Christopher Eur

Curriculum Vitae

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Employment

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

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

Education

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

Aug 2011 – May 2015  
Harvard University, **B.A. in mathematics**.
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

**Polyhedral and Tropical Geometry of Flag Positroids**  
*with Jonathan Boretsky and Lauren Williams*
Algebra & Number Theory (to appear). arXiv:2208.09131

**Intersection theory of polymatroids**  
*with Matt Larson*
International Mathematics Research Notices (2023). 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 (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 (2023). 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

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

Multimatroids and rational curves with cyclic action  
*with Emily Clader, Chiara Damiolini, Daoji Huang, and Shiyue Li*  
*submitted.* arXiv:2311.09314
Kapranov degrees
*with Joshua Brakensiek, Matt Larson, and Shiyue Li*
submitted.  arXiv:2308.12285

Cohomologies of tautological bundles of matroids
submitted.  arXiv:2307.04813

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

The tropical critical points of an affine matroid
*with Federico Ardila-Mantilla and Raul Penaguiao*
submitted.  arXiv:2212.08173

Signed permutohedra, delta-matroids, and beyond
*with Alex Fink, Matt Larson, and Hunter Spink*
submitted.  arXiv:2209.06752

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

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**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

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**Selected Invited Talks**

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.

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**Conferences/Seminars Organized**

**Fall 2022 ~** *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 ~** *The Fellowship of the ring: CA + AG seminar,*
Spring 2020  (main organizer: David Eisenbud). UC Berkeley.

**Fall 2019**  *AMS Special Session on Combinatorial Algebraic Geometry,*
9/14 ~ 9/15  (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**

Advances in Mathematics  
Algebraic Combinatorics  
Bulletin of the London Mathematical Society  
Electronic Journal of Combinatorics  
Refereed for:

Advances in Applied Mathematics  
Annals of Combinatorics  
Combinatorial Theory  
International Mathematics Research Notes  
Journal of Algebraic Combinatorics  
Journal of Algebra  
Journal of the American 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  TBD: Summer School in Algebraic Combinatorics. [website](link)

Winter 2022  A Tale of Two Rings: MaTroCom Minicourse. [website](link)

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](link) ([canvas](link))

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

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

Spring 2022  Math 279R: Positivity in Matroid Theory. [website](link)

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:

Spring 2020  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
