SHELBY COX

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SUMMARY

Using tools from tropical geometry, algebraic geometry, and combinatorics, I solve problems in biology, statistics, physics, and machine learning. I use a variety of mathematical software to advance my research.

EDUCATION AND EXPERIENCE

2024 - 2026 **Max Planck Institute, Leipzig**
Postdoctoral Researcher.

2018 - 2024 **University of Michigan, Ann Arbor**
Ph.D. Mathematics, May 2024.

2014 - 2018 **University of Massachusetts, Amherst**
B.S., Mathematics and B.A., Linguistics, May 2018.
summa cum laude, with honors

PUBLICATIONS

* denotes first author, otherwise authors are listed alphabetically by last name.

2026 **ML degrees of Brownian motion tree models: star trees and root invariance**
with Jane Coons, Aida Maraj, and Ikenna Nometa, *Journal of Symbolic Computation*, 132 (2026)

2025+ **Tropical Fermat-Weber points over spaces of M-ultrametrics**
with John Sabol, Roan Talbut, and Ruriko Yoshida, accepted to the *Vietnam Journal of Mathematics*

2025 **Tropicalizing binary geometries**
with Igor Makhlin, *Le Matematiche*, 80(1) (2025).

2025 **Group-based phylogenetic models on 3-sunlet networks**
with Elizabeth Gross and Samuel Martin, *Bulletin of Mathematical Biology*, 87(132) (2025)

2024 **Homaloidal polynomials and Gaussian models of ML degree one**
with Pratik Misra and Pardis Semnani. *Algebraic Statistics* 15(2), 167-198 (2024).

2023 **Valuations.m2** (code package)
with Colin Alstad, Oliver Clarke, Michael Burr, Michael Byrd, Courtney George, Ethan Partida.

2023 **Classifying tree topologies along tropical line segments**
Algebraic Statistics 14(1), 71–90 (2023).

2022 **Tree topologies along a tropical line segment**
with Ruriko Yoshida*. *Vietnam Journal of Mathematics*. 50, 395-419 (2022).

2022 **On the Reproducibility of "G-Mixup: Graph Data Augmentation for Graph Classification"**
with Dylan Cordaro, Yiman Ren, and Teresa Yu, *ML Reproducibility Challenge 2022*.

2019 **Finding Euler characteristics of Hilbert schemes using colored Young diagrams**
with Amal Mattoo. *Minnesota Journal of Undergraduate Mathematics*. 5(1) (2019).

PREPRINTS AND ONGOING PROJECTS

submitted **Maxout polytopes**
with Andrei Balakin, Georg Loho, and Bernd Sturmfels. Available at: arXiv:2509.21286.

preprint **The tropical polytope is the set of all weighted tropical Fermat-Weber points**
with Mark Curiel. Available at: arXiv:2310.07732.

GRANTS AND AWARDS

2023	Rackham Research Grant, UMich	$3000
2023	Rackham Travel Grant, UMich	$1150
2023	SIAM Student Travel Award	$800
2020	UMich International Center Grant	$400
2018 - 2023	NSF Graduate Research Fellowship	$138,000
2017	Honorable Mention, Barry Goldwater Scholarship	
2017 - 2018	William Field Alumni Scholarship, UMass	$750
2017	Leon Emory Lincoln and Robert Bradley Lincoln Scholarship, UMass	
2017	Monahan Student Leadership Award, UMass	
Fall 2016	M.K. Bennett Geometry Award, UMass	
2014-2018	Chancellor's Award, UMass	$48,000

TEACHING

Winter 2024 **Graduate Student Mentor** **University of Michigan, Ann Arbor**

- Conducted observations of first-year instructors.
- Contributed to development and review of university-wide calculus exams.
- Served as a substitute instructor for introductory calculus courses as needed.

2019 - 2021 **Instructor of Record** **University of Michigan, Ann Arbor**

- Math 116: Calculus II (2 semesters), and Math 115: Calculus I (1 semester).
- Classes of 15 - 20 students, meeting for 80 minutes, three times per week.
- Designed worksheets, lesson plans, and quizzes.

2015 - 2018 **Undergraduate Teaching Assistant** **University of Massachusetts, Amherst**

- Led recitations for Math 300: Fundamental Concepts of Math (4 semesters),
- Office hours and in-class assistant for Math 127: Calculus for Life and Social Sciences, and Math 104: Algebra, Analytic Geometry and Trigonometry (1 semester each).

REFERENCES

Ph.D. Advisor **David Speyer** **speyer@umich.edu**
Professor, University of Michigan, Ann Arbor

Postdoc Advisor **Bernd Sturmfels** **bernd@mis.mpg.de**
Director, Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany

Serkan Hoşten **serkan@sfsu.edu**
Professor, San Francisco State University

Ruriko Yoshida **ryoshida@nps.edu**
Professor, Naval Postgraduate School

SELECTED TALKS AND POSTERS

* denotes invited plenary talk.

Jul 2025 **Tropical phylogenetics***
New Directions in Algebraic Statistics, IMSI, Chicago, IL

Jul 2025 **Weighted tropical Fermat-Weber points**
SIAM AG 2025, Madison, WI

Mar 2025 **Maxout polytopes (poster)**
Algebraic Statistics 2025, Munich, Germany

Jan 2025 **Tropical tree spaces**
Tropical geometry in Frankfurt, Frankfurt, Germany

Jul 2024 **ML degrees of Brownian motion tree models: star trees and root invariance**
Effective Methods in Algebraic Geometry (MEGA) 2024, Leipzig, Germany

Oct 2023 **Homaloidal polynomials and ML degree one models**
with Pratik Misra and Pardis Semnani
Apprenticeship week: Varieties from statistics, IMSI, Chicago, IL

Sept 2023 **Snapshot: ML degree of Brownian motion tree models**
with Ikenna Nometa
Algebraic Statistics and Our Changing World Long Program, IMSI, Chicago, IL

Jul 2023 **Classifying tree topologies along tropical line segments**
SIAM AG 2023, Eindhoven, The Netherlands

Nov 2022 **Tropical phylogenetics**
Matroids Day, University of Wisconsin, Madison, WI

Jun 2022 **Tropical turning points (poster)**
Poster Session at CCAAGS-22, University of Washington, Seattle, WA

May 2022 **Tree topologies along the tropical line segment**
Algebraic Statistics 2022, University of Hawaii, Manoa, HI

July 2021 **Minicourse in tropical geometry**
Math Summer Mini-Courses, University of Michigan, Ann Arbor, MI

Jan 2017 **Euler characteristics of Hilbert schemes via colored Young diagrams**
with Amal Mattoo
Joint Mathematics Meeting, AMS Special Session, Atlanta, GA

Jan 2017 **Euler characteristics of Hilbert schemes via colored Young diagrams (poster)**
with Amal Mattoo
Joint Mathematics Meeting, MAA Poster Session, Atlanta, GA

PROGRAMMING

Most experienced with: Python, Julia, Macaulay2, and Oscar**.**

Some experience with: Polymake, R, Sage, and qhull**.**

SERVICE

July 2023 **Midwest Research Experience for Graduate Students (MREG)**

- MREG is a 2-week research program for early graduate students,
- Mentor for a group led by Juliette Bruce, studying matroid complexes,
- Co-organizer for MREG in 2022.

Fall 2021 **Directed Reading Program**

- Mentor for a semester-long reading course on curvature with an undergraduate student,
- Assisted the student in creating a presentation on Steiner symmetrization.

2016-2023 **Association for Women in Mathematics (AWM), Local Chapters**

- Founded and served as president of UMass AWM chapter (2016 – 2018),
- Served on the executive board of UMich AWM chapter (2019 – 2023),
- Organized professional development and community events to broaden participation by women in math, including: panel on graduate school for undergraduates, website-making workshop, and lunches with visiting faculty.

2019 - 2020
2021 - 2022 **Graduate Student Advisory Committee UMich (GSAC)**

- Member of GSAC, which advises the department on graduate student issues,
- Co-organized programs for graduate students, including: MREG, and workshops on academic job opportunities in math.