

JEFFREY F. BROCK

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PROFESSIONAL APPOINTMENTS

Yale University, New Haven, CT.

Zhao and Ji Professor of Mathematics, 2019-present.
Dean, School of Engineering & Applied Science, August 2019-present.
Dean of Science, Faculty of Arts & Sciences, January 2019-present.
Professor, Department of Mathematics, 2018-present.

Brown University, Providence, RI.

Director, Data Science Initiative, 2016-2018.
Chair, Department of Mathematics, 2013-2017.
Deputy Director, ICERM, 2010-2013. *Associate Director*, 2013-2017.
Professor, Department of Mathematics, 2007-2018.
Associate Professor (with tenure), Department of Mathematics, 2003-2007.

University of Chicago, Chicago, IL.

Assistant Professor, Department of Mathematics, 2000-2003.

Stanford University, Stanford, CA.

Szegö Assistant Professor, *NSF Postdoc*, Department of Mathematics, 1997-2000.

VISITING POSITIONS

Université Paul Sabatier, Toulouse, France.

Maître de Conférence invité, 2010. *Professeur invité*, 2015.

University of Texas, Austin, TX.

Donald D. Harrington Faculty Fellow, 2003-2004.

EDUCATION

University of California, Berkeley, CA.

Ph.D. in mathematics, 1997, under the supervision of Curtis T. McMullen.

Yale University, New Haven, CT.

B.A. Phi Beta Kappa, *Magna Cum Laude*, distinction in mathematics, 1992.

RESEARCH INTERESTS

Hyperbolic geometry, group theory, low-dimensional topology, moduli spaces

ACADEMIC HONORS

Elected Fellow, American Mathematical Society, 2017.

Simons Fellowship, (declined), 2016.

John Simon Guggenheim Fellow, 2008.

Donald D. Harrington Faculty Fellow, University of Texas at Austin 2003-2004.

NSF Postdoctoral Fellow, Stanford University, 1997-2000.

Alfred P. Sloan Doctoral Dissertation Fellow, U.C. Berkeley, 1996-1997.

Outstanding Graduate Student Instructor Award, U.C. Berkeley, 1996.

NSF Graduate Fellow, U.C. Berkeley, 1993-1996.

Stanley and DeForest Mathematics Prizes, Yale University, 1991 and 1992.

SELECTED INVITED PRESENTATIONS

2018–present

- Upcoming in 2022, *Geometry, Arithmetic, and Groups*, Invited Speaker, Austin, TX.
- *Noteworthy Math: the math of music and the music of math*, Guest Speaker, MoMath, New York, NY.
- *Frontiers of Analysis and Geometry of Teichmüller Spaces*, Invited Speaker, Yau Mathematical Sciences Center, Sanya, China.
- *Geometric Data Analysis*, Invited Speaker, University of Chicago, Chicago, IL.
- *Multiple Perspectives on Geometric Inequalities*, Invited Speaker, Centre Recerca Matemàtica, Barcelona, Spain.
- *Model Driven Discovery & the Science of Data*, Invited Speaker, RedHat Research Day, Boston, MA.
- *Representation varieties and geometric structures in low dimensions*, Invited Speaker, Mathematics Institute, University of Warwick, Warwick, UK.
- *Workshop on Geometry of Teichmüller Space*, Invited Speaker, Fields Institute, Toronto, ON.

2015–2017

- *Geometric Topology in Low Dimensions*, Invited Speaker, Mathematics Institute, University of Warwick, Warwick, UK.
- *Teichmüller Theory and Geometric Structures on 3-manifolds*, Invited Speaker, University of Luxembourg.
- *Geometric Topology in Cortona*, Minicourse Speaker, Cortona, Italy.
- *Geometry, Topology and Dynamics of Moduli Spaces*, Main Speaker, Singapore.
- *Advanced School on Geometric Group Theory and Low-Dimensional Topology*, Lecturer in three hour mini-course at ICTP, Trieste, Italy.
- *Random Lectures in Geometry*, Main Speaker, University of Fribourg, Fribourg, Switzerland.
- *Geometric Topology, Geometric Group Theory & Dynamical Systems*, Invited Speaker, Inter-University Centre Dubrovnik, Croatia.
- *Classical and quantum hyperbolic geometry and topology*, Main Speaker, Université Paris Sud, Paris, France.
- *Hyperbolic Geometry and Minimal Surfaces*, IMPA. Rio de Janeiro, Brazil.
- *Teichmüller theory and surfaces in 3-manifolds*, Main Speaker. Centro De Giorgi, Scuola Normale Superiore, Pisa, Italy.

2011–2014

- *The 10th William Rowan Hamilton Geometry and Topology Workshop*, Public Lecture. Dublin, Ireland.
- *Hyperbolic Geometry and Geometric Group Theory - ICM Satellite Conference*, Plenary Speaker. Tokyo, Japan.
- *Teichmüller theory and surfaces in 3-manifolds*, Main Speaker. Centro De Giorgi, Scuola Normale Superiore, Pisa, Italy.
- *The 9th William Rowan Hamilton Geometry and Topology Workshop*, Plenary Speaker. Dublin, Ireland.
- *The XXII Nevanlinna Colloquium*, Plenary Speaker. Henslinki, Finland.

- *Hyperbolic Geometry and Mapping Class Groups*, three-lecture graduate minicourse. Pisa, Italy.
- *Geometric Topology in Cortona*, Plenary Speaker. Cortona, Italy.
- *The Poincaré Symposium*, Brown University, Providence, RI.
- *Tech Topology Conference*, Georgia Institute of Technology, Atlanta, GA.
- *Gear Junior Retreat*, Three lecture mini-course on *Combinatorial Teichmüller Theory*. Urbana, IL.
- *Geometric Structures on Surfaces*, summer@ICERM minicourse. Providence, RI.
- *Rigidity and Flexibility in Dimensions 2, 3, and 4*, Steve Kerckhoff's Birthday Conference. Luminy, France.
- *Immersed Surfaces in Three-Manifolds* Institut Henri Poincaré, Paris, France.
- *Current Events Bulletin* One-hour invited talk at the Joint Meetings of the American Mathematical Society. Boston, MA.
- *The hyperbolic and Riemannian geometry of surfaces and other manifolds - A conference in honor of Peter Buser*, Ascona, Switzerland.
- *The 7th William Rowan Hamilton Geometry and Topology Workshop*, Invited to give minicourse on Teichmüller theory, Dublin, Ireland.
- *Wasatch Topology Conference*, Park City, UT.
- *Aspects of hyperbolicity in geometry, topology, and dynamics - A workshop in honor of Caroline Series' 60th Birthday*, Warwick, England.

2005-2010

- Fourth *de Brún Workshop on Group Actions* (four-lecture minicourse), NUI Galway, Galway, Ireland. 2010
- *Geometry and Analysis of Riemann Surfaces and Their Moduli* (Scott Wolpert's birthday conference), U. Maryland, College Park, MD. 2010
- *Geometry Topology and Dynamics of Character Varieties*, NUS, Singapore. 2010
- *Advanced School and Workshop on Discrete Groups in Complex Geometry*, ICTP, Trieste, Italy. 2010

- *M. E. Hamstrom Memorial Lecture*, University of Illinois, Urbana-Champaign. 2010
- *Dynamics and Geometry of Teichmüller Space*, Luminy, France. 2009
- *The Evans-Hall Memorial Lecture*, Emory University, Atlanta, GA. 2009
- *The Julia Wells Bower Lecture*, Connecticut College, New London, CT. 2009
- *MSRI-Evans Lecture*, Berkeley, CA, 2007.
- William Thurston's 60th Birthday Conference, Princeton, NJ, 2007.
- *Teichmüller Space and Outer Space*, Marseille, France, 2007
- *Geometry of Moduli Spaces*, Stanford, CA, 2007.
- MAA Invited Adress, AMS-MAA National Meetings, New Orleans, LA, 2007.
- Three-lecture series, *3-Manifolds After Perelman*, Edinburgh, Scotland, 2006.
- Three-lecture series, *Trois Journées de Topologie à Orsay*, Orsay, France, 2005.
- Low-dimensional topology meeting, Oberwolfach, Germany, 2005.
- *Geometry and Topology of Three Manifolds*, Trieste, Italy, 2005.

pre-2005

- AMS Invited Address, Pittsburgh, PA, 2004.
- Wesleyan Geometric Analysis Conference, Middletown, CT, 2004.
- Main Lecturer, VIGRE mini-course, Salt Lake City, UT, 2004.
- Cornell Topology Festival, Ithaca, NY, 2004.
- IUC conference on Teichmüller space and moduli space, Chicago, IL, 2003.
- *Wasatch Topology Conference*, Salt Lake City, UT 2002.
- Georgia Topology Conference, Athens, GA, 2002.
- Plenary Address, *Ahlfors-Bers Colloquium*, Storrs, CT, 2001.
- *Kleinian Groups and Hyperbolic 3-Manifolds*, Warwick, England, 2001.
- *Iberoamerican Congress on Geometry*, Guanajuato, Mexico, 2001.
- Bay Area Topology Seminar, Stanford, CA, 1999.

GRANT SUPPORT

- PI, NSF REU Site Grant, 4/2021-4/2024 *Summer Undergraduate Math Research at Yale*. Ian Adelstein Co-PI. Extends Yale-funded summer undergraduate research program to external students. Amount \$400,000.
- Co-PI, NSF CCF TRIPODS+X Grant, 9/2018-9/2021 *From Data Science to Neuroscience* Amount \$300,000. Nicholas Turk-Browne, PI, Damon Clark, John Lafferty co-PI.
- PI, NSF CCF TRIPODS Institute Grant 1740741, 9/2017-9/2020 *Foundations of Model Driven Discovery from Massive Data*. Amount: \$1,482,177. Eli Upfal, Stuart Geman, Bjorn Sandstede, Joseph Hogan, Co-PIs.
- NSF Grant, DMS-1608759, 9/2016-9/2019. *Volume and Combinatorics, in Hyperbolic Geometry*. Amount: \$239,997.
- NSF Grant, DMS-1207572, 6/2012-6/2016. *Combinatorics, Models, and Bounds in Hyperbolic Geometry*. Amount: \$364,703.
- Co-PI, NSF Mathematical Sciences Research Institute Grant, DMS-0931908. *The Institute for Computational and Experimental Research in Mathematics*. Amount: \$15,495,376.
- NSF Grant, DMS-0906229, 8/2009-8/2012. *Teichmüller theory, Kleinian groups, and the complex of curves*. Amount: \$210,754.
- NSF FRG Grant, DMS-0553694, (Co-PIs Bromberg, Canary, and Minsky), 6/2006-6/2009. *Geometry and Deformation Theory of Hyperbolic 3-Manifolds*. Amount: \$255,420.
- NSF Grant DMS-0354288, 6/2005-6/2008. *Effective Rigidity, Combinatorial Models and Parameter Spaces for Low-Dimensional Hyperbolic Manifolds*. Amount: \$294,624.
- NSF Grants DMS-0204454 (Chicago) and DMS-0354288 (Brown), 6/2002-6/2005. *The Classification Problem for Hyperbolic 3-Manifolds*. Amount: \$101,601.
- Postdoctoral Associate, NSF Research Grant DMS-0072133, 2000-2002.
- NSF Mathematical Sciences Postdoctoral Research Fellow, Stanford, 1997-2000.

SERVICE

- Co-Director, *SUMRY: Summer Undergraduate Mathematics Research at Yale*, NSF REU Program, 2021–present.
- Organizer, *Random and Arithmetic Structures in Topology*, Fall 2020 MSRI program.
- Scientific Advisory Board, Heidelberg Institute for Theoretical Studies (HITS), 2019–present.
- Committee on Science Policy, American Mathematical Society, 2018–present.
- Physical Sciences and Engineering Advisory Committee, Yale University. 2018–
- Diversity Committee, Brown Mathematics Department, 2017–2018.
- Organizer, Summer@ICERM Program, *Topological Data Analysis*. ICERM, 2017.
- Scientific Advisory Board, ICERM, 2017–present.
- Committee on Committees, American Mathematical Society, 2017–2018
- Steering Committee, Brown University Data Science Initiative, 2015
- Co-Chair, Search Committee, ICERM Director, 2014–2015
- Graduate Admissions Committee, 2012.
- Tenure Promotion and Appointments Committee, 2010–2012
- Organizer, *Geometry and Dynamics in Surfaces and 3-Manifolds, II*, Summer 2009 FRG conference.
- Director of Undergraduate Studies, 2008–2009.
- Undergraduate Science Education Committee, 2006–2007.
- Organizer, *Kleinian groups and Teichmüller Theory*, Fall 2007 MSRI program.
- Organizer, *Geometry and Dynamics in Surfaces and 3-Manifolds*, Spring 2007 FRG conference.
- Colloquium Chair, 2004–2006.
- Senior Appointments Committee, 2005–2006.
- Tamarkin Assistant Professor Committee, 2004–2005.
- Organizer, *Tameness in Texas*, Harrington Conference at U.T. Austin, 2004.

RESEARCH SUPERVISION

Postdoctoral Sponsor for:

- **Franco Vargas Pallete**, NSF Postdoctoral Fellow, Yale University, 2020-2021.
- **Kathryn Mann**, NSF Postdoctoral Fellow, Brown University, 2017-2018.
- **Tarik Aougab**, NSF Postdoctoral Fellow, Brown University, 2015-2018.
- **Sara Maloni**, Tamarkin Assistant Professor, Brown University, 2013-2016.
- **Johanna Mangahas**, NSF Postdoctoral Fellow, Brown University, 2011-2014.
- **Autumn Kent**, NSF Postdoctoral Fellow, Brown University, 2006-2010.
- **David Dumas** NSF Postdoctoral Fellow, Brown University, 2005-2008.

Ph.D. Thesis Advisor for:

- **Peihong Jiang**, 2015-2021.
- **Yang Xiao**, 2015-2020.
- **Ashley Weber**, 2015-2019.
- **Elchanan Solomon**, 2014-2019.
- **Yunhui Wu**, 2008-2012.
- **Ali Gokturk**, 2006-2011.

Undergraduate Thesis Advisor for **Ilya Kopsitsky**, Brown University 2005-2006.

UTRA Supervisor, **Yuji Kosugi**, Brown University, Summer 2006.

Secondary graduate advisor to **Dan Margalit** and **Pallavi Dani**,
University of Chicago.

EDITORIAL WORK

Editorial Board, Journal of Topology. 2018 – present.

PUBLICATIONS

1. **The Weil-Petersson gradient flow of renormalized volume and 3-dimensional convex cores.** (With Martin Bridgeman and Kenneth Bromberg). *Preprint*, 2020.
2. **Windows, cores, and skinning maps.** (With Ken Bromberg, Dick Canary, and Yair Minsky). *Ann. Sci. Éc. Norm. Supér. (4)* **53** (2020), no. 1, p. 173–216.
3. **Limit sets of Weil-Petersson geodesics with nonminimal ending laminations.** (With Christopher Leininger, Babak Modami, and Kasra Rafi). *J. Topol. Anal.* **12** (2020), pp. 1–28.
4. **Limit sets of Teichmüller geodesics with minimal nonuniquely ergodic vertical foliation, II.** (With Chris Leininger, Babak Modami, and Kasra Rafi). *J. Reine Angew. Math.* **758** (2020), 1–66.
5. **Limit sets of Weil-Petersson geodesics.** (With Christopher Leininger, Babak Modami, and Kasra Rafi). *Int. Math. Res. Not. IMRN* 2019, no. 24, pp. 7604–7658.
6. **Local topology in deformation spaces of hyperbolic 3-manifolds II.** (With Ken Bromberg, Richard Canary, Cyril Lecuire, and Yair Minsky). *Groups Geom. & Dyn.* **13** (2019), no. 3, 767–793.
7. **Schwarzian derivatives, projective structures, and the Weil-Petersson gradient flow for renormalized volume.** (With Martin Bridgeman and Ken Bromberg). *Duke Math. J.* **168** (2019), no. 5, 867–896.
8. **Correction to "On the density of geometrically finite Kleinian groups."** (With Ken Bromberg). *Acta Math.* **219** (2017), pp. 17–19.
9. **Machine learning algorithm for automatic detection of CT-identifiable hyperdense lesions associated with traumatic brain injury.** Krishna N. Keshavamurthy ; Owen P. Leary ; Lisa H. Merck ; Benjamin Kimia ; Scott Collins ; David W. Wright ; Jason W. Allen ; Jeffrey F. Brock ; Derek Merck. Proc. SPIE 10134, Medical Imaging 2017: Computer-Aided Diagnosis, 101342G (March 23, 2017); doi:10.1117/12.2254227.
10. **Norms on the cohomology of hyperbolic 3-manifolds.** (With Nathan Dunfield). *Invent. Math.* **210** (2017), no. 2, pp. 531–558.

11. **Geometric inflexibility of hyperbolic cone-manifolds.** (With Ken Bromberg). In “Hyperbolic geometry and geometric group theory”, *Adv. Stud. Pure. Math* **73** (2017), pp. 47-64.
12. **Inflexibility, Weil-Petersson distance, and volumes of fibered 3-manifolds.** (With Ken Bromberg). *Math. Res. Lett.* **23** (2016), pp. 649-674.
13. **Recurrent Weil-Petersson geodesic rays with non-uniquely ergodic ending laminations.** (With Babak Modami). *Geometry & Topology* **19** (2015), pp. 3565-3602.
14. **Convergence and divergence of Kleinian groups.** (With Ken Bromberg, Richard Canary, Cyril Lecuire). *J. Topol.* **8** (2015), 811-841.
15. **Bounded combinatorics and uniform models for hyperbolic 3-manifolds.** (With Yair Minsky, Hossein Namazi, and Juan Souto). *J. Topol.* **9** (2) (2016), 451-501
16. **Injectivity radii of hyperbolic integer homology 3-spheres.** (With Nathan Dunfield). *Geometry & Topology* **19** (2015), 497-523.
17. **Convergence properties of end invariants.** (With Ken Bromberg, Dick Canary, and Yair Minsky). *Geometry & Topology* **17** (2013), pp. 2877-2922.
18. **The classification of Kleinian surface groups II: the ending lamination conjecture.** (With Dick Canary and Yair Minsky). *Ann. of Math.* **176** (2012), pp. 1-149.
19. **Assembling surfaces from random pants: mixing, matching and correcting in the proofs of the surface-subgroup and Ehrenpreis conjectures.** In AMS Current Events Bulletin (2012).
20. **Local topology of deformation spaces of hyperbolic 3-manifolds.** (With Ken Bromberg, Richard Canary, and Yair Minsky). *Geometry & Topology* **15** (2011), pp. 1169-1224.
21. **Asymptotics of Weil-Petersson geodesics II: bounded geometry and unbounded entropy.** (With Howard Masur and Yair Minsky). *Geom. & Funct. Anal.* **21** (2011), pp. 820-850.
22. **Taming the Field of Hyperbolic 3-Manifolds.** *In the Annual Report of the Clay Mathematics Institute*, 2009 pp. 10-18.
23. **Geometric inflexibility and 3-manifolds that fiber over the circle.** (With Ken Bromberg). *Journal of Topology*, **4** (2011), pp. 1-38.

24. **Asymptotics of Weil-Petersson geodesics I: ending laminations, recurrence and flows.** (With Howard Masur and Yair Minsky). *Geom. & Funct. Anal.* **19** (2010), pp. 1229-1257.
25. **Coarse and synthetic Weil-Petersson geometry: quasi-flats, geodesics, and relative hyperbolicity.** (With Howard Masur). *Geometry & Topology* **12** (2008), 2453-2495.
26. **Weil-Petersson isometries via the pants complex.** (With Dan Margalit). *Proc. A.M.S.* **135** (2007), pp. 795-803
27. **Algebraic limits of geometrically finite manifolds are tame.** (With Juan Souto). *Geom. & Funct. Anal.* **16** (2006), pp. 1-39.
28. **Curvature and rank of Teichmüller space.** (With Benson Farb). *Amer. J. Math.* **128** (2006), pp. 1-22.
29. **The Weil-Petersson visual sphere.** *Geometriae Dedicata* **1** (2005), pp. 1-18
30. **On the density of geometrically finite Kleinian groups.** (With Ken Bromberg). *Acta Math.* **192** (2004), pp. 33-93.
31. **Tameness on the boundary and Ahlfors' measure conjecture.** (With Ken Bromberg, Richard Evans, and Juan Souto). *Publ. Math. I.H.E.S.* **98** (2003), pp. 145-166.
32. **Pants decompositions and the Weil-Petersson metric.** In *Complex Manifolds and Hyperbolic Geometry*, American Mathematical Society, Providence, 2002, 343 pp.
33. **Cone-manifolds and the density conjecture.** (With Ken Bromberg). In *Kleinian Groups and Hyperbolic 3-Manifolds*, London Math Society Lecture Note Series, Cambridge University Press, 2003.
34. **Weil-Petersson translation distance and volumes of mapping tori.** Preprint (2001). *Comm. Anal. Geom.* **11** (2003), pp. 987-999.
35. **The Weil-Petersson metric and volumes of 3-dimensional hyperbolic convex cores.** *J. Amer. Math. Soc.* **16** (2003), pp. 495-535.
36. **Boundaries of Teichmüller spaces and end-invariants for hyperbolic 3-manifolds.** *Duke Math. J.* **106** (2000), pp. 527-552.

37. **Continuity of Thurston's length function.** *Geom. & Funct. Anal.* **10** (2000), pp. 741-797.
38. **Iteration of mapping classes and limits of hyperbolic 3-manifolds.** *Invent. Math.* **143** (2001), pp. 523-570.
39. **Iteration of mapping classes on a Bers slice: examples of algebraic and geometric limits of hyperbolic 3-manifolds.** In *Lipa's Legacy*, J. Dodziuk, L. Keen, ed., Proceedings of the Bers Colloquium, 1997, pp. 81-106.
40. **The standard double bubble in \mathbb{R}^2 uniquely minimizes perimeter.** (with M. Alfaro et. al.) *Pacific Journal of Mathematics* **159** (1993), no. 1, 47-59.
41. **Almost Alternating Links.** (with C. Adams et. al.) *Topology and its Applications* **46** (1992), no. 2, 151-165.

Preprints available at <http://jeffreybrock.net>.