

## Matthew Kahle

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- CONTACT** Department of Mathematics *Voice:* (206) 427-3654  
The Ohio State University *Fax:* (614) 292-0167  
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Columbus, OH 43210
- RESEARCH INTERESTS** I am broadly interested in interactions of topology and geometry with probability, statistical mechanics, and combinatorics.
- PROFESSIONAL EXPERIENCE** Assistant Professor, The Ohio State University, 2011–present  
Member, Institute for Advanced Study, Princeton, 2010–2011  
Samelson postdoctoral fellow, Stanford University, 2007–2010
- EDUCATION** University of Washington, Seattle, Washington USA  
Ph.D., Mathematics, June 2007
- Dissertation: *Random simplicial complexes and phase transitions for homology*
  - Advisors: Eric Babson and Christopher Hoffman
- Colorado State University, Fort Collins, Colorado USA  
M.S., Mathematics, May 2001  
B.S., Mathematics, May 1999
- GRANTS** NSF #CCF-1017182: Higher-dimensional spanning trees, 2013–14  
DARPA #N66001-12-1-4226: Topology and geometry of random simplicial complexes, 2012–14  
NSA #H98230-10-1-0227: Random simplicial complexes, 2009–2011
- FELLOWSHIPS** Alfred P. Sloan Research Fellowship, 2012–2014  
Samelson Postdoctoral Fellowship, Stanford, 2007–2010  
NSF Mathematical Sciences Postdoctoral Research Fellowship, 2007–2010 (declined)  
NSF Vertical Integration of Research and Education Fellowship, 2001–2004, 2005–2006  
Andrew Gavin Gaudette – ARCS Foundation Fellowship 2001–2004
- PAPERS**
1. M. Davis and M. Kahle. Random graph products of finite groups are rational duality groups. To appear in *J. Topol.*, arXiv:1210.4577.
  2. M. Kahle. Topology of random simplicial complexes: a survey. To appear in *Contemp. Math.*, arXiv:1301.7165.
  3. M. Kahle. Sharp vanishing thresholds for cohomology of random flag complexes. To appear in *Ann. of Math.*, arXiv:1207.0149.
  4. M. Kahle and E. Meckes. Limit theorems for Betti numbers of random simplicial complexes. *Homology, Homotopy Appl.* 15(2) (2013), 343–374.
  5. Y. Baryshnikov, P. Bubenik, and M. Kahle. Min-type Morse theory for configuration spaces of hard spheres. *Int. Math. Res. Notices*, doi:10.1093/imrn/rnt012, 2013.
  6. D. Dotterer and M. Kahle. Coboundary expanders. *J. Topol. Anal.* 4 (2012), no. 4, 499–514.
  7. M. Kahle. Sparse locally-jammed disk packings. *Ann. Comb.* 16(4) (2012), 773–780.

8. G. Carlsson, J. Gorham, M. Kahle, and J. Mason. Computational topology for configuration spaces of hard disks. *Phys. Rev. E*, 85:011303, Jan. 2012.
9. M. Kahle. Random geometric complexes. *Discrete Comput. Geom.*, 45 (2011), no. 3, 553–573.
10. E. Babson, C. Hoffman, and M. Kahle. The fundamental group of random 2-complexes. *J. Amer. Math. Soc.* 24 (2011), no. 1, 1–28.
11. M. Kahle. Topology of random clique complexes. *Discrete Math.*, 309 (2009), no. 6, 16581671.
12. M. Kahle. Points in a triangle forcing small triangles *Geombinatorics* 18 (2009), no. 3, 114–128.
13. M. Kahle. The neighborhood complex of a random graph. *J. Combin. Theory Ser. A* 114 (2007), no. 2, 380–387.
14. M. Kahle. Scatters, unavoidable shapes, and crystallization. *Geombinatorics* 15 (2006), no. 3, 138–149.
15. M. Kahle. A generalization of the chromatic number of the plane. *Geombinatorics* 1 (2000), no. 2, 69–74.

#### PREPRINTS

1. C. Hoffman, M. Kahle, and E. Paquette. The threshold for integer homology in random  $d$ -complexes. (submitted, arXiv:1308.6232)
2. M. Kahle and B. Pittel. Inside the critical window for cohomology of random  $k$ -complexes. (submitted, arXiv:1301.1324)
3. C. Hoffman, M. Kahle, and E. Paquette. Spectral gaps of random graphs and applications to random topology, submitted, arXiv:1201.0425)
4. S. Fadnavis and M. Kahle. Warmth and mobility of random graphs. (submitted, arXiv:1009.0792)

#### IN PREPARATION

1. M. Kahle and R. MacPherson. Configuration spaces of hard spheres in an infinite strip.

#### RESEARCH TALKS (\* = PLENARY OR COLLOQUIUM TALK

- (\* AMS Short Course on Geometry and Topology in Statistical Inference, Baltimore, 2014-01-14
- (\* Colloquium, Western Ontario University, 2013-11-07
- (\* IMA workshop: Topological data analysis, 2013-10-09
- Applied and interdisciplinary mathematics seminar, Northeastern, 2013-10-01
- Research seminar in mathematics, Northeastern, 2013-10-01
- Combinatorics seminar, Ohio State, 2013-09-18
- Topology, geometry, and data seminar, Ohio State, 2013-09-13 and 2013-09-20
- Metric Geometry, Geometric Topology and Groups, BIRS, Banff, Canada, 2013-08-04
- (\* Applied and Computational Algebraic Topology, ALTA, Bremen, Germany, 2013-07-18
- (\* Dynamics and Applied Topology, (three lectures), Kyoto, week of 2013-06-09
- (\* Colloquium, Indiana, 2013-03-22
- (\* Triangle lectures in combinatorics, Wake Forest University, 2013-02-09
- Data seminar, Duke, 2013-02-07
- MacPherson seminar, IAS, 2013-01-24 & 2013-01-31
- Workshop: Topological data analysis and machine learning theory, Banff, 2012-10-15
- (\* Colloquium, University of Washington, 2012-10-05
- (\* Stanford symposium on Algebraic topology: applications and new directions, 2012-07-25
- (\* ATMCS 5, Edinburgh, 2012-07-04
- (\* Dynamics, topology, and computation, Bedlewo, Poland, 2012-06-27
- Workshop: Triangulations, Oberwolfach, 2012-05-03
- CATS (Combinatorics, Algebra, Topology, and Statistics) seminar, Kentucky, 2012-04-23
- (\* Colloquium, Colorado State, 2012-04-13
- Topology seminar, Ohio State, 2012-04-10
- Applications of Combinatorial Topology to Computer Science, Dagstuhl, Germany, 2012-03-20
- AMS Meeting, Tampa, FL, special session in algebraic & geometric combinatorics, 2012-03-10

Topology seminar, Rice, 2012-02-27  
 Invitation to Mathematics, Ohio State, 2012-01-18 & 2012-01-25  
 Workshop: Computational topology, Fields Institute, 2011-11-07  
 Topology and geometry of data seminar, Ohio State, October 21, 2011  
 SIAM Conference on Applied Algebraic Geometry, NC State, October 6, 2011  
 Topological Methods in Complex Systems, U Penn, August 9, 2011  
 (\*) Applied Algebraic Topology, ETH-Zurich, July 6, 2011  
 Geometric group theory conference, Ohio State, June 2, 2011  
 Combinatorics seminar, Washington, May 18, 2011  
 (\*) Colloquium, Alcatel-Lucent, Murray Hill, May 12, 2011  
 (\*) Distinguished interdisciplinary speaker series, NC State, April 29, 2011  
 Geometry/topology seminar, Chicago, March 10, 2011  
 Geometry seminar, Yale, February 21, 2011  
 (\*) Colloquium, Colorado State, February 3, 2011  
 (\*) Colloquium, Ohio State, January 18, 2011  
 Soft matter seminar, U Penn, November 29, 2010  
 Members seminar, IAS, Princeton, November 15, 2010  
 Geometry seminar, Courant Institute, NYU, November 2, 2010  
 Topology: identifying order in complex systems, Rutgers, October 6, 2010  
 Geometry & cell complexes seminar, IAS, Princeton, October 5, 2010  
 Algebra and Topology: Methods, Computation, and Science IV, Münster, Germany, June 24, 2010  
 (\*) 2010 Barrett Memorial Lectures in Discrete Differential Geometry and Applications, May 17, 2010  
 Workshop in algebraic and random topology I, Chicago, April 18, 2010  
 Applied topology seminar, University of Zürich, March 26, 2010  
 (\*) Colloquium, Case Western Reserve, March 19, 2010  
 Geometry seminar, Toronto, March 8, 2010  
 Theory seminar, Dartmouth, March 2, 2010  
 Combinatorics seminar, Dartmouth, March 1, 2010  
 (\*) Colloquium, Cleveland State, February 26, 2010  
 Combinatorics seminar, UC Berkeley, February 22, 2010  
 (\*) Colloquium, Oregon, January 25, 2010  
 Joint seminar in probability and topology, Oregon, November 20, 2009  
 Probability seminar, Stanford, November 9, 2009  
 Applied topology, Chicago, November 5, 2009  
 Topological complexity of random sets, American Institute of Mathematics, August 12, 2009  
 Topological Methods in Scientific Computing seminar, Stanford, May 18, 2009  
 Data analysis using computational topology and geometric statistics, Banff, March 11, 2009  
 Probability seminar, Washington, February 9, 2009  
 Discrete math seminar, Berkeley, February 4, 2009  
 Probability seminar, Duke, October 30, 2008  
 Computational algebraic topology, Oberwolfach, June 29–July 5, 2008  
 Topology seminar, Oregon, April 22, 2008  
 (\*) Colloquium, Cal. State East Bay, February 22, 2008  
 Bay Area Discrete Math Day, Google, October 20, 2007  
 Geometry/topology seminar, Davis, October 18, 2006  
 Computational applications of algebraic topology, MSRI, October 2, 2006

COURSES TAUGHT    *Ohio State (2011–)*: Linear algebra and differential equations for engineers, Random graphs and percolation theory (graduate topics course), Graph Theory and Combinatorics I & II (graduate courses)  
*Stanford (2007–2010)*: Mathematics of the Rubik’s Cube, Modern Algebra, Applied Number Theory and Cryptography, Polya Problem Solving Seminar, Ordinary Differential Equations and Linear

Algebra, Introduction to Combinatorics, Set Theory, Linear Algebra and Multivariable Calculus  
*Canada/USA Mathcamp (Summers 2003, 2005–2007)* Zoology of Polytopes, Moore Method Topology, Topological and Geometric Graph Theory, The Probabilistic Method, Combinatorial Homotopy Theory, Linear algebra, Symmetric Functions, Enumeration Celebration, . . .  
*University of Washington (2001–2007)*: Ordinary Differential Equations, Linear algebra, Calculus; grader for Topology and Geometry of Manifolds  
*Colorado State University (1999–2001)*: Modern Algebra, Linear algebra, Calculus, Trigonometry; Assistant director of the Individualized Mathematics Program

ORGANIZING

Executive committee, ATMCS 6, Vancouver, Canada, summer 2014.  
 Scientific committee, Applied Topology, Bedlewo, Poland, summer 2013.  
 Co-organizer, special session in applied topology, AMS sectional meeting, Akron, OH, October 20–21, 2012  
 Organizer, combinatorics seminar, Ohio State, 2011–  
 Co-organizer, IAS seminar in “Geometry and cell complexes”, 2010–2011  
 Co-organizer, seminar in “Graph homomorphisms”, Stanford, Fall 2009  
 Co-organizer, Bay Area Discrete Math Day, 2007–2010  
 Local organizer, Bay Area Discrete Math Day, Stanford, September 27, 2008  
 Co-organizer, Combinatorics and geometry seminar, Stanford, 2007–2008  
 Co-organizer, Graduate Student Conference in Combinatorics, UW, Spring 2007.

OUTREACH AND  
 SYNERGISTIC  
 ACTIVITIES

**Mentor, Canada/USA Mathcamp, summers 2003, 2005–2007**  
 Judge, Colorado Math Olympiad, several times, 1991–2013  
 Polya problem solving seminar, Stanford, Fall 2009

Visitor and speaker, Nebraska IMMERSE program, week of 2013-07-01  
 Judge, Denman Undergraduate Research Forum, Ohio State, March 2013  
 Radical Pi (OSU undergraduate math club): 2013-02-27 and 2012-08-02  
 Visitor, Canada/USA Mathcamp, Summer 2012  
 Invitation to Mathematics, Ohio State, January 18 & 25, 2012  
 Columbus Math Circle, 2012-03-25  
 IAS School of Mathematics Council Meeting, 2013-06-13  
 Undergraduate math club, Yale, 2011-02-22  
 Visitor, Canada/USA Mathcamp, week of 2010-07-04  
 Coach of 4<sup>th</sup> place team, William Lowell Putnam competition, Stanford, Fall 2009  
 Graduate Student Representative, UW, 2004–2005

PUBLIC TALKS

Panel discussion: Colorado Math Olympiad, 30th Anniversary award ceremony, 2013-05-03  
 Demonstrations, Shift studio, Seattle, 2007-06-02

PH.D. STUDENTS

Greg Malen (current Ph.D. student)  
 Kyle Parsons (current Ph.D. student)

OTHER STUDENTS  
 MENTORED (AND  
 NEXT POSITION)

Ted Dokos, B.S., Ohio State, 2012 (Ph.D. program in mathematics, UCLA)  
 Elliot Paquette, Ph.D., Washington, 2013 (NSF Postdoc, Weizmann Inst.)

Dominic Dotterer, Ph.D., Toronto, 2013 (Dickson Assistant Professor, Chicago)  
Sukhada Fadnavis, Ph.D., Stanford, 2012 (Benjamin Peirce Fellow, Harvard)  
Jackson Gorham, undergraduate, Stanford 2010 (Ph.D. program in statistics, Stanford)  
Heather M. Lee, undergraduate, Washington 2007 (Ph.D. program in mathematics, Berkeley)

REFEREEING

Algebraic & Geometric Topology  
Annals of Applied Probability  
Annals of Probability  
Discrete & Computational Geometry  
Discrete Mathematics  
Experimental Mathematics  
European Journal of Combinatorics  
Journal of Topology & Analysis  
Probability Theory and Related Fields  
Proceedings of the American Mathematical Society  
Random Structures & Algorithms  
Rose-Hulman Undergraduate Journal  
Symposium on Computational Geometry