Christopher Eur

Curriculum Vitae

✉ *ceur@cmu.edu*
https://math.cmu.edu/~ceur

Employment

Sep 2024 – **Carnegie Mellon University**, *Assistant Professor*.

Jul 2021 – **Harvard University**, *NSF / Benjamin Peirce postdoctoral fellow*.
Aug 2024 Sponsoring scientist: Lauren Williams

Aug 2020 – **Stanford University**, *NSF postdoctoral fellow*.
Jun 2021 Sponsoring scientist: June Huh

Education

Aug 2015 – **University of California Berkeley**, *Ph.D. in mathematics*.
May 2020 Advisor: David Eisenbud, Thesis: *The Geometry of Divisors on Matroids*

Aug 2011 – **Harvard University**, *B.A. in mathematics*.
May 2015 Advisor: Melody Chan, Thesis: *A Brief Introduction to Toric Varieties*

Research Interests

Interplay between algebraic geometry and combinatorics, particularly in the context of matroids and their generalizations to arbitrary Lie types.

Publications

Cohomologies of tautological bundles of matroids
Selecta Mathematica N.S. (to appear). arXiv:2307.04813

The tropical critical points of an affine matroid
with Federico Ardila-Mantilla and Raul Penaguiao
SIAM Journal on Discrete Mathematics **38(2)** (2024). arXiv:2212.08173

Multimatroids and rational curves with cyclic action
with Emily Clader, Chiara Damiolini, Daoji Huang, and Shiyue Li
International Mathematics Research Notices **2024(12)** (2024). arXiv:2311.09314

Polyhedral and Tropical Geometry of Flag Positroids
with Jonathan Boretsky and Lauren Williams
Algebra & Number Theory **18-7** (2024). arXiv:2208.09131

Signed permutohedra, delta-matroids, and beyond
with Alex Fink, Matt Larson, and Hunter Spink
Proceedings of the London Mathematical Society **128(3)** (2024). arXiv:2209.06752

Intersection theory of polymatroids
with Matt Larson
International Mathematics Research Notices **2024(5)** (2024). arXiv:2301.00831

Stellahedral geometry of matroids
with June Huh and Matt Larson
Forum of Mathematics, Pi **11** (2023). arXiv:2207.10605

Essence of independence: Hodge theory of matroids since June Huh
Bulletin of the American Mathematical Society **61** (2023). arXiv:2211.05724

Tautological classes of matroids
with Andrew Berget, Hunter Spink, and Dennis Tseng
Inventiones Mathematicae **233** (2023). arXiv:2103.08021, FPSAC abstract

Simplicial generation of Chow rings of matroids
with Spencer Backman and Connor Simpson
Journal of the European Mathematical Society **26(11)** (2024). arXiv:1905.07114, FPSAC abstract

Reciprocal maximum likelihood degrees of diagonal linear concentration models
with Tara Fife, Jose Samper, and Tim Seynnaeve
Le Matematiche **76(2)** (2021). arXiv:2011.14182

Reciprocal maximum likelihood degrees of Brownian motion tree models
with Tobias Boege, Jane Ivy Coons, Aida Maraj, and Frank Röttger
Le Matematiche **76(2)** (2021). arXiv:2009.11849

Tropical flag varieties
with Madeline Brandt and Leon Zhang
Advances in Mathematics **384** (2021). arXiv:2005.13727

K-theoretic Tutte polynomials of morphisms of matroids
with Rodica Dinu and Tim Seynnaeve
Journal of Combinatorial Theory, Series A **181** (2021). arXiv:2004.00112

The Universal valuation of Coxeter matroids
with Mario Sanchez and Mariel Supina
Bulletin of London Mathematical Society **53** (2021). arXiv:2008.01121

Free resolutions of function classes via order complexes
with Justin Chen, Greg Yang, and Mengyuan Zhang
Advances in Applied Mathematics **120** (2020). arXiv:1909.02159

Logarithmic concavity for morphisms of matroids
with June Huh
Advances in Mathematics **367** (2020). arXiv:1906.00481

Coxeter submodular functions and deformations of Coxeter permutohedra
with Federico Ardila, Federico Castillo, and Alex Postnikov
Advances in Mathematics **365** (2020). arXiv:1904.11029, FPSAC abstract

Divisors on matroids and their volumes
Journal of Combinatorial Theory, Series A **169** (2020). arXiv:1803.07103, FPSAC abstract

Complete intersections of a given Hilbert polynomial
with Sung Hyun Lim
Journal of Commutative Algebra **13** (2021). arXiv:1712.05886

Preprints

Wondertopes
with Sarah Brauner, Elizabeth Pratt, and Raluca Vlad
submitted. arXiv:2403.04610

K-theoretic positivity for matroids
with Matt Larson
submitted. arXiv:2311.11996

Kapranov degrees
with Joshua Brakensiek, Matt Larson, and Shiyue Li
submitted. arXiv:2308.12285

K-classes of delta-matroids and equivariant localization
with Matt Larson and Hunter Spink
submitted. arXiv:2307.02550

GKMVarieties: a Macaulay2 package
with Ritvik Ramkumar
Documentation page, GitHub link

Awards

2023-2026 NSF Research Grant (DMS-2246518)
2020-2023 NSF Postdoctoral Fellowship (DMS-2001854)
2020 Ribet–Goldberg Award in Algebra
2019 FPSAC Best student paper award
2019 UC Dissertation-year fellowship
2017 Outstanding Graduate Student Instructor (OGSI) Award
2014, 2015 Derek Bok Certificate of Distinction for Excellence in Teaching

Selected Invited Talks

7/15/2024 *Log-concave rainbows and where to find them*. Summer School in Algebraic Combinatorics, MPI Leipzig.
6/21/2024 *Toric vector bundles from hyperplane arrangements*. Oberwolfach.
5/22/2024 *Geometry of independence*. KOALA 2024, University of Kentucky.
11/4/2023 *A Tale of two rings*. CALICO (online).
10/1/2023 *Matroids as positive vector bundles*. AWM symposium.
7/18/2023 *Tautological classes of matroids*. FPSAC, UC Davis.
7/12/2023 *Lorentzian Polynomials from Matroid Bundles*. SIAM AG, Eindhoven Netherlands.
3/13/2023 *How or when do matroids behave like positive vector bundles?* Algebraic Aspects of Matroid Theory, Banff Research Station.

1/9/2023 *A Tale of two rings*. Workshop on Matroids and Tropical Combinatorics, Queen Mary University of London.

1/6/2023 *An Essence of independence: recent works of June Huh and combinatorics and Hodge theory*. Current Events Bulletin JMM 2023.

8/1/2022 *When or how do matroids behave like positive vector bundles?* LMS-Bath Workshop on Combinatorial Algebraic Geometry.

6/27/2022 *Tautological classes of matroids*. Arrangements in Ticino. Locarno, Switzerland.

6/21/2021 *Tautological bundles of matroids*. Oberwolfach Workshop: Classical Algebraic Geometry. (Hybrid-online)

4/12/2021 *Tautological classes of matroids*. ICERM Workshop: Algebraic Geometry and Polyhedra. (Online)

3/14/2021 *Tautological bundles of matroids*. AMS Special Session on Tropical Geometry, F1-connections and Matroids. (Online)

2/2/2021 *Introduction to Lorentzian polynomials*. ICERM Introductory Workshop: Combinatorial Algebraic Geometry. (Online)

12/10/2020 *Tautological Bundles of matroids*. Online Nottingham algebraic geometry seminar.

9/12/2020 *Free resolutions in learning theory*. AMS Special Session on Free resolutions, combinatorics, and geometry. (Online)

3/17/2020 *Simplicial generation of Chow rings of matroids*. Unimodality, Log-concavity and beyond. Mittag-Leffler Institute, Sweden. (Online video talk)

1/18/2020 *Towards a tropical geometry of Coxeter matroids*. AMS Special Session on Representations of Finite Groups and Related Structures, JMM 2020 Denver, CO.

10/28/2019 *On geometrically distinguished divisors on matroids*. Commutative Algebra and Lattice Polytopes. RIMS, Kyoto University, Japan.

9/27/2019 *Simplicial generation of Chow rings of matroids*. Harvard/MIT combinatorics seminar

7/1/2019 *Divisors on matroids and their volumes*. 31st International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC). Ljubljana, Slovenia.

10/21/2018 *Divisors on matroids and their volumes*. AMS Special Session on Multiplicities and Volumes: An Interplay Among Algebra, Combinatorics, and Geometry, University of Michigan Ann Arbor.

4/15/2018 *Complete intersections of a given Hilbert polynomial*. AMS Special Session on Commutative Algebra, Portland State University.

3/12/2016 *Examination of the proof, Part 3*. Workshop on the Global Attractor Conjecture with invited guest Gheorghe Craciun, San Jose State University.

Conferences/Seminars Organized

Fall 2022 ∼ Spring 2024 *Stanley Combinatorics Seminar* (formerly *Harvard-MIT-MSR Combinatorics Seminar*) (with Henry Cohn, Alex Postnikov, Lisa Sauermann, Lauren Williams, Yufei Zhao). website

4/10/2021 *Bay Area Discrete Math Day (BADMath Day)* (with Jessica De Silva, Magda Hlavacek, Isabelle Shankar, Mariel Supina, Foster Tom). UC Berkeley. website, videos hosted at Simons Institute

Fall 2018 ∼ Spring 2020 *The Fellowship of the ring: CA + AG seminar*, (main organizer: David Eisenbud). UC Berkeley.

Fall 2019 9/14 ∼ 9/15 *AMS Special Session on Combinatorial Algebraic Geometry*, (with Juliette Bruce, Daniel Erman, and Lily Silverstein). AMS Fall Central Sectional Meeting, University of Wisconsin–Madison. AMS website

Fall 2018 *Student Algebraic Geometry Seminar: algebraic surfaces*. UC Berkeley. website

Spring 2018 *Student Algebraic Geometry Seminar: toric geometry*. UC Berkeley. website

Fall 2017 *Student Commutative Algebra Seminar*. UC Berkeley.

Fall 2016 *Student Commutative Algebra Seminar*. UC Berkeley. website

Services

Refereed for:

Advances in Mathematics
Advances in Applied Mathematics
Algebraic Combinatorics
Annals of Combinatorics
Bulletin of the London Mathematical Society
Combinatorial Theory
Electronic Journal of Combinatorics
International Mathematics Research Notes
Journal of Algebraic Combinatorics
Journal of Algebra
Journal of the American Mathematical Society
Journal of the London Mathematical Society
Journal of the European Mathematical Society
Journal of Combinatorial Theory Series A
Mathematische Annalen
Proceedings of the American Mathematical Society
Selecta Mathematica
SIAM Journal on Applied Algebra and Geometry

2016–2020 Board member in *Unbounded Representation (URep)*, a graduate student group promoting diversity in mathematics.

2013-2015 Publicity chair for *Harvard Applied Math Society* (SIAM: Harvard Chapter)

Teaching

Workshops / Graduate summer schools:

Summer 2024 Log-concave rainbows and where to find them: Summer School in Algebraic Combinatorics at MPI Leipzig. website

Winter 2022 A Tale of Two Rings: MaTroCom Minicourse. website

Summer 2021 Geometric models of matroids: LMS Summer school on Combinatorial Algebraic Geometry

Spring 2021 Introduction to matroids and Lorentzian polynomials. ICERM Introductory workshop

BP Fellow at Harvard University:

Spring 2024 Math 25b: Theoretical linear algebra and real analysis II. website (canvas)

Fall 2023 Math 25a: Theoretical linear algebra and real analysis I. website (canvas)

Spring 2023 Math 232b: Algebraic Geometry II. website (canvas)

Spring 2022 Math 279R: Positivity in Matroid Theory. website

Fall 2021 Math 21b: Linear Algebra and Differential Equations

Graduate Student Instructor (GSI) at University of California at Berkeley:

Spring 2019 Math 54: Linear Algebra and Differential Equations

Fall 2017 Math 54: Linear Algebra and Differential Equations

*Spring 2017 Math 54: Linear Algebra and Differential Equations

*Fall 2016 Math 54: Linear Algebra and Differential Equations

Spring 2016 Math 53: Multivariable Calculus

Fall 2015 Math 1A: Calculus I

**Outstanding Graduate Student Instructor Award*

Mentor for the Directed Reading Problem (DRP) at UC Berkeley:

Spring2020 Topic: Algebraic geometry by problem-solving

Fall 2018 Topic: Rank functions of symplectic matroids

Spring 2017 Topic: Divisors on chain-of-loops graphs

Fall 2016 Topic: Divisors on metric graphs

Fall 2015 Topic: elliptic curves and applications to cryptography

Course Assistant at Harvard University:

†Spring 2015 Math 110: Introduction to Fourier Series

†Fall 2014 Math 152: Discrete Mathematics

†Spring 2014 Math 110: Introduction to Fourier Series

Fall 2013 Math 23a: Linear Algebra and Real Analysis

Fall 2013 Math 1b: Calculus and Differential Equations

†*Derek Bok Certificate of Distinction for Excellence in Teaching*