

Department of Mathematics
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RESEARCH INTERESTS

Discrete differential geometry (including geometry of piecewise flat/polyhedral manifolds), deep learning, applications of differential geometry (e.g., to graph drawing, inverse problems, data science, pattern formation, foams/crystals etc.), geometric analysis (including Ricci flow and other geometric flows), biological rhythms.

DISSERTATION

Dissertation Title: *Precompactness of solutions to the Ricci flow and a maximum principle for combinatorial Yamabe flow*
Advisor: Prof. Bennett Chow

EDUCATION

- Ph.D. Mathematics, June 2003
University of California, San Diego
- M.A. Mathematics, December 1999
University of California, San Diego
- B.A. Mathematics (*Cum Laude*) and Computer Science, May 1997
Cornell University

POSITIONS

- University of Arizona, Associate Head for the Mathematics Graduate Program, June 2014 - Present
- University of Arizona, Member of Graduate Interdisciplinary Program in Applied Mathematics, March 2020 - Present
- University of Arizona, Professor, August 2018 - Present
- University of Arizona, Associate Professor, August 2009 - August 2018

- University of Arizona, Assistant Professor, August 2003 - August 2009
- Massachusetts Institute of Technology, C.L.E. Moore Instructor, September 2003 - May 2005 (on leave 2003-2004)

RESEARCH PUBLICATIONS

- *The impact of social rhythm and sleep disruptions on waist circumference after job loss: A prospective 18-month study* (authors: Patricia Haynes, Matthew Hoang, George Howe, Graciela Silva, Cynthia Thomson, Stuart Quan, Duane Sherrill, April Yingst, Ume Kobayashi, David Glickenstein), to appear in *Obesity* (2022).
- *Determinant of the finite volume Laplacian* (with Thomas Doehrman), to appear in *Discrete Comput. Geom.*
- *Persistent Classification: A New Approach to Stability of Data and Adversarial Examples* (with Brian Bell, Keaton Hamm, and Carlos Scheidegger), submitted.
- *Inconsistent Social Rhythms are Associated with Abdominal Adiposity after Involuntary Job Loss* (authors: Patricia L. Haynes; Gabriella R. Apolinar; Candace Mayer; Ume Kobayashi; Graciela Silva; David Glickenstein; Cynthia A. Thomson; Stuart Quan), *Obesity Science and Practice* (2021). DOI: <https://doi.org/10.1002/osp4.479>
- *DimReader: Axis lines that explain non-linear projections* (with Rebecca Faust and Carlos Scheidegger), *IEEE Transactions on Visualization and Computer Graphics* 25 (2018), no. 1, 481-490.
- *Multi-Level Steiner Trees* (authors: Reyan Ahmed, Patrizio Angelini, Faryad Darabi Sahneh, Alon Efrat, David Glickenstein, Martin Gronemann, Niklas Heinsohn, Stephen G. Kobourov, Richard Spence, Joseph Watkins, Alexander Wolff), *17th International Symposium on Experimental Algorithms* (SEA 2018), Article No. 15; pp. 15:1–15:14.
- *A bug's eye view: the Riemannian exponential map on polyhedral surfaces.* *Math. Intelligencer.* 40 (2018), no. 2, 1-9.
- *Make PVC Polyhedra.* *Math Horiz.* 25 (2018), no. 3, 25–27.
- *Asymptotic behavior of β -polygon flows* (with Jinjin Liang). *J. Geom. Anal.* 28 (2018), no. 3, 2902–2925.
- *Distortion estimates for barycentric coordinates on Riemannian simplices* (with Stefan W. von Deylen and Max Wardetzky).

Preprint at arXiv:1610.01168.

- *Longitudinal assessment of daily activity patterns on weight change after involuntary job loss: the ADAPT study protocol* (authors: Patricia L. Haynes, Graciela E. Silva, George W. Howe, Cynthia A. Thomson, Emily A. Butler, Stuart F. Quan, Duane Sherrill, Molly Scanlon, Darlynn M. Rojo-Wissar, Devan N. Gengler, David A. Glickenstein), *BMC Public Health* (2017) 17-793.
- *Soliton metrics for two-loop renormalization group flow on 3D unimodular Lie groups* (with Liang Wu). *J. Fixed Point Theory Appl.* 19 (2017), no. 3, 1977–1982.
- *Duality structures and discrete conformal variations of piecewise constant curvature surfaces* (with Joseph Thomas). *Adv. Math.* 320 (2017), 250–278.
- *Euclidean formulation of discrete uniformization of the disk.* *Geom. Imaging Comput.* 3 (2016), no. 3-4, 57–80.
- *Regge's Einstein-Hilbert functional on the double tetrahedron* (with Daniel Champion and Andrea Young). *Differential Geom. Appl.* 29 (2011), 109-124, doi:10.1016/j.difgeo.2010.10.001.
- *Discrete conformal variations and scalar curvature on piecewise flat two and three dimensional manifolds.* *J. Differential Geom.* 87 (2011), 201-237.
- *Ricci flow on three-dimensional, unimodular metric Lie algebras* (with Tracy L. Payne). *Comm. Anal. Geom.* 18 (2010), no. 5, 927-962.
- *Riemannian groupoids and solitons for three-dimensional homogeneous Ricci and cross curvature flows.* *Int. Math. Res. Not. IMRN* 2008, no. 12, Art. ID rnn034, 49 pp.
- *A monotonicity property for weighted Delaunay triangulations.* *Discrete Comput. Geom.* 38 (2007), No. 4, 651-664.
- *Geometric duality and discrete Laplacians on manifolds.*
Preprint at arXiv:math/0508188v1 [math.MG].
- *A semi-discrete linear curve shortening flow* (with Bennett Chow). *Amer. Math. Monthly* 114 (2007), No. 4, 316-328.
- *Collapsing sequences of solutions to the Ricci flow on 3-manifolds with almost nonnegative curvature* (with Bennett Chow and Peng Lu). *Math. Zeit.*, 254 (2006) 1-28.
- *A combinatorial Yamabe flow in three dimensions.* *Topology* 44 (2005), No. 4, 791-808.
- *A maximum principle for combinatorial Yamabe flow.* *Topology* 44 (2005), No. 4, 809-825.
- *Metric transformations under collapsing of Riemannian manifolds* (with Bennett Chow and Peng Lu). *Math Res Lett.* 10 (2003), No. 5-6, 737-746.

- *Precompactness of solutions to the Ricci flow in the absence of injectivity radius estimates.* *Geom. Topol.* 7 (2003), 487-510.
- *Nonlinear self-similar measures and their Fourier transforms* (with Robert Strichartz). *Indiana Univ. Math. J.* 45 (1996), no. 1, 205-220.

PAPERS IN PREPARATION

- *Convergence of discrete conformal maps on surfaces* (with Lee Sidbury)

SUMMARY PUBLICATIONS

- Editorial: *Mathematical Fundamentals of Machine Learning* (with Keaton Hamm, Xioming. Huo, Yajun Mei, and Martin Stoll). *Frontiers in Applied Mathematics and Statistics.* 7 (2021), 18.
- Book review: *Ricci flow for shape analysis and surface registration: Theories, algorithms and applications by Wei Zeng and Xianfeng David Gu* (with Bennett Chow and Feng Luo). *Bulletin of the American Mathematical Society.* 54 (2017), no. 1, 141-150.
- *The Ricci Flow: Techniques and Applications Part IV* (with Bennett Chow, Sun-Chin Chu, Christine Guenther, Jim Isenberg, Tom Ivey, Dan Knopf, Peng Lu, Feng Luo, and Lei Ni), *Mathematical Surveys and Monographs*, 206. American Mathematical Society, Providence, RI, 2015.
- *The Ricci Flow: Techniques and Applications Part III: Geometric-Analytic Aspects* (with Bennett Chow, Sun-Chin Chu, Christine Guenther, Jim Isenberg, Tom Ivey, Dan Knopf, Peng Lu, Feng Luo, and Lei Ni), *Mathematical Surveys and Monographs*, 163. American Mathematical Society, Providence, RI, 2010.
- *The Ricci Flow: Techniques and Applications Part II: Analytic Aspects* (with Bennett Chow, Sun-Chin Chu, Christine Guenther, Jim Isenberg, Tom Ivey, Dan Knopf, Peng Lu, Feng Luo, and Lei Ni), *Mathematical Surveys and Monographs*, 144. American Mathematical Society, Providence, RI, 2008.
- *The Ricci Flow: Techniques and Applications Part I: Geometric Aspects* (with Bennett Chow, Sun-Chin Chu, Christine Guenther, Jim Isenberg, Tom Ivey, Dan Knopf, Peng Lu, Feng Luo, and Lei Ni), *Mathematical Surveys and Monographs*, 135. American Mathematical Society, Providence, RI, 2007.

GRANTS (FUNDED)

- 2022-2024, NSF DUE 2130405, PI, S-STEM: Enhancing Pathways in the Mathematical Sciences. Funds awarded: \$150,000 for 2 years.
- 2020-2025, NSF DMS 1937229 (PI: Kevin Lin), Co-PI, RTG: Applied Mathematics and Statistics for Data-Driven Discovery. Funds awarded: \$2,496,374 for 5 years.
- 2018-2021, NSF DMS 1760538, PI, FRG: Collaborative Research: Geometric and Topological Methods for Analyzing Shapes, with Joel Hass, Patrice Koehl, Feng Luo, and S. T. Yau. Funds awarded: \$214,999 (total for all sites: \$1,500,000) for 3 years, plus \$68,657 supplement.
- 2017-2021, NSF CCF 1740858, TRIPODS (PI: Hao Helen Zhang), Co-PI, UA-TRIPODS: Building Theoretical Foundations for Data Sciences. Funds awarded: \$1,368,500 for 3 years, plus \$48,000 REU supplement.
- 2016-2019, NIH R01HL117995-01A1 (PI: Patricia Haynes), Co-I, Examining sleep and social rhythms as mechanisms for weight gain after job loss. Percent effort: 3%. Funds awarded on grant: \$3,101,435.
- 2008-2016, NSF DMS 0748283, PI, CAREER: Discrete and Generalized Riemannian Geometry and Curvature Flows. Funds awarded: \$401,686 for 5 years plus no cost extensions.
- 2007, NSF DMS 0628812, PI, Workshop on "Analysis on Homogeneous Spaces," with Philip Foth and Kirti Joshi, Analysis program. Funds awarded: \$19,750 for 1 year.
- 2006, University of Arizona foreign travel grant.

CONFERENCES AND SESSIONS ORGANIZED

- FRG Workshop on Discrete Shapes co-organized with Joel Hass, Patrice Koehl, Feng Luo, Maria Trnkova, and S.-T. Yau), Center of Mathematical Sciences and Applications, Harvard University, Cambridge, MA, May 6-8, 2022.
- RTG Research Showcase: Showcasing Research in Data-Driven Discovery (co-organized with Avinash Karamchandani, Kevin Lin, and Laura Miller), University of Arizona, Tucson, AZ, March 1, 2022.
- FRG Workshop on Geometric Methods for Analyzing Discrete Shapes (co-organized with Joel Hass, Patrice Koehl, Feng Luo, and Tianqi Wu), Center of Mathematical Sciences and Applications, Harvard University, virtually online, May 7-9, 2021.
- RTG Research Showcase: Showcasing Research in Data-Driven Discovery (co-organized with Kevin Lin and Avinash Karamchandani), University of Arizona, virtually online, March 10, 2021.

- Applied and Computational Differential Geometry and Geometric PDEs (co-organized with Joel Hass, Yanyan Li, Haomin Zhou), Banff International Research Station for Mathematical Innovation and Discovery, Banff, Canada, August 9-14, 2020 (canceled).
- FRG Workshop on Discrete Shapes (co-organized with Joel Hass, Patrice Koehl, Feng Luo, and Tianqi Wu), Davis, CA. September 20-22, 2019.
- AMS Special Session on Geometric Analysis and Geometric Flows (co-organized with Brett Kotschwar), Joint Mathematics Meetings, San Diego, CA, January 10, 2018.
- Special Session on Geometric Analysis and Riemannian Geometry (co-organized with Guofang Wei and Andrea Young), AMS Fall Western Sectional Meeting, Tucson, AZ, October 27-28, 2012. Also introduced plenary speaker Michael Hutchings.
- Special Session on Partial Differential Equations and Geometric Analysis (co-organized with Sunhi Choi and Lennie Friedlander), AMS Spring Western Section Meeting, Tucson, AZ, April 21-22, 2007.
- Conference on Analysis on Homogeneous Spaces (co-organized with Philip Foth and Kirti Joshi), March 22-25, 2007. Supported by NSF DMS 0628812.

OUTREACH

- Dodecahedron display: designed and constructed a 9 foot diameter PVC dodecahedron used by the Physics Factory (c/o Bruce Bayly) for elementary and middle school science programs throughout Arizona
- Museum exhibit: Designed/developed exhibit Puzzles, Proofs, and Patterns: Explore the World of Mathematics. At Flandrau Science Center in 2015-2018.
 - Press: <http://uanews.org/story/interactive-math-exhibit-opens-at-flandrau>
 - <http://flandrau.org/exhibits/puzzles-proofs-patterns>
 - <https://uanews.arizona.edu/story/flandrau-exhibition-goes-beyond-mere-facts-math>
- Tucson Math Teachers' Circle: designed and ran a workshop on *Short Paths on Surfaces* (Feb. 2014) for high school teachers.
- STEAMWorks exhibitor (April 2016).

STUDENT CONTACT (ALL UNIVERSITY OF ARIZONA)

- Director of Arizona Summer Program, Summer 2010, attended by 12 undergraduate students and 1 secondary teacher for conducting research.

- Postdoctoral advisor: Andrea Young (VIGRE postdoc, 2008-2011), Jinjin Liang (2018-2019), Keaton Hamm (2018-2020)
- Postdoctoral mentor: Katie Walsh (2016-2017)
- Ph.D.s directed:
 - Jefferson Taft (Math, May 2010), Dissertation title: *Intrinsic Geometric Flows on Manifolds of Revolution*.
 - Daniel Champion (Math, April 2011), Dissertation title: *Möbius Structures, Einstein Metrics, and Discrete Conformal Variations on Piecewise Flat Two and Three Dimensional Manifolds*.
 - Yuliya Gorlina (Math, September 2011), Dissertation title: *Weighted Delaunay Triangulations of Piecewise-flat Surfaces*.
 - Joseph Thomas (Math, May 2015), Dissertation title: *Conformal Variations of Piecewise Constant Curvature Two and Three Manifolds*.
 - Jinjin Liang (Math, August 2018), Dissertation title: *Curve flows on polygons and surface clusters*.
 - Andrew MacLaughlin (Math, October 2018), Dissertation title: *Using Homogeneous Structures to Measure Homogeneity of Riemannian Manifolds*.
- Masters supervised:
 - Benjamin Pittman-Polletta (Applied Math, April 2007), Thesis title: *A Definition of Scalar Curvature on Simplicial Approximations to Riemannian Manifolds*.
 - Veronica Marino (Math, May 2011), Thesis title: *Geodesics and shortest paths on piecewise linear surfaces*.
 - Lindsay (Lee) Swift (Sidbury) (Math, April 2018), Thesis title: *Curvature on piecewise flat manifolds*.
- Ph.D. comprehensive examinations supervised: Jefferson Taft (Math, December 2006), Benjamin Pittman-Polletta (Applied Math, April 2007), Daniel Champion (Math, February 2008), Yuliya Gorlina (Math, December 2008), Joseph Thomas (Math, May 2013), Jinjin Liang (Math, April 2015), Lee Swift (Sidbury) (Math, June 2019), Brian Bell (Applied Math, October 2020), Robert (Emily) Banks (Math, November 2020), Thomas Doehrman (Math, July 2021).
- Doctoral dissertation committee (not advisor): Derek Habermas (Math, May 2006), Panagiota Konstantinou (Math, May 2006), Abhishek Bhattacharya (Math, November 2008), Chunmei Chen (Aerospace/Mech. Engineering, April 2009), McKenzie Lamb (Math, August 2009), Tom LaGatta (Math, May 2010), Benjamin Pittman-Polletta

(Applied Math, May 2010), John Gemmer (Applied Math, April 2012), Matt Pennypacker (Applied Math, May 2013), Jeremiah Birrell (Applied Math, April 2014), Sankar Veeramoni Mythili (Computer Science, October 2014), M. Jawaherul Alam (Computer Science April 2015), Angel Chavez (Math, May 2015), Elham Sadeghi (Systems and Industrial Engineering, December 2015), Toby Shearman (Applied Math, August 2017), Lanbo Fang (Math, April 2018), Matthew Fox (Math, June 2018), Angelica Gonzalez (Math, September 2018), Mohamad Moussa (Math, November 2018), Yuan Tao (Math, December 2018), William Lippitt (Math, June 2019), Dylan Murphy (Math, August 2019), Rachel Oliver (Math, April 2020), Ryan Coatney (Math, June 2020), Jason Quinones (Mathematics, July 2020), Jonathan Ramalheira-Tsu (Math, August 2020), Mohammed Attia (Electrical and Computer Engineering, November 2020), Jean de Dieu Mutangana (Electrical and Computer Engineering, May 2021), Abu Reyan Ahmed (Computer Science, July 2021), Wei-Ting Chang (Electrical and Computer Engineering, May 2022), Brian Bollen (Applied Math, May 2022)

- Comprehensive examination committee (not advisor): J. Arlo Caine (Math, April 2004), Abhishek Bhattacharya (Math, December 2006), McKenzie Lamb (Math, December 2006), Chunmei Chen (Aerospace/Mech. Engineering, May 2008), John Gemmer (Applied Math, October 2009), Matt Pennypacker (Applied Math, May 2011), Patrick Waters (Math, March 2012), Jeremiah Birrell (Applied Math, April 2012), Angel Chavez (Math, April 2012), Sankar Veeramoni Mythili (Computer Science, December 2013), M. JawaherulAlam (Computer Science February 2014), Tova Brown (Math, May 2014), Vida Ravenmehr (Electrical and Computer Engineering, January 2015), Lanbo Fang (Math, April 2015), Elham Sadeghi (Systems and Industrial Engineering, May 2015), Angelica Gonzalez (Math, February 2016), Yuan Tao (Math, May 2016), Jason Quinones (Math, December 2016), Matthew Fox (Math, March 2017), William Lippitt (Math, March 2017), Jonathan Ramalheira-Tsu (Math, August 2017), Staci Smith (Computer Science, January 2018), Mohamad Moussa (Math, March 2018), Li Li (Electrical and Computer Engineering, March 2018), Rachel Oliver (Math, December 2018), Mohamed Attia (Electrical and Computer Engineering, February 2019), Irmak Aykin (Electrical and Computer Engineering, March 2019), Jean de Dieu Mutangana (Electrical and Computer Engineering, April 2019), Reyan Ahmed (Computer Science, October 2019), Rohit Phillips (Electrical and Computer Engineering, November 2019), Brian Bollen (Applied Math, October 2020), Islam Shaban (Electrical and Computer Engineering, October 2020), Thomas Harris (Math, February 2021), Wei-Ting Chang (Electrical and Computer Engineering, April 2021)
- Masters committee (not advisor): Angelica Gonzalez (Math, January 2015), Rachel Baumann (Math, May 2015), Mohamad Moussa (Math, May 2017), Spencer Lunderman (Math, February 2018), Chloe Ondracek (Math, April 2020), Brian Bennett (Math, May 2020)
- External Examiner: Yun Shun Matthias (MPHIL in Mathematics, Chinese University

of Hong Kong, August 2012)

- Graduate Minor test supervision: Chunmei Chen (Aerospace/Mech. Engineering, May 2007).
- Undergraduate Research Assistants - Alex Henniges (Summer/Fall 2008, Spring/Summer/Fall 2009, Spring/Summer 2010), Tom Williams (Summer/Fall 2008), Mitch Wilson (Summer 2008), Kurtis Norwood (Spring/Summer/Fall 2009, Spring 2010), Joseph Thomas (Spring/Summer 2009), Taylor Johnson (Spring/Summer 2010), Howard Cheng (Spring/Summer 2010), Kira Kiviat (Fall 2010, Spring 2011), Taylor Corcoran (Summer 2012), Qiming Shao (Summer 2012), Staci Smith (Summer 2012), Jeremy Mirchandani (Spring/Summer/Fall 2013), Tanner Prynne (Spring/Summer/Fall 2013), Camille Korbut (Summer 2021–2022, joint with Kevin Lin), Chloe Matilla (Summer 2021- joint with Kevin Lin), Eric Dudabout (Summer 2021 - joint with Kevin Lin), Michelle Bang (Summer 2022 - joint with Kevin Lin).
- Undergraduate Teaching Assistants - Mitch Wilson (Fall 2006), Ryan Wong (Fall 2008), Ruby Abrams (Fall 2015)
- Research tutorial group (1st year graduate research projects): Jeremiah Birrell (Applied Math, 2010), Liang Wu (Math, 2012), Jinjin Liang (Math, 2013), Robert Banks (Math, 2017), Thomas Doehrman (Math, 2018), Brian Bell (Applied Math, 2018), Alex Christensen (Applied Math, 2020).
- Math Alliance: Facilitated Graduate Application Process (F-GAP) Facilitator (2017-2019), Master Facilitator (2019-2020), Doctoral Faculty Council (2020-present)

COURSES TAUGHT

- Pre-calculus, Calculus I, Calculus II, Mathematical Analysis for Engineers, Formal Reasoning and Writing, Linear Algebra, Advanced Applied Analysis, Theory of Graphs and Networks, Introduction to Mathematical Modeling, Geometry and Topology, Global Differential Geometry, Circle Packing and Discrete Conformal Mappings, Ricci flow and the Poincare Conjecture, Partial Differential Equations (independent study).

SELECTED COLLOQUIA, CONFERENCE, AND (OUT OF TOWN) SEMINAR TALKS

- Math of Data and Decisions at Davis seminar: *Discrete conformal geometry and adversarial examples of neural networks*. (Davis, CA, online, November 2021).
- Fields Institute Seminar: *Determinant of finite volume Laplacian*. (Fields Institute, Toronto, CA, online, May 2021).
- University of Wyoming Colloquium: *Discrete conformal geometry and adversarial examples of neural networks*. (Laramie, WY, online, April 2021).
- Workshop on the Geometry of Circle Packings: *The zoo of discrete conformal structures*. (Fields Institute, online April 2021).
- CIMAT/UA TRIPODS 2020 Meeting: *Geometry of classifiers and data: trying to understand adversarial examples of neural networks*. (Guanajuato, Mexico, January 2020).
- Data Science in the Mathematics Department (invited speaker/panelist). (MAA Mathfest, Denver, CO, August 2018).
- 9th Minimeeting in Differential Geometry: (3 talks - invited speaker) *Circle packings and discrete conformal structures on surfaces and domains, Special metrics and geometric flows, Discrete Riemannian geometry in three dimensions: progress and open problems*. (Guanajuato, Mexico, December 2016).
- SIAM Conference on Analysis of PDE: Session on PDE and Geometric Analysis: *Curvature Flows on Homogeneous Spaces: Applications of the Bracket Flow*. (Scottsdale, AZ, December 2015).
- Special Session on Ricci Curvature for Homogeneous Spaces and Related Topics, Joint Mathematics Meetings: *The RG-2 bracket flow on Lie groups and related flows*. (San Antonio, TX, January 2015).
- Arizona State Differential Geometry Seminar: *Numerical Riemannian Geometry*. (Tempe, AZ, April 2014).

- Colorado State Applied Math Seminar: *Discrete conformal geometry and applications*. (Fort Collins, CO, December 2013).
- UC Davis Geometry/Topology Seminar: *Discrete conformal geometry*. (Davis, CA, November 2013).
- ITS-CUNY Symposium on Perspectives on Ricci flow (invited): *Problems in combinatorial and numerical Ricci flow* (New York, NY, February 2013).
- University of Kansas Ellis B. Stouffer Colloquium: *Discrete conformal geometry*. (Lawrance, KS, May 2012).
- Arizona State Mathematical and Statistical Sciences Colloquium: *Discrete conformal geometry*. (Tempe, AZ, April 2012).
- Special Session on Geometric Evolution Equations and Related Topics, AMS Fall Western Sectional Meeting (invited): *Flows to find (approximate) Riemann mappings*. (Salt Lake City, UT, October 2011).
- Numerical Ricci Flow in Computer Science, Geometry, and Physics workshop at Applied Mathematics Perspectives 2011 (invited): *Scalar curvature on piecewise flat manifolds and other topics*. (Vancouver, CA, July 2011).
- Rocky Mountain Mathematics Consortium Summer School: *Curvature and Laplacians on polyhedral manifolds*. (Laramie, WY, June 2011).
- Undergraduate Research (REU) seminar at University of Wyoming: *Unfoldings: (locally) short paths and life on a polyhedral surface* (Laramie, WY, June 2011).
- Oregon State University Colloquium: *Discrete conformal geometry*. (Corvallis, OR, February 2011).
- Joint UC Irvine/UC San Diego Geometry Seminar: *Discrete conformal variations of piecewise flat manifolds*. (Irvine, CA, November 2010).
- Special Session on Global Geometric Analysis, AMS Fall Western Sectional Meeting (invited): *Discrete conformal variations of piecewise flat manifolds*. (Los Angeles, CA, October 2010).
- Barrett Memorial Lectures (contributed): *Conformal Variations of Regge's Einstein-Hilbert Functional*. (Townsend, TN, May 2010).
- Cornell Analysis Seminar: *Ricci flow on 3D metric Lie algebras*. (Ithaca, NY, December 2009).
- Rutgers Geometry and Topology Seminar: *Discrete conformal variations and discrete scalar curvatures*. (New Brunswick, NJ, December 2009).

- University of Arizona Mathematics Colloquium: *Curvature functionals and canonical metrics in smooth and discrete Riemannian structures*. (Tucson, AZ, November 2009).
- Special Session on Global Analysis on Homogeneous Spaces, AMS Fall Central Section Meeting (invited): *Riemannian groupoids, homogeneous spaces, and Ricci flow*. (Waco, TX, October 2009).
- Geometric Flows in Mathematics and Theoretical Physics (invited and supported): *Discrete conformal variations and discrete scalar curvatures*. (Pisa, Italy, June 2009).
- Symposia on Analysis of Geometric Evolution (invited and supported): *Ricci flow on 3D Lie groups*. (Austin, TX, May 2009).
- Pacific Northwest Geometry Seminar (invited and supported): *Ricci flow on 3D Lie groups and their quotients*. (Corvallis, OR, October 2008).
- Workshop on Ricci Flow and Related Topics at the Institut Henri Poincaré (invited and supported): *Geometric flows on homogeneous spaces from a Riemannian groupoid perspective*. (Paris, France, June 2008).
- Idaho State University Mathematics Colloquium: *Ricci flow: applications and long term solutions*. (Pocatello, ID, April 2008).
- UC San Diego Differential Geometry Seminar: *Weighted Delaunay triangulations and discrete Laplacians*. (La Jolla, CA, May 2006).
- Workshop on Discrete Differential Geometry at Mathematisches Forschungsinstitut Oberwolfach (invited and supported): *Discrete curvature flows and Laplacians*. (Oberwolfach, Germany, March 2006).
- Workshop on Geometric Analysis and Flows (invited and supported): *Combinatorial Yamabe flow*. (La Jolla, CA, June 2005).
- Princeton Differential Geometry Seminar: *Combinatorial Yamabe flow*. (Princeton, NJ, April 2005).
- UC San Diego Differential Geometry Seminar: *Combinatorial Yamabe flow*. (La Jolla, CA, April 2005).
- U of Texas Differential Geometry Seminar: *Combinatorial Yamabe flow*. (Austin, TX, March 2005).
- MIT Differential Geometry Seminar: *Ricci flow and collapsing manifolds*. (Cambridge, MA, November 2004).
- Colorado State Algebra Seminar: *Combinatorial Yamabe flow: between geometric analysis and graph theory*. (Fort Collins, CO, September 2004).

- U of Colorado Kempner Colloquium: *Ricci flow, geometrization, and beyond*. (Boulder, CO, August 2004).
- Universita di Pavia, Physics Department (invited): *Ricci flow and Thurston's Program; Compactness of solutions to the Ricci flow, collapse, and Gromov-Hausdorff distance; Combinatorial Ricci-Yamabe flow in 2 and 3D PL manifolds* (3 supported talks). (Pavia, Italy, May 2004).
- AMS/MAA Joint meetings (invited): *Combinatorial curvature flow methods and PDE*. (Phoenix, AZ, January 2004).
- U of Oklahoma Karcher Colloquium: *Ricci flow with bounded curvature and compactness theorems* (2 talks). (Norman, OK, October 2003).
- U of Arizona Mathematics Colloquium: *Solutions of the Ricci flow with bounded curvature*. (Tucson, AZ, February 2003)
- AMS/MAA Joint Meetings (contributed): *Precompactness of solutions of the Ricci flow in the absence of injectivity radius estimates*. (Baltimore, MD, January 2003)
- UC Irvine Differential Geometry Seminar: *Precompactness of solutions of the Ricci flow in the absence of injectivity radius estimates*. (Irvine, CA, November 2002)
- Stanford Geometry Seminar: *Precompactness of solutions of the Ricci flow in the absence of injectivity radius estimates*. (Palo Alto, CA, October 2002)
- U of New Mexico Differential Geometry Seminar: *Introduction to the Ricci flow on Riemannian manifolds*. (Albuquerque, NM, October 2002)
- UC San Diego Differential Geometry Seminar: *Precompactness of solutions to the Ricci flow*. (La Jolla, CA, October 2002)
- Workshop on Geometric Evolution Equations, National Center for Theoretical Sciences, Tsing Hua University: *A (pre) compactness property for solutions of the Ricci flow in the absence of injectivity radius estimates*. (Hsinchu, Taiwan, August 2002)

U OF ARIZONA SEMINAR TALKS

- Analysis, Dynamics, and Applications Seminar: *Discrete Conformal and Harmonic Maps for Surface Analysis*. (Tucson, AZ, February 2019).
- TRIPODS Seminar: *Geometric Methods for Analysis of Shapes* (Tucson, AZ, February 2019).

- RTG (research training group, joint Math/Applied Math): *Some Problems in Data Science*. (Tucson, AZ, May 2018).
- Analysis, Dynamics, and Applications Seminar: *Curvature flows on homogeneous spaces: applications of the bracket flow*. (Tucson, AZ, January 2017).
- Research Blitz: *Geometric and electrical problems* (5 minute talk) (Tucson, AZ, December 2015).
- Analysis, Dynamics, and Applications Seminar: *Discrete conformal mappings of domains* (Tucson, AZ, September 2015).
- UA Math Research Blitz: *Circle packing and the Riemann Mapping Theorem*. (4.5 minute talk) (Tucson, AZ, October 2014)
- Analysis, Dynamics, and Applications Seminar: *Riemannian finite elements* (Tucson, AZ, October 2014).
- RTG (research training) lectures: *Geometric flows* (3 talks) (Tucson, Arizona, January 2013).
- Computer Science and Mathematics Collaboration Seminar: *Curvature/heat flow-inspired techniques for graph drawing*. (Tucson, AZ, September 2012).
- Graduate Student Recruitment Seminar: *The Poincaré Conjecture*. (Tucson, AZ, March 2012).
- Undergraduate TA Seminar: *Abstract geometric manifolds*. (Tucson, AZ, February 2012).
- Computer Science and Mathematics Collaboration Seminar: *Some ideas in intrinsic geometry*. (Tucson, AZ, September 2011).
- Graduate Student Recruitment Seminar: *The Poincaré Conjecture*. (Tucson, AZ, March 2011).
- Geometry Seminar: *Discrete conformal variations of piecewise flat manifolds*. (Tucson, AZ, October 2010).
- Geometry Seminar, Geometry Slam: *Discrete conformal geometry: circle packings meet Delaunay triangulations*. (4.5 minute talk) (Tucson, AZ, September 2010).
- Geometry Seminar: *Curvatures of convex and nonconvex sets*. (Tucson, AZ, February 2010).
- Geometry Seminar: *Discrete conformal variations and discrete scalar curvatures*. (Tucson, AZ, February 2010).

- RTG (research training) lectures (with A. Young): *Geometric flows in Riemannian and discrete geometry*. (2 talks) (Tucson, AZ, January/February 2009).
- Geometry seminar: *Ricci flow on 3D Lie groups and their quotients*. (Tucson, AZ, October 2008).
- Geometry Seminar: *Discrete Riemann mappings and circle packings*. (Tucson, AZ, March, 2008).
- Geometry Seminar: *Fun with the universal cover of $SL(2, R)$* (Tucson, AZ, September, 2007).
- Geometry Seminar: *Polygon shortening flows*. (Tucson, AZ, March 2007).
- Graduate Student Recruitment Seminar: *The Poincaré Conjecture: What is it?* (Tucson, AZ, March, 2007).
- Geometry Seminar: *Ricci flow on Riemannian groupoids*. (Tucson, AZ, November 2006).
- Analysis and Its Applications Seminar: *Proof of the Poincare Conjecture and Ricci Flow*. (Tucson, AZ, September 2006).
- Geometry Seminar: *Weighted Delaunay triangulations and discrete Laplacians* (2 talks). (Tucson, AZ, March 2006).
- Geometry Seminar: *Combinatorial Yamabe flow*. (Tucson, AZ, October 2005).
- Mathcats (undergraduate math group): *Ricci flow and the Poincare conjecture*. (Tucson, AZ, November 2004).
- Graduate Student Seminar: *Curvature flow in the discrete setting*. (Tucson, AZ, March 2004).
- Graduate Student Recruitment Workshop: *Diffusion in differential equations, geometry, and one million dollars*. (Tucson, AZ, March 2004).
- Geometry Seminar: *An introduction to Perelman's work on the Poincare conjecture*. (Tucson, AZ, February 2004).
- Geometry Seminar: *Introduction to metric geometry, Introduction to the Ricci flow, Ricci flow and compactness theorems* (3 talks). (Tucson, AZ, September 2003)

ABSTRACTS (REFEREED)

- Leah Callovini, Gaby Gubka, Candace Mayer, Darlynn Rojo-Wissar, David Glickenstein, Cynthia Thomson, Stuart Quan, Graciela Silva, Patricia Haynes, 086 Sleep midpoint after job loss predicts breakfast skipping patterns, *Sleep*, Volume 44, Issue Supplement_2, May 2021, Page A36, <https://doi.org/10.1093/sleep/zsab072.085>
- P L Haynes, G Apolinar, C A Thomson, S Quan, G E Silva, U Kobayashi, D A Glickenstein, 1047 Social Rhythm Instability Is Associated With Abdominal Adiposity After Involuntary Job Loss, *Sleep*, Volume 43, Issue Supplement_1, April 2020, Pages A397–A398, <https://doi.org/10.1093/sleep/zsaa056.1043>
- C M Mayer, Y Liu, C A Thomson, D A Glickenstein, P L Haynes, 1049 Sleep Fragmentation And Sleep Restriction Are Associated With Increased Energy Intake Among Individuals Who Have Involuntarily Lost Their Jobs, *Sleep*, Volume 43, Issue Supplement_1, April 2020, Pages A398–A399, <https://doi.org/10.1093/sleep/zsaa056.1045>
- Patricia L Haynes, PhD, Darlynn M Rojo-Wissar, MPH, Cynthia A Thomson, PhD, Candace Mayer, BS, Graciela E Silva, PhD, MPH, David A Glickenstein, PhD, Ann Skulas-Ray, PhD, 0176 Longer Sleep Duration Precedes Greater Water Intake At Breakfast, *Sleep*, Volume 42, Issue Supplement_1, April 2019, Page A72, <https://doi.org/10.1093/sleep/zsaa056.1045>

ADDITIONAL HONORS, AWARDS, AND CONFERENCES ATTENDED

- 2021 University of Arizona Department of Mathematics Undergraduate Advising Award
- 2021 ParaDIGMs Spring Conference: Diversity in Graduate Mathematical Sciences, Institute for Mathematical and Statistical Innovation, Chicago, IL (online).
- 2020,2021 Women in Data Science (WiDS) Conference at Tucson, AZ.
- 2019,2020 TPSE Graduate Education Forum (online).
- 2018, TPSE Mountain Regional Meeting on Upper-Division Pathways, Orem, UT.
- 2018, Keynote Speaker for University of Arizona Honors Convocation.
- 2014, 2015, 2019, 2020 Math Alliance Field of Dreams Conference (panelist 2015).
- 2006, Joint AMS, IMS, SIAM conference on Discrete and Computational Geometry Twenty Years Later, Snowbird, UT.
Partially supported by AMS.
- 2006, Southern California Geometric Analysis Conference, Irvine, CA.
Supported by NSF.
- 2005, MSRI workshop on Optimal Mass Transportation, Berkeley, CA.
Supported by MSRI.

- 2005, Southern California Geometric Analysis Conference, La Jolla, CA
Supported by NSF.
- 2004, Current Developments in Mathematics, Cambridge, MA.
- 2004, IPAM program on Geometric Flows: Theory and Computation, Los Angeles, CA.
- 2004, Southern California Geometric Analysis Conference, Irvine, CA.
Supported by NSF.
- 2004, AMS/MAA Joint Meetings, Phoenix, AZ.
- 2003, MSRI program on Ricci flow and geometrization of manifolds (invited participant), Berkeley, CA.
Supported by MSRI.
- 2003, Southern California Geometric Analysis Conference, La Jolla, CA
- 2003, AMS/MAA Joint Meetings, Baltimore, MD.
- 2002, Yamabe Festival, Minneapolis, MN
Supported by NSF.
- 2002, Conference on Geometric Evolution Equations, Hsinchu, Taiwan
Partially supported by the Institute for Theoretical Sciences
- 2002, AMS/MAA Joint Meetings, San Diego, CA.
- 2001, Teaching Assistant Excellence Award
Awarded by the Mathematics Department of UCSD.
- 2001, Southern California Geometric Analysis Conference, Irvine, CA
Supported by NSF.
- 2001, MSRI/Clay Mathematics Institute on the Global Theory of Minimal Surfaces
Supported by Clay Math Institute.
- 1999, MSRI Summer Graduate program on Moving Frames and Exterior Differential Systems
Supported by Mathematical Sciences Research Institute (nominated by UCSD).

PROFESSIONAL ACTIVITIES AND SERVICE

- Topic Editor, Mathematical Fundamentals of Machine Learning, special issue of *Frontiers in Applied Mathematics and Statistics*, Mathematics of Computation and Data Science, 2021.
- Netherlands Organisation for Scientific Research (NWO) External Reviewer (2018).
- Fellow to UA Academic Leadership Institute, 2017-2018.
- Editorial Advisory Board, *Geometric Flows*, published by de Gruyter (2014-2020).
- Reviewer, *Mathematical Reviews*.
- Reviewer (at large) for Journal of Differential Geometry, Discrete and Computational Geometry, Geometry and Topology, Geometriae Dedicata, Communications in Analysis and Geometry, Proceedings of the American Mathematical Society, Journal of Geometric Analysis, Advances in Mathematics, International Math Research Notices IMRN, Pacific Journal of Mathematics, Mathematische Zeitschrift, Physica D, SIAM Review, Journal of Mathematical Physics, Journal of Physics A, Classical and Quantum Gravity, Advances in Theoretical and Mathematical Physics, Journal of Differential Equations, Journal of Mathematical Analysis and Applications, Journal of Geometry and Physics, International Journal of Computer Applications in Technology, IMA Journal of Numerical Analysis, Advances in Geometry, Geometric Modeling and Processing 2014, SoCG'17, Transactions of the AMS, ACM SIGGRAPH
- National Science Foundation Review Committees (2009, 2012, 2019, 2021).
- AMS-NSA Mathematical Sciences Grant Program External Reviewer.
- Swiss National Science Foundation External Reviewer.
- Tenure Reviewer for Florida International University
- Habilitation Reviewer for Universität Wien
- Task Force on Core Mathematics for University of Arizona, discussion leader for social sciences and business (2005).
- Grade Appeal Committee, College of Science, May 2009, May 2015.
- Promotion and Tenure committee (elected, Math Dept., 2010-2012).
- Hiring Committee (appointed, 2010-2012).
- Peer Review Committee (elected, 2013)
- Head Search Committee (elected, 2013, 2016)

- Organizer, Geometry Seminar, including the Geometry Slam (2005-2012).
- Founder/Organizer, Computer Science and Math Collaboration Seminar (2011-2013).
- Judge for Southern Arizona Regional Science and Engineering Fair.
- Member of American Mathematical Society (AMS), Mathematical Association of America (MAA), Society for Industrial and Applied Mathematics (SIAM).