

# Christopher Eur

## Curriculum Vitae

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📄 <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

#### Combinatorial Hodge theory

*with Matt Larson*

Notices of the American Mathematical Society (to appear). [arXiv:](#)

#### K-theoretic positivity for matroids

*with Matt Larson*

Algebraic Geometry (to appear). [arXiv:2311.11996](#)

#### K-classes of delta-matroids and equivariant localization

*with Matt Larson and Hunter Spink*

Transactions of the American Mathematical Society (to appear). [arXiv:2307.02550](#)

#### Cohomologies of tautological bundles of matroids

*Selecta Mathematica N.S.* **30**, 85 (2024). [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](#)

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## Preprints

### On two notions of total positivity for generalized partial flag varieties of classical Lie types

with Grant Barkley, Jonathan Boretsky, and Jiyang Gao

submitted. [arXiv:2410.11804](#)

### Wondertopes

with Sarah Brauner, Elizabeth Pratt, and Raluca Vlad

submitted. [arXiv:2403.04610](#)

### Kapranov degrees

with Joshua Brakensiek, Matt Larson, and Shiyue Li

submitted. [arXiv:2308.12285](#)

### 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

- 2/4/2025 *Exceptional Hirzebruch–Riemann–Roch theorems*. Combinatorics of Enumerative Geometry, Institute for Advanced Study.
- 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.

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## Conferences/Seminars Organized

- Spring 2025 *ACO Seminar* (Algorithms, Combinatorics, and Optimization seminar at CMU) [website](#)

- Fall 2024 *Geometry of Matroids Workshop*  
 10/21~10/25 (with Matt Baker, June Huh, Oliver Lorscheid, Felipe Rincon). [website](#)
- Fall 2022 ~ *Stanley Combinatorics Seminar* (formerly *Harvard-MIT-MSR Combinatorics Seminar*)  
 Spring 2024 (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

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|---------------|--|---|--|
| 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 <i>Unbounded Representation (URep)</i> , a graduate student group promoting diversity in mathematics. |  |
|               | 2013-2015                                    | Publicity chair for <i>Harvard Applied Math Society</i> (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

Assistant professor Carnegie Mellon University:

- Spring 2025 21-849: Algebraic Geometry I. [website](#) ([canvas](#))
- Spring 2024 21-610: Algebra I. [website](#) ([canvas](#))

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:

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

Fall 2013 Math 1b: Calculus and Differential Equations

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