-12/2020

EDUCATION

Massachusetts Institute of Technology, USA

Ph.D. in Mathematics, 6/2018

- Thesis: Cardy embedding of random planar maps and a KPZ formula for mated trees
- Advisor: Scott Sheffield

University of Oslo, Norway

M.S. in Applied Mathematics, 12/2010

- Thesis: Portfolio optimization in a jump-diffusion market with durability and local substitution: A penalty approximation of a singular control problem
- Advisor: Kenneth Karlsen

University of Oslo, Norway

B.S. in Mathematics and Computational Science, 6/2008

Oxford University, United Kingdom

Visiting Student in Mathematics, 9/2006-6/2007

HONORS AND
AWARDS

2024	ICBS Frontiers of Science Award in Mathematics
2023-26	National Science Foundation Probability Grant
2023	Rollo Davidson Prize
2023	Nansen's Award for Young Researchers in Science and Medicine
2022	Viggo Brun Prize
2021	Maryam Mirzakhani New Frontiers Breakthrough Prize
2020	UBC Science Early Career Award
2020	Bernoulli Society New Researcher Award
2019	SwissMAP Innovator Prize
2014-17	Scholarship from the Norwegian Research Council
2014	Ida M. Green Scholarship from MIT
2010	McKinsey award for academic results and extracurricular activities
2005	International Mathematical Olympiad, Honourable mention
2005	Norwegian Mathematical Olympiad, first place

PUBLICATIONS   *Liouville quantum gravity weighted by conformal loop ensemble nesting statistics*, with M. Lehmkuehler. Probability and Mathematical Physics, to appear.

Integrability of SLE via conformal welding of random surfaces, with M. Ang and X. Sun. Communications in Pure and Applied Mathematics (CPAM), 2024.

Percolation on triangulations: a bijective path to Liouville quantum gravity, with O. Bernardi and X. Sun. Memoirs of the American Mathematical Society, 2023.

Convergence of uniform triangulations under the Cardy embedding, with X. Sun. Acta Mathematica, 2023.

Mating of trees for random planar maps and Liouville quantum gravity: a survey, with E. Gwynne and X. Sun. Panoramas et Syntheses, 2023.

The SLE loop via conformal welding of quantum disks, with M. Ang and X. Sun. Electronic Journal of Probability, 2023.

Baxter permuton and Liouville quantum gravity, with J. Borga, X. Sun, and P. Yu. Probability Theory and Related Fields, 2023.

Brownian half-plane excursion and critical Liouville quantum gravity, with J. Aru, E. Powell, and X. Sun. Journal of the London Mathematical Society, 2023.

Conformal welding of quantum disks, with M. Ang and X. Sun. Electronic Journal of Probability, 2023.

Natural parametrization of percolation interface and pivotal points, with X. Li and X. Sun. Annales de l'Institut Henri Poincare, 2022.

Minkowski content of Brownian cut points, with G. Lawler, X. Li, and X. Sun. Annales de l'Institut Henri Poincare, 2022.

Liouville dynamical percolation, with C. Garban, A. Sepúlveda, and X. Sun. Probability Theory and Related Fields, 2021.

Conformal welding for critical Liouville quantum gravity, with E. Powell. Annales de l'Institut Henri Poincare, 2021.

Gravitational allocation for uniform points on the sphere, with Y. Peres and A. Zhai. Annals of Probability, 2021.

Joint scaling limit of site percolation on random triangulations in the metric and peanosphere sense, with E. Gwynne and X. Sun. Electronic Journal of Probability, 2021.

An almost sure KPZ relation for SLE and Brownian motion, with E. Gwynne and J. Miller. Annals of Probability, 2020.

A mating-of-trees approach to graph distances in random planar maps, with E. Gwynne and X. Sun. Probability Theory and Related Fields, 2020.

Scaling limits of the Schelling model, with S. Sheffield. Probability Theory and Related Fields, 2020.

Lower bounds for trace reconstruction, with R. Lyons. Annals of Applied Probability, 2020.

Liouville quantum gravity with central charge in $(1, 25)$*: a probabilistic approach*, with E. Gwynne, J. Pfeffer, and G. Remy. Communications in Mathematical Physics, 2020.

Scaling limit of large triangulations of polygons, with M. Albenque and X. Sun. Electrnic Journal of Probability, 2020.

Communication cost of consensus for nodes with limited memory, with G. Fanti, Y. Peres, and G. Ranade. Proceedings of the National Academy of Sciences of the United States of America (PNAS), 2020.

Dimension transformation formula for conformal maps into the complement of an SLE curve, with E. Gwynne and J. Miller. Probability Theory and Related Fields, 2019.

How round are the complementary components of planar Brownian motion? with S. Naçu, Y. Peres, and T. S. Salisbury. Annales de l'Institut Henri Poincaré, 2019.

SLE as a mating of trees in Euclidean geometry, with X. Sun. Communications in Mathematical Physics, 2018.

A distance exponent for Liouville quantum gravity, with E. Gwynne and X. Sun. Probability Theory and Related Fields, 2018.

Gravitational allocation on the sphere, with Y. Peres and A. Zhai. Proceedings of the National Academy of Sciences of the United States of America (PNAS), 2018.

Negative moments for Gaussian multiplicative chaos on fractal sets, with C. Garban, A. Sepulveda, and X. Sun. Electronic Communications in Probability, 2018.

Sparse exchangeable graphs and their limits via graphon processes, with C. Borgs, J. T. Chayes, and H. Cohn. Journal of Machine Learning Research (JMLR), 2018.

Trace reconstruction with varying deletion probabilities, with L. Hartung and Y. Peres. Analytic Algorithmics and Combinatorics (ANALCO), 2018.

Subpolynomial trace reconstruction for random strings and arbitrary deletion probability, with R. Pemantle and Y. Peres. Conference On Learning Theory (COLT), 2018.

Brownian motion correlation in the peanosphere for kappa>8, with E. Gwynne, J. Miller, and X. Sun. Annales de l'Institut Henri Poincaré, 2017.

ARXIV PREPRINTS   *Conformal welding of quantum disks and multiple SLE: the non-simple case*, with M. Ang, X. Sun and P. Yu. ArXiv e-prints, October 2023.

Regularity of the Schramm-Loewner evolution: Up-to-constant variation and modulus of continuity, with Y. Yuan. ArXiv e-prints, 2205.05074.

Joint scaling limit of a bipolar-oriented triangulation and its dual in the peanosphere sense, with E. Gwynne and X. Sun. ArXiv e-prints, 1603.01194.

EMPLOYMENT (NON-ACADEMIC)   **Statkraft**, Energy Market Analyst and Graduate Trainee, Norway, Germany, Belgium,

and Brazil, 8/2010-6/2013. Modelling and analysis of the European, Asian and South-American power markets, trading, risk analysis.

INTERNSHIPS	**Microsoft Research**, Summer Intern, Redmond, WA, 6/2017-8/2017 and 6/2018-8/2018. Trace reconstruction, gravitational allocation, and consensus protocols.
	Microsoft Research, Consulting Researcher, Redmond, WA, 7/2016-1/2017 (8 weeks). Planar Brownian motion and gravitational allocation.
	Microsoft Research, Summer Intern, Cambridge, MA, 6/2015-8/2015. Theory of graphons for sparse graphs.
	Sintef, Summer Intern, Oslo, Norway, 6/2009-8/2009. Vehicle routing optimization problems and heuristic algorithms for the travelling salesman problem.
	CERN, Technical Student, Geneva, Switzerland, 7/2008-12/2008. Simulation of ion beams in the LHC (Large Hadron Collider).
	Simula Research Laboratory, Summer Intern, Oslo, Norway, 6/2007-8/2007. Numerical methods for mathematical modelling of heart cells.
	Norwegian Defense Research Establishment, Horten, Norway, 6/2006-8/2006. Models for underwater transmission of sound with applications to mine sweepers.

TALKS		
	6/2025	Minicourse at the PIMS-CRM summer school, Vancouver
	8/2024	Advances in probability theory and interacting particle systems – a conference in honor of S. R. Srinivasa Varadhan, Harvard University
	8/2024	Schramm Lecture, Bernoulli-IMS World Congress, Bochum, Germany
	7/2024	Invited Speaker, 9th European Congress of Mathematics, Seville, Spain
	3/2024	New Directions in Conformal Field Theory Workshop, Fields institute
	1/2024	Graduate student and postdoc seminar, Courant Institute
	1/2024	University of Michigan Mathematics Colloquium
	8/2023	Women in mathematical physics, Banff (virtual)
	6/2023	Plenary talk, 29th Nordic Congress of Mathematicians in collaboration with the EMS, Aalborg, Denmark
	5/2023	Norwegian women in math (virtual)
	5/2023	Southeastern Probability Conference, Duke
	3/2023	Plenary Speaker, German congress of probability and statistics
	12/2022	123rd Statistical Mechanics Conference, Rutgers University
	12/2022	Princeton probability seminar
	9/2022	Probability and the City seminar, Columbia University and NYU
	9/2022	Plenary Speaker, Meeting of Norwegian Mathematicians (virtual/Tromso)
	8/2022	Plenary Speaker, European Women in Mathematics General Meeting, Helsinki (virtual)
	7/2022	Plenary Speaker, 42nd conference on Stochastic Processes and their Applications (SPA), Wuhan, China (virtual)
	7/2022	Probability and Mathematical Physics ICM satellite, Helsinki (virtual)
	6/2022	50 Years of Number Theory and Random Matrix Theory Conference, IAS, Princeton (virtual)
	4/2022	The Analysis and Geometry of Random Spaces, MSRI (Berkeley/virtual)
	2/2022	Rochester Mathematics Colloquium (virtual)
	2/2022	Australia and New Zealand Math Physics (virtual)

2/2022	MSRI Introductory Workshop: The Analysis and Geometry of Random Spaces (Berkeley/virtual)
12/2021	PIMS Pacific Workshop on Probability and Statistical Physics (virtual)
12/2021	Australian Mathematical Society Early Career Workshop (virtual)
11/2021	Mathematical physics One World Seminar (virtual)
11/2021	Probability and Statistics Seminar, University of Southern California (virtual)
11/2021	Analysis-Applied Math-Physics Seminar, Dalhousie University (virtual)
10/2021	String Theory Seminar, Amsterdam (virtual)
10/2021	Integrability in Conformal Probability Conference (virtual)
9/2021	Atiyah Memorial Conference, Newton Institute, Cambridge, UK (virtual)
8/2021	Invited Session, Bernoulli-IMS World Congress Prob. & Stat., Seoul (virtual)
8/2021	High Energy Theory Lunch, McGill Physics (virtual)
6/2021	Lattice Paths, Combinatorics and Interactions Conference, CIRM (virtual)
6/2021	SPDE and Friends Conference, Berlin (virtual)
5/2021	Theoretical Physics Seminar, Stanford (virtual)
5/2021	New Developments in Probability, Tulane University (virtual)
4/2021	Bristol Probability Seminar (virtual)
2/2021	Berlin Probability Colloquium (virtual)
1/2021	Hausdorff Colloquium, Bonn (virtual)
1/2021	Oberwolfach, Spatial Networks and Percolation (virtual)
1/2021	Colloquium, Perimeter Institute, Waterloo (virtual)
1/2021	Developments in the Mathematical Sciences Conference, Max Planck Leipzig
12/2020	Mathematics Colloquium, University of British-Columbia (virtual)
12/2020	Stochastic Analysis Seminar, Imperial College (virtual)
11/2020	Math Physics Seminar, Perimeter Institute, Waterloo (virtual)
11/2020	Probability and Math Physics Seminar, Chicago (virtual)
10/2020	Discrete Maths and Probability Seminar, Oxford (virtual)
10/2020	AMS sectional meeting (virtual)
9/2020	Seminar, Max Planck Leipzig
8/2020	Bernoulli-IMS One World Symposium (virtual)
8/2020	Open Online Probability School: SLE mini course (virtual)
4/2020	One World Probability Seminar (virtual)
2/2020	Statistical Physics Conference, Diablerets, Switzerland
2/2020	Theory Seminar, EPFL, Lausanne, Switzerland
12/2019	Mathematical Physics and Analysis Seminar, IAS, Princeton
11/2019	Probability Seminar, University of Münster, Germany
11/2019	Probability Seminar, RUHR-University Bochum, Germany
9/2019	6th SwissMAP General Meeting, Villars-sur-Ollons, Switzerland
8/2019	12th Math Society of Japan, Seasonal Institute, Fukuoka, Japan
6/2019	Probability Seminar, TU Berlin
6/2019	Probability and quantum field theory, Porquerolles, France
6/2019	Dynamics of Random Processes school, SLE mini course, Montreal
5/2019	Probability Seminar, University of Warwick, UK
4/2019	Graduate Seminar, NYU Shanghai, China
4/2019	Probability Seminar, NYU Shanghai, China
3/2019	Random Walks and Polymers Workshop, Tourtour, France
2/2019	Special Seminar, Columbia University
2/2019	Mathematics Department Colloquium, New York University
1/2019	Probability Seminar, Columbia University
1/2019	Analysis and Geometry of Random Shapes, IPAM, UCLA
12/2018	Amir Dembo's birthday conference, Stanford
12/2018	French Math Society State of Research: Stat. Mech., IHP, Paris
12/2018	Combinatorics Seminar, Paris Nord
11/2018	Probability Seminar, Marseille, France
11/2018	ITS Fellows Seminar, Zürich, Switzerland
10/2018	Reading group on Yang-Mills, ETH Zürich
10/2018	Analysis, Probability and Math Physics Seminar, IST Austria

10/2018	Probability Seminar, ETH Zürich
8/2018	Theory Lunch, University of Washington, Seattle, WA
8/2018	Theory Lunch, Microsoft Research, Redmond, WA
7/2018	Random Geometry Followup Conference, Cambridge, UK
7/2018	COLT, Stockholm, Sweden
7/2018	IMS Annual Meeting on Probability and Statistics, Lithuania
4/2018	AMS Sectional Meeting, Northeastern University
2/2018	Mathematics Department Colloquium, Stanford University
2/2018	Probability Seminar, Berkeley
12/2017	Workshop on Log-Correlated Random Fields, Columbia University
11/2017	Probability Reading Group, ETH Zürich
11/2017	Probability Seminar, ENS Lyon
11/2017	Probability Seminar, Stanford University
11/2017	Analysis Seminar, Stony Brook
10/2017	Topics in Probability Seminar, Princeton University
7/2017	Theory Lunch, Microsoft Research, Redmond
5/2017	Discrete Math Seminar, Brown
4/2017	Pure Math Graduate Student Seminar (Pumagrass), MIT
4/2017	Probability Seminar, MIT
4/2017	AMS Sectional Meeting, Indiana University
3/2017	Probability Seminar, Harvard
3/2017	SLE, GFF and LQG Conference, Columbia University
3/2017	WINRS Conference, Brown
2/2017	AMS Grad Student Conference, Analysis and Probability, Brown
2/2017	Probability Seminar, University of Chicago
1/2017	Probability Seminar, Penn/Temple Universities
1/2017	Probability Seminar, University of Washington
11/2016	Probability Seminar, Cornell
8/2016	Big Data Conference, Harvard
6/2016	Recent developments in SLE, Mittag-Leffler, Sweden
2/2016	Probability Seminar, Toronto University
2/2016	Rainwater Analysis Seminar, University of Washington
3/2015	Probability Seminar, Cambridge University

TEACHING	New York University: Probability Theory II (2023, 2024)
	Massachusetts Institute of Technology: Multivariable Calculus; Probability and Random Variables (recitations; 2016-17)
	University of Oslo: Modelling and Computations; Linear Optimization; Differential equations (recitations; 2007-10)
SUPERVISION	PhD thesis: Xingjian Di (with Wei Wu; in progress) and Zhenfeng Tu (in progress)
	Master student reading course: Valeria Ambrosio (2019), Luis Brummet (2022), Jason Guo (2023)
	Undergraduate research: Jianliang Ye (2023), Kexin Zhang (2023)

(Co-)organizer	2024	Conference on Two-dimensional Random Geometry, IMSI, UChicago
	2024	Session at the International Congress of Mathematical Physics, Strasbourg
	2023-	ENYGMMa: events for gender-minorities in math in the New York area
	2023	Northeast Probability Seminar, New York University
	2023	Workshop on the Schramm-Loewner evolutions, UPenn
	2022	Workshop on Random Geometry and Statistical Mechanics, UPenn
	2022	Session at IMS Annual meeting, London
	2021	Session at Bernoulli-IMS World Congress in Probability and Statistics, Seoul
	2020-23	Online seminar series, Random Geometry and Statistical Mechanics
	2020	Working group at ETH Zürich about Liouville quantum gravity
	2018-20	ETH Zürich probability lunches
	2014	MIT pure mathematics graduate student seminar

Departmental service	2023-24	Courant Instructor Committee, New York University
	2023-24	Hiring committee for the Courant Institute, New York University
	2023	Hiring committee for New York University in Abu Dhabi

Non-departmental service	2026	Scientific Committee, Log CFT, Loop Models & Random Geometry, CIRM
	2024-	Associate Editor, Annals of Probability
	2024	Scientific committee, Stochastic Processes and their Applications
	2023	PhD thesis jury for Baojun Wu
	2023	Program Committee, 11th World Congress in Probability and Statistics
	2021-	Associate Editor, Annales de l'Institut Henri Poincare

Reviews and opinions

General mathematics journals: Annales Henri Lebesgue, Communications in Pure and Applied Mathematics, Duke, EMS Surveys in Mathematical Sciences, Forum of Mathematics, Pi, Inventiones, Journal of the European Mathematical Society, Journal of the American Mathematical Society, Mathematische Zeitschrif, Memoirs of the AMS, Transactions of the AMS

Probability, mathematical physics and combinatorics journals: ALEA, Annales de l'Institut Henri Poincare, Annals of Applied Probability, Annals of Probability, Communications in Mathematical Physics, Journal of Theoretical Probability, Letters in Mathematical Physics, Probability and Mathematical Physics, Probability Theory and Related Fields, Random Structures and Algorithms, RANDOM, Stochastics

Computer science conferences: FOCS, SODA, STOC

Grants: NSF, ERC, NSERC

Theses: Baojun Wu (2023), Alexander Glazman (2022)