
Personal information

Name Hirsch, Christian
Date of birth September 3, 1985
Address Ny Munkegade 118, 8000 Aarhus C, Denmark
Web site <https://christian-hirsch.netlify.app/>

Academic employment

12/21 - **Associate Professor**, *Aarhus University*.
01/20 - 11/21 **Assistant Professor**, *University of Groningen*.
02/19 - 12/19 **Assistant Professor**, *University of Mannheim*.
04/18 - 01/19 **Postdoc**, *Aalborg University*.
10/16 - 03/18 **Postdoc**, *LMU Munich*.
09/14 - 09/16 **Postdoc**, *WIAS Berlin*.

Education

16/12/2014 **PhD**, summa cum laude, *Ulm University*.
Connectivity and percolation properties of stochastic networks; Supervisor: *V. Schmidt*.
28/05/2010 **Diploma in Mathematics**, passed with distinction, *LMU Munich*.
Cohomological invariants of reflection groups; Supervisor: *F. Morel*.

Research funding

05/25 **DKK 6,187,579. Danmarks Frie Forskningsfond.**
DFF2 project "Biomimetic Neural Network-Like Materials with Adaptive Learning?"
12-month postdoc for my group; grant proposal with Brigitte Städler as PI
08/25 **DKK 113,800. Carlsberg Foundation and Danish Data Science Academy.**
Summer school "Topological data analysis in stochastic geometry and image processing"
Grant proposal
07/25 **Aarhus Institute of Advanced Studies.**
Two-week research visit of Markus Heydenreich
Grant proposal
06/25 **DKK 30,000. Aarhus Universitets Forskningsfond.**
Sabbatical grant to visit Daniel Valesin
Grant proposal
01/25 **DKK 3,999,375. Villum Fonden.**
Villum Synergy project "Can Active Colloids Have Collective Behavior?"
24-month postdoc for my group; grant proposal with Brigitte Städler as PI
07/24 **DKK 30,000. Aarhus Universitets Forskningsfond.**
International mobility grant for Takashi Owada
Support during the application process (collaboration topic, support letter, proof reading)

¹Remaining 50 % from department funding

- 09/23 **DKK 9,500. DIGIT project grant.**
Participation at ICERM workshop Topology and Geometry in Neuroscience
 Grant proposal
- 07/23,01/24 **DKK 24,000. Danish Data Science Academy.**
Visit grant for Nils Heerten and Martina Petráková
 Support during the application process (collaboration topic, support letter, proof reading)
- 06/23 **DKK 80,000. Carlsberg Foundation and Danish Data Science Academy.**
Summer school "TDA and spatial statistics"
 Grant proposal
- 11/22 **DKK 1,800,000. Danish Data Science Academy.**
PhD scholarship for Péter Juhász
 Support during the application process (finding topic, proposal writing, mock interview)
- 09/21 **€ 4,000. STAR & NWO.**
TDA workshop in Groningen
 Grant proposal
- 01/19 **€ 800. German Excellence Initiative.**
One-week research visit of Markus Heydenreich
 Grant proposal
- 10/16 - 03/18 **50% Postdoc position¹ and € 22,000. German Excellence Initiative.**
Own position, travel and conference funding
 Grant proposal
- 11/16 - 10/17 **€ 35,000. Orange S.A..**
Continuum percolation theory applied to device to device
 Project work and participation in contract negotiations and set-up

Academic awards and honors

- 09/24–08/26 **Associate Fellow in the Aarhus Institute of Advanced Studies.**
- 12/22 **Offer for W2 professor position at Philipps-Universität Marburg (declined).**
- 02/21 **Offer for WASP AI assistant professor position at Umea University (declined)**
 After an international competition, I was offered a WASP AI assistant professor position at Umea University. The starting package included 2 PhDs and 2 Postdocs as well as SEK 740,000 of funds for me as PI plus SEK 480,000 for my group.
- 06/20 **Nomination for the KNAW Early-Career Award**
 I was chosen to be one of two nominees from the *Bernoulli Institute for Mathematics, Computer Science and Artificial Intelligence* for the KNAW Early-Career Award, the most prestigious scientific award for Dutch early-career researchers in the Netherlands.
- 2016–2018 **Member of the Young Center at the Center for Advanced Studies LMU.**
 The Young Center is an organization of early-career researchers holding prestigious fellowships from research funding organizations. It provides a fertile ground for an exchange of ideas and for building networks that transcend disciplinary boundaries.

Scientific focus areas

- ▷ **Statistical foundations of topological data analysis**
- ▷ **Large deviations theory in stochastic geometry**
- ▷ **Percolation theory of spatial random networks.**

Research visits

- 05/25–06/25 University of Warwick.
- 05/24–07/24 Université Paris Cité.
- 09/17 KAIST, Daejeon.
- 11/12, 09/13 University of Queensland, Brisbane & University of Melbourne .

Publications

Preprints.

- G. Amir, M. Heydenreich, and **C. Hirsch**. Planar reinforced k -out percolation *arXiv preprint arXiv:2407.12484*.
- M. Brun, **C. Hirsch**, M. Otto, and P. Juhász. Random Connection Hypergraphs *arXiv preprint arXiv:2407.16334*.
- C. Hirsch** and R. Lachièze-Rey. Functional central limit theorem for topological functionals of Gaussian critical points *arXiv preprint arXiv:2411.11429*.
- C. Hirsch** and K. Nam. Large deviations for the isoperimetric constant in 2D percolation. *arXiv preprint arXiv:2304.14882*.
- C. Hirsch**, N. N. Lundbye, and M. Otto. Poisson approximation of large-lifetime cycles *arXiv preprint arXiv:2412.17482*.
- C. Hirsch** and T. Owada. Limit theorems under heavy-tailed scenario in the age dependent random connection models *arXiv preprint arXiv:2409.00582*.
- S. Moka, **C. Hirsch**, V. Schmidt, and D. P. Kroese. Efficient Rare-Event Simulation for Random Geometric Graphs via Importance Sampling *arXiv preprint arXiv:2504.10530*.

Articles.

- 2025 N. Heerten, **C. Hirsch**, and M. Otto. Cumulant method for weighted random connection models. *J. Appl. Probab.*, 62(4).
- C. Hirsch**, B. Jahnel, S.K.Jhawar, and P. Juhász. Poisson approximation of fixed degree nodes in weighted random connection models. *Stochastic Process. Appl.* 183: Paper No. 104593.
- C. Hirsch** and P. Juhász. On the topology of higher-order age-dependent random connection models. *Methodol. Comput. Appl. Probab.*, forthcoming.
- C. Hirsch**, M. Otto, and A.M. Svane. Normal approximation for Gibbs processes via disagreement couplings. *Electron. J. Probab.*, forthcoming.
- C. Hirsch** and M. Petráková. Large deviation analysis for canonical Gibbs measures *J. Stat. Phys.*, forthcoming.

- C. Hirsch** and D. Valesin. Face and cycle percolation. *J. Appl. Comput. Topol.* 9(1): Paper No. 6.
- C. Hirsch**, M. Otto, T. Owada, and C. Thäle. Large deviations for hyperbolic k -nearest neighbor balls. *Ann. Inst. Henri Poincaré Probab. Stat.*, forthcoming.
- 2024 **M. Botnan** and **C. Hirsch**. On the consistency and asymptotic normality of multiparameter persistent Betti numbers. *J. Appl. Comput. Topol.*, 8:1465–1502.
- C. Hirsch**, J. Krebs, and C. Redenbach. Persistent homology based goodness-of-fit tests for spatial tessellations. *J. Nonparametric Stat.*, 36(1):39–59.
- C. Hirsch** and D. Willhalm, Upper large deviations for power-weighted edge lengths in spatial random networks. *Adv. Appl. Probab.*, 56(1):34–70.
- C. Hirsch** and D. Willhalm, Lower large deviations for geometric functionals in sparse, critical and dense regimes. *ALEA. Lat. Am. J. Probab. Math. Stat.*, 21:923–962.
- C. Hirsch** and D. Willhalm, Large deviations of one-hidden-layer neural networks. *Stoch. Dyn.* 24(8): Paper No. 2550002.
- 2023 **G. Bonnet**, **C. Hirsch**, D. Rosen, and D. Willhalm. Limit theory of sparse random geometric graphs in high dimensions. *Stoch. Process. Their Appl.*, 163:203–236.
- A. Cipriani, **C. Hirsch**, and M. Vittorietti. Topology-based goodness-of-fit tests for sliced spatial data. *Computational Statistics and Data Analysis*, 179:107655.
- C. Hirsch**, A. Bharti, T. Pedersen and R. Waagepetersen. Bayesian inference for stochastic multipath radio channel models. *IEEE Trans. Antennas Propag.*, 71:3460–3472.
- C. Hirsch**, M. Holmes, and V. Kleptsyn. Infinite WARM graphs: strong reinforcement regime. *Nonlinearity*, 36:3013.
- C. Hirsch**, B. Jahnel, and E. Cali. Connection intervals in multi-scale dynamic networks. *Stochastic Models*, 39(4):851–877.
- C. Hirsch** and T. Owada, Large deviation principle for geometric and topological functionals and associated point processes. *Ann. Appl. Probab.*, 33(5):4008–4043.
- C. Hirsch**, T. Kang, and T. Owada. Large deviations for the volume of k -nearest neighbor balls. *Electron. J. Probab.*, 28, paper no. 105.
- C. Hirsch**, M. Neumann, and V. Schmidt. Asymptotic properties of one-layer artificial neural networks with sparse connectivity. *Stat. Probab. Lett.*, 193:109698.
- 2022 **N. Chenavier** and **C. Hirsch** Extremal lifetimes of persistent cycles. *Extremes*, 25:299–330.
- S. Gille and **C. Hirsch**. On the splitting principle for cohomological invariants of reflection groups. *Transformation Groups*, 27:1261–1285.
- M. Heydenreich and **C. Hirsch**. Extremal linkage networks. *Extremes*, 25:229–255.
- C. Hirsch**, B. Jahnel, and E. Cali. Percolation and connection times in multi-scale dynamic networks. *Stochastic Process. Appl.*, 151:490–518.
- C. Hirsch**, B. Jahnel, and S. Muirhead. Sharp phase transition for Cox percolation. *Electron. Commun. Probab.*, 27, paper no. 48.

- C. Hirsch**, S. Jansen and P. Jung. Large deviations in the quantum quasi-1D jellium. *Probability and Mathematical Physics*, 3:381–429.
- C. Hirsch**, S. B. Moka, T. Taimre and D. P. Kroese. Rare events in random geometric graphs. *Methodol. Comput. Appl. Probab.*, 24:1367–1383.
- J. Krebs and **C. Hirsch**. Functional central limit theorems for persistent Betti numbers on cylindrical networks. *Scand. J. Stat.*, 49:427–454.
- 2021 S. A. Bethuelsen, **C. Hirsch** and C. Mönch. Quenched invariance principle for random walks on dynamically averaging random conductances *Electron. Commun. Probab.*, 26:1–13.
- B. Błaszczyszyn and **C. Hirsch**. Optimal stationary markings. *Stochastic Processes and their Applications*, 138:153–185.
- Y. Couzinié and **C. Hirsch**. Weakly reinforced Pólya urns on countable networks. *Electron. Commun. Probab.*, 26:1–10.
- C. Hirsch**, A. Bharti, T. Pedersen and R. Waagepetersen. Maximum likelihood calibration of stochastic multipath radio channel models. *IEEE Trans. Antennas Propag.*, 69:4058–4069.
- C. Hirsch**, M. Holmes, and V. Kleptsyn. Absence of WARM percolation in the very strong reinforcement regime. *Ann. Appl. Probab.*, 31:199–217.
- 2020 C. Biscio, N. Chenavier, **C. Hirsch** and A.M. Svane. Testing goodness of fit for point processes via topological data analysis. *Electron. J. Stat.*, 14:1024–1074.
- C. Hirsch**. On the decomposability of mod 2 cohomological invariants of Weyl groups. *Commentarii Mathematici Helvetici*, 95:765–809.
- C. Hirsch**, B. Jahnel, and A. Tóbiás. Lower large deviations for geometric functionals. *Electronic Communications of Probability*, 25:paper no. 41.
- C. Hirsch** and C. Mönch. Distances and large deviations in the spatial preferential attachment model. *Bernoulli*, 26:927–947.
- 2019 **C. Hirsch** and B. Jahnel. Large deviations for the capacity in dynamic spatial relay networks. *Markov Processes and Related Fields*, 25:33–73.
- C. Hirsch**, B. Jahnel and E. Cali. Continuum percolation for Cox point processes. *Stochastic Processes and their Applications*, 129:3941–3966.
- M. Neumann, **C. Hirsch**, J. Staněk, V. Beneš, and V. Schmidt. Estimation of geodesic tortuosity and constrictivity in stationary random closed sets. *Scandinavian Journal of Statistics*, 46:848–884.
- 2018 D. Coupier and **C. Hirsch**. Coalescence of Euclidean geodesics on the Poisson-Delaunay triangulation. *Bernoulli*, 24:2721–2751.
- M. Heydenreich, **C. Hirsch**, and D. Valesin. Uniformity of hitting times of the contact process. *ALEA. Latin American Journal of Probability and Mathematical Statistics*, 15:233–245.

- C. Hirsch**, B. Jahnel, and R. Patterson. Space-time large deviations in capacity-constrained relay networks. *ALEA. Latin American Journal of Probability and Mathematical Statistics*, 15:587–615.
- C. Hirsch**, B. Jahnel, P. Keeler, and R. Patterson. Large deviations in relay-augmented wireless networks. *Queueing Systems*, 88:349–387.
- C. Hirsch** and G. Last. On maximal hard-core thinnings of stationary particle processes. *Journal of Statistical Physics*, 170:554–583.
- 2017 **C. Hirsch**, T. Brereton, and V. Schmidt. Percolation and convergence properties of graphs related to minimal spanning forests. *Electronic Journal of Probability*, 22:paper no. 105, 1–21.
- C. Hirsch**, B. Jahnel, P. Keeler, and R. Patterson. Traffic flow densities in large transport networks. *Advances in Applied Probability*, 49:1091–1115.
- C. Hirsch**. From heavy-tailed Boolean models to scale-free Gilbert graphs. *Braz. J. Probab. Stat.*, 31:111–143.
- 2016 **C. Hirsch**. Bounded-hop percolation and wireless communication. *Journal of Applied Probability*, 53:833–845.
- C. Hirsch**, B. Jahnel, P. Keeler, and R. Patterson. Large-deviation principles for connectable receivers in wireless networks. *Adv. Appl. Probab.*, 48:1061–1094.
- C. Hirsch**, D. Neuhäuser, and V. Schmidt. Moderate deviations for shortest-path lengths on random segment processes. *ESAIM: Probab. Stat.*, 20:261–292.
- D. Neuhäuser, **C. Hirsch**, C. Gloaguen, and V. Schmidt. A stochastic model for multi-hierarchical fixed access telecommunication networks. *Methodology and Computing in Applied Probability*, 18:1129–1151.
- C. Hirsch**. On the absence of percolation in a line-segment based lilypond model. *Ann. Inst. Henri Poincaré Probab. Stat.*, 52:127–145.
- 2015 **C. Hirsch**. A Harris-Kesten theorem for confetti percolation. *Random Structures & Algorithms*, 47:361–385.
- C. Hirsch**, G. Delaney, and V. Schmidt. Stationary Apollonian Packings. *J. Stat. Phys.*, 161:35–72.
- C. Hirsch**, G. Gaiselmann, and V. Schmidt. Asymptotic properties of collective-rearrangement algorithms. *ESAIM: Probability and Statistics*, 19:236–250.
- C. Hirsch**, D. Neuhäuser, C. Gloaguen, and V. Schmidt. Asymptotic properties of Euclidean shortest-path trees in random geometric graphs. *Statistics and Probability Letters*, 107:122–130.
- C. Hirsch**, D. Neuhäuser, C. Gloaguen, and V. Schmidt. First-passage percolation on random geometric graphs and an application to shortest-path trees. *Advances in Applied Probability*, 47:328–354.
- D. Neuhäuser, **C. Hirsch**, C. Gloaguen, and V. Schmidt. Parametric modelling of sparse random trees using 3D copulas *Stochastic Models*, 31:226–260.

- D. Neuhäuser, **C. Hirsch**, C. Gloaguen, and V. Schmidt. Joint distributions for total lengths of shortest-path trees in telecommunication networks. *Annals of Telecommunications*, 70:221–232, 2015.
- 2014 T. Brereton, **C. Hirsch**, V. Schmidt, and D. Kroese. A critical exponent for shortest-path scaling in continuum percolation *Journal of Physics A: Mathematical and Theoretical*, 47:505003–505014.
- M. C. Christiansen, **C. Hirsch**, and V. Schmidt. Prediction of regionalized insurance risks based on control variates. *Statistics & Risk Modeling*, 31:163–181.
- D. Neuhäuser, **C. Hirsch**, C. Gloaguen, and V. Schmidt. Ratio limits and simulation algorithms for the Palm version of stationary iterated tessellations. *Journal of Statistical Computation and Simulation*, 84:1486–1504.
- O. Stenzel, **C. Hirsch**, V. Schmidt, T. Brereton, D. Kroese, B. Baumeier, and D. Andrienko. A general framework for consistent estimation of charge transport properties via random walks in random environments. *Multiscale Modeling & Simulation*, 12:1108–1134.
- 2013 **C. Hirsch**, D. Neuhäuser, and V. Schmidt. Connectivity of random geometric graphs related to minimal spanning forests. *Advances in Applied Probability*, 45:20–36.
- D. Neuhäuser, **C. Hirsch**, C. Gloaguen, and V. Schmidt. On the distribution of typical shortest–path lengths in connected random geometric graphs. *Queueing Systems*, 71:199–220.
- Conference proceedings.**
- 2022 C. Ghribi, E. Cali, **C. Hirsch**, and B. Jahnelt. Agent-Based Simulations for Coverage Extensions in 5G Networks and Beyond. *Proceedings of ICIN 2022*.
- 2019 M. Heydenreich and **C. Hirsch**. A spatial small-world graph arising from activity-based reinforcement. *Proceedings of WAW 2019*, 102–114.
- A. Hinsin, **C. Hirsch**, B. Jahnelt and E. Cali. Typical Voronoi cells for Cox point processes on Manhattan grids. *Proceedings of WiOpt 2019*.
- 2018 E. Cali, N. Gafur, **C. Hirsch**, B. Jahnelt, T. En-Najjary, and R. Patterson. Percolation for D2D networks on street systems. *Proceedings of WiOpt/SpaSWiN 2018*.
- 2014 R. Shah, **C. Hirsch**, D. Kroese, and V. Schmidt. Rare event probability estimation for connectivity of large random graphs. In A. Tolks, S.D. Diallo, I.O Ryzhov, L. Yilmaz, and S. Buckley (eds.), *Proceedings of the Winter Simulation Conference*.
- 2013 D. Neuhäuser, **C. Hirsch**, C. Gloaguen, and V. Schmidt. A parametric copula approach for modelling shortest-path trees in telecommunication networks. In A. Dudin and K. Turck, editors, *Analytical and Stochastic Modeling Techniques and Applications*, pages 324–336. Springer, Berlin.

Supervision

Postdoc **M. Otto** (02/22-08/24); now: Asst.-Prof. at *Leiden University*.

- PhD **N.N. Lundbye**(02/23-). *Statistical foundations of TDA.*
P. Juhász(11/22-). *TDA-based models of evolving higher-order networks.*
D. Willhalm(05/20–04/24). *Limit theory for spatial random networks*; now: Postdoc at *Metropolitan University Toronto.*
- MSc **M.H. Petersen-Westergaard**(06/25). *Efficient Monte Carlo Methods for Estimating Nonlinear Financial Models.*
R.H. Nielsen (06/25). *Analyzing the Simulation of Semistationary Processes.*
C. Perch (06/25). *Monte Carlo Methods and Importance Sampling Techniques for Forecasting Macroeconomic Risks.*
L. de Jonge (07/21). *Absence of WARM percolation on geometric networks*; now: PhD student at *University of Osnabrück.*
Y. Couzinié (09/18). *Sublinearly reinforced Pólya urns on graphs of bounded degree*; now: Postdoc at *Tokyo Tech.*
F. Rudiger (09/18). *Recurrence and transience of graphs generated by point processes*; now: Data Engineer at *Accenture.*
A. Hinojosa Calleja (08/16). *Interference in high-density telecommunication systems*; now: PhD student at *Universitat de Barcelona.*
E. Rolly (06/16). *Gibbs-Maße für Trajektorien in einem Kommunikationsnetzwerk .*
A. Tóbiás (04/16). *Highly dense mobile communication networks with random fadings*; now: Assistant Professor at *Budapest University of Technology.*
- BSc **T. Brejner** (06/25). *Rare-event simulation for random connection models.*
O.E. Bech & E.J. Elberg (06/25). *Improving Coronary artery segmentation for tachycardia patient.*
J.S. Knudsen & F. Nordberg (06/25). *Prediction of coronary artery calcification in breast cancer radiotherapy CT-scan.*
C.D. Fuglkjær & M. Fridorf (06/25). *Federated learning in dentistry.*
K.B. Bräuner & A. Kristensen (05/24). *Forudgaende tidsbestilling for patienter.*
J. Borg (05/24). *Markov beslutningsteori: Optimal opladning af elbiler.*
A.P. Diakovasilis & L.V. Jacobsen (05/24). *Optimal ambulanceudsendelse.*
M.-C. Mociran (05/24). *Optimering af blodplader oplagring.*
F. Tækker (05/24). *Screening og behandling af kroniske sygdomme.*
C. Teoridis (05/24). *Optimal tildeling af forespørgsler blandt trådløse sensornetværk.*
C.S. Pallesen (05/24). *Forudgaende patientkonsultationsplanlægning.*
H.C. Hansen (01/24). *Convex hull algorithms for constructing alpha complexes.*
B.H. Kristensen (06/23). *Asymptotic normality for tessellation-based Betti numbers.*
B. Buttenschøn (06/23). *A law of large numbers for wide one-layer neural networks.*
H. Hong (07/21). *Geometric and topological approaches to mode clustering.*

- L. Kriouar** (07/21). *Analysis of financial time series data with persistent homology.*
- J. Langenbahn** (12/19). *Konvergenz des Pseudo-Marginalen MCMC Verfahren.*
- H. Blocher** (02/18). *Poisson Matching*; now: PhD student at *LMU Munich*.
- F. Brück** (06/17). *Percolation properties of Poisson graphs*; now: Postdoc at *UNIGE*.

Presentations

Minicourses.

- 12/23 *Statistical foundations of TDA*, (10 hours), PhD course, UCLouvain.
- 11/20 *Percolation and large deviations in telecommunications*, (6 hours), *Stochastic Geometry & Telecommunications*, Berlin.
- 10/19 *Functional CLT for persistent Betti numbers*, (4 hours), *Cumulants, Concentration & Superconcentration*, Osnabrück.

Invited talks at workshops.

- 04/25 *Stochastic models for learning in networks*, AUNAB kick-off symposium, AU.
- 03/25 *Normal and α -stable convergence in weight-dependent random connection models*, *German Probability and Statistics Days*, TU Dresden.
- 02/25 *Normal and α -stable convergence in weight-dependent random connection models*, *Stochastic Processes on Random Geometries*, TU Braunschweig.
- 09/24 *Random Connection Hypergraphs*, *Stochastic Geometry in Action*, Bath University.
- 09/24 *Limit theorems under heavy-tailed scenario in the age dependent random connection models*, *Stein's method and stochastic geometry*, TU Hamburg.
- 08/24 *Limit theory of sparse random geometric graphs in high dimensions*, *Mathematics, Statistics, and Geometry of Extreme Events in High Dimensions*, Oberwolfach.
- 06/24 *Large deviations for geometric functionals in Euclidean and hyperbolic space*, *21st Workshop on Stochastic Geometry and Image Analysis*, Bad Herrenalb.
- 02/24 *New frontiers of percolation theory in stochastic geometry*, *MAT-DYN-NET*, Braga.
- 01/24 *Poisson approximation of fixed-degree nodes in weighted random connection models*, *Random Graphs and Random Media*, Frauenwörth.
- 10/23 *Functional central limit theorems for Betti numbers of Gaussian excursion sets*, *Geometric and topological properties of random algebraic varieties*, Cologne.
- 09/23 *On the topology of higher-order age-dependent random connection models*, *Workshop on Random Graphs*, Dortmund.
- 06/23 *On the topology of higher-order age-dependent random connection models*, *10th IWAP*, Thessaloniki.
- 05/23 *Central limit theorems for point processes with a focus on Gibbsian functionals*, *Meeting of the Danish Statistical Society*, Aalborg.

- 03/23 ***Extremal linkage networks***, *Stochastic Reinforcement Graphs*, Oberwolfach.
- 02/23 ***Normal approximation of Gibbsian functionals via disagreement couplings***, *BOS workshop on stochastic geometry*, Osnabrück.
- 02/23 ***Modeling learning through dynamically reinforced random networks***, *Adaptive Learning and Opinion Dynamics in Social Networks*, Tel Aviv.
- 12/22 ***Statistical foundations of topological data analysis (keynote)***, *Sharing of teaching and learning in Statistics and Data science*, University of Bergen.
- 11/22 ***Topological data analysis of sliced data***, *Danish Data Science 2022*, Billund.
- 10/22 ***Large deviation principle for geometric and topological functionals and associated point processes***, *New Trends in Spatial Stochastic Processes*, TU Eindhoven.
- 09/22 ***Topology-based goodness-of-fit tests for sliced data***, *Adaptive and high-dimensional spatio-temporal methods for forecasting*, CIRM, Luminy.
- 09/22 ***Limit theory of sparse random geometric graphs in high dimensions***, *Limit theorems for spatial random structures*, Bochum.
- 08/22 ***Large deviation principle for geometric and topological functionals and associated point processes***, *Westfälische Stochastiktag*, Paderborn.
- 06/22 ***Large deviation principle for geometric and topological functionals and associated point processes***, *IMS Annual Meeting*, London.
- 06/22 ***Goodness-of-fit tests for spatial tessellations based on the persistence diagram***, *International Symposium on Nonparametric Statistics 2022*, Paphos.
- 05/22 ***CLTs for the persistence diagram on Gibbsian tessellations***, *Aarhus-Aalborg meeting in spatial data science*, Aarhus.
- 03/22 ***Large deviations in the kNN***, *Random geometric graphs*, Darmstadt.
- 03/22 ***CLTs for the persistence diagram on Gibbsian tessellations***, *New trends in point process theory*, KIT.
- 07/21 ***Extremal life times of persistent loops and holes***, *International Conference on Extreme Value Analysis 2021*, virtual.
- 06/18 ***Estimation of geodesic tortuosity and constrictivity in stationary closed sets***, *International Workshop on Applied Probability 2018*, Budapest.
- 06/18 ***Rare-event probabilities in space-time models for wireless networks***, *International Workshop on Applied Probability 2018*, Budapest.
- 01/16 ***Scale-free Gilbert graphs***, *Continuum Percolation*, Lille.
- 04/14 ***Stationary Apollonian packings***, *Stochastic Geometry Days 2014*, Lille.

Contributed talks at workshops.

- 08/24 ***Extremal lifetimes in the sparse regime***, *10th Bernoulli World Congress*, Bochum.
- 06/23 ***On the topology of higher-order random connection models***, *23rd NCM*, Aalborg.
- 09/22 ***Topology-based goodness-of-fit tests for sliced data***, *3rd Workshop on Topological Methods in Data Analysis*, Heidelberg.

- 10/21 **Rare events in random graphs**, *Geometric random graph models*, virtual.
- 08/21 **Simplicial percolation**, *German Probability and Statistics Days 2021*, virtual.
- 07/21 **Large deviations in quantum quasi-1D Coulomb systems**, *10th World Congress in Probability and Statistics*, virtual.
- 06/21 **MLE in stochastic channel models**, *Nordstat 2021*, virtual.
- 08/20 **Large deviations in quantum quasi-1D Coulomb systems**, *IMS One World Symposium 2020*, virtual.
- 12/19 **A spatial small-world graph arising from activity-based reinforcement**, *Mannheim meets Konstanz*, Konstanz.
- 07/19 **Testing goodness of fit for point processes via topological data analysis**, *Spatial Statistics: Towards Spatial Data Science*, Sitges.
- 07/19 **A spatial small-world graph arising from activity-based reinforcement**, *Algorithms and Models for the Web Graph*, Brisbane.
- 06/19 **Optimal stationary markings**, *19th Workshop on Stochastic Geometry, Stereology and Image Analysis*, Sandbjerg Estate.
- 02/19 **CLTs for persistent Betti numbers**, *Topics in Stochastic Geometry*, Darmstadt.
- 12/18 **Large deviations in the spatial preferential attachment model**, *Self-Similarity*, Bath.
- 03/18 **Graph-based Pólya urns on countable networks**, *German Probability and Statistics Days 2018*, Freiburg.
- 12/17 **Continuum percolation in D2D networks**, *Points in Time and Space*, Aalborg.
- 11/17 **Big Data – todays and tomorrows opportunities**, *Big Data and Legal Aspects*, Robert Bosch Foundation, Stuttgart.
- 05/17 **On maximal hard-core thinnings of stationary particle processes**, *Workshop on Stochastic Geometry, Stereology and Image Analysis 19*, Luminy.
- 03/16 **Large deviations in relay-augmented wireless networks**, *German Probability and Statistics Days 2016*, Bochum.
- 01/16 **Large deviations in relay-augmented wireless networks**, *Dynamical networks and network dynamics*, Edinburgh.
- 09/15 **Asymptotic properties of collective-rearrangement algorithms**, *Geometry and Physics of Spatial Random Systems*, Bad Herrenalb.
- 05/15 **Large-deviation principles in SINR-based wireless network models**, *Networks and Stochastic Geometry*, Austin.
- 03/15 **From heavy-tailed Boolean models to scale-free Gilbert graphs**, *Workshop on Stochastic Geometry, Stereology and Image Analysis 18*, Lingen.
- 04/14 **First-passage percolation on random geometric graphs and an application to shortest-path trees**, *New frontiers in random geometric graphs*, Lorentz Center.
- 03/14 **Stationary Apollonian packings**, *German Probability and Statistics Days 2014*, Ulm.
- 03/14 **A framework for consistent estimation of charge transport properties via random walks in random environments**, *German Probability and Statistics Days 2014*, Ulm.

- 09/13 *First-passage percolation on random geometric graphs and an application to shortest-path trees*, *Geometry and Physics of Spatial Random Systems*, Freudenstadt.
- 08/13 *Apollonian packings*, *Meeting of PhD Candidates in Stochastics 2013*, Göttingen.
- 06/13 *First-passage percolation on random geometric graphs and an application to shortest-path trees*, *Stochastic Geometry, Stereology and Image Analysis 17*, Torún.
- 08/12 *Critical probabilities for Voronoi percolation*, *Meeting of PhD Candidates in Stochastics 2012*, Freudenstadt.
- 03/12 *Connectivity of random geometric graphs related to minimal spanning forests*, *German Probability and Statistics Days 2012*, Mainz.
- 06/11 *On the distribution of typical shortest-path lengths in fully connected random geometric graphs*, *Stochastic Geometry, Stereology and Image Analysis 16*, Sandbjerg.
- 05/11 *Connectivity and first-passage percolation of random geometric graphs related to minimal spanning forests*, *Stochastic networks and related topic*, Bedlewo.

Talks at seminars.

- 01/25 *Normal and α -stable convergence in weight-dependent random connection models*, *Graph Theory Seminar*, Toronto Metropolitan University.
- 12/24 *Random Connection Hypergraphs*, *Purdue Probability Seminar*, Purdue University.
- 10/24 *Large deviations of one-hidden-layer neural networks*, *Probability Seminar*, Politecnico di Milano.
- 06/24 *On the topology of higher-order age-dependent random connection models*, *MAP5 seminar*, Université Paris Cité, Paris.
- 05/24 *Large deviations of one-hidden-layer neural networks*, *INRIA Seminar*, Paris.
- 03/24 *On the topology of higher-order age-dependent random connection models*, *Gothenburg statistics seminar*, Chalmers, Gothenburg.
- 12/23 *On the topology of higher-order age-dependent random connection models*, *Seminar Stochastics and Data Science*, FAU, Erlangen.
- 12/23 *Simplicial percolation*, *Oberseminar Wahrscheinlichkeitstheorie*, TUM/LMU.
- 11/23 *On the topology of higher-order age-dependent random connection models*, *CATS seminar*, KTH, Stockholm.
- 09/23 *Normal approximation for Gibbs processes via disagreement couplings*, *Stochastics Seminar*, Charles University, Prague.
- 06/23 *Statistical foundations of topological data analysis*, *Mathematical Colloquium*, University of Stuttgart.
- 06/23 *On the topology of higher-order age-dependent random connection models*, *Stochastics Seminar*, Augsburg University.
- 05/23 *On the topology of higher-order age-dependent random connection models*, *Seminar Interacting Random Systems*, WIAS Berlin.
- 12/22 *Statistical foundations of topological data analysis*, *BESEDA Seminar*, Charles University Prague.

- 10/22 *Limit results for large Coulomb systems*, SAARC Colloquium, KAIST Daejeon.
- 06/22 *Large deviations in the k -nearest neighbor graph*, SAARC Seminar, KAIST Daejeon.
- 04/22 *Simplicial percolation*, Applied Topology Seminar, EPFL.
- 04/22 *Simplicial percolation*, Probability Seminar, Seminar at Université du Littoral.
- 10/21 *Simplicial percolation*, Asia Pacific Seminar on Applied Topology, virtual.
- 05/21 *Maximum likelihood estimation in stochastic channel models*, Online Seminar of Spatial Statistics and Point Processes, virtual.
- 03/21 *Statistical hypothesis testing through TDA*, Probability Seminar, TU Kaiserslautern/Fraunhofer ITWM.
- 02/21 *Maximum likelihood estimation in stochastic channel models*, Joint Statistical Seminar, Umea University.
- 02/21 *Modeling synaptic plasticity through dynamically reinforced random networks*, SPO Seminar, TU Eindhoven.
- 03/20 *Lower large deviations for geometric functionals*, Applied Stochastics Seminar, Radboud University Nijmegen.
- 03/20 *Testing goodness of fit for point processes and spatial networks via TDA*, Seminar series in Probability and Statistics, TU Delft.
- 12/19 *Graph-Pólya urns on countable networks*, Probability Seminar, University of Mainz.
- 07/19 *Optimal stationary markings*, AG Stochastic Geometry, KIT.
- 07/19 *Distances and large deviations in the spatial preferential attachment model*, Mathematical Colloquium, University of Kassel.
- 07/18 *Graph-Pólya urns on countable networks*, Seminar on stochastic processes and their applications to biology, TU Berlin.
- 03/18 *Large deviations in quantum quasi-1D Coulomb systems*, GDMV 2018, Paderborn.
- 02/18 *Machine Learning und Datenschutz*, Codecentric, München.
- 10/17 *Heavy-tailed Boolean models*, Probability Seminar, TU Darmstadt.
- 08/17 *Space-time large deviations in capacity-constrained relay networks*, Probability Seminar, KAIST Daejeon.
- 06/17 *Space-time large deviations in capacity-constrained relay networks*, Probability Seminar, Monash University.
- 06/17 *Space-time large deviations in capacity-constrained relay networks*, Probability Seminar, Ruhr-Universität Bochum.
- 04/17 *On maximal hard-core thinnings of particle processes*, Stochastic Processes Seminar, University of Melbourne.
- 03/17 *Space-time large deviations in capacity-constrained relay networks*, ACEMS Seminar, University of Queensland.
- 11/16 *Heavy-tailed Boolean models*, Probability Seminar, WWU Münster.
- 04/16 *On maximal hard-core thinnings of particle processes*, Probability Seminar, Munich.

- 02/16 *Stationary Apollonian packings*, CSGB Seminar, Aarhus.
- 11/14 *Heavy-tailed Boolean models & scalefree Gilbert graphs*, Probability Seminar, KIT.
- 01/14 *Stationary Apollonian packings*, Probability Seminar, University of Helsinki.

Organization of scientific meetings

- 08/25 Lead Organizer (with C.A.N. Biscio, L. Fajstrup, M. Kiderlen, J. Sparring and A.M. Svane), *Summer school on TDA in stochastic geometry*.
- 07/25 Session Organizer (with S. B. Moka), *Stochastic models – theoretic*, INFORMS Applied Probability Society Conference, Atlanta.
- 07/23 Session Organizer (with S. Bethuelsen and D. Valesin), *Stochastic processes on random networks*, Nordic Congress of Mathematicians, Aalborg.
- 06/23 Lead Organizer (with C.A.N. Biscio, W. Chachólski, O. Cronie, L. Fajstrup, A. Garin and M. Scolamiero), *Danish-Swedish summer school on TDA and spatial statistics*.
- 06/23 Session Organizer, *Extremes and stochastic geometry*, International Conference on Extreme Value Analysis, Milano.
- 09/21 Lead Organizer (with G. Bonnet and M. Botnan), *Randomness unleashed: geometry, topology & data*, Groningen.
- 04/19 Organizer (with L. Döring, H. Pitters, D. Prömel, Q. Shi and A. Watson), *Stochastic modeling of complex systems*, Mannheim.
- 03/18 Lead Organizer (with M. Heydenreich), *Random structures in neuroscience and biology*, Herrsching.
- 11/16 Lead Organizer (with B. Jahnel, P. Keeler, W. König and R. Patterson), *Probabilistic methods in telecommunications*, Berlin.

Reviewing activities

PhD committee, F. Milinanni, KTH Stockholm (06/25); M. Lienau, TU Hamburg-Harburg (02/25); A. Garin, EPFL (02/22); H. Sanna (12/20), University of Groningen.

Reviewer for grant applications, DFG, ERC Starting Grant FONDECYT, NKFI,NWO Vidi Panel, SFI.

Referee, Adv. Appl. Probab., ALEA, Annales de l’Institut Henri Poincaré, Ann. Prob., Ann. Stat., Ann. Appl. Probab., Bernoulli, Braz. J. Probab. Stat., Electron. Commun. Probab., Electron. J. Probab., IEEE Transactions on Information Theory, IEEE Transactions on Wireless Commun., Journal de l’Ecole Polytechnique, J. Math. Anal. Appl., J. Appl. Comput. Topol., J. Appl. Probab., J. Complex Networks, Journal of Physics A, J. Stat.Phys., Found. data sci., Metrika, Nonlinearity, Probab. Theory Related Fields, Random Structures Algorithms, Sigma, Stat. Probab. Lett., SIAM J. Appl. Algebra Geom, SoftwareX, Stochastics, Stochastic Models, Stochastic Process. Appl.

Institutional responsibilities

- 2024–2026 *AU Network on Artificial Biology*, Steering Group.

2024– *Quantum Campus Aarhus*, Seminar Committee.

2019 *Fakultätsrat*, University of Mannheim.

Teaching

Date. “S/Fxx” stands for “Spring/Fall 20xx”.

Place. **AU.** Aarhus University; **UoG.** University of Groningen; **UoM.** Univ. of Mannheim;; **LMU.** LMU Munich.

Level. “B/M” stands for “Bachelor/Master”.

Evaluation. By program committee (grades A–D) or by students.

Course	Date	Place	Level	Hours/Week	Evaluation
Monte Carlo Simulation	F25,24,23,22	AU	M	5h	4.1,4.0/5
Markov Decision Processes	S24, F19	AU, UoM	B	4h	
Topological Data Analysis	S25, S23, F21, F20	AU, UoG	M	5h	3.7/5, A+
Stochastic Geometry	S25	AU	M	5h	3.7/5
Probability Theory	S21,20,19	UoG, UoM	B	4h	A, A-
Stochastic Processes	S21, S20, F17	UoG, LMU	M	3h	7.1/10, 7.3/10
Probabilistic Foundations of Neural Networks	S17	LMU	M	2h	
The Poisson Point Process	F16	LMU	B+M	2h	

Outreach

04/25 **Mathematics of stochastic gradient descent**

Presentation at the *Teacher Day* at Aarhus University.

08/17, 08/18, **Deep Learning; Generative Models; Reinforcement Learning; TDA**

08/19, 08/21 1-week courses at the summer academy of the *CdE* which is an association supporting gifted high-school and starting university students.

05/17 **Foundations of machine learning and deep learning**

1-day course at the Workshop on Artificial Intelligence. Organized by the *Cusanuswerk*, an association supporting gifted catholic students of all disciplines.

10/16 **Founder of Kaggle Munich Meetup group**

now 2,211 members.

Management experience

▷ Two-day peer-mentoring program for experienced supervisors (Aarhus University).

▷ Four-day training course on coaching PhD students (University of Groningen).