



David Dumas

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Academic Positions

- *Professor*, University of Illinois at Chicago, 2016-
- *Associate Professor*, University of Illinois at Chicago, 2011-2016
- *Assistant Professor*, University of Illinois at Chicago, 2008-2011
- *Tamarkin Assistant Professor/NSF Postdoctoral Fellow*, Brown University, 2005-2008
- *NSF Postdoctoral Fellow*, Rice University, 2004-2005

Visiting Positions

- *Simons Visiting Professor*, MSRI, Spring 2015
- *Research Fellow*, ICERM, Fall 2013
- *Professeur Invité*, Université Paris-Sud 11, June 2009
- *Member*, MSRI, Fall 2007

Education

- Ph.D. in Mathematics, Harvard University, June 2004. Advisor: Curtis T. McMullen
- B.S. in Mathematics and in Physics, Pennsylvania State University, May 1999

Research Interests

- Teichmüller theory, complex geometry, locally homogeneous geometric structures, representations of surface groups in Lie groups
- Algorithms, computer experiments, and visualization in geometry

Awards and Grants

External research support

- NSF Research Grant, PI, DMS-1709877, 2017-2020
- NSF CAREER Award, PI, DMS-0952869, 2010-2016
- NSF Research Grant, PI, DMS-0805525, 2008-2011
- NSF Postdoctoral Research Fellowship, 2004-2008
- NSF Graduate Research Fellowship, 1999-2004

Internal research support

- *Visualizing the fourth dimension using virtual reality*
UIC College of Liberal Arts and Sciences Undergraduate Research Initiative semester grant for supervision of undergraduate research project, Fall 2017
- *The Mathematical Computing Laboratory: An Undergraduate Research Center*
Award for Faculty of Science, UIC College of Liberal Arts and Sciences, co-PI with Benjamin Antieau, 2015-2016.

- *A Laboratory for Mathematical Computation*
Award for Faculty of Science, UIC College of Liberal Arts and Sciences, co-PI with Marc Culler and Jan Verschelde, 2012-2013

Conference grants

- NSF Conference Grant, PI, DMS-1822457, for the 2018 Graduate Student Topology and Geometry Conference, April 7-8, 2018
- GEAR Research Network workshop grant for “Dynamics on Moduli Spaces” at MSRI, April 13-17, 2015

Teaching awards

- UIC Teaching Recognition Program recipient, 2017
- UIC MSCS Teaching Award, 2016

Research Articles

In preparation

- *Rays of conformally thick convex real projective surfaces* (with Michael Wolf).
- Anosov representations, locally homogeneous complex manifolds, and deformation theory (with Andrew Sanders).
- *Experiments with skinning maps* (with Autumn Kent).

Submitted

- *Geometry of compact complex manifolds associated to generalized quasi-Fuchsian representations* (with Andrew Sanders). Preprint, 68pp.
- *Coarse and fine geometry of the Thurston metric* (with Anna Lenzen, Kasra Rafi, and Jing Tao). Preprint, 40pp.

Accepted

- *Asymptotics of Hitchin’s metric on the Hitchin section* (with Andrew Neitzke). To appear in *Communications in Mathematical Physics*. Published online July 24, 2018.

Published

- *Holonomy limits of complex projective structures*. *Advances in Mathematics* 315 (2017), 427-473.
- *Polynomial cubic differentials and convex polygons in the projective plane* (with Michael Wolf). *Geometric and Functional Analysis* 25 (2015), no. 6, 1734-1798.
- *Skinning maps are finite-to-one*. *Acta Mathematica* 215 (2015), no. 1, 55-126.
- *Grafting rays follow travel Teichmüller geodesics* (with Young-Eun Choi & Kasra Rafi). *International Mathematics Research Notices* 2012 (2012), 2445-2492.
- Bers slices are Zariski dense (with Autumn Kent). *Journal of Topology* 2 (2009), 373-379.
- *Complex projective structures* (survey). In *Handbook of Teichmüller Theory, Volume II* (EMS, 2009). 58pp.
- *Slicing, skinning, and grafting* (with Autumn Kent). *American Journal of Mathematics* 131 (2009), 1419-1429.
- *Projective structures, grafting, and measured laminations* (with Michael Wolf). *Geometry & Topology* 12 (2008), 351-386.

- *Distribution of intersection lengths of a random geodesic with a geodesic lamination* (with Martin Bridgeman). *Ergodic Theory and Dynamical Systems* 27 (2007), 1055-1072.
- *The Schwarzian derivative and measured laminations on Riemann surfaces*. *Duke Mathematical Journal* 140 (2007), 203-243.
- *Grafting, pruning, and the antipodal map on measured laminations*. *Journal of Differential Geometry* 74 (2006), 93-118.
Erratum. *Ibid.*, 77 (2007), 175-176.
- *Complex projective structures, grafting, and Teichmüller theory*. PhD Thesis, Harvard University, 2004

Other Publications

- *Geometry Labs United: An Invitation* (with Jayadev Athreya, William Goldman, Sergey Grigorian, Rosemary Guzman, Philipp Hieronymi, Sean Lawton, Anton Lukyanenko, Jeremy Tyson, and Aaron Wilson). *Notices of the American Mathematical Society* 65 (2018), no. 9, 1088-1094.

Software and Visualization Projects

- **Balanced Ideal Enumeration (2018)**, with Florian Stecker
 - Finds all balanced ideals in the Weyl group of a semisimple Lie group. These correspond to cocompact domains of discontinuity in flag varieties.
 - <https://florianstecker.de/balancedideals/>
- **ManifoldBall (2017)**, with Horalia Armas, Brandon Reichman, and Hai Tran.
 - VR game for Oculus Rift to illustrate geometry of multiply-connected manifolds and orbifolds by playing racquetball. Joint project with team of graduate and undergraduate researchers.
 - <https://github.com/uicmcl/manifoldball>
 - Press coverage in *Nature*: <https://dx.doi.org/10.1038/543473a>
- **Bubble Wrap (2016)**, with Ellie Dannenberg, Kimberly Kim, and Jacob Lewis.
 - GUI application and Python library for exploring complex projective structures on compact surfaces admitting circle packings. Joint project with team of graduate and undergraduate researchers.
 - <https://github.com/daviddumas/bubble-wrap/>
- **The fence conjecture for polygonal affine spheres (2014-)**, with Michael Wolf
 - Images and animations illustrating numerical experiments that led to a conjecture about affine spheres over convex polygons in the projective plane
 - <http://dumas.io/fence-conjecture/>
- **The PML visualization project (2012-)**, with François Guéritaud
 - Images, animations, and open source software for visualizing Thurston's embedding of the space of projective measured laminations on a surface
 - <http://dumas.io/PML/>
- **RandomChord (2006)**
 - Java applet for exploration of random chords in a hyperbolic ideal triangle
 - <http://dumas.io/applets/RandomChord/>

- Bear (2004-2007)
 - Open source software for exploring Bers slices and other aspects of the representation variety of punctured torus groups
 - <http://bear.sourceforge.net/>

Selected Presentations

2019

- *Opers on Riemann surfaces*
 - Graduate mini-course (4 lectures) at “Winter school on geometric structures”, Université de Nice Sophia Antipolis

2018

- *Compact complex manifolds associated to surface group representations*
 - Geometry Seminar, University of Virginia
- *Asymptotics of Hitchin's metric on Teichmüller space*
 - Conference “Representation varieties and geometric structures in low dimensions”, University of Warwick
 - Conference “The Mathematical Legacy of Maryam Mirzakhani”, Stanford University

2017

- *Geometric limits of convex \mathbf{RP}^2 structures and cubic differentials*
 - Conference “Surface Group Representations and Geometric Structures”, International Center for Theoretical Sciences, Bangalore
 - Informal Geometry and Topology Seminar, Stanford University
 - Geometry, Groups, and Dynamics / GEAR Seminar, University of Illinois at Urbana-Champaign
 - Conference “Higgs Bundles and Related Topics”, Laboratoire J.A. Dieudonné, Université Nice Sophia Antipolis
- Python for mathematical visualization: A four-dimensional case study
 - PyCon 2017, Portland, Oregon
- Geometry and topology of complex Anosov domain quotients
 - Topology Seminar, Yale University

2016

- *Coarse and fine geometry of the Thurston metric*
 - Geometry and Topology Seminar, California Institute of Technology
- *Geometry and topology of complex Anosov domain quotients*
 - Workshop “Chicago Action Now”, University of Chicago
- *Surface group representations in $SL(3)$: An invitation to higher Teichmüller theory*
 - Workshop “Analytic Aspects of Higher Teichmüller theory”, Rutgers-Newark
- *Complex deformations of n -Fuchsian representations*
 - Workshop “Moduli Spaces of Geometric Structures”, Institute for Mathematical Sciences, National University of Singapore
- *Visualizing PML*
 - Conference “Illustrating Mathematics”, ICERM

- *Representations of surface groups in higher-rank complex Lie groups*
 - Colloquium, Rutgers University, Newark

2015

- *Complex deformations of n -Fuchsian representations*
 - Conference “Differentialgeometrie im Grossen”, Oberwolfach
- *From polynomials to polygons via affine differential geometry*
 - Colloquium, University of California, Berkeley
 - Colloquium, University of Southern California
- *The moduli space of convex real projective structures*
 - Geometry/Topology Seminar, University of Chicago
 - Research Seminar, “Dynamics on moduli spaces of geometric structures”, MSRI

2014

- *Polygons, polynomials, fences, and flows*
 - Workshop “Geometry, topology and physics of moduli spaces of Higgs bundles”, Institute for Mathematical Sciences, National University of Singapore
- *Computing the image of Thurston's skinning map*
 - Workshop “Teichmüller theory and surfaces in 3-manifolds”, Pisa
- *Complex projective structures and theory holonomy limits*
 - Mini-course at the GEAR Junior Retreat, University of Michigan

2013

- *Skimming maps and Lagrangian intersections*
 - Geometric Group Theory and Topology Seminar, Tufts University
- *Examples of moduli spaces*
 - Undergraduate Colloquium, College of the Holy Cross
 - Public Lecture, Jawaharlal Nehru University, New Delhi
- *Computing the image of Thurston's skinning map*
 - Conference “Exotic Geometric Structures”, ICERM
 - Complex dynamics seminar, CUNY Graduate Center
- *Polygons in RP^2 and the Hitchin component of the complex plane*
 - Conference “Algebraic Geometry and Hyperbolic Geometry—New Connections”, Cabo Frio, Rio de Janeiro
- *Convex polygons, complex polynomials, and hyperbolic affine spheres*
 - Dynamics and Geometry Seminar, Harvard University
 - Conference “Advances in Teichmüller theory”, ESI, Vienna

2012

- *Osculation in complex projective and hyperbolic structures*
 - GEAR Research Network Retreat, University of Illinois at Urbana-Champaign
- *Polynomial Pick forms and polygons*
 - Research Seminar, Institut Henri Poincaré
 - AMS Special Session, University of Kansas

2011

- *Real and complex boundaries in the character variety*
 - Wasatch Topology Conference
 - Geometry and Topology Seminar, University of Wisconsin, Madison
- *Floyd's theorem and Λ -trees*
 - William Rowan Hamilton Geometry and Topology Workshop, Trinity College, Dublin
- *Holonomy of projective structures and flat surfaces in hyperbolic space*
 - Conference "Aspects of hyperbolicity in geometry, topology, and dynamics", University of Warwick
- *Intersections in the character variety*
 - Topology/Geometry Seminar, Stanford University
 - Geometry/Topology Seminar, University of California, Davis
 - Geometry and Topology Seminar, California Institute of Technology
- *Skinning maps are finite-to-one*
 - Conference "Analysis, Geometry, and Surfaces", Autrans, France
- *Kähler structures on ML and applications*
 - Center for Dynamics and Geometry Seminar, Pennsylvania State University

2010

- *Kähler structures on ML and applications*
 - Geometry Seminar, Indiana University
- *Complex projective structures and character varieties*
 - Colloquium, University of Illinois at Urbana-Champaign
 - Colloquium, Indiana University
- Lecture series: *Complex projective structures and their holonomy representations*
 - Summer school on "Geometry, Topology and Dynamics of Character Varieties", Institute for Mathematical Sciences, National University of Singapore
- *Skinning maps are finite-to-one*
 - Special session, V Iberoamerican Congress on Geometry, Pucón, Chile
 - AMS Special Session, Albuquerque, New Mexico
- *Rigidity and skinning maps*
 - Topology Seminar, Ohio State University

2009

- *Rigidity and skinning maps*
 - Geometry-Analysis Seminar, Rice University
- *Kähler structures on ML*
 - Geometry and Topology Seminar, University of Warwick
 - Dynamics Seminar, Université Paris-Sud 11
- *Epstein surfaces, trees, and bubbles*
 - AMS Special Session, University of Illinois at Urbana-Champaign
 - UIC Geometry, Topology, and Dynamics Seminar

- *Bers slices are Zariski dense*
 - AMS-MAA Joint Meetings, Special Session, Washington, DC

2008

- *Complex projective structures on surfaces*
 - Karcher Colloquium, University of Oklahoma
- *Holonomy limits of complex projective structures*
 - Seminar, Indiana University
 - Seminar, University of Illinois at Urbana-Champaign
- *Grafting and the Teichmüller metric*
 - The Fourth Ahlfors-Bers Colloquium, Rutgers University, Newark
 - Seminar, University of Chicago
 - Seminar, Brown University
- *Complex projective structures and applications*
 - Colloquium, Queens College (CUNY)
 - Colloquium, University of Connecticut
 - Colloquium, University of California, Riverside
 - Colloquium, University of California, Santa Cruz
 - Colloquium, Lehman College (CUNY)

2007

- *Complex projective structures and applications*
 - Colloquium, University of Illinois at Chicago
 - Colloquium, University of Massachusetts, Amherst
 - Seminar, Johns Hopkins University
- *The Zariski closure of a Bers slice*
 - Conference “Topics in Teichmüller Theory and Kleinian Groups”, MSRI
- *Slicing, skinning, and grafting*
 - Conference “Hyperbolic structures on 3-manifolds and large scale geometry of Teichmüller space”, University of Warwick
- *Slicing, skinning, and grafting*
 - Conference “Geometry and Dynamics in Surfaces and 3-Manifolds”, Brown Univ.
 - Seminar, Johns Hopkins University
- *Shapes of polygons*
 - Brown Symposium for Undergraduates in the Mathematical Sciences
- *Skinning maps are never constant*
 - Seminar, University of Pennsylvania

2006

- *Grafting coordinates for Teichmüller space*
 - Seminar, University of Michigan
 - Seminar, California Institute of Technology
 - AMS Special Session, University of Connecticut
 - Seminar, University of Maryland

- *Analysis and geometry of CP^1 structures on surfaces*
 - Conference “Teichmüller Theory, Classical and Quantum”, Oberwolfach
 - Georgia Topology Conference, University of Georgia
 - Conference “Teichmüller Theory and Moduli Problems”, Harish-Chandra Research Institute, Allahabad, India

2002-2005

- *The Schwarzian derivative and measured laminations on surfaces*
 - Seminar, Brown University, 2005
- *Grafting, the Schwarzian derivative, and CP^1 structures on surfaces*
 - “The Third Ahlfors Bers Colloquium”, University of Michigan, 2005
- *Grafting, pruning, and the Teichmüller geodesic involution*
 - “Hyperbolic Geometry and Geometric Analysis”, Wesleyan University, 2004
- *The geometry of complex projective Riemann surfaces*
 - Colloquium, Wesleyan University, 2004
 - Seminar, Brown University, 2004
- *Grafting and complex projective Riemann surfaces*
 - Seminar, University of Minnesota, 2004
- *Grafting of Riemann surfaces and limits of complex projective structures*
 - Seminar, Yale University, 2003
 - Seminar, University of Maryland, 2003
- *Complex projective structures and the Bers embedding*
 - Program “Spaces of Kleinian Groups”, Isaac Newton Institute, Cambridge, 2003
- *Projective structures with quasi-Fuchsian holonomy*
 - Seminar, Wesleyan University, 2002
- *Projective structures and quasi-Fuchsian groups*
 - Colloquium, Oklahoma State University, 2002

Teaching

- University of Illinois at Chicago
 - Math 550: Differentiable Manifolds II, Spring 2019
 - Math 445: Introduction to Topology I, Spring 2019
 - Math 320: Linear Algebra I, Fall 2018
 - Math 445: Introduction to Topology I, Spring 2018
 - Math 549: Differentiable Manifolds I, Fall 2017
 - Math 210: Calculus III, Fall 2017
 - Math 569: Representations of surface groups, Spring 2017
 - Math 180: Calculus I, Fall 2016
 - Math 320: Linear Algebra I, Fall 2016
 - Math 535: Complex Analysis I, Spring 2016
 - Math 445: Introduction to Topology I, Fall 2015
 - Math 210: Calculus III, Fall 2015
 - Math 550: Differentiable Manifolds II, Fall 2014

- Math 180: Calculus I, Fall 2014
- MCS 481: Computational Geometry, Spring 2014
- Math 180: Calculus I, Spring 2014
- Math 215: Introduction to Advanced Mathematics, Spring 2013
- Math 570: Teichmüller Theory and Geometric Structures, Spring 2013
- MCS 481: Computational Geometry, Spring 2012
- Math 180: Calculus I, Fall 2011 (two sections)
- MCS 481: Computational Geometry, Spring 2011
- Math 442: Differential Geometry of Curves and Surfaces, Fall 2010
- Math 535: Complex Analysis I, Spring 2010
- Math 180: Calculus I, Fall 2009
- Math 442: Differential Geometry of Curves and Surfaces, Spring 2009
- Math 210: Multi-variable Calculus, Fall 2008
- Supervised reading courses:
 - Complex projective structures and asymptotic value theory (Spring 2016)
 - Hyperbolic surfaces and Teichmüller spaces (Fall 2015 – Spring 2016)
 - Harmonic Maps and Teichmüller Theory (Spring 2013)
 - Riemann Surfaces (Fall 2012)
 - Teichmüller Theory (Spring 2010)
 - Lie Groups and Riemannian Geometry (Spring 2010)
 - Differential Geometry (Fall 2009)
- Supervised undergraduate research projects:
 - Destructive Topology: Slicing Surfaces in VR (Fall 2018)
 - Visualizing the fourth dimension with VR (Fall 2017)
 - Hyperbolic racquetball (Spring 2017)
 - Tangle toy moduli (Fall 2016)
 - Immersive visualization of 3-sphere data sets (Fall 2015, Summer 2016)
 - Circle packing visualization (Summer 2016)
- Brown University
 - Math 18: Multi-variable Calculus, Fall 2007
 - Math 104: Fundamental Problems in Geometry, Spring 2006
 - Math 52: Introduction to Linear Algebra, Fall 2005
- Harvard University
 - Math Xb: Functions and Calculus II, Spring 2003
 - Groups of Möbius Transformations, Summer 2002
 - QR26: Decisions, Games, and Negotiation, Fall 2001
 - Hyperbolic Geometry in Two and Three Dimensions, Summer 2001
- Other teaching:
 - SESAME: Weekend enrichment for secondary school teachers, Fall 2002
 - Substitute mathematics teaching, West Roxbury, MA, Spring 2002

Advising

- Current graduate students

- Charles Alley
- Nathan Lopez
- Keaton Quinn
- Former graduate students
 - Ellie Dannenberg (2017 PhD)
 - Jonah Gaster (2014 PhD)
- Former postdoctoral advisees
 - Andrew Sanders (2013-2016 NSF Postdoctoral Fellow)

Service

- Department level
 - Mathematical Computing Laboratory, Director (2018-), founder and board member (2015-)
 - Current committees (2017-2018 academic year):
 - Pure mathematics graduate admissions coordinator (2018-2019)
 - Information Technology (since 2012)
 - Previous committees:
 - Advisory (2015-2017 and 2011-2013, as chair 2012-2013), Visitors Fund (2012-2013), Tenure-Track Hiring (2011-2012), Postdoctoral Hiring (2012-2015, 2017-2018), Calculus (2009-2011), Undergraduate studies (2010-2011, 2014-2015), Undergraduate Advising (2012-2014), Colloquium (2009-2011, 2014-2015), Graduate admissions (2008-2009)
 - Other department service:
 - Faculty advisor to the Undergraduate Math Club (2009-2014)
 - Calculus coordinator (Fall 2011, Fall 2009)
- University level
 - UIC Faculty Senate (2011-2014)
- Event organization
 - Annual conferences
 - *Undergraduate Mathematics Symposium at UIC*. Founder and organizer since 2010.
 - Past conferences
 - *Workshop on Geometry of Teichmüller Space*, Fields Institute, August 27-31, 2018. Organizer.
 - *Graduate Student Topology & Geometry Conference*. April 7-8, 2018. Organizer.
 - *Dynamics on Moduli Spaces*, MSRI workshop. April 2015. Lead organizer.
 - *Workshop in Dynamics at UIC*. May 17-21, 2010. Organizer.
 - Upcoming conferences and programs
 - *Illustrating Mathematics*, Semester Program at ICERM. Fall 2019. Program organizer.
 - *Illustrating Geometry and Topology*, ICERM workshop. September 16-20, 2019. Organizer.
- Peer review activities
 - Editor, *Geometriae Dedicata* (2013-)

- Editor, *Conformal Geometry and Dynamics* (2018-)
- NSF panelist (3 times since 2008)
- Referee for journals including *Inventiones Mathematicae*, *Duke Mathematical Journal*, *Geometry & Topology*, *Geometriae Dedicata*.

Version

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