

# Benjamin Schweinhart

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RESEARCH INTERESTS Stochastic, applied, and computational topology and geometry, and applications to materials science, physics, and biology.

POSITIONS **University At Albany**  
Assistant Professor, September 2020 –

**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

PUBLICATIONS B. Schweinhart, *Fractal Dimension and the Persistent Homology of Random Geometric Complexes*, *Advances in Mathematics* **372** (2020). [arXiv:1808.02196](https://arxiv.org/abs/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](https://arxiv.org/abs/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](https://arxiv.org/abs/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).

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).

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

PREPRINTS P. Duncan, M. Kahle, and B. Schweinhart, *Plaquette Percolation on the Torus*, (November 2020). arXiv:2011.11903.

F. Manin, É. Roldán, and B. Schweinhart, *Topology and Local Geometry of the Eden Model*, submitted (May 2020). arXiv:2005.12349.

B. Schweinhart, *Limits of Embedded Graphs, and Universality Conjectures for The Network Flow*, unpublished preprint (2017). arXiv:1605.09063.

#### IN PREPARATION

SOFTWARE Swatches: Local Structure Classification in Graphs.

Dimension Estimation with PH0.

HONORS, AWARDS, AND GRANTS 2016–2019 NSF Mathematical Sciences Postdoctoral Research Fellowship  
2012–2015 National Science Foundation Graduate Research Fellowship  
2010–2013 Centennial Fellowship, Princeton University

PENDING SUPPORT *Collaborative Research: QRM: Metrics on Microstructures for Additive Manufacturing*. PIs: J. K. Mason and B. Schweinhart. PD 19-088Y, Advanced Manufacturing Program, Division of Civil, Mechanical and Manufacturing Innovation, NSF. Submitted November 2020.

TEACHING EXPERIENCE 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)

MENTORING Jiaqi Yang Undergraduate Thesis Topic: Local Configurational Entropy of Point Clouds (The Ohio State University, 05/2018—05/2020)

PROGRAMMING C++, MATLAB, Mathematica, Python

INVITED TALKS *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 Probability 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–North-eastern 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 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)

## REFERENCES

**Robert MacPherson**, Professor Emeritus, School of Mathematics, Institute for Advanced Study, Princeton, NJ [rdm@ias.edu](mailto:rdm@ias.edu)

**Matthew Kahle**, Professor, Department of Mathematics, The Ohio State University, Columbus, OH [kahle.70@osu.edu](mailto:kahle.70@osu.edu)

**Herbert Edelsbrunner**, Professor, Institute of Science and Technology Austria, Klosterneuburg, Austria [edels@ist.ac.at](mailto:edels@ist.ac.at)

**Jeremy Mason**, Assistant Professor, Department of Materials Science and Engineering, University of California Davis, Davis, CA [jkmason@ucdavis.edu](mailto:jkmason@ucdavis.edu)

**William Husen** (Teaching Reference), Director of Undergraduate Education, Ohio State University, Columbus, OH [husen.1@osu.edu](mailto:husen.1@osu.edu)