Benjamin Schweinhart

CONTACT INFORMATION

George Mason University
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POSITIONS

George Mason University

Assistant Professor, August 2021 –

University At Albany

Assistant Professor, September 2020 – August 2021

The Ohio State University

NSF Postdoctoral Fellow, September 2016 – August 2019
Zassenhaus Assistant Professor, September 2017 – August 2020

Harvard University

Postdoctoral Fellow, Center of Mathematical Sciences and Applications
September 2015 – August 2016

EDUCATION

Princeton University

Ph.D., Mathematics, August 2015

- Dissertation Topic: Statistical Topology of Embedded Graphs
- Advisor: Robert MacPherson, Institute for Advanced Study

NSF Graduate Research Fellow, 2012–2015
M.A. in Mathematics, May 2011

Swarthmore College

B.A. in Mathematics with Highest Honors, May 2009

HONORS, AWARDS, AND GRANTS

2022–2024	Collaborative Research: EAGER: ADAPT: Charting the Space of Material Microstructures with Artificial Intelligence, Role: Principal Investigator, Funding source: NSF DMR, Joint with: Jeremy Mason (PI, UC Davis) and Tyrus Berry (co-PI, GMU). Total award: $299,141. GMU portion: $192,372.
2016–2019	NSF Mathematical Sciences Postdoctoral Research Fellowship
2012–2015	National Science Foundation Graduate Research Fellowship
2010–2013	Centennial Fellowship, Princeton University

PUBLICATIONS

P. Duncan, M. Kahle, and B. Schweinhart, *Homological Percolation on a Torus: Plaquettes and Permutohedra* to appear in Annales de l'Institut Henri Poincaré, Probabilités et Statistiques (AIHP, 2024). arXiv:2011.11903.

F. Manin, É. Roldán, and B. Schweinhart, *Topology and Local Geometry of the Eden Model*, Discrete and Computational Geometry **69.3** (2023). arXiv:2005.12349.

B. Schweinhart, *Fractal Dimension and the Persistent Homology of Random Geometric Complexes*, Advances in Mathematics **372** (2020). arXiv:1808.02196.

B. Schweinhart, D. Rodney, and J. K. Mason, *Statistical Topology of Bond Networks with Applications to Silica*, Physical Review E **101** (2020) arXiv:1910.05842.

J. Jaquette and B. Schweinhart, *Fractal Dimension Estimation with Persistent Homology: A Comparative Study*, Communications in Nonlinear Science and Numerical Simulation **84** (2020). arXiv:1907.11182.

B. Schweinhart, *Persistent Homology and the Upper Box Dimension*, Discrete and Computational Geometry (2019).

B. Schweinhart, J. K. Mason, and R. D. MacPherson, *Topological Similarity of Random Cell Complexes and Applications*, Physical Review E **93** (2016). arxiv:1407.6989.

K. Emmett, B. Schweinhart, and R. Rabadan, *Multiscale Topology of Chromatin Folding*, Proceedings of the 9th International Conference on Bio-inspired Information and Communications Technologies (2015). arxiv:1511.01426.

R. D. MacPherson and B. Schweinhart, *Measuring Shape with Topology*, Journal of Mathematical Physics **53** (2012). arxiv:1011.2258.

Preprints

P. Duncan and B. Schweinhart, *A Sharp Deconfinement Transition for Potts Lattice Gauge Theory in Codimension Two* (August 2023). arXiv:2308.07534.

P. Duncan and B. Schweinhart, *Topological Phases in the Plaquette Random-Cluster Model and Potts Lattice Gauge Theory* (July 2022). arXiv:2207.08339.

Software

Swatches: Local Structure Classification in Graphs.

Dimension Estimation with PH0.

Teaching Experience

Spring 2024	Topology of Metric Spaces (MATH 631, GMU)
Fall 2023	Analytic Geometry and Calculus III (MATH 213, GMU)
Spring 2023	Mathematics of Data Science (MATH 465/665, GMU)
Fall 2022	Linear Algebra with Data Applications (MATH 464/664, GMU)
Spring 2022	The Probablistic Method (MATH 649, GMU)
Fall 2021	Linear Algebra (MATH 322, GMU)
Spring 2021	The Probablistic Method (Albany)
Spring 2021	Topological and Geometric Data Analysis II (Albany)
Fall 2020	Topological and Geometric Data Analysis I (Albany)
Spring 2020	Probability (OSU)
Fall 2019	Curves and Surfaces in Euclidean Three Space (OSU)
Spring 2019	Linear Algebra (OSU)
Fall 2018	Linear Algebra (OSU)
Spring 2018	Introductory Analysis I (OSU)
Fall 2017	Linear Algebra (OSU)
Spring 2013	Linear Algebra (Princeton University)

Graduate Advising

Summer Eldridge	Current
Shrunal Pothagoni	Current
Anthony Pizzimenti	Current

Undergraduate Student Mentoring	Morgan Shuman	Current
	Dhruv Gramopadhye	2023
	Jiaqi Yang	OSU, 2018—2020 (currently a PhD student at the Emory University Department of Mathematics)

Programming C++, MATLAB, Mathematica, Python

Invited Talks *The Plaquette Random Cluster Model and Potts Lattice Gauge Theory*, Statistical Mechanics Beyond 2D, IPAM, UCLA (05/2024)

Topology of Random Polycubes, Randomness in Topology and its Applications, University of Chicago (03/2023)

The Plaquette Random Cluster Model and Potts Lattice Gauge Theory, Stochastic Topology Seminar, MPI Leipzig (10/2022)

Mini-course: Percolation and Topology, VIIth Mexican Workshop on Geometric and Topological Data Analysis, CIMAT (09/2021)

Mini-course: Percolation and Topology, VIIth Mexican Workshop on Geometric and Topological Data Analysis, CIMAT (09/2021)

Plaquette Percolation on the Torus, Thematic Mini-Conference on Stochastic Topology, TU Berlin (09/2021)

Plaquette Percolation on the Torus, Cornell Probability Seminar (04/2021)

Plaquette Percolation on the Torus, Percolation Today Webinar (02/2021)

Fractal Dimension Estimation with Persistent Homology, Georgia Topology Conference (06/2020) (Canceled)

Topological Classification of Local Structure in Materials, Special Session on Multi-Scale Statistical Descriptors of Materials, SIAM Conference on Mathematical Aspects of Materials Science, Bilbao (05/2020) (Canceled)

Fractal Dimension Estimation with Persistent Homology, Minisymposium on Topological Time Series Analysis, SIAM Conference on Mathematics of Data Science (06/2020) (Canceled)

Statistical Topology of Silica Networks, Thematic Einstein Semester Conference on Structure of Materials, Berlin (03/2020) (Canceled)

Topology and Geometry of Complex Systems, University of Florida Math Department Colloquium (02/2020)

Topology and Geometry of Complex Systems, University At Albany (01/2020)

Fractal Dimension and Random Minimum Spanning Trees, Boston University Probability Seminar (12/2019)

Fractal Dimension and Random Minimum Spanning Trees, Boston University Proba-

bility Seminar (12/2019)

Fractal Dimension Estimation with Persistent Homology, Special Session on Applied Topology: Theory and Applications, AMS Fall Southeastern Sectional Meeting, Gainesville (11/2019)

Fractal Dimension Estimation with Persistent Homology, University at Albany Algebra/Topology Seminar (10/2019)

Fractal Dimension Estimation with Persistent Homology, Northeastern University Topology Seminar (10/2019)

Fractal Dimension Estimation with Persistent Homology, Brandeis–Harvard–MIT– Northeastern Joint Mathematics Colloquium (at Brandeis) (10/2019)

Fractal Dimension Estimation with Persistent Homology, Special Session on Recent Trends in the Mathematics of Data, AMS Fall Central Sectional Meeting, Madison (09/2019)

Local Atomic Environments in Oxide Glass, Workshop: Structure in the Micro-world, The Ohio State University (05/2019)

The Persistent Homology of Random Geometric Complexes on Fractals, Conference on Geometric Data Analysis, The University of Chicago (05/2019)

The Persistent Homology of Random Geometric Complexes on Fractals, JMM Special Session on Topological Data Analysis, Joint Mathematics Meetings, Baltimore (01/2019)

Local Feature Classification in Microstructures using the Euclidean Wasserstein Metric, Mini-symposium on on Statistical Descriptors of Materials at Multiple Length Scales, SIAM Conference on Mathematical Aspects of Materials Science, Portland (07/2018)

Persistent Homology and the Upper Box Dimension, JMM Special Session on Topological Data Analysis, Joint Mathematics Meetings, San Diego (01/2018)

Topological Similarity of Cell Complexes, Minisymposium on Statistics and Applied Algebraic Topology, SIAM Conference on Applied Algebraic Geometry, Atlanta (07/2017)

Limits of Embedded Graphs, Computational Topology and Geometry Workshop, Foundations of Computational Mathematics Conference, Barcelona (07/2017)

Statistical Topology of Random Cell Complexes, and Applications, TGDA Seminar, OSU (01/2017)

Statistical Topology of Random Cell Complexes, and Applications, Stochastic Topology Seminar, ICERM, Brown University (11/2016)

Statistical Topology of Random Cell Complexes, and Applications, Topology, Geometry, and Data Analysis Conference, The Ohio State University (05/2016)

Universality Conjectures for Curvature Flow on Graphs, Center of Mathematical Sciences and Applications Members' Seminar, Harvard University (03/2016)

Statistical Topology of Random Cell Complexes, and Applications , Applied Algebraic Topology Research Network Seminar (03/2016)

Universality Conjectures for Curvature Flow on Graphs, Mathematical Physics Seminar, Harvard University, (10/2015)

Topological Similarity of Random Cell Complexes, Kavli Seminar, Harvard University School of Engineering and Applied Sciences, (10/2015)

Topological Similarity of Random Cell Complexes, AIMR Tohoku University, (06/2015)

Topological Similarity of Random Cell Complexes, Workshop on Topology: Identifying Order in Complex Systems, Institute for Advanced Study, (12/2014)

Topological Similarity of Random Cell Complexes, Center for Nonlinear Analysis Seminar, Carnegie Mellon University, (10/2014)

Topological Similarity of Random Cell Complexes, Applied Interdisciplinary Mathematics Seminar, University of Michigan, (10/2014)

Topological Similarity of Random Cell Complexes, Special Session on Random Spaces, AMS Central Sectional Meeting, University of Wisconsin - Eau Claire, (09/2014)

Measuring Shape with Topology, Rabadan Lab Seminar, Columbia University, (06/2013)

Measuring Shape with Topology, MacPherson Informal Seminar, Institute for Advanced Study, (12/2012)