

Education

University of Chicago Mathematics Advisor: Alex Eskin	Dissertation: <i>Geodesics track random walks in Teichmüller space</i>	MS 1999, PhD 2005
Harvard University Mathematics and Women's Studies		BA 1998

Appointments

Tufts University Associate Professor		2015—
Assistant Professor		2011–2015
Director, Program in Science, Technology, & Society		2015—
University of Michigan Assistant Professor (postdoctoral)		2008–2011
University of California, Davis NSF VIGRE Postdoctoral Fellow		2005–2008

Research Interests

Geometric group theory, growth of groups, mapping class groups, nilpotent groups.
Geometric topology, hyperbolicity, Teichmüller theory.
Large-scale geometry, metric geometry, isoperimetric inequalities.
Random walks, random groups, dynamics of group actions.
Civil rights, redistricting, geometry of gerrymandering.
History, philosophy, anthropology of science. Critical mathematics.

Graduate Advising

Mai Mansouri (MS 2014), Kevin Buckles (PhD 2015), Ayla Sánchez (PhD 2017),
Sunrose Shrestha (PhD expected 2019), Nate Fisher (candidacy 2017)

Awards & Distinctions

AMS-MAA-SIAM Gerald and Judith Porter Lecture , Joint Mathematics Meetings	2018
Senior Fellow , Jonathan M. Tisch College of Civic Life, Tufts University	2017–2018
Fellow of the American Mathematical Society	class of 2017
AMS Invited Address , Eastern Sectional Meeting	2016
MAA Distinguished Lecture	2016
NSF CAREER award - Finer coarse geometry	2013–2018
Bernstein Faculty Fellowship , Tufts University	2013–2015
Professor of the Year , Tufts Math Society	2012–2013
NSF grants - Finer coarse geometry, Metric geometry of groups and surfaces	2009–2015

American Institute of Mathematics SQuaRE grant for five-person working group	2009–2011
AAUW Dissertation Fellowship	2004–2005
NSF Graduate Fellowship	1998–2002
Lawrence and Josephine Graves Prize for Excellence in Teaching (U Chicago)	2002
Robert Fletcher Rogers Prize (Harvard)	1995–1996

Publications & Preprints

Gerrymandering metrics: How to measure? What's the baseline?

Preprint. For the Bulletin of the American Academy of Arts and Sciences.

Medium-scale curvature for Cayley graphs

Preprint. (with Assaf Bar-Natan and Rob Kropholler)

Horofunctions in nilpotent groups

Preprint. (with Sebastiano Nicolussi Golo)

Rational growth in the Heisenberg group

Submitted. (with Michael Shapiro)

A formula goes to court: Partisan gerrymandering and the efficiency gap

Notices of the American Mathematical Society **64**, No. 9, (2017), 1020–1024. (with Mira Bernstein)

International Mobility and U.S. Mathematics

Notices of the American Mathematical Society **64**, No. 7, (2017), 682–683.

Random nilpotent groups I

International Math. Res. Not., doi:10.1093/imrn/rnv370 (2017), 1–33.

(with Matthew Cordes, Yen Duong, Meng-Che Ho, and A.P. Sánchez)

Hyperbolic groups

chapter in *Office Hours with a Geometric Group Theorist*, eds. Matt Clay and Dan Margalit, Princeton University Press (2017), 177–203.

Counting in groups: Fine asymptotic geometry

Notices of the American Mathematical Society **63**, No. 8 (2016), 871–874.

A sharper threshold for random groups at density one-half

Groups, Geometry, and Dynamics **10**, No. 3 (2016), 985–1005.

(with Katarzyna Jankiewicz, Shelby Kilmer, Samuel Lelièvre, John M. Mackay, and A.P. Sánchez)

Equations in nilpotent groups

Proceedings of the AMS **143** (2015), 4723–4731. (with Hao Liang and Michael Shapiro)

Statistical hyperbolicity in Teichmüller space

Geometric and Functional Analysis, Volume 24, Issue 3 (2014), 748–795. (with Howard Masur and Spencer Dowdall)

Fine asymptotic geometry of the Heisenberg group

Indiana University Math Journal 63 No. 3 (2014), 885–916. (with Christopher Mooney)

Pushing fillings in right-angled Artin groups

Journal of the London Math. Society, Volume 87, Issue 3 (2013), 663–688.

(with Aaron Abrams, Noel Brady, Pallavi Dani, and Robert Young)

Spheres in the curve complex

In the Tradition of Ahlfors and Bers VI, Contemp. Math. **590** (2013), 1–8. (with Howard Masur and Spencer Dowdall)

The sprawl conjecture for convex bodies

Experimental Mathematics, Volume 22, Issue 2 (2013), 113–122. (with Samuel Lelièvre and Christopher Mooney)

Filling loops at infinity in the mapping class group

Michigan Math. Journal, Volume 61, Issue 4 (2012), 867–874.
(with Aaron Abrams, Noel Brady, Pallavi Dani, and Robert Young)

The geometry of spheres in free abelian groups

Geometriae Dedicata, Volume 161, Issue 1 (2012), 169–187. (with Samuel Lelièvre and Christopher Mooney)

Statistical hyperbolicity in groups

Algebraic and Geometric Topology **12** (2012) 1–18. (with Samuel Lelièvre and Christopher Mooney)

Length spectra and degeneration of flat metrics

Inventiones Mathematicae, Volume 182, Issue 2 (2010), 231–277. (with Christopher Leininger and Kasra Rafi)

Divergence of geodesics in Teichmüller space and the mapping class group

Geometric and Functional Analysis, Volume 19, Issue 3 (2009), 722–742. (with Kasra Rafi)

Curvature, stretchiness, and dynamics

In the Tradition of Ahlfors and Bers IV, Contemp. Math. **432** (2007), 19–30.

Geodesics track random walks in Teichmüller space

PhD Dissertation, University of Chicago 2005.

Talks and Lectures

Gerald and Judith Porter Public Lecture

AMS-MAA-SIAM, Joint Mathematics Meetings, San Diego, CA

January 2018

AMS Invited Address

Eastern Sectional Meeting, Brunswick, ME

September 2016

MAA Distinguished Lecture

Carriage House, Washington, DC

October 2016

Named university lectures

- School of Science Colloquium Series, The College of New Jersey
- Kieval Lecture, Cornell University
- G. Milton Wing Lectures, University of Rochester
- Norman Johnson Lecture, Wheaton College
- Constitution Day Lecture, Dartmouth College
- Dan E. Christie Lecture, Bowdoin College

Department colloquia

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| - University of Illinois | Sept 2017 | - the Technion | Oct 2014 | - University of Hawaii | Feb 2011 |
| - University of Utah | Aug 2017 | - Wisconsin–Madison | Sept 2014 | - USC | Jan 2011 |
| - Wesleyan | Dec 2016 | - Stony Brook | Mar 2013 | - Central Connecticut | May 2010 |
| - WPI | Dec 2016 | - Bradley University | Feb 2013 | - Dartmouth College | Jan 2010 |
| - Univ de Neuchâtel | Jun 2016 | - Colby College | Nov 2012 | - San Jose State | Sept 2008 |
| - Brandeis University | Mar 2016 | - Wentworth Tech | Nov 2012 | - Univ of Oklahoma | Apr 2008 |
| - Swarthmore College | Oct 2015 | - NYU Poly | Oct 2012 | - Wesleyan University | Nov 2007 |
| - Bowling Green | May 2015 | - Cornell University | Sept 2012 | - Reed College | Nov 2005 |
| - CCONY | Feb 2015 | - University of Ghana | July 2012 | | |
| - Indiana University | Nov 2014 | - Wellesley College | Oct 2011 | | |

Recent Minicourses

- Workshop in geometric topology (main speaker, three talks), Provo, UT June 2017
- Growth in groups (two talks), MSRI, Berkeley, CA August 2016
- Hyperbolicity in Teichmüller space (three talks), Université de Grenoble May 2016
- Counting and growth (four talks), IAS Women's Program, Princeton May 2016
- Nilpotent groups (three talks), Seoul National University October 2014
- Sub-Finsler geometry of nilpotent groups (five talks), Galatasaray Univ., Istanbul April 2014

Recent Seminars

2016. Rennes, Michigan, UT Austin, San Francisco State

2015. Boston University, UC Berkeley

Recent Conferences

- Stochastic Topology and Thermodynamic Limits, ICERM October 2016
- Geometric Group Theory and Low-Dim. Topology workshop, ICTP Trieste, Italy May-June 2016
- Effective & Algorithmic Methods in Hyp. Geom. and Free Groups, ICERM May 2016
- L^2 Geometry-Topology Seminar, Lafayette College, PA March 2015
- Hyperbolic Geometry and Minimal Surfaces workshop, IMPA, Rio, Brazil January 2015

Program organization and development

Directed Reading Program since 2003

Directed Reading Program Network since 2017

Co-founded program at U Chicago pairing math majors with grad student mentors for reading projects.

Co-founded national network linking Directed Reading Programs in a range of math departments around the country to facilitate best practices for mentorship.

This highly impactful mentoring program has been "cloned" by its alumni and now exists at 14 institutions and counting.

Now serving on five-person faculty oversight team for NSF-funded network project.

Research Cluster in Polygonal Billiards Summer 2017

Research Cluster in Random Groups Summer 2014

Ran six-week programs for mix of undergrads, grads, and faculty, mixing experimental and research projects.

Hosted at Tufts University, funded by NSF CAREER grant.

Undergraduate Faculty Program in Geometric Group Theory Summer 2012

Directed three-week "Research Lab" with 16 participating faculty members from undergraduate institutions.

Park City Math Institute, funded by NSF and IAS.

Research Experience for Undergraduates (REU) on Metric Geometry Summer 2006

Designed and ran month-long program supervising seven undergraduates and three grad students.

Hosted at UC Davis, funded by NSF VIGRE grant.

Warmup Program/"WOMP" since 2001

Co-founded program at U Chicago preparing new graduate students for the doctoral program.

Mathematical outreach

Pre-collegiate enrichment/advancement

Montgomery Blair High School, Silver Spring, MD visiting speaker	2017
Fogelson Memorial Mathematics Symposium at Trinity School, NYC keynote speaker	2016
Canada/USA Mathcamp nine-time visitor	since 2005
PROMYS, Bloomington Math Circle, Girls' Angle, HCSSiM, Davis Math Circle	2015, 2015, 2013, 2011, 2008
International Science and Engineering Fair AMS Karl Menger Prize judge	2012

Undergraduate talks

Indiana, Chico State, Salem State, UC Davis, Yale, Reed, USF, Lehman, UConn, Mt Holyoke, Smith, Kennesaw State
MIT (DW Weeks lecture), College of Staten Island (Simons Lecture)

Survey talks at student conferences

Women's Intellectual Network Research Symposium Brown University	2017
TEXTAG: Texas Undergraduate Topology and Geometry Conference UT Austin	2016
Graduate Student Topology and Geometry Conference University of Michigan	2010
Examples of Groups Ohio State University	2010
Binghamton University Graduate Conference in Algebra and Topology (BUGCAT)	2010

Professional development and mentoring

Gender Inclusivity in Mathematics panel discussions Harvard University	2015, 2017
Association for Women in Mathematics chapters UChicago, UIC, Dartmouth, Utah, San Francisco State	
Infinite Possibilities Conference for minority women in mathematics UMBC	2012
Topology Students Workshop Georgia Tech	2012, 2014

International

MISE Foundation Summer Program Accra, Ghana	Summer 2012
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Education outreach

With pre-service teachers

Center for Inquiry-Based Learning redesign of Math for Elementary School Teachers at U Michigan	2008–2011
M.A.T. (Master of Arts in Teaching) courses course development at UC Davis	2005–2008

With in-service teachers

Geometry of Redistricting Summer School Developing training for 100 current teachers	2017
Poincaré Institute NSF-funded teacher enrichment program at Tufts	2011–2012
Polk Bros. teacher training program University/foundation partnership in Chicago Public Schools	2000–2002

With high school students

Connelly Youth Center Boston-area juvenile correctional facility	2015
Collegiate Scholars Program U. Chicago/Chicago Public Schools	2004–2005

High school curriculum development

Puente Valley Charter School project Bassett Unified School District, Eastern L.A. County	2005–2006
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Conference organization

Geometry of Nilpotent Groups; Geometric Group Theory (special sessions) AMS Eastern Sectional meeting Brunswick, ME	September 2016
Mentoring Workshop for Graduate Advisors in Mathematics Tufts University Medford, MA	April 2015
Geometric Methods in Dynamical Systems Centre International de Rencontres Mathématiques Luminy, France	April 2014
Geometric Structures in Low-Dimensional Dynamics Institute for Computational and Experimental Research in Mathematics Providence, RI	November 2013
Geometric Group Theory (special session) Spring Topology and Dynamics Conference Hartford, CT	March 2013
Young Geometric Group Theory Banach Center Będlewo, Poland	January 2012
Connections for Women: Teichmüller Theory and Kleinian Groups Mathematical Sciences Research Institute Berkeley, CA	August 2007

Visiting Positions

Research Member Geometric Group Theory program Mathematical Sciences Research Institute Berkeley, CA	Fall 2016
Research Member Random Walks and Asymptotic Geometry of Groups program Institut Henri Poincaré Paris, France	Spring 2014
Research Member Low-dimensional Topology, Geometry, and Dynamics program Institute for Computational and Experimental Research in Mathematics Providence, RI	Fall 2013
Research Member Geometric and Analytic Aspects of Group Theory program Institut Mittag-Leffler Stockholm, Sweden	May 2012
Postdoctoral Fellow Teichmüller "project blanc" Agence Nationale de la Recherche (Collège de France) Paris, France	Spring 2009
Research Member Teichmüller Theory and Kleinian Groups program Mathematical Sciences Research Institute Berkeley, CA	Fall 2007