

# MATTHEW L. WRIGHT

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St. Olaf College  
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Northfield, Minnesota USA

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## EDUCATION

- University of Pennsylvania** (Philadelphia, Pennsylvania) August 2011  
Doctor of Philosophy in Mathematics  
Thesis: *Hadwiger Integration of Definable Functions*  
Advisor: Robert Ghrist
- Messiah College** (Grantham, Pennsylvania) May 2006  
Bachelor of Arts  
Major in Mathematics and Computer Science, Minor in Spanish

## EMPLOYMENT

- Visiting Assistant Professor of Mathematics** August 2015 – present  
St. Olaf College (Northfield, Minnesota)
- Postdoctoral Fellow** August 2013 – August 2015  
Institute for Mathematics and its Applications, University of Minnesota
- Assistant Professor of Mathematics** August 2011 – May 2013  
Huntington University (Huntington, Indiana)

## GRANTS AWARDED

- PI: NSF DMS-1606967, total award \$210,217** September 2015 – August 2018  
Computation and Visualization of Multi-Parameter Topological Invariants of Data  
Co-PI: Michael Lesnick (Princeton)
- Co-PI: NSF DMS-1642637, total award \$34,300** January – December 2017  
CBMS Regional Research Conference on Topological Data Analysis  
PI: Lori Ziegelmeier (Macalaster); Co-PI: Matthew Richey (St. Olaf)

## RESEARCH INTERESTS

The goal of my research is to develop mathematical tools for topological data analysis. My focus is on the computation and visualization of multidimensional persistent homology and its use in the analysis of complex data. I also study topological and geometric integrals and their applications; I proved a classification theorem for Hadwiger integrals in my Ph.D. thesis. Additionally, I am interested in stochastic geometry, both for its abstract elegance and for its relevance to the above work.

## PUBLICATIONS

- Michael Werman and Matthew Wright, “Intrinsic Volumes of Random Cubical Complexes”, *Discrete and Computational Geometry*, vol. 56, no. 1 (July 2016) pp. 93 – 113.

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Shilad Sen, Isaac Johnson, Rebecca Harper, Huy Mai, Samuel Olsen, Benjamin Mathers, Laura Vonessen, Matthew Wright, and Brent Hecht “Towards Domain-Specific SR: A Case Study from Geography”, *Proc. of IJCAI 2015*, (July 2015) pp. 2362 – 2370.

Matthew Wright, “Hadwiger Integration of Random Fields”, *Topological Methods in Nonlinear Analysis*, vol. 45, no. 1 (March 2015) pp. 117 – 128, [arXiv:1311.3308](https://arxiv.org/abs/1311.3308).

Brian Bargh, John Chase, and Matthew Wright, “Colorful Symmetries”, *Math Horizons*, vol. 21, no. 4 (April 2014) pp. 14 – 17.

Robert Ghrist, Matthew Wright, and Yuliy Baryshnikov, “Hadwiger’s Theorem for Definable Functions”, *Advances in Mathematics*, vol. 245 (1 Oct. 2013) pp. 573 – 586, [arXiv:1203.6120](https://arxiv.org/abs/1203.6120).

### PAPERS SUBMITTED AND IN PREPARATION

Kristen Mazur, Tia Sondjaja, Matthew Wright, and Carolyn Yarnall, “Approval Voting in Product Societies”, submitted, 2016.

Michael Lesnick and Matthew Wright, “Interactive Visualization of 2-D Persistence Modules”, submitted, 2015, [arXiv:1512.00180](https://arxiv.org/abs/1512.00180).

Michael Lesnick and Matthew Wright, “Efficient Computation of Bigraded Betti Numbers”, in preparation, 2016.

Abdel-Rahman Madkour, Philip Nadolny, and Matthew Wright, “Finding Minimal Spanning Forests in a Graph”, in preparation, 2016.

P. Christopher Staecker and Matthew Wright, “A Hadwiger Theorem for Simplicial Maps”, preprint, 2014, [arXiv:1402.6391](https://arxiv.org/abs/1402.6391).

Matthew Wright, “Cycles of Digits” preprint, 2013, [www.mlwright.org/docs/cycles.pdf](http://www.mlwright.org/docs/cycles.pdf).

### SOFTWARE AND MULTIMEDIA

*Rank Invariant Visualization and Exploration Tool (RIVET)*: Software in development, with Michael Lesnick. To be released in November 2016 at <http://rivet.online>.

*Introduction to Persistent Homology*: Video, appeared in the 25<sup>th</sup> Multimedia Exposition in Computational Geometry; <https://youtu.be/2PSqWBIn90>.

### AWARDS AND HONORS

Postdoctoral Fellowship, Institute for Mathematics and its Applications	2013 – 2015
Ben Franklin Fellowship, University of Pennsylvania	2006 – 2011
Good Teaching Award, Penn Math Department	Spring 2011
Penn Prize for Excellence in Teaching by Graduate Students	April 2008
Good Teaching Award, Penn Math Department	2008
William Lowell Putnam Mathematics Exam	
Scored 30 on the 2005 Putnam Exam (rank 256 nationally)	2005
Scored 31 on the 2004 Putnam Exam (rank 287 nationally)	2004

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## BOOK EDITED

H. Harrington, M. Omar, and M. Wright, eds., *Algebraic and Geometric Methods in Discrete Mathematics*, Contemporary Mathematics, American Mathematical Society, forthcoming.

## TEACHING EXPERIENCE

### *Courses taught at St. Olaf College*

Math 262: Probability Theory	Fall 2015, Fall 2016
Math 230: Differential Equations	Spring 2016, Fall 2016
Math 126: Calculus II	Fall 2015
CSCI 121: Principles of Computer Science	Spring 2016

### *Courses taught at Huntington University*

MA 481: Seminar in Contemporary Mathematics	Fall 2011, Fall 2012
MA 431: Introduction to Real Analysis	Fall 2012
MA 311: Elements of Linear Algebra	Spring 2013
MA 171: Analytic Geometry and Calculus I	Fall 2011, Fall 2012
MA 161: Math for Managerial and Social Sciences	Spring 2012
MA 151: Introduction to Probability and Statistics	Fall 2011, Spring 2012, Summer 2012
CS 355: Operating Systems	Spring 2013
CS 111: Introduction to Computer Science	Spring 2012, Fall 2012, Spring 2013

### *Course taught at the University of Pennsylvania*

Math 103: Introduction to Calculus	Summer 2008
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### *Teaching Assistant appointments at the University of Pennsylvania*

Math 240: Calculus III	Spring 2009
Math 116: Honors Calculus	Fall 2010
Math 115: Calculus II with Probability and Matrices	Spring 2011
Math 114: Calculus II	Fall 2008
Math 104: Calculus I	Spring 2008
Math 103: Introduction to Calculus	Fall 2007

## MENTORING EXPERIENCE

Summer Research Mentor (St. Olaf College)	summer 2016
Worked with two students on mathematical and algorithmic problems necessary for the implementation of parallel computation of multidimensional persistent homology.	
Research Mentor for the MAXIMA REU (IMA)	summer 2014
Worked with a group of students investigating geographic proximity and semantic relatedness by mining data from Wikipedia and conducting a survey.	
Math Mentor, Center for Teaching and Learning (Penn)	summer 2011
Mentored graduate students teaching summer math courses at the University of Pennsylvania.	

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## SELECTED LECTURES PRESENTED

- SIAM Central States Section Meeting, Applied and Computational Topology Mini-Symposium  
“Computing Multidimensional Persistent Homology” October 2016  
Applications and Statistics of Multidimensional Persistence (Lausanne, Switzerland)  
“Efficiently Computing the Bigraded Betti Numbers” August 2016  
Symposium on Computational Geometry (Boston, MA)  
“Visualizing Multidimensional Persistent Homology” June 2016  
Section NExT Invited Lecture; MAA North Central Section Meeting (St. Paul, MN)  
“Introduction to Persistent Homology” April 2016  
Applied Topology and High-Dimensional Data Analysis, University of Victoria (Victoria, Canada)  
“Euler Characteristic and Data Analysis” August 2015  
“Computing Multidimensional Persistent Homology” August 2015  
Algebraic Topology: Computation, Data Analysis, and Applications, U. Oxford (Oxford, UK)  
“Introduction to Persistent Homology” February 2015  
“Multidimensional Persistence Computation” February 2015  
Math, Stats, and CS Seminar, Macalester College (Minneapolis, MN)  
“How many ways are there to juggle?” February 2015  
School on Topological Data Analysis and Stochastic Topology, CIMAT (Guanajuato, Mexico)  
“Computing Persistent Homology” January 2015  
“Visualizing Multidimensional Persistent Homology” January 2015  
Computer Science and Mathematics Lecture, Bryn Mawr College (Philadelphia, PA)  
“Euler Characteristic and Data Analysis” November 2014  
Industrial and Applied Mathematics Seminar, University of Oxford (Oxford, UK)  
“Visualizing Multi-Dimensional Persistent Homology” November 2014  
Math Department Colloquium, University of Mary Washington (Fredericksburg, VA)  
“Euler Integration and Applications” October 2014  
Statistics and Topology Seminar, Technion (Haifa, Israel)  
“Intrinsic Volumes of Random Cubical Complexes” May 2014  
Postdoc Seminar, Institute for Mathematics and its Applications (Minneapolis, MN)  
“Intrinsic Volumes of Random Cubical Complexes” April 2014  
“Hadwiger and Lefschetz: Valuations on Simplicial Maps” December 2013  
Geometry, Topology, and Data Seminar, The Ohio State University (Columbus, OH)  
“Hadwiger Integration and Applications” November 2013  
Plenary Talk, Applied Topology Conference (Będlewo, Poland)  
“Hadwiger Integration and Applications” July 2013  
Geometry Seminar, University of Illinois at Urbana-Champaign (Urbana, IL)  
“Hadwiger Integrals of Random Fields” October 2012  
“Hadwiger Integration and Applications” April 2012

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## SELECTED CONFERENCES AND WORKSHOPS ATTENDED

Applications and Statistics of Multidimensional Persistence (Lausanne, Switzerland)	August 2016
Symposium on Computational Geometry (Boston, MA)	June 2016
Applied Topology and High-Dimensional Data Analysis (Victoria, Canada)	August 2015
The Power of Randomness in Computation (Atlanta, GA)	March 2015
Algebraic Topology: Computation, Data Analysis, and Applications (Oxford, UK)	February 2015
Discrete, Computational, and Algebraic Topology (Copenhagen, Denmark)	November 2014
Generalized Persistence and Applications (AIM, Palo Alto, CA)	September 2014
Teaching a Science of Information Course (San Diego, CA)	August 2014
Algebraic and Geometric Methods in Applied Discrete Mathematics AMS Mathematics Research Community (Snowbird, UT)	June 2014
Algebra and Topology: Methods, Computation, & Science (Vancouver, Canada)	May 2014
IMA Thematic Year on Scientific and Engineering Applications of Algebraic Topology (6 workshops, Minneapolis, MN)	Sept. 2013 – June 2014
Applied Topology (Będlewo, Poland)	July 2013
Algebra and Topology: Methods, Computation, & Science (Münster, Germany)	June 2010
Sensor Topology and Minimal Planning (Austin, TX)	February 2010
Geometric & Topological Methods in Computer Science (Aalborg, Denmark)	January 2010
Sensor Topology and Minimal Planning (Seattle, WA)	July 2009

## LANGUAGE AND COMPUTER SKILLS

English: complete fluency

Spanish: near fluency; studied in Quito, Ecuador for the Fall 2003 semester

Experience in Mathematica, R, Unix, Java, JavaScript, C++, Python, HTML, CSS, PHP, and MySQL

## INSTITUTIONAL AND PROFESSIONAL SERVICE

Co-organizer of AMS Special Session on Applied and Computational Topology at the 2016 JMM (with Nick Scoville and Paweł Dłotko)	January 2016
Co-organizer of AMS Special Session on Algebraic and Geometric Methods in Applied Discrete Mathematics at the 2015 JMM (with Heather Harrington and Mohamed Omar)	January 2015
Organizer of contributed paper session Best Practices for Teaching Online Courses (MAA MathFest)	August 2013
Science Division Scholarship Committee (Huntington University)	2012-2013
Forester Lecture Committee (Huntington University)	2012-2013

## REFERENCES AVAILABLE UPON REQUEST