Henry Adams

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Academic Employment

Assistant Professor, University of Florida Department of Mathematics, 2023–present.

Associate Professor, Colorado State University Department of Mathematics, 2021–2023.

Visiting Professor, IST Austria Department of Mathematics, 2021-2022.

Assistant Professor, Colorado State University Department of Mathematics, 2015–2021.

Visiting Assistant Professor, Duke University Department of Mathematics, 2014–2015.

Postdoctoral Fellow, Institute for Mathematics and its Applications, 2013–2015.

Education

Stanford University, Ph.D. Mathematics, 2013.
Advisor: Gunnar Carlsson. Thesis: *Evasion paths in mobile sensor networks*.

Stanford University, B.S. Mathematics with honors and distinction, 2007.
Advisor: Gunnar Carlsson. Thesis: *Spaces of range image patches*. Minor in Economics.

Grants

2023-2028 Simons Travel Support for Mathematicians, *Bridging Applied and Quantitative Topology*. Principal Investigator.

2019–2021 NSF Grant #1934725, *DELTA: Descriptors of Energy Landscapes by Topological Analysis*, NSF Harnessing the Data Revolution (HDR): Institutes for Data-Intensive Research in Science and Engineering Frameworks (I-DIRSE-FW). Co-Principal Investigator.

2019 Simons Travel Support for Mathematicians, *Reconstruction via metric thickenings*. Principal Investigator. (Declined when I became ineligible due to the grant above.)

2017–2019 DARPA-BAA-16-42 "Prometheus" grant, *Geometric, Topological and Dynamic Features of Early Warning of Contagious Respiratory Infection*. Senior Investigator.

2019 Research in Pairs visit from the Mathematical Research Institute of Oberwolfach, on *Quantifying topology via metric thickenings*, with Florian Frick and Žiga Virk.

2015 Research in Pairs visit from the Mathematical Research Institute of Oberwolfach, on *Behavior of geometric complexes as the scale increases*, with Michał Adamaszek.

Research

My research interests are in topology, geometry, data analysis, and machine learning. More specific subfields of interest include applied topology, computational topology and geometry, metric geometry, and combinatorial topology. I advance the study of Vietoris–Rips and Čech simplicial complexes, and I apply topology to data analysis, machine learning, and sensor networks. My research forms bridges between applied topology and nearby areas of mathematics, including quantitative topology, geometric group theory, Riemannian geometry, metric geometry, optimal transport, equivariant topology, and

combinatorics, and I have experience working with datasets arising in interdisciplinary research areas such as computational chemistry, computer vision, collective motion in biological systems, sensor networks, and knowledge-guided machine learning.

Mathematical Press

51. *How to Tutorial-a-thon*, with Hana Dal Poz Kouřimská, Teresa Heiss, Sarah Percival, and Lori Ziegelmeier. Notices of the American Mathematical Society, Volume 68, Number 9, October 2021.

50. *How do I . . . develop an online research seminar?* Notices of the American Mathematical Society, Volume 67, Number 8, September 2020.

49. *Topological data analysis of collective motion*, with Maria-Veronica Ciocanel, Chad M. Topaz, and Lori Ziegelmeier, SIAM News, January/February Issue, 2020.

Books (* denotes graduate student coauthor)

48. *Counting Rocks! An Introduction to Combinatorics*, with Kelly Emmrich*, Maria Gillespie, Shannon Golden*, and Rachel Pries. Available at `https://www.mathematicalgemstones.com/maria/OER.php`, 2023.

Preprints (* denotes graduate student coauthor, • denotes undergraduate student coauthor)

47. *Hausdorff vs Gromov–Hausdorff distances*, with Florian Frick, Sushovan Majhi, Nicholas McBride•. Available at `arXiv:2309.16648`, 2024.

46. *Time-varying spaces and mobile sensor networks*, with Tia Karkos•. Available at `arXiv:2311.15392`, 2024.

45. *Elementary methods for persistent homotopy groups*, with Mehmet Ali Batan*, Mehmetcik Pamuk, Hanife Varlı. Available at `arXiv:1909.08865`, 2024.

44. *Gromov–Hausdorff distances, Borsuk–Ulam theorems, and Vietoris–Rips complexes*, with Johnathan Bush, Nate Clause*, Florian Frick, Mario Gómez*, Michael Harrison, R. Amzi Jeffs, Evgeniya Lagoda*, Sunhyuk Lim, Facundo Mémoli, Michael Moy*, Nikola Sadovek*, Matt Superdock, Daniel Vargas*, Qingsong Wang, Ling Zhou*. Available at `arXiv:2301.00246`, 2024.

43. *Čech complexes of hypercube graphs*, with Samir Shukla and Anurag Singh. Available at `arXiv:2212.05871`, 2024.

42. *Efficient evader detection in mobile sensor networks*, with Deepjyoti Ghosh*, Clark Mask•, William Ott, and Kyle Williams*. Available at `arXiv:2101.09813`, 2024.

41. *Vietoris–Rips complexes of regular polygons*, with Samir Chowdhury*, Adam Jaffe•, and Bonginkosi Sibanda•. Available at `arXiv:1807.10971`, 2021.

Refereed Journal Papers (* denotes graduate student coauthor, • undergraduate student coauthor)

40. *Geometric approaches to persistent homology*, with Baris Coskunuzer. Accepted to appear in SIAM Journal on Applied Algebra and Geometry, 2024.

39. *The topology of projective codes and the distribution of zeros of odd maps*, with Johnathan Bush* and Florian Frick. Accepted to appear in Michigan Mathematical Journal, 2024.

38. *The persistent topology of optimal transport based metric thickenings*, with Facundo Mémoli, Michael Moy*, and Qingsong Wang*. Algebraic & Geometric Topology 24:393–447, 2024.

37. *Lower bounds on the homology of Vietoris–Rips complexes of hypercube graphs*, with Žiga Virk. Bulletin of the Malaysian Mathematical Sciences Society, 47:72, 2024.

36. *Additive energy functions have predictable landscape topologies*, with Brittany Story*, Biswajit Sadhu, and Aurora Clark. Journal of Chemical Physics 158:164104, 2023.

35. *A Primer on Topological Data Analysis to Support Image Analysis Tasks in Environmental Science*, with Lander Ver Hoef*, Emily King, and Imme Ebert-Uphoff. Artificial Intelligence for the Earth Systems 2:e220039, 2023.

34. *Metric thickenings and group actions*, with Mark Heim* and Chris Peterson. Journal of Topology and Analysis 14:587-613, 2022.

33. *Vietoris thickenings and complexes have isomorphic homotopy groups*, with Florian Frick and Žiga Virk. Journal of Applied and Computational Topology 7:221–241, 2022.

32. *On Vietoris–Rips complexes of hypercube graphs*, with Michał Adamaszek. Journal of Applied and Computational Topology 6:177–192, 2022.

31. *Support vector machines and Radon's theorem*, with Elin Farnell and Brittany Story*. Foundations of Data Science, 4:467–494, 2022.

30. *Capturing dynamics of time-varying data via topology*, with Lu Xian•, Chad Topaz, and Lori Ziegelmeier. Foundations of Data Science 4:1–36, 2022.

29. *The persistent homology of cyclic graphs*, with Sophia Coldren• and Sean Willmot•. International Journal of Computational Geometry and Applications 4:1–37, 2022.

28. *The middle science: Traversing scale in complex many-body systems*, with Aurora E Clark, Rigoberto Hernandez, Anna I Krylov, Anders Niklasson, Sapna Sarupria, Yusu Wang, Stefan M Wild, Qian Yang. ACS Central Science 7:1271–1287, 2021.

27. *Lions and contamination, triangular grids, and Cheeger constants*, with Leah Gibson• and Jack Pfaffinger•. Accepted to appear in Ellen Gasparovic, Vanessa Robins, and Kate Turner, eds., Research in Computational Topology 2, AWM Springer series, 2021.

26. *Topology applied to machine learning: From global to local*, with Michael Moy*. Frontiers in Artificial Intelligence; Machine Learning and Artificial Intelligence, 4:668302, 2021.

25. *Representations of energy landscapes by sublevelset persistent homology: An example with n-alkanes*, with Joshua Mirth*, Yanqin Zhai*, Johnathan Bush*, Enrique G Alvarado*, Howie Jordan*, Mark Heim*, Bala Krishnamoorthy, Markus Pflaum, Aurora Clark, and Y Z. Journal of Chemical Physics, 154:114114, 2021.

24. *An adaptation for iterative structured matrix completion*, with Lara Kassab* and Deanna Needell. Foundations of Data Science 3:769–791, 2021.

23. *Metric thickenings, Borsuk–Ulam theorems, and orbitopes*, with Johnathan Bush* and Florian Frick. Mathematika 66:79–102, 2020.

22. *On homotopy types of Vietoris–Rips complexes of metric gluings*, with Michał Adamaszek, Ellen Gasparovic, Maria Gommel*, Emilie Purvine, Radmila Sazdanovic, Bei Wang, Yusu Wang, Lori Ziegelmeier. Journal of Applied and Computational Topology, 4:425–454, 2020.

21. *Multidimensional scaling on metric measure spaces*, with Mark Blumstein and Lara Kassab*. Rocky Mountain Journal of Mathematics, 50:397–413, 2020.

20. *A torus model for optical flow*, with Johnathan Bush*, Brittany Carr*, Lara Kassab*, and Joshua Mirth*. Pattern Recognition Letters, 129:304–310, 2020.

19. *Metric thickenings of Euclidean submanifolds*, with Joshua Mirth*. Topology and its Applications, 254:69–84, 2019.

18. *On Vietoris–Rips complexes of ellipses*, with Michał Adamaszek and Samadwara Reddy•. Journal of Topology and Analysis, 11:661–690, 2019.

17. *Metric reconstruction via optimal transport*, with Michał Adamaszek and Florian Frick. SIAM Journal on Applied Algebra and Geometry, 2:597–619, 2018.

16. *Persistence images: A stable vector representation of persistent homology*, with Sofya Chepushtanova, Tegan Emerson*, Eric Hanson, Michael Kirby, Francis Motta, Rachel Neville*, Chris Peterson, Patrick Shipman, and Lori Ziegelmeier. Journal of Machine Learning Research, 18(8):1–35, 2017.

15. *The Vietoris–Rips complexes of a circle*, with Michał Adamaszek. Pacific Journal of Mathematics, 290:1–40, 2017.

14. *Random cyclic dynamical systems*, with Michał Adamaszek and Francis Motta. Advances in Applied Mathematics, 83:1–23, 2017.

13. *Nerve complexes of circular arcs*, with Michał Adamaszek, Florian Frick, Chris Peterson, and Corrine Previte-Johnson. Discrete & Computational Geometry, 56:251–273, 2016.

12. *Evasion paths in mobile sensor networks*, with Gunnar Carlsson. International Journal of Robotics Research 34:90–104, 2015.

11. *Nudged elastic band in topological data analysis*, with Atanas Atanasov and Gunnar Carlsson. Topological Methods in Nonlinear Analysis, 45:247–272, 2015.

10. *On the nonlinear statistics of range image patches*, with Gunnar Carlsson. SIAM Journal on Imaging Sciences 2:110–117, 2009.

Book chapters (* denotes graduate student coauthor)

9. Chapter on *Topological data analysis*, with Johnathan Bush* and Joshua Mirth*, in the book Data Science for Mathematicians, editor Nathan Carter, Chapman & Hall/CRC, New York, 2020.

Refereed Proceedings / Transactions (* denotes graduate student coauthor, • denotes undergraduate student coauthor)

8. **[Conference version of reference 24 above]** *An adaptation for iterative structured matrix completion*, with Lara Kassab* and Deanna Needell. 54th Asilomar Conference on Signals, Systems, and Computers, 1451–1456, 2021.

7. *Operations on metric thickenings*, with Johnathan Bush* and Joshua Mirth*. In: Spivak, D., Vicary, J. (eds), Applied Category Theory, Electronic Proceedings in Theoretical Computer Science 333:261–275, 2021.

6. **[Conference version of reference 27 above]** *Lions and contamination, triangular grids, and Cheeger constants*, with Leah Gibson• and Jack Pfaffinger•. 37th European Workshop on Computational Geometry, 7:1–7:6, 2021.

5. *A fractal dimension for measures via persistent homology*, with Manuchehr Aminian, Elin Farnell, Michael Kirby, Chris Peterson, Joshua Mirth*, Rachel Neville, and Clayton Shonkwiler. In: Baas N., Carlsson G., Quick G., Szymik M., Thaule M. (eds), Topological Data Analysis. Abel Symposia, Springer vol 15:1–32, 2020.

4. **[Conference version of reference 20 above]** *On the nonlinear statistics of optical flow*, with Johnathan Bush*, Brittany Carr*, Lara Kassab*, and Joshua Mirth*. Proceedings of Computational Topology in Image Context, LNCS volume 11382:151–165, 2019.

3. **[Conference version of reference 22 above]** *Vietoris–Rips and Čech complexes of metric gluings*, with Michał Adamaszek, Ellen Gasparovic, Maria Gommel*, Emilie Purvine, Radmila Sazdanovic, Bei Wang, Yusu Wang, Lori Ziegelmeier. Proceedings of the 34th International Symposium on Computational Geometry, 3:1–3:15, 2018.

2. *Sweeping costs of planar domains*, with Brooks Adams• and Colin Roberts•. In Erin W Chambers, Brittany T Fasy, and Lori Ziegelmeier, eds., *Research in Computational Topology*, pages 71–92, AWM Springer series, volume 13, 2018.

1. *Javaplex: A research software package for persistent (co)homology*, with Andrew Tausz and Mikael Vejdemo-Johansson. In Han Hong and Chee Yap, editors, Proceedings of International Congress on Mathematical Software, Lecture Notes in Computer Science 8592: 129–136, 2014.

Research Talks (since 2017)

2024 June, Biomolecular Topology: Modelling and Data, Institute for Mathematical Sciences, Singapore.

2024 May, 19th Annual Topology Workshop, Nipissing University, North Bay, Canada.

2024 Mar, Mid-Atlantic Topology Conference, Northeastern University, Boston, MA.

2024 Feb, STEMinar Series, Daytona State College, Daytona Beach, FL.

2024 Jan, AMS Special Session on Discrete Homotopy Theory, Joint Meetings, San Francisco, CA.

2023 Nov, SIAM Texas-Louisiana Sectional Meeting, online.

2023 Nov, Math Department Colloquium, Florida State University, Tallahassee, FL.

2023 Oct, Frontiers in AI Technology, Artificial Intelligence Days, University of Florida.

2023 June, Advances in Homotopy Theory IV, BIMSA, Beijing, China, online.

2023 May, Mathematics and Computer Science for Materials Innovation, University of Liverpool, online.

2023 May, Continuum Theory, Dimension Theory, Dynamical Systems, Nipissing University, Canada.

2023 Apr, AMS Spring Central Sectional Meeting, University of Cincinnati, OH.

2023 Apr, Algorithms, Combinatorics, Optimization (ACO) seminar, Carnegie Mellon, PA.

2023 Mar, AIMS Data Science Training School, Kigali, Rwanda.

2023 Mar, One World Seminar Series on the Mathematics of Machine Learning, online.

2023 Mar, Quantifying Topology Seminar, University of Tennessee, Knoxville, TN.

2023 Feb, Math Department Colloquium, San Diego State University, CA.

2023 Jan, Math Department Colloquium, University of Florida, Gainesville, FL.

2023 Jan, Math Department Colloquium, University of South Florida, Tampa, FL.

2022 Dec, Math Department Colloquium, Willamette University, Salem, OR.

2022 Nov, CIMAT Applied Geometry and Topology seminar, online.

2022 Oct, Oklahoma University Topology and Data Science Seminar, online.

2022 Oct, Geometry, Topology, Dynamical Systems Seminar, UT Dallas, TX.

2022 Sep, 2nd POSTECH MINDS Workshop on TDA and ML, Pohang, South Korea.

2022 Sep, Math Department Colloquium, Auburn University, AL.

2022 Sep, Topology Seminar, Auburn University, AL.

2022 Aug, Algebraic Topology and TDA: In honor of Gunnar Carlsson, IMA, Minneapolis, MN.

2022 July, Institute for Mathematical Sciences, Singapore, online.

2022 June, ATMCS 10, Oxford University, England.

2022 June, The Euler Circle, Palo Alto, CA, online.

2022 June, Computer Science Department, Sorbonne Université, Paris, France.

2022 May, SIAM Pacific Northwest Section, Washington State University, online.

2022 May, Special Session on Computational Topology, AMS Western Sectional, online.

2022 May, Institute of Geometry, TU Graz, Austria.

2022 May, Seminar series on TDA and its applications, NTU Singapore, online.

2022 Apr, Oklahoma University Topology and Data Science Seminar, online.

2022 Mar, EPFL Applied Topology Seminar, Lausanne, Switzerland, online.

2022 Mar, Bilkent Topology Seminar, Turkey, online.

2022 Feb, Codes and Expansions (CodEx) Seminar, online.

2022 Jan, IST Austria Institute Colloquium, Klosterneuburg, Austria.

2021 Dec, Copenhagen-Jerusalem Combinatorics Seminar, Copenhagen, Denmark.

2021 Nov, Facets of Complexity research seminar, Berlin, Germany.

2021 Nov, Discrete Geometry & Topological Combinatorics seminar, Freie Universität, Berlin, Germany.

2021 Nov, Computational Persistence Workshop, online.

2021 Oct, Workshop on Topology, Algebra and Geometry in Computer Vision at ICCV 2021, online.

2021 Oct, Geometry Seminar, Pennsylvania State University, online.

2021 Sept, Computational Topology and Machine Learning, Einstein Semester, Berlin, Germany, online.

2021 Sept, Algebraic Geometry and Geometric Topology Seminar, Tulane University, online.

2021 Aug, Workshop on Beyond TDA - Persistent functions and its applications in data sciences, online.

2021 Aug, DANGER workshop on applications of machine learning to pure mathematics, online.

2021 Aug, Workshop on Knowledge Guided Machine Learning (KGML), online.

2021 Aug, CIMAT/TRIPODS 2021 Summer Conference, online.

2021 June, 38th Annual Workshop in Geometric Topology, online.

2021 May, SIAM conference on Applications of Dynamical Systems, online.

2021 May, SIAM Conference on Mathematics Aspects of Materials Science, online.

2021 May, 54th Spring Topology and Dynamical Systems Conference, online. Two talks.

2021 May, Virtual Workshop on TDA: Theory and Applications, Tutte Institute, Canada, online.

2021 Apr, American Chemical Society symposium on Graph Theory and Chemistry, online.

2021 Mar, Vietoris–Rips seminar, online.

2021 Feb, Geometry: Education, Art, and Research, Banff International Research Station, online.

2021 Jan, AMS Special Session on Combinatorial Approaches to Topology, Joint Meetings, online.

2021 Jan, AMS Special Session on Applied Topology, Joint Meetings, online.

2021 Jan, AMS Special Session on Geometry in the Mathematics of Data Science, Joint Meetings, online.

2020 Oct, Topology and Dynamics Seminar, University of Florida, Gainesville FL, online.

2020 July, Workshop on Optimal Transport, TDA, and Applications, MBI, Columbus, OH, online.

2020 June, Workshop on Topological Data Analysis, Fields Institute, Toronto, Canada, online.

2020 June, Mathematics of Data Science Virtual Lecture Series, online.

2020 June, Mathematics of Data and Decisions at Davis (MADDD) Seminar, UC Davis, CA, online.

2020 June, SIAM Conference on Mathematics of Data Science (MDS20), Cincinatti OH, online.

2020 May, Online Algebraic Topology Seminar (OATS).

2020 Jan, Geometric and Topological Data Analysis, CIMAT, Guanajuato, Mexico. Three talks.

2020 Jan, AMS Special Session on *Vietoris-Borsuk-Rips Homotopy*, Joint Math Meetings, Denver, CO.

2019 Sept, Applied Mathematics Colloquium, University of Colorado, Boulder, CO.

2019 July, Summer School on Data Science for Dynamical Systems, Lorentz Center, Leiden University, Netherlands. Three talk lecture series, with an afternoon software tutorial session.

2019 May, NSF-CBMS Conference and Software Day on Topological Methods in Machine Learning and Artificial Intelligence, College of Charleston, SC. Also led a week-long research conversation group.

2019 Apr, Arches Topology Conference, Hurricane, UT.

2019 Jan, AMS Special Session on TDA, Joint Meetings, Baltimore, MD.

2018 Nov, Symposium of Physics and Mathematics, University of Michoacan, Morelia, Mexico.

2018 Nov, Math Department Colloquium, Texas State University, San Marcos, TX.

2018 Nov, Topology Seminar, Texas State University, San Marcos, TX.

2018 Nov, Upstate New York Topology Seminar (UNYTS), University of Albany, NY.

2018 Nov, Data Science Seminar, University of Tennessee, TN.

2018 Apr, Lafayette-Lehigh Geometry-Topology Seminar, PA.

2018 Apr, Undergraduate Math Colloquium, Lafayette College, PA.

2018 Mar, Math Department Colloquium, Williams College.

2018 Jan, AMS Special Session on Topological Data Analysis, Joint Meetings, San Diego, CA.

2017 Dec, Topological data analysis of exclusion zones, Edinburgh, Scotland.

2017 Oct, Applied Algebraic Topology Research Network, Online Seminar.

2017 May, 58th Cascade Topology Seminar, University of British Columbia.

2017 Mar, Applied Topology Seminar, Brown University, RI.

2017 Feb, Topology, Geometry, and Data Analysis seminar, Ohio State University, OH.

2017 Jan, Florida International University Winter Conference on Geometry, Topology, and Applications, Miami, FL. Two talks.

Panels

2020 Sept, Department of Energy (DOE) Basic Energy Sciences (BES) Chemical Sciences, Geosciences, and Biosciences (CGSB) Data Science Workshop. On Panel 3: *Understanding Topology of Chemical Data*.

2020 Jan, *Next Steps: Mathematics Departments and the Explosive Growth of Computational and Quantitative Offerings in Higher Education*, AMS Committee on Education Panel, Joint Meetings, Denver, CO.

Teaching

Teaching Awards

2021 Faculty Excellence in Undergraduate Teaching and Mentoring Award, College of Natural Sciences, Colorado State University.

2011 Centennial Teaching Assistant Award, Stanford University.

University of Florida

Math MTG 4303/5317, Introduction to Topology 2, Spring 2024.
Math MTG 4302/5316, Introduction to Topology 1, Fall 2023.

Colorado State University

Math 510, Linear Programming and Network Flows, Fall 2022, 2020.
Math 472, Introduction to Topology, Fall 2022, 2016.
DSCI (Data Science) 475, Topological Data Analysis, Spring 2021. **Developed as a new course.**
Math 366, Introduction to Abstract Algebra, Spring 2021, 2020, 2019.
Math 301, Introduction to Combinatorial Theory, Fall 2019, 2018, 2016, 2015.
Math 571, Topology II, Spring 2018.
Math 570, Topology I, Fall 2017.
Math 580a2, Topological Data Analysis, Spring 2017. **Developed as a new course.**
Math 435, Projects in Applied Mathematics, Spring 2017 and 2016.

Duke University

Math 431, Introduction to Analysis, Spring 2015.

Outreach Teaching

Week-long training course on *The geometry of data* for Quantum Leap Africa, at the African Institute for Mathematical Sciences, Kigali, Rwanda, March 2023.
Minicourse on *Geometric complexes in applied topology* at the TDA workshop at CIMAT, in Guanajuato, Mexico, January 2020.
Two week course on *Computational Topology* at the Universidad de Costa Rica, Summer 2017.
One week minicourse on *Computational Topology* at the REU program Summer@ICERM 2017.

Advising

I am interested in helping make academia more welcoming, more transparent, more diverse, more accessible, and less intimidating.

Postdoctoral Advisees

1. Alex Elchesen, Postdoctoral Fellow in Topology, co-advised with Amit Patel. 2022–present.

Graduate Student Advisees

1. Sucharita Mallick, UF, Mathematics PhD student, 2nd year.

2. Michael Moy, CSU, Mathematics PhD student, 5th year. Masters in 2021.

3. Péguy Kem-Meka (main supervisor is Ismail Akhalwaya), Data Science PhD student at Quantum Leap Africa, 2nd year.

Graduate Student Alumni

1. Lander Ver Hoef (co-advised by Emily King), CSU, Mathematics PhD in 2023. Currently a Postdoctoral Researcher at the Cooperative Institute for Research in the Atmosphere (CIRA).

2. Daniel Vargas-Rosario, CSU, Mathematics PhD in 2023. Masters in 2021 under the direction of Jeanne Duflot.

3. Brittany Story, CSU, Mathematics PhD in 2022 and Masters in 2019. Currently a Postdoctoral Researcher in the Department of Mathematics at the University of Tennessee, Knoxville, and jointly at the Aberdeen Proving Ground.

4. Lara Kassab, CSU, Mathematics PhD in Fall 2021 and Masters in 2019. Outstanding Graduate Teaching Award in 2020. Currently a Postdoctoral Researcher in the Department of Mathematics at the University of California, Los Angeles.

5. Johnathan Bush, CSU, Mathematics PhD in 2021 and Masters in 2018. Currently a Postdoctoral Fellow in the Department of Mathematics at the University of Florida.

6. Mark Heim (co-advised by Chris Peterson), CSU, Mathematics Masters in 2020.

7. Joshua Mirth, CSU, Mathematics PhD in 2020 and Masters in 2017. Outstanding Graduate Teaching Award in 2019. Currently a Faculty Member at St John's College.

In addition to the committees chaired above, I have served as a member on 16 MS and 11 PhD completed committees at CSU (plus 7 more external to CSU and UF), and I am currently a member on 3 PhD committees at UF and 4 PhD committees at CSU (plus 3 more external to CSU and UF).

Undergraduate student advisees

An undergraduate research project was my entrance into research mathematics, and I believe strongly in the importance of mentoring undergraduate students.

Tia Karkos, Mobile sensor networks and time-varying homeomorphisms, 2022–present.

Nicholas McBride, Geometric complexes and their shadows, 2022–present.

Leah Gibson and Jack Pfaffinger, research paper *Lions and contamination, triangular grids, and Cheeger constants*, 2020–2021.

Ty Jensen, Sophia Ressler, Taylor Rogers, Caroline Wendt, *Laplacian eigenmaps of the circle*, 2020.

Natalie Burke, bachelor's thesis *An exploration in Perron's theorem*, 2019–2020.

Lu Xian from Macalester College; main advisor is Professor Lori Ziegelmeier. Research paper *Capturing dynamics of time-varying data via topology*, 2018–2021.

Sophia Coldren, bachelor's thesis *On Vietoris-Rips complexes of planar curves* and research paper *The persistent homology of cyclic graphs*, 2018–2019.

Sean Willmot, research paper *The persistent homology of cyclic graphs*, 2017–2019.

Adam Jaffe (Stanford University) and Bonginkosi Sibanda (Brown University), via the Summer@ICERM 2017 program. Research paper *Vietoris–Rips complexes of regular polygons*, 2017–2020.

Samadwara Reddy via the Duke PRUV Fellowship. Bachelor's thesis *The Vietoris–Rips complexes of finite subsets of an ellipse of small eccentricity* and research paper *On Vietoris–Rips complexes of ellipses*, 2015–2017.

Colin Roberts, bachelor's thesis *Sweeping costs of simply-connected domains* and research paper *Sweeping costs of planar domains*, 2016–2017.

Brooks Adams, research paper *Sweeping costs of planar domains*, 2016–2017.

John Obuch, undergraduate research paper *Crystallization processes in 1-D*, 2016.

Honors option for 4 students (Natalie Burke, Math 301, Fall 2019; Isabella Zapata, Math 366, Spring 2019; Leah Gibson, Math 301, Fall 2018; Andrea Vigil, Math 301, Fall 2015).

Committee member: Honors Theses, Marlena Giannone, 2021, Nicole Miller, 2023.

External examiner: Williams College, Senior Honors Thesis, Zhiqi Li, 2019.

Service and Outreach

Service leadership in applied topology

Executive Director, Applied Algebraic Topology Research Network (AATRN), 2016–present.

AATRN is an extremely active online network, and in my role as Executive Director I develop new ways for members of our research community to meet each other, collaborate, and share their work.

Our AATRN YouTube channel has **6,400 subscribers, 550 videos, and 20 hours watched per day**.

- Co-organizer of the AATRN Seminar, which hosted 104 talks and 14 tea-times in 2021–2023.
- Co-organizer of the AATRN Vietoris–Rips Seminar, which hosted 49 talks in 2021–2023.
- Co-organizer of the AATRN Interview Series, which hosted 13 interviews in 2020–2023.
- Co-organizer of two AATRN Tutorial-a-thons; attendees made 60 video tutorials in 2021.
- Co-organizer of three AATRN Poster Sessions, with 52 posters presented in 2021–2022.

Software

Author and maintainer of tutorials for the Javaplex and JPlex software packages for applied topology.

Editorship

Editor for the journal *Foundations of Data Science*, 2021–present.

Editor for the journal *Experimental Mathematics*, 2024–present.

Conference program committees and guest editorships

2022–2025, Spring Topology and Dynamical Systems Conferences, Steering Committee Member.

2023, Editor for a Special Issue of the Journal of Computational Geometry.

2022, Symposium on Computational Geometry (SoCG), Program Committee Member, Berlin, Germany.

2022, NeurIPS Workshop in Symmetry and Geometry in Neural Representations, Program Committee Member, New Orleans, LA.

2022, DANGER workshop on interactions between data science and pure mathematics, Oversight Committee Member, online.

2020, Symposium on Computational Geometry (SoCG), Multimedia Exposition Track Committee Member, Zürich, Switzerland.

2019, Program committee member for the IEEE ICMLA Special Session on Topological Data Analysis in Machine Learning, Boca Raton, FL.

Conferences co-organized (weeklong)

2025, *The Geometric Realization of AATRN*, Institute for Mathematical and Statistical Innovation (iMSi), Chicago, IL.

2022, *Bridging Applied and Quantitative Topology (BAQT)*, online.

2019, *ICERM Topical Workshop on Applied mathematical modeling with topological techniques*, Providence, RI.

2018, *TRIPODS Summer Bootcamp on Topology and Machine Learning* at ICERM, Providence, RI.

Mini-symposia co-organized

2024, Special Session on *Computational Topology: Foundations, Algorithms, and Applications*, Joint Meetings of Unione Matematica Italiana (UMI) and the American Mathematical Society (AMS), Palermo, Italy.

2024, AMS Special Session on *Topological Algorithms for Complex Data and Biology*, Sectional Meeting, Florida State University, FL.

2024, AMS Special Session on *Bridging Applied and Quantitative Topology*, Joint Meetings, San Francisco, CA.

2022, AMS Special Session on *Presenting Research Mathematics Through Visual Storytelling: Slides Without Words and Equations*, Joint Meetings, Seattle, WA, online.

2020, AMS Special Session on *Applied Topology*, Joint Meetings, Denver, CO.

2018, Minisymposium on *Applied and Computational Topology* at the SIAM Central States Section Meeting, University of Oklahoma, OK.

2018, 7th Annual Minisymposium on *Computational Topology* at Computational Geometry Week, Budapest, Hungary.

2018, AMS Special Session on *Topological Data Analysis* at the Joint Meetings, San Diego, CA.

2017, Minisymposium on *Symmetric Simplicial Complexes and Polytopes* at the SIAM Conference on Applied Algebraic Geometry, Atlanta, GA.

2017, Special Session on *Recent Advances in Applied Algebraic Topology* at the AMS Spring Western Sectional Meeting, Washington State University, WA.

2016, Minisymposium on *Applied and Computational Topology* at the SIAM Central States Section Meeting, University of Arkansas at Little Rock, AR.

Departmental committees

UF, Lecturer Search Committee, 2023–2024.

CSU, Diversity, Equity, Inclusion, and Justice Committee, Department of Mathematics, 2020–2023.

CSU, Graduate Committee, Department of Mathematics, 2022–2023.

CSU, Graduate Curriculum Committee, Department of Mathematics, 2020–2022.

CSU, Data Science Major Committee Member, College of Natural Sciences, 2016–2018.

CSU, Departmental Action Team (DAT) for improving undergraduate mathematics program, 2017–2018.

Departmental seminar organization

CSU, Co-organizer of the Topology Seminar, 2017–2023.

CSU, Member of the Pattern Analysis Lab, 2015–2023.

CSU, Coach for the Putnam Mathematical Competition, 2015–2020.

CSU, Advisor for the Mathematical Contest in Modeling team, 2016–2017.

Refereeing

Reviewer for Geometry & Topology, Algebraic & Geometric Topology, Discrete & Computational Geometry, SIAM Journal on Applied Algebra and Geometry, Journal of Applied and Computational Topology, Proceedings of the National Academy of Sciences, Journal of Topology & Analysis, Homology,

Homotopy and Applications, Foundations of Computational Mathematics, Journal of Geometric Analysis, SIAM Journal on Discrete Mathematics, Journal of Chemical Physics, Journal of Machine Learning Research, Mathematical Reviews (MathSciNet), and many other mathematics and computer science journals.

I have reviewed grants for the Simons Foundation Travel Support for Mathematicians, Simons Foundation Collaboration Grants for Mathematicians, NSF Computer and Information Science and Engineering (CISE), NSF Computational and Data-Enabled Science and Engineering (CDS&E) Office of Advanced Cyberinfrastructure (OAC), Mathematics Division at the US Army Research Office (ARO), Austrian Science Fund, Banff International Research Station conference proposals, Section Activity Grants Committee for the Rocky Mountain Section of the Mathematical Association of America, internal grant at Wilkes University.

Memberships

American Mathematical Society (AMS)

Society for Industrial and Applied Mathematics (SIAM)