

Harrison Bray

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Positions

Aug 2022–present	Assistant Professor. <i>George Mason University.</i> Fairfax, VA.
Aug 2020–May 2022	Term Assistant Professor. <i>George Mason University.</i> Fairfax, VA.
Aug 2020–May 2022	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, 2013	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, coarsely hyperbolic metric spaces, geometrically finite group actions, and relatively Anosov representations.

Preprints and Publications

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| 2024 | H Bray and G Tiozzo. <i>A global shadow lemma and logarithm law for geometrically finite Hilbert geometries.</i> (2024). Preprint. https://arxiv.org/abs/2111.04618 |
| 2023 | H Bray, R Canary, and L-Y Kao. <i>Pressure metrics for deformation spaces of quasifuchsian groups with parabolics.</i> (2023). Algebraic and Geometric Topology. Vol 23: (8) 3615-3653. |

- 2023 H Bray, R Canary, L-Y Kao, and G Martone. *Pressure metrics for cusped Hitchin components*. (2023). **Advances in Mathematics**. Vol 435: 109352.
- 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). **J. Reine Angew. Math. (Crelle's Journal)**. Vol 791: 1/1/51.
- 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, 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 Funding

- Sep. 2024 **4-VA Collaborative Research Grant Award**. *University of Virginia*. (\$30,000)
PI(s): J.D. Quigley. Co-PI(s): H. Bray, R. Field, A. Lukyanenko, and A. Moore.
- Sep. 2024 **4-VA Collaborative Research Matching Grant Award**. *George Mason University*. (\$5,000)
PI(s): H. Bray. Co-PI(s): A. Lukyanenko.
- 2018 – 2022 **AMS Simons Research Travel Grant**. *American Mathematical Society*. (\$4,000)
- Jun. 2019 **LG&TBQ: a conference celebrating LGBTQ+ mathematicians in geometry, topology, and dynamical systems**. *National Science Foundation*. (\$40,000)
Co-PI(s): H. Bray and A. Kent.
- Jun. 2019 **University of Michigan College of Literature, Science, and the Arts Mini-Grant**. *University of Michigan College of Literature, Science, and the Arts*. (\$2,500)
- Aug. 2016 **GEAR Graduate Intern Travel Grant**. *Geometric Structures and Representation Varieties (GEAR) Network*. (\$3,100)
- 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*.

Awards and Honors

- Apr. 2019 **The Frederick Gehring Award for Postdoctoral Excellence**. *The University of Michigan Mathematics Department*.
- Apr. 2016 **Outstanding Academic Scholarship Nominee**. *Tufts University Graduate School of Arts and Sciences*. (Finalist)

- May – Dec. 2015 **Graduate Institute for Teaching Fellowship.** *Tufts University Graduate School of Arts and Sciences.*
- 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.*

Mentoring and Advising

- Fall 2022 – Spring 2023 **Director.** *Mason Experimental Geometry Lab.*
- Spring 2023 **Mason Experimental Geometry Lab (MEGL) Project Mentor.** *Hyperbolic Crochet.* Nguphuong Au, Merold Saffa, Aidan Self, Sydney Thu (undergraduates, George Mason University).
- Fall 2020 – Fall 2022 **Supervisor.** *George Mason Learning Assistant Program.*
- Fall 2020 – Spring 2022 **Director of Outreach.** *Mason Experimental Geometry Lab.*
- 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).
- 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).
- 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).
- Summer 2017 **Michigan Summer REU Project Mentor.** *Random walks on the fundamental group of the once punctured torus.* Jennifer Jones-Baro (undergraduate, Centro de Investigación en Matemáticas) and Adam Holeman (masters student, University of Montana).

Service and Leadership

Leadership

- Sep. 2022 – Aug. 2023 **Director.** *Mason Experimental Geometry Lab (MEGL).*
- Sep. 2020 – Aug. 2022 **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).*

- 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).
- Jan. – Apr. 2020 **Co-Organizer.** *University of Michigan.* Inquiry Based Learning Lunch.
- 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.
- 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

- Jul. 2024 **Qualifying Exam Committee Member.** *George Mason University.* Doctoral candidate Jeanie Schreiber, advised by Tyrus Berry.
- 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.*
- 23 Feb. 2024 **SIAM Faculty Symposium Lecturer.** *George Mason Department of Mathematical Sciences.*
- Feb. 2023 **Math department representative.** *College of Science User Group Interviews.*
- 6 Jan. 2023 **Recruiter and GMU Representative.** *Joint Mathematics Meetings Graduate Fair.*
- Spring 2023 **Mentor.** *George Mason Department of Mathematical Sciences.* Mentored and trained new faculty member and Mason Experimental Geometry Lab (MEGL) outreach director Rosenberg Toala.
- 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.
- 2 Apr. 2021 **Co-Facilitator.** *George Mason University.* Active Learning Discussion Series: on Equity in the Classroom.
- 16 Jan. 2019 **Panelist.** *Joint Mathematics Meetings.* Association for Women in Mathematics Panel: Promoting Inclusion in Stem.

Community Outreach

- 28 May 2024 **Mason TV filmed presenter.** *Mason Experimental Geometry Lab (MEGL).*
- 12 Mar. 2024 **Activity Facilitator.** *Lewis Coates Elementary School.* Mason Experimental Geometry Lab (MEGL) Outreach Event.

3 Dec. 2022	Activity Facilitator. <i>Mason Early Identification STEM Fusion program.</i> Making Mathematics Meaningful.
Sep. 2020	Director of Outreach. <i>Mason Experimental Geometry Lab (MEGL).</i>
8 Mar. 2020, 22 Mar. 2020	Activity Facilitator. <i>University of Michigan Math Circle.</i> Middle school students.
Oct. – Nov. 2017	Activity Facilitator. <i>Wolverine Pathways.</i> High school students.
Nov. 2016, Mar. 2017, Nov. 2017	Activity Facilitator. <i>Females Excelling in Math, Engineering, and the Sciences (FEMMES) Capstone Event.</i> 4th-6th grade girls.
Jul. 2012	Instructor. <i>MISE Math Camp.</i> Accra, Ghana.

Teaching Experience

George Mason University

Fa 23	Math 679: Ergodic Theory. <i>Primary Instructor.</i>
Sp 23	Math 776: Measure and Integration. <i>Primary Instructor.</i>
Fa 22	Math 125: Discrete Mathematics I. <i>Primary Instructor.</i>
Sp 22	Math 300: Introduction to Advanced Mathematics. <i>Primary Instructor.</i> (Two sections)
Fa 21	Math 271: Mathematics for Elementary Teachers I. <i>Primary Instructor.</i> (Two sections)
Su 21	Math 321: Abstract Algebra. <i>Primary Instructor.</i> (Virtual, synchronous)
Sp 21	Math 271: Mathematics for Elementary Teachers I. <i>Primary Instructor.</i> (Virtual, synchronous, two sections)
Fa 20	Math 114: Calculus II. <i>Primary Instructor.</i> (Virtual, synchronous with asynchronous option)
Fa 20	Math 271: Mathematics for Elementary Teachers I. <i>Primary Instructor.</i> (Virtual, synchronous)

University of Michigan

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

Tufts University

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

Conferences, Seminars, Workshops, and Visits

Invited Presentations

18 Jul. 2024	Moving to higher rank: from hyperbolic to Anosov. A conference in honor of Dick Canary. Cetraro, Italy.
28 Apr. 2024	Knots in Washington 49.9843375. <i>George Washington University.</i> Washington, DC.
10 Apr. 2024	RTG seminar on geometry, topology, and dynamics. <i>University of Michigan.</i> Ann Arbor, MI.
18 Mar. – 1 Apr. 2024	Minicourse on logarithm laws for hyperbolic metric spaces. <i>George Mason University.</i> Fairfax, VA. (3 courses)
1 Feb. 2024	Randomness and Geometry Seminar. <i>Fields Institute.</i> Toronto, ON, Canada.
2 Dec. 2023	Collaborative team conference. Charlottesville, VA.
9 Feb. 2023	Dynamics Seminar. <i>University of Maryland.</i> College Park, MD.
6 Jan. 2023	Joint Mathematics Meeting AMS-Spectra Special Session on Research by LGBTQ+ Mathematicians. Boston, MA.
4 Jan. 2023	Joint Mathematics Meeting Special Session: Dynamics, Geometry & Group Actions. Boston, MA.
9 Dec. 2022	Knots in Washington 49.875. <i>George Washington University.</i> Washington, DC.
11 Nov. 2022	Topology, Algebra, and Dynamics Seminar. <i>George Mason University.</i> Fairfax, VA.
1 Nov. 2022	Geometry Seminar. <i>University of Virginia.</i> Charlottesville, VA.
19 Sep. 2022	Geometry Seminar. <i>George Mason University.</i> Fairfax, VA.
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 (3 classes). <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.

Invited Visits

22 Jan. – 2 Feb. 2024	Randomness and Geometry Thematic Semester. <i>Fields Institute.</i> Toronto, ON, Canada.
8 – 12 Aug. 2022	Invited Guest. <i>University of Wisconsin.</i> Madison, WI.
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.

Memberships

American Mathematical Society (AMS)