Harrison Bray

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Positions

Aug 2022–present	**Assistant Professor**. *George Mason University*. Fairfax, VA.
Aug 2020–May 2022	**Term Assistant Professor**. *George Mason University*. Fairfax, VA.
Aug 2020–May 2022	**Director of Outreach for the Mason Experimental Geometry Lab**. *George Mason University*. Fairfax, VA.
Sep 2016–May 2020	**Visiting Assistant Professor**. *University of Michigan*. Ann Arbor, MI.
Sep 2019–May 2020	**Parekh Family Fellow**. *University of Michigan*. Ann Arbor, MI.
Sep 2016–Aug 2018	**Research Training Grant (RTG) Postdoctoral Fellow**. *University of Michigan*. Ann Arbor, MI.

Education

PhD, 2016	**Tufts University**. *Graduate School of the Arts and Sciences*. Medford, MA. Mathematics. **Advisor**: Boris Hasselblatt
MS, 2016	**Tufts University**. *Graduate School of the Arts and Sciences*. Medford, MA. Mathematics
BA, 2011	**Hamilton College**. *School of Arts and Sciences*. 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

2022	H Bray, R Canary, L-Y Kao, and G Martone. *Counting, equidistribution and entropy gaps at infinity with applications to cusped Hitchin representations*. (2022). **Journal für die reine und angewandte Mathematik (Crelles Journal)**.
2021	H Bray, R Canary, L-Y Kao, and G Martone. *Pressure metrics for cusped Hitchin components*. (2021). **Preprint**. https://arxiv.org/abs/2111.07493

2021   H Bray and G Tiozzo. *A global shadow lemma and logarithm law for geometrically finite Hilbert geometries*. (2021). **Preprint**. `https://arxiv.org/abs/2111.04618`

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). Accepted at **Algebraic and Geometric Topology**.

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'Institute 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

Fall 2022 – present	**Director**. *Mason Experimental Geometry Lab*.
	Supervised a management team of 6 graduate students and oversaw outreach operations led by a doctoral student and a team of 2 undergraduates and 1 MS student.
Fall 2020 – Fall 2022	**Supervisor**. *George Mason Learning Assistant Program*.
	Mentored 11 different undergraduate learning assistants (LAs) in my active learning courses over five semesters, with some LAs working with me for up to three semesters. On average, I supervised 14/5=2.8 LAs per semester.
Fall 2020 – Spring 2022	**Director of Outreach**. *Mason Experimental Geometry Lab*.
	Supervised 3 undergraduates and 2 graduate interns in outreach design and facilitation, including extensive training.
Summer 2020	**Advisor**. *University of Michigan Mathematics Department first year honors advising*.
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 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.
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

Sep. 2022 – present	**Director**. *Mason Experimental Geometry Lab (MEGL)*.
Sep. 2020	**Director of Outreach**. *Mason Experimental Geometry Lab (MEGL)*.
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

Spring 2022 – present	**Co-Organizer**. *George Mason University.* Geometry Seminar (MMA: metrics, measures, and algorithms).
16 Jan. 2020	**Co-Organizer**. *Joint Mathematics Meetings.* So you're going to be a postdoc, now what? A Mathematical Association of America (MAA) 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

May 2022	**Hiring Committee Member**. *George Mason University.*
Apr. 2020	**Dissertation Committee Member**. *University of Michigan.* Doctoral candidate Samantha Pinella, advised by Ralf Spatzier.

Professional Service

1 Feb. 2023 – 31 Jan. 2026	**Mathematics Research Communities Advisory Board**. *American Mathematical Society.*
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

Sep. 2020	**Director of Outreach**. *Mason Experimental Geometry Lab (MEGL).*
	Reached 1938 students in K-12 Public School both in-person and virtually. Designed new outreach curriculum materials. Trained and supervised a team of 4 undergraduate and graduate student interns.

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

Fa 22	Math 125: **Discrete Mathematics I**. *Primary Instructor*.
Sp 22	Math 300: **Introduction to Advanced Mathematics**. *Primary Instructor*. (Two sections)
Fa 21	Math 271: **Mathematics for Elementary Teachers I**. *Primary Instructor*. (Two sections)
Su 21	Math 321: **Abstract Algebra**. *Primary Instructor*. (Virtual, synchronous)
Sp 21	Math 271: **Mathematics for Elementary Teachers I**. *Primary Instructor*. (Virtual, synchronous, two sections)
Fa 20	Math 114: **Calculus II**. *Primary Instructor*. (Virtual, synchronous with asynchronous option)
Fa 20	Math 271: **Mathematics for Elementary Teachers I**. *Primary Instructor*. (Virtual, synchronous)

University of Michigan

Wi 20	Math 440: **The Lab of Geometry at Michigan, LoGM**. *Primary Instructor and Course Creator*.
Fa 19	Math 440: **The Lab of Geometry at Michigan, LoGM**. *Primary Instructor and Course Creator*.
Fa 19	Math 217: **Linear Algebra with Introduction to Proof**. *Primary Instructor*.
Wi 19	Math 217: **Linear Algebra with Introduction to Proof**. *Primary Instructor*. (Two sections)
Fa 18	Math 217: **Linear Algebra with Introduction to Proof**. *Primary Instructor*. (Two sections)
Fa 17	Math 217: **Linear Algebra with Introduction to Proof**. *Primary Instructor*. (Two sections)
Wi 17	Math 310: **Explorations in Probability**. *Primary Instructor*.
Fa 16	Math 490: **Introduction to Topology**. *Primary Instructor*.

Tufts University

Fa 15	Math 36: **Applied Calculus II**. *Primary Instructor*.
Sp 15	Math 19: **The Mathematics of Social Choice**. *Primary Instructor*.
Fa 14	Math 19: **The Mathematics of Social Choice**. *Primary Instructor*.
Fa 12 – Su 14	**Poincaré Institute for Mathematics Education**. *Online Course Moderator and Research Assistant*.

Conferences, Seminars, Workshops, and Visits

Invited Presentations

Jan. 2023	**Joint Mathematics Meeting Special Session: Dynamics, Geometry & Group Actions**. Boston, MA.
14 – 25 Jun. 2021	**The Nearly Carbon Neutral Geometric Topology Conference**. (virtual)
23 Mar. 2021	**Topology and Geometry Seminar**. *Florida State University*. Tallahassee, FL. (virtual)
18 Nov. 2020	**Max Dehn Seminar**. *University of Utah*. Salt Lake City, UT. (virtual)
10 Apr. 2020	**Geometry and Topology Seminar**. *Columbia University*. New York, NY. (virtual)
18 Nov. 2019	**Geometry and Discrete Groups Seminar**. *Institute Hautes Études Scientifiques (IHES)*. Bures-sur-Yvette, France.
24 – 28 Jun. 2019	**Perspectives on convex projective geometry**. Sète, France.
4 – 6 Jun. 2019	**Boundaries of random walks**. *Bowdoin College*. 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**. *Ohio State University*. 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**. *The Hamilton Mathematics Institute*. Dublin, Ireland.
30 Apr. 2018	**Dynamics seminar**. *University of Chicago*. 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**. *Northwestern University*. Evanston, IL.
22 Apr. 2017	**Junior Geometry and Topology in the Midwest Conference**. *University of Wisconsin*. Madison, WI.
13 Mar. 2017	**Geometry and Topology Seminar**. *University of Toronto*. Toronto, ON, Canada.
9 Feb. 2017	**Ergodic Theory/Probability Seminar**. *Ohio State University*. Columbus, OH.
28 Nov. 2016	**Complex Analysis, Dynamics, and Geometry seminar**. *University of Michigan*. Ann Arbor, MI.
4 Nov. 2016	**Howard University Mathematics Colloquium**. Washington, DC.
27 – 30 Oct. 2016	**Workshop in Dynamical Systems**. *Pennsylvania State University*. State College, PA.
2 – 11 Aug. 2016	**Minicourse on ergodic geometry in a nonuniformly hyperbolic setting**. *University of Maryland*. College Park, MD. (4 courses)
26 Apr. 2016	**Dynamics and Algebra seminar**. *Wesleyan University*. Middletown, CT.
15 Feb. 2016	**Dynamics seminar**. *University of Chicago*. Chicago, IL.
3 Dec. 2015	**Everytopic seminar**. *Brandeis University*. Waltham, MA.
31 Oct. 2015	**Midwest Dynamical Systems Meeting**. *Ohio State University*. Columbus, OH. (poster)

21 Feb. 2015	**Graduate Student Math Conference**. *Brown University*. Providence, RI.
12 May 2014	**IRMA Master Class: student-postdoc seminar**. *University of Strasbourg*. Strasbourg, France.
31 Mar. 2014	**School on Geometry and Dynamics**. *Centre International de Rencontres Mathématiques (CIRM)*. Luminy, France. (poster)
28 Mar. 2014	**Séminaire Teich**. *Aix-Marseille University*. Marseille, France.

Conferences Attended

15 – 17 Apr. 2016	**Workshop on Dynamical Systems and Related Topics**. *University of Maryland*. College Park, MD.
Apr. 2014	**Finsler Geometry and Applications**. *Galatasaray University*. Istanbul, Turkey.
29 Nov. 2013	**Young Mathematicians in Dynamical Systems**. *Centre International de Rencontres Mathématiques (CIRM)*. Luminy, France.
4 – 7 Oct. 2018	**Workshop in Dynamical Systems and Related Topics**. *Pennsylvania State University*. State College, PA.
12 – 13 Aug. 2017	**Geometry Labs United**. *University of Washington*. 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**. *Institute for Mathematical Sciences*. Singapore.
22 – 24 Jun. 2016	**Geometries, surfaces and representations of fundamental groups**. *University of Maryland*. College Park, MD.
7 – 11 Mar. 2016	**Fractal Geometry, Hyperbolic Dynamics and Thermodynamical Formalism**. *Institute for Computational and Experimental Research in Mathematics (ICERM)*. Providence, RI.
6 – 9 Jan. 2016	**Joint Mathematics Meetings**. Seattle, WA.
14 – 15 Nov. 2015	**AMS Fall Eastern Sectional Meeting**. *Rutgers University*. New Brunswick, NJ.
19 Sep. 2015	**Women In Mathematics In New England (WiMiN)**. *Smith College*. Northampton, MA.
15 – 16 Jan. 2015	**MSRI Connections for Women: Dynamics on Moduli Spaces of Geometric Structures**. *Mathematical Sciences Research Institute (MSRI)*. Berkeley, CA.
20 – 23 Jan. 2015	**MSRI Introductory Workshop: Dynamics on Moduli Spaces of Geometric Structures**. *Mathematical Sciences Research Institute (MSRI)*. Berkeley, CA.
4 – 14 Jun. 2014	**ICTP-NLAGA School in Dynamical Systems and Ergodic Theory**. *African Institute for Mathematical Sciences (AIMS)*. Dakar, Senegal.
9 – 17 May 2014	**IRMA Master Class: Around Thurston-Grothendieck-Teichmüller theories**. *University of Strasbourg*. Strasbourg, France.
20 – 24 Jan. 2014	**Young Researchers in Geometric Groupy Theory**. *Centre International de Rencontres Mathématiques (CIRM)*. Luminy, France.
2 – 6 Dec. 2013	**Hyperbolicity and Dimension**. *Centre International de Rencontres Mathématiques (CIRM)*. 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**. *University of Michigan*. Ann Arbor, MI.
Sep. 2016 – May 2020	**Topology seminar**. *University of Michigan*. Ann Arbor, MI.
Sep. 2014 – May 2016	**Geometric Group Theory and Topology Seminar**. *Tufts University*. Medford, MA.
Feb. – Apr. 2014	**Séminaire: Dynamique, Arithméthique et Combinatoire**. *Institut de Mathématiques de Marseille*. Marseille, France.
Jan. – Apr. 2014	**Séminaire: Teich**. *Aix-Marseille University*. Marseille, France.
Sep. 2012 – Dec. 2013	**Dynamics Seminar**. *Tufts University*. Medford, MA.
Spring 2013	**Working seminar on Ergodic Geometry**. *Tufts University*. Medford, MA.

Invited Visits

8 – 12 Aug. 2022	**Invited Guest**. *University of Wisconsin*. Madison, WI.
Nov. 2019	**Invited Guest**. *Institute Hautes Études Scientifiques (IHES)*. Bures-sur-Yvette, France.
Jan. – Apr. 2014	**Invited Guest**. *Centre International de Rencontres Mathématiques (CIRM)*. Luminy, France.

Pedagogical Training

Spring 2021 – present	**Teaching Seminar**. *George Mason University*. Department of Mathematical Sciences. Fairfax, VA.
Winter 2018 – Winter 2020	**Learning Community on Inclusive Teaching (LCIT)**. *University of Michigan*. Department of Mathematics. Ann Arbor, MI.
Fall 2016 – Spring 2020	**Inquiry Based Learning (IBL) working seminar**. *University of Michigan*. Department of Mathematics. Ann Arbor, MI.
Summer 2016, Summer 2017	**Inquiry Based Learning (IBL) Workshop**. *University of Michigan*. 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**. *University of Michigan*. 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)**. *Tufts University*. 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)