

Moon Duchin

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Department of Mathematics, Tufts University

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 Assistant Professor Director, Program in Science, Technology, & Society	2015— 2011–2015 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.

Graduate Advising

Mai Mansouri (MS 2014), Kevin Buckles (PhD 2015), Andrew P. Sánchez (PhD expected 2017),
Sunrose Shrestha (candidacy Fall 2016)

Awards & Distinctions

Fellow of the American Math Society	since 2016
AMS Invited Address , Eastern Sectional Meeting	2016
MAA Distinguished Lecturer	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

Rational growth in the Heisenberg group

Submitted. (with Michael Shapiro)

Counting in groups: Fine asymptotic geometry

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

Random nilpotent groups I

International Math. Res. Not., *to appear.* (with Matthew Cordes, Yen Duong, Meng-Che Ho, and Andrew P. Sánchez)

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 Andrew P. Sánchez)

Equations in nilpotent groups

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

Hyperbolic groups

chapter in *Office Hours with a Geometric Group Theorist*, eds. Matt Clay and Dan Margalit, Princeton University Press, *to appear.*

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

AMS Invited Address

Eastern Sectional Meeting, Brunswick, ME

September 2016

MAA Distinguished Lecture

Carriage House, Washington, DC

October 2016

Department colloquia

- Université de Neuchâtel	Jun 2016	- NYU Poly	Oct 2012
- Brandeis University	Mar 2016	- Cornell University	Sept 2012
- Swarthmore College	Oct 2015	- University of Ghana	July 2012
- Bowling Green	May 2015	- Wellesley College	Oct 2011
- City College of New York	Feb 2015	- University of Hawaii	Feb 2011
- Indiana University	Nov 2014	- University of Southern California	Jan 2011
- the Technion	Oct 2014	- Central Connecticut State	May 2010
- Wisconsin–Madison	Sept 2014	- Dartmouth College	Jan 2010
- Stony Brook	Mar 2013	- San Jose State	Sept 2008
- Bradley University	Feb 2013	- University of Oklahoma	Apr 2008
- Colby College	Nov 2012	- Wesleyan University	Nov 2007
- Wentworth Tech	Nov 2012	- Reed College	Nov 2005

Minicourses

- 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
- Hyperbolic groups (ten talks), CIRM, Luminy, France	January 2014
- Teichmüller geometry (three talks), Math. Research Communities, Snowbird, UT	June 2008

Recent Seminars

2016. Rennes, Michigan, UT Austin

2015. Boston University, UC Berkeley

2014. Warwick, KCL–UCL (England), IHP, Paris-Nord, Grenoble, Toulouse, Montpellier (France), Kyoto University (Japan), Tel Aviv University, the Technion (Israel), Indiana

2013. UC Davis, Harvard, Stony Brook, Toronto, Boston College

2012. CUNY Graduate Center, Buffalo, Cornell, Karlsruhe (Germany), Mittag-Leffler (Sweden), Yale

2011. MSRI, Harvard, CUNY Graduate Center, MIT

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
- Chico Topology Conference, Chico, CA May 2014
- Geometry of Moduli Spaces (two talks), RIMS, Kyoto, Japan November 2013
- Teichmüller Theory, Ergodic Theory, Group Actions, JNU, Delhi, India October 2013
- Finsler Geometry, Samos, Greece June 2013
- Random Walks on Groups, University of Michigan March 2013
- Istanbul Workshop on Teichmüller Theory October 2012
- Hyperbolic Geometry and Teichmüller Theory, Hunter College, NYC September 2012
- Surface groups in Paris, Institut Henri Poincaré March 2012

Recent special sessions

- Low-Dimensional Topology, CMS Winter Meeting, Montreal December 2015
- Random Spaces, Eau Claire, WI September 2014
- Geometric Group Theory, Mexico City, Mexico March 2012
- Hyperbolicity in Manifolds and Groups, Boston, MA January 2012
- Algorithmic and Geometric Properties of Groups and Semigroups, Lincoln, NE October 2011
- Geometric Group Theory & Riemannian Geometry, AWM Centennial, ICERM September 2011

Program organization and development

Research Cluster in Random Groups Summer 2014

Ran six-week program for three undergrads, five grads, and three 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.

Directed Reading Program since 2003

Co-founded program at U Chicago pairing math majors with grad student mentors for reading projects.
This program has been "cloned" by its alumni at Rutgers, Maryland, MIT, Texas, UConn, and UC Berkeley.

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

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, MIT, Lehman, UConn, Mt Holyoke, Smith, UT Austin

Survey talks at graduate conferences

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

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

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