

Harrison Bray

hbray@gmu.edu
www.harrisonbray.com

Dept. of Mathematical Sciences
George Mason University
4400 University Dr
Fairfax, VA 22030

Positions

Sep 2020–present	Term Assistant Professor. <i>George Mason University.</i> Fairfax, VA.
Sep 2020–present	Director of Outreach for the Mason Experimental Geometry Lab. <i>George Mason University.</i> Fairfax, VA.
Sep 2016–May 2020	Visiting Assistant Professor. <i>University of Michigan.</i> Ann Arbor, MI.
Sep 2019–May 2020	Parekh Family Fellow. <i>University of Michigan.</i> Ann Arbor, MI.
Sep 2016–Aug 2018	Research Training Grant (RTG) Postdoctoral Fellow. <i>University of Michigan.</i> Ann Arbor, MI.

Education

PhD, 2016	Tufts University. <i>Graduate School of the Arts and Sciences.</i> Medford, MA. Mathematics. Advisor: Boris Hasselblatt
MS, 2016	Tufts University. <i>Graduate School of the Arts and Sciences.</i> Medford, MA. Mathematics
BA, 2011	Hamilton College. <i>School of Arts and Sciences.</i> Clinton, NY. Major: Mathematics. Minor: Psychology

Research Interests

My research interests are in geometry, topology, and dynamical systems. More specifically, I am interested in geodesic flows, geometric structures on manifolds, convex projective structures, Hilbert geometries, Patterson-Sullivan theory, ergodic theory, thermodynamic formalism, symbolic dynamics, (nonuniformly) hyperbolic dynamical systems, and (rel) hyperbolic spaces and groups.

Preprints and Publications

- 2021 H Bray, R Canary, L-Y Kao, and G Martone. *Pressure metrics for cusped Hitchin components.* (2021). **In preparation.**
- 2021 H Bray and G Tiozzo. *A global shadow lemma for geometrically finite Hilbert geometries.* (2021). **In preparation.**
- 2021 H Bray, R Canary, L-Y Kao, and G Martone. *Counting, equidistribution and entropy gaps at infinity with applications to cusped Hitchin representations.* (2021). **Submitted.** <https://arxiv.org/abs/2102.08552>

- 2021 H Bray and D Constantine. *Entropy rigidity for finite volume strictly convex projective manifolds*. (2021). **Geometrie Dedicata**. Vol 214: 543-557.
- 2021 H Bray, R Canary, and L-Y Kao. *Pressure metrics for deformation spaces of quasifuchsian groups with parabolics*. (2021). **Submitted**. <https://arxiv.org/abs/2006.06184>
- 2021 H Bray, D Davis, K Lindsey, and C Wu. *The Shape of Thurston's Master Teapot*. (2021). **Advances in Mathematics**. Vol 377: 107481.
- 2020 H Bray. *Ergodicity of Bowen-Margulis measure for the Benoist 3-manifolds*. (2020). **Journal of Modern Dynamics**. Vol 16: 0 305-329.
- 2020 H Bray. *Geodesic flow of nonstrictly convex Hilbert geometries*. (2020). **Annales de l'Institut Fourier**. Vol 70: 4 1563-1593.
- 2019 I Adeboye, H Bray, and D Constantine. *Entropy rigidity and Hilbert volume*. (2019). **Discrete Contin. Dyn. Syst. Ser. A**. Vol 39: 4 1731-1744.

Grants and Awards

- Jun. 2019 **LG&TBQ: a conference celebrating LGBTQ+ mathematicians in geometry, topology, and dynamical systems**. *National Science Foundation*.
- Jun. 2019 **University of Michigan College of Literature, Science, and the Arts Mini-Grant**. *University of Michigan College of Literature, Science, and the Arts*.
- Apr. 2019 **The Frederick Gehring Award for Postdoctoral Excellence**. *The University of Michigan Mathematics Department*.
- 2018 – 2022 **AMS Simons Research Travel Grant**. *American Science Foundation*.
Awarded to early career mathematicians with strong research potential.
- Apr. 2016 **Outstanding Academic Scholarship Nominee**. *Tufts University Graduate School of Arts and Sciences*. (Finalist)
- Oct. 2015 **Distinguished Teaching Prize**. *Tufts University Department of Mathematics*.
- Apr. 2015 **The Robert P. Guertin Graduate Student Leadership Award**. *Tufts University Graduate School of Arts and Sciences*.
- May – Dec. 2015 **Graduate Institute for Teaching Fellowship**. *Tufts University Graduate School of Arts and Sciences*.
- Aug. 2016 **GEAR Graduate Intern Travel Grant**. *Geometric Structures and Representation Varieties (GEAR) Network*.
- Jan. 2016 **AMS Graduate Student Travel Grant**. *American Science Foundation*.
- 2012 – 2014 **Tufts GSAS Conference Travel Grant**. *Tufts University Graduate School of Arts and Sciences*.

Mentoring and Advising

- Summer 2020 **Advisor**. *University of Michigan Mathematics Department first year honors advising*.

- Fall 2019 **Lab of Geometry at Michigan (LoGM) Project Mentor.** *Growth rates of tent maps.* Robert Buckley, Grace O'Brien, Zoe Zhou (undergraduates, University of Michigan).
Co-Mentors: Samuel Hansen (mathematics and statistics librarian, University of Michigan)
Preprint authored by Buckley, Chen, O'Brien, and Zhou submitted. Data in preparation for publication.
- Winter 2020 **Lab of Geometry at Michigan (LoGM) Project Mentor.** *Entropy degeneration of ideal projective pants.* Marianne DeBrito, Andrew Nguyen, Marisa O'Gara (undergraduates, University of Michigan).
Co-Mentors: Giuseppe Martone (postdoc, University of Michigan) and Mitul Islam (graduate student, University of Michigan)
Preprint authored by DeBrito, Nguyen, and O'Gara submitted for publication
- Fall 2018 **Lab of Geometry at Michigan (LoGM) Project Mentor.** *3d printing nonstrictly convex projective structures.* Steven Schaefer, Rudra Ranganathan, Hanissa Shamsuddin (undergraduates, University of Michigan).
Co-Mentors: Samantha Pinella and Robert Walker (graduate students, University of Michigan)
- Summer 2017 **Michigan Summer REU Project Mentor.** *Random walks on the fundamental group of the once punctured torus.* Jennifer Jones-Baro (undergraduate, Centro de Investigacion en Matemáticas) and Adam Holeman (masters student, University of Montana).
Co-Mentors: Caleb Ashley (postdoc, University of Michigan)

Service and Leadership

Leadership

- Aug. 2020 **Assistant to the organizers.** *University of Michigan.* Inquiry Based Learning Workshop.
- Jul. 2017 – May 2020 **Director.** *Lab of Geometry at Michigan (LoGM).*
- Jun. – Jul. 2017 **Assistant to the organizers.** *Mathematical Research Community Workshop on Dynamical Systems: Smooth, Symbolic, and Measurable.*
- Sep. 2014 – May 2016 **President.** *Tufts University Student Chapter of the Association for Women in Math (AWM).*
Organized outreach activities at local high schools, panel discussions with women in mathematics from the greater Boston area, coffee and donuts meet-ups with female guest seminar speakers, and regular group meetings to create a community centered around encouraging the participation of underrepresented genders in mathematics.
- Sep. 2013 – Aug. 2014 **Vice-President, Co-founder.** *Tufts University Student Chapter of the Association for Women in Math (AWM).*
- Sep. 2012 – Aug. 2013 **Second Year Class Representative.** *Tufts University Org. of Graduate Students in Mathematics.*

Organizational Work

- 16 Jan. 2020 **Co-Organizer.** *Joint Mathematics Meetings.* So you're going to be a postdoc, now what? A Mathematical Association of America Panel.
- Jan. – Apr. 2020 **Co-Organizer.** *University of Michigan.* Inquiry Based Learning Lunch.
- 10 – 14 Jun. 2019 **Co-Organizer.** *University of Michigan.* LG&TBQ: a conference celebrating the work of diverse mathematicians in geometry, topology, and dynamics..

Sep. 2014 – Apr. 2016 **Organizer.** *Tufts University.* Dynamics Seminar.
 May 2014 **Co-Organizer.** *Research in Pairs.* Joint with Mickaël Crampon.

Committee Work

Apr. 2020 **Dissertation committee member.** *University of Michigan.* Doctoral candidate Samantha Pinella, advised by Ralf Spatzier.

Professional Service

2 Apr. 2021 **Co-Facilitator.** *George Mason University.* Active Learning Discussion Series: on Equity in the Classroom.
 21 – 22 May 2021 **Co-Facilitator.** *DC-MD-VA Communities for Mathematics Inquiry in Teaching (COMMIT) Network.* Workshop on Standards Based Grading and Active Learning.
 16 Jan. 2019 **Panelist.** *Joint Mathematics Meetings.* Association for Women in Mathematics Panel: Promoting Inclusion in Stem.

Community Outreach

8 Mar. 2020, 22 Mar. 2020 **Activity Facilitator.** *University of Michigan Math Circle.* Middle school students.
 Oct. – Nov. 2017 **Activity Facilitator.** *Wolverine Pathways.* High school students.
 Math circle leader for 8th and 11th graders on three different Saturdays in Fall 2017.
 Nov. 2016, Mar. 2017, Nov. 2017 **Activity Facilitator.** *Females Excelling in Math, Engineering, and the Sciences (FEMMES) Capstone Event.* 4th-6th grade girls.
 Jul. 2012 **Instructor.** *MISE Math Camp.* Accra, Ghana.
 Instructed number theory for exceptional high school students in Ghana. The month long summer camp included three weeks of course work and culminated in one week of small groups research projects.

Teaching Experience

George Mason University

Summer 2021 Math 321: **Abstract Algebra.** *Primary Instructor.* (Virtual, synchronous)
 Spring 2021 Math 271: **Mathematics for Elementary Teachers I.** *Primary Instructor.* (Virtual, synchronous, two sections)
 Fall 2020 Math 114: **Calculus II.** *Primary Instructor.* (Virtual, synchronous with asynchronous option)
 Fall 2020 Math 271: **Mathematics for Elementary Teachers I.** *Primary Instructor.* (Virtual, synchronous)

University of Michigan

Winter 2020 Math 440: **The Lab of Geometry at Michigan, LoGM.** *Primary Instructor and Course Creator.*
 Fall 2019 Math 440: **The Lab of Geometry at Michigan, LoGM.** *Primary Instructor and Course Creator.*

Fall 2019	Math 217: Linear Algebra with Introduction to Proof. <i>Primary Instructor.</i>
Winter 2019	Math 217: Linear Algebra with Introduction to Proof. <i>Primary Instructor.</i> (Two sections)
Fall 2018	Math 217: Linear Algebra with Introduction to Proof. <i>Primary Instructor.</i> (Two sections)
Fall 2017	Math 217: Linear Algebra with Introduction to Proof. <i>Primary Instructor.</i> (Two sections)
Winter 2017	Math 310: Explorations in Probability. <i>Primary Instructor.</i>
Fall 2016	Math 490: Introduction to Topology. <i>Primary Instructor.</i>

Tufts University

Fall 2015	Math 36: Applied Calculus II. <i>Primary Instructor.</i>
Spring 2015	Math 19: The Mathematics of Social Choice. <i>Primary Instructor.</i>
Fall 2014	Math 19: The Mathematics of Social Choice. <i>Primary Instructor.</i>
Fall 2012 – Summer 2014	Poincaré Institute for Mathematics Education. <i>Online Course Moderator and Research Assistant.</i>

Conferences, Seminars, Workshops, and Visits

Invited Presentations

14 – 25 Jun. 2021	The Nearly Carbon Neutral Geometric Topology Conference. (virtual)
23 Mar. 2021	Topology and Geometry Seminar. <i>Florida State University.</i> Tallahassee, FL. (virtual)
18 Nov. 2020	Max Dehn Seminar. <i>University of Utah.</i> Salt Lake City, UT. (virtual)
10 Apr. 2020	Geometry and Topology Seminar. <i>Columbia University.</i> New York, NY. (virtual)
18 Nov. 2019	Geometry and Discrete Groups Seminar. <i>Institute Hautes Études Scientifiques (IHES).</i> Bures-sur-Yvette, France.
24 – 28 Jun. 2019	Perspectives on convex projective geometry. Sète, France.
4 – 6 Jun. 2019	Boundaries of random walks. <i>Bowdoin College.</i> Brunswick, ME.
27 – 31 May 2019	Dynamics of group actions: a conference in the honor of Yves Benoist. Cetraro, Italy.
11 Apr. 2019	Geometric Group Theory Seminar. <i>Ohio State University.</i> Columbus, OH.
16 – 19 Jan. 2019	Joint Mathematics Meeting Special Session on Geometry Labs United: Research, Visualization, and Outreach. Baltimore, MD.
30 Jul. – 3 Aug. 2018	Conference on group actions and ergodic theory in geometry and topology. <i>The Hamilton Mathematics Institute.</i> Dublin, Ireland.
30 Apr. 2018	Dynamics seminar. <i>University of Chicago.</i> Chicago, IL.
10 – 13 Jan. 2018	Joint Mathematics Meeting Special Session: Boundaries for groups and spaces. San Diego, CA.
2 May 2017	Dynamical Systems Seminar. <i>Northwestern University.</i> Evanston, IL.

22 Apr. 2017	Junior Geometry and Topology in the Midwest Conference. <i>University of Wisconsin.</i> Madison, WI.
13 Mar. 2017	Geometry and Topology Seminar. <i>University of Toronto.</i> Toronto, ON, Canada.
9 Feb. 2017	Ergodic Theory/Probability Seminar. <i>Ohio State University.</i> Columbus, OH.
28 Nov. 2016	Complex Analysis, Dynamics, and Geometry seminar. <i>University of Michigan.</i> Ann Arbor, MI.
4 Nov. 2016	Howard University Mathematics Colloquium. Washington, DC.
27 – 30 Oct. 2016	Workshop in Dynamical Systems. <i>Pennsylvania State University.</i> State College, PA.
2 – 11 Aug. 2016	Minicourse on ergodic geometry in a nonuniformly hyperbolic setting. <i>University of Maryland.</i> College Park, MD. (4 courses)
26 Apr. 2016	Dynamics and Algebra seminar. <i>Wesleyan University.</i> Middletown, CT.
15 Feb. 2016	Dynamics seminar. <i>University of Chicago.</i> Chicago, IL.
3 Dec. 2015	Everytopic seminar. <i>Brandeis University.</i> Waltham, MA.
31 Oct. 2015	Midwest Dynamical Systems Meeting. <i>Ohio State University.</i> Columbus, OH. (poster)
21 Feb. 2015	Graduate Student Math Conference. <i>Brown University.</i> Providence, RI.
12 May 2014	IRMA Master Class: student-postdoc seminar. <i>University of Strasbourg.</i> Strasbourg, France.
31 Mar. 2014	School on Geometry and Dynamics. <i>Centre International de Rencontres Mathématiques (CIRM).</i> Luminy, France. (poster)
28 Mar. 2014	Séminaire Teich. <i>Aix-Marseille University.</i> Marseille, France.

Conferences Attended

15 – 17 Apr. 2016	Workshop on Dynamical Systems and Related Topics. <i>University of Maryland.</i> College Park, MD.
Apr. 2014	Finsler Geometry and Applications. <i>Galatasaray University.</i> Istanbul, Turkey.
29 Nov. 2013	Young Mathematicians in Dynamical Systems. <i>Centre International de Rencontres Mathématiques (CIRM).</i> Luminy, France.
4 – 7 Oct. 2018	Workshop in Dynamical Systems and Related Topics. <i>Pennsylvania State University.</i> State College, PA.
12 – 13 Aug. 2017	Geometry Labs United. <i>University of Washington.</i> Seattle, WA.
18 – 24 Jun. 2017	Mathematical Research Community Workshop on Dynamical Systems: Smooth, Symbolic, and Measurable. Snowbird Resort, UT.
15 – 19 Aug. 2016	Workshop on Moduli Spaces of Geometric Structures. <i>Institute for Mathematical Sciences.</i> Singapore.
22 – 24 Jun. 2016	Geometries, surfaces and representations of fundamental groups. <i>University of Maryland.</i> College Park, MD.

7 – 11 Mar. 2016	Fractal Geometry, Hyperbolic Dynamics and Thermodynamical Formalism. <i>Institute for Computational and Experimental Research in Mathematics (ICERM).</i> Providence, RI.
6 – 9 Jan. 2016	Joint Mathematics Meetings. Seattle, WA.
14 – 15 Nov. 2015	AMS Fall Eastern Sectional Meeting. <i>Rutgers University.</i> New Brunswick, NJ.
19 Sep. 2015	Women In Mathematics In New England (WiMiN). <i>Smith College.</i> Northampton, MA.
15 – 16 Jan. 2015	MSRI Connections for Women: Dynamics on Moduli Spaces of Geometric Structures. <i>Mathematical Sciences Research Institute (MSRI).</i> Berkeley, CA.
20 – 23 Jan. 2015	MSRI Introductory Workshop: Dynamics on Moduli Spaces of Geometric Structures. <i>Mathematical Sciences Research Institute (MSRI).</i> Berkeley, CA.
4 – 14 Jun. 2014	ICTP-NLAGA School in Dynamical Systems and Ergodic Theory. <i>African Institute for Mathematical Sciences (AIMS).</i> Dakar, Senegal.
9 – 17 May 2014	IRMA Master Class: Around Thurston-Grothendieck-Teichmüller theories. <i>University of Strasbourg.</i> Strasbourg, France.
20 – 24 Jan. 2014	Young Researchers in Geometric Group Theory. <i>Centre International de Rencontres Mathématiques (CIRM).</i> Luminy, France.
2 – 6 Dec. 2013	Hyperbolicity and Dimension. <i>Centre International de Rencontres Mathématiques (CIRM).</i> Luminy, France.
27 May – 6 Jun. 2013	Beyond Uniform Hyperbolicity. Będlewo, Poland.

Seminars Attended

Sep. 2016 – May 2020	RTG working seminar on geometry, topology, and dynamics. <i>University of Michigan.</i> Ann Arbor, MI.
Sep. 2016 – May 2020	Topology seminar. <i>University of Michigan.</i> Ann Arbor, MI.
Sep. 2014 – May 2016	Geometric Group Theory and Topology Seminar. <i>Tufts University.</i> Medford, MA.
Feb. – Apr. 2014	Séminaire: Dynamique, Arithmétique et Combinatoire. <i>Institut de Mathématiques de Marseille.</i> Marseille, France.
Jan. – Apr. 2014	Séminaire: Teich. <i>Aix-Marseille University.</i> Marseille, France.
Sep. 2012 – Dec. 2013	Dynamics Seminar. <i>Tufts University.</i> Medford, MA.
Spring 2013	Working seminar on Ergodic Geometry. <i>Tufts University.</i> Medford, MA.

Invited Visits

Nov. 2019	Invited Guest. <i>Institute Hautes Études Scientifiques (IHES).</i> Bures-sur-Yvette, France.
Jan. – Apr. 2014	Invited Guest. <i>Centre International de Rencontres Mathématiques (CIRM).</i> Luminy, France.

Pedagogical Training

Spring 2021 – present	Teaching Seminar. <i>George Mason University.</i> Department of Mathematical Sciences. Fairfax, VA.
Winter 2018 – Winter 2020	Learning Community on Inclusive Teaching (LCIT). <i>University of Michigan.</i> Department of Mathematics. Ann Arbor, MI.
Fall 2016 – Spring 2020	Inquiry Based Learning (IBL) working seminar. <i>University of Michigan.</i> Department of Mathematics. Ann Arbor, MI.
Summer 2016, Summer 2017	Inquiry Based Learning (IBL) Workshop. <i>University of Michigan.</i> Department of Mathematics. Ann Arbor, MI. The annual three day IBL workshop consists of observing and analyzing an inquiry-based learning (IBL) classroom and discussing IBL-style instructional practices.
Summer 2016	Michigan Teaching Training. <i>University of Michigan.</i> Department of Mathematics. Ann Arbor, MI. The University of Michigan has an extensive teacher training program for new hires, run by the mathematics department in conjunction with the Michigan Center for Research on Learning and Teaching (CRLT).
Spring – Fall 2016	Graduate Institute for Teaching (GIFT). <i>Tufts University.</i> Graduate School of Arts and Sciences. Medford, MA. The Tufts Graduate Student Institute for Teaching (GIFT) awards fellowships on a competitive basis across all fields of scholarship at Tufts. Teaching fellows participate in an intensive summer workshop on pedagogy before working with a faculty mentor in the classroom the following semester.

Memberships

American Mathematical Society (AMS)