

# Alexander Black

aeblack@ucdavis.edu, alexblackmath.com

## EDUCATION

**UC Davis**, Davis, CA, USA

Sep 2019 – Jun 2024 (Expected)

- Ph.D. in Mathematics advised by Jesús De Loera
- GPA: 4.00

**Cornell University**, Ithaca, NY, USA

Jul 2017 – May 2019

- B.A. in Mathematics with Distinction in All Subjects
- Summa Cum Laude in Mathematics
- GPA: 3.90

**Hamilton College**, Clinton, NY, USA

Aug 2015 - Jul 2017

- GPA: 4.00

**Courses:** Introduction to Combinatorics, Topics in Topological Combinatorics, Algebraic Geometry I and II, Readings in Representation Theory, Algebraic Combinatorics, Numerical Optimization, Optimization

## PUBLICATIONS

1. Sampling Planar Tanglegrams and Pairs of Disjoint Triangulations (Kevin Liu, Alex McDonough, Garrett Nelson, Michael C. Wigal, Youngho Yoo, and Mei Yin), *Advances in Applied Mathematics* 2023, accessible at [arXiv:2304.05318](#)

2. On the Simplex Method for 0/1 Polytopes (with J. De Loera, S. Kafer, and L. Sanità) accepted at *Mathematics of Operations Research* 2023, accessible at [arXiv:2111.14050](#)

3. Small Shadows of Lattice Polytopes, published in the *ACM-SIAM Symposium on Discrete Algorithms (SODA)* 2023, accessible at [arXiv:2204.09129](#)

4. The Polyhedral Geometry of Pivot Rules and Monotone Paths (with J. De Loera, N. Lütjeharms, and R. Sanyal) accepted to *SIAM Journal of Applied Algebra and Geometry (SIAGA)* 2023, accessible at [arXiv:2201.05134](#)

5. Monotone paths on cross-polytopes (with J. De Loera) accepted to *Discrete and Computational Geometry* 2023, accessible at [arXiv:2102.01237](#)

6. Fair splittings by independent sets in sparse graphs (with U. Cetin, F. Frick, A. Pacun, and L. Setiabrata) in *Israel Journal of Mathematics* 2020. accessible at [arXiv:1809.03268](#)

## UNDER REVIEW

7. Realizable Standard Young Tableaux (with I. Araujo, A. Burcroff, Y. Gao, R. Krueger, and A. McDonough) 2023, accessible at [arXiv:2302.09194](#)

8. Short Circuit Walks on Hirsch Counterexamples (with S. Borgwardt and M. Brugger) 2023, accessible at [arXiv:2302.03977](#)

9. Flag Polymatroids (with R. Sanyal) 2022, accessible at [arXiv:2207.12221](#)

**PRESENTATIONS**

06/2023: Strict Monotone Diameters of Lattice Polytopes (SIAM Conference on Optimization)  
 05/2023: On the Circuit Diameter Conjecture for Hirsch Counterexamples (Circuits Workshops at CU Denver)  
 04/2023: The Polyhedral Geometry of Pivot Rules (UW Seattle Combinatorics Seminar)  
 01/2023: Small Shadows of Lattice Polytopes (SODA 2023)  
 12/2022: Smooth Torus Orbit Closures in Flag Varieties (OVGU Magdeburg Algebra Seminar)  
 12/2022: Monotone Path Polytopes (FU Berlin Student Seminar)  
 12/2022: Realizable Standard Young Tableaux (FU Berlin Discrete Geometry Seminar)  
 10/2022: Small Shadows of Lattice Polytopes (Bocconi University, INFORMS 2022)  
 09/2022: Torus Orbits in Full Flag Varieties (MPI Leipzig)  
 09/2022: Small Shadows of Lattice Polytopes (TU Munich, ETH Zurich, Cargese Workshop in Combinatorial Optimization)  
 09/2022: Flag Polymatroids (Geometry meets Combinatorics in Bielefeld)  
 02/2022: Monotone Paths on Polytopes (University of Nebraska Lincoln Discrete Math Seminar)  
 01/2022: Small Shadows of 0/1 Polytopes (University of Colorado at Denver Network Flows Seminar)  
 10/2021: Polyhedral Geometry of Pivot Rules (Frankfurt-Bochum Joint Combinatorics Seminar)  
 09/2021: Modifications of the Shadow Vertex Pivot Rule (Hausdorff Institute of Mathematics at Bonn - Trimester on Geometry of Linear Programming)  
 04/2021: Monotone Paths on Cross-Polytopes (Max Planck Institute at Leipzig - (Polytop)ics: Recent advances on polytopes)  
 02/2021: Monotone Paths on Polyhedral Unit Balls (UC Davis Student Research Seminar)  
 10/2019: The Square Peg Problem for Two Curves (UC Davis Student Research Seminar)  
 08/2019: The Square Peg Problem for Two Curves (MAA Mathfest 2019)  
 05/2019: Ring on a String 2: Group on a Loop (Cornell Undergraduate Math Club)  
 10/2018: Ring on a String (Cornell Undergraduate Math Club)  
 10/2017: Inverse Semigroups of Self Similar Graph Actions (Cornell Undergrad Research Symposium)  
 08/2017: Modeling Relationship Function in Social Networks (MAA Mathfest 2017)

**AWARDS & SCHOLARSHIPS**

- 2023 Alice Siu-Fun Leung Scholarship in Mathematics Jun 2023  
 \$5,000 Departmental award given annually to a math graduate student at UC Davis for excellence in research
- 2022 George Nicholson Paper Competition Finalist Sep 2022  
 Top 6 of 129 students in competition for the best graduate student operations research paper among students graduating after June 2021 for my paper "Small Shadows of Lattice Polytopes"
- Mixed Integer Programming (MIP) 2022 Workshop Best Poster Award May 2022  
 Best poster among 30 graduate students presenting at MIP 2022
- Yueh-Jing Lin Fund Scholarship Jun 2021  
 \$2,000 award given to high-achieving UC Davis math graduate students
- NSF Graduate Research Fellowship Mar 2021  
 Scholarship funds amounting to more than \$100,000 to pursue graduate study in applied mathematics
- MAA Mathfest Outstanding Presentation Award Jul 2017  
 Award given to the top 10% of undergraduate presenters at MAA Mathfest

**TEACHING**

**Mathematics Department** UC Davis, Davis, CA, USA

- Graduate TA Sep 2019 – Jun 2021
  - Manage groups of 20-40 students through 2 hours of weekly discussion sections
  - Write lesson plans and review resources for 3-5 exams and 10 discussions
  - Grade and write rubrics for exams given to hundreds of students

**Math Support Center** Cornell University, Ithaca, NY, USA

- Mathematics Tutor Jan 2019 – May 2019
  - Assisted Cornell students with homework in mathematics courses 4 hours each week

**Upward Bound** Cornell University, Ithaca, NY, USA

- Upward Bound Tutor Aug 2018 – May 2019
  - Helped local high school students 2-4 hours each with math homework
  - Collaborated with a team of tutors to develop new strategies for teaching and motivating students

**Mathematics Department** Cornell University, Ithaca, NY, USA

- Calculus 1 Course Assistant Aug 2018 – Dec 2018
  - Hosted office hours 1.5 hours each week
  - Provided students with feedback by grading problem sets

**Quantitative and Symbolic Reasoning Center** Hamilton College, Clinton, NY, USA

- Mathematics Tutor Aug 2016 – May 2017
  - Hosted drop-in tutoring 2.5 hours each week in linear algebra and calculus
  - Tutored a high school student online 1.5 hours each week in the Art of Problem Solving calculus course

**SERVICE**

- Jointly ran a preparation workshop for the GRE Quantitative section for the University of Nebraska Lincoln McNair Scholars program in summer 2023
- Co-founded and ran a commutative algebra REU for first generation, low-income students at University of Nebraska Lincoln in summer 2023 (PI: Eloisa Grifo)
- Organizer of the student/postdoc seminar at ICERM at Brown University for the Spring 2023 semester on discrete optimization
- Reviewer for the SIAM Journal of Discrete Mathematics (SIDMA), Operations Research Letters, and Mathematics of Operations Research
- Co-founder of the student-run algebra and discrete math seminar at UC Davis
- Co-advised research of undergraduate Owen Gao at UC Davis

**SKILLS**

$\LaTeX$  (Advanced), Python (Intermediate), Sage (Beginner), Beamer/TikZ (Intermediate), HTML (Beginner)

**INTERESTS**

Performing stand up comedy and improv