Alexander Black

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EDUCATION	**University of California at Davis**, CA, USA	Sep 2019 – Jun 2024

- 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

APPOINTMENTS

ETH Zürich — Sep 2024 –
Hermann Weyl Instructor

RESEARCH VISITS

ICERM at Brown University Long term participant in the semester program on discrete optimization — Jan 2023 – May 2023

Freie Universität Berlin Visited professor Raman Sanyal — Nov 2022 – Dec 2022

Goethe Universität Frankfurt Visited professor Raman Sanyal — Sep 2021 – Oct 2021

PUBLICATIONS

1. A. Black and R. Sanyal *Underlying flag polymatroids* Advances in Mathematics **453** (2024) 109835.

2. A. Black, J. De Loera, S. Kafer, and L. Sanità *On the simplex method for 0/1-polytopes* accepted at Mathematics of Operations Research (2024),

3. A. Black, K. Liu, A. McDonough, G. Nelson, M. C. Wigal, Y. Yoo, and M. Yin *Sampling planar tanglegrams and pairs of disjoint triangulations*, Advances in Applied Mathematics **149** (2023) 102550.

4. A. Black *Small shadows of lattice polytopes*, Proceedings of the 2023 Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), SIAM, 2023 1669–1679

5. A. Black, J. De Loera, N. Lütjeharms, and R. Sanyal *The polyhedral geometry of pivot rules and monotone paths*, SIAM Journal of Applied Algebra and Geometry (SIAGA) **7** (2023), no. 3, 623-650

6. A. Black, J. De Loera *Monotone paths on cross-polytopes*, Discrete and Computational Geometry (2023), 1–21

7. A. Black, U. Cetin, F. Frick, A. Pacun, and L. Setiabrata *Fair splittings by independent sets in sparse graphs*, Israel Journal of Mathematics **236** (2020) 603-627.

UNDER REVIEW

8. A. Black and F. Criado *Random shadows of fixed polytopes* (2024), accessible at arXiv:2406.06936

9. A. Black, N. Lütjeharms, and R. Sanyal *From linear programming to colliding particles* (2024), accessible at arXiv:2405.08506

10. A. Black *Exponential lower bounds for many pivot rules for the simplex method* (2024), accessible at arXiv:2403.04886

11. I. Araujo, **A. Black**, A. Burcroff, Y. Gao, R. Krueger, and A. McDonough *Realizable standard Young tableaux* (2023), accessible at arXiv:2302.09194

12. A. Black, S. Borgwardt, and M. Brugger *Short circuit walks on Hirsch counterexamples* (2023), accessible at arXiv:2302.03977

INVITED TALKS	Flag Polymatroids (UC Davis Algebra and Discrete Math Seminar) May 2024

Monotone Paths on Polytopes in Combinatorics and Optimization (CUNEF Seminar)   Jan 2024

Monotone Paths on Polytopes in Combinatorics and Optimization (UCLA Combinatorics Forum) Oct 2023

Strict Monotone Diameters of Lattice Polytopes (SIAM Conference on Optimization)   Jun 2023

On the Circuit Diameter Conjecture for Hirsch Counterexamples (Circuit Diameters and   May 2023
Augmentation at the University of Colorado Denver)

Random Shadows of Fixed Polytopes (Institue for Computational and Experimental   May 2023
Research Methods (ICERM) at Brown Unversity)

The Polyhedral Geometry of Pivot Rules (University of Washington Seattle   Apr 2023
Combinatorics Seminar)

Smooth Torus Orbit Closures in Flag Varieties (Otto-von-Guericke-University (OVGU)   Dec 2022
Magdeburg Algebra Seminar)

Realizable Standard Young Tableaux (Freie Universität Berlin Discrete Geometry Seminar)   Dec 2022

Small Shadows of Lattice Polytopes (Bocconi University Seminar)   Oct 2022

Small Shadows of Lattice Polytopes (INFORMS Annual Meeting)   Oct 2022

Torus Orbits in Full Flag Varieties (Max Planck Institute at Leipzig Nonlinear   Sep 2022
Algebra Seminar)

Small Shadows of Lattice Polytopes (Technische Universität (TU) Munich   Sep 2022
Optimization Seminar)

Small Shadows of Lattice Polytopes (ETH Zurich Computer Science Seminar)   Sep 2022

Monotone Paths on Polytopes (University of Nebraska Lincoln Discrete Math Seminar)   Feb 2022

Small Shadows of 0/1 Polytopes (University of Colorado at Denver Network Flows Seminar)   Jan 2022

Polyhedral Geometry of Pivot Rules (Goethe-Universität Frankfurt-Bochum Joint   Oct 2021
Combinatorics Seminar)

Modifications of the Shadow Vertex Pivot Rule (Hausdorff Institute of Mathematics at Bonn   Sep 2021
- Trimester on Geometry of Linear Programming)

CONTRIBUTED TALKS	Exponential Lower Bounds for Many Pivot Rules for the Simplex Method (FRICO 2024)	Sep 2024
	Random Shadows of Fixed Polytopes (Cargese Workshop on Combinatorial Optimization)	Sep 2024
	The Polyhedral Geometry of Pivot Rules (Santander Workshop on Geometric and Algebraic Combinatorics)	Jan 2024
	Small Shadows of Lattice Polytopes (Symposium on Discrete Algorithms (SODA23))	Jan 2023
	Monotone Path Polytopes (Freie Universität Berlin Student-run Combinatorics Seminar)	Dec 2022
	Small Shadows of Lattice Polytopes (Cargese Workshop on Combinatorial Optimization)	Sep 2022
	Flag Polymatroids (Geometry meets Combinatorics in Bielefeld)	Sep 2022
	Monotone Paths on Cross-Polytopes (Max Planck Institute at Leipzig - (Polytop)ics: Recent advances on polytopes)	Apr 2021
	Monotone Paths on Polyhedral Unit Balls (UC Davis Student Research Seminar)	Feb 2021

AWARDS & SCHOLARSHIPS	▪ NSERC Postdoctoral Fellowship (Declined) Scholarship funds of $90,000 CA for two years of postdoctoral study in mathematics	Feb 2024
	▪ 2023 Alice Siu-Fun Leung Scholarship in Mathematics $5,000 Departmental award given annually to a math graduate student at UC Davis for excellence in research	Jun 2023
	▪ 2022 George Nicholson Paper Competition Finalist 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"	Sep 2022
	▪ Mixed Integer Programming (MIP) 2022 Workshop Best Poster Award Best poster among 30 graduate students presenting at MIP 2022	May 2022
	▪ Yueh-Jing Lin Fund Scholarship $2,000 award given to high-achieving UC Davis math graduate students	Jun 2021
	▪ NSF Graduate Research Fellowship Scholarship funds amounting to more than $100,000 to pursue graduate study in applied mathematics	Mar 2021
	▪ MAA Mathfest Oustanding Presentation Award Award given to the top 10% of undergraduate presenters at MAA Mathfest	Jul 2017

TEACHING	**Commutative Algebra REU** University of Nebraska Lincoln, Lincoln, NE, USA	
	▪ Co-Founder and Research Advisor	Jul 2023
	• Advised four first generation, low income students for a summer research project • Designed and a taught a two week bootcamp to introduce students to proof writing and Python programming • Planned all program activities including multiple weekly professional development sessions	
	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

- Volunteered to help set up the 2023 conference on Formal Power Series and Algebraic Combinatorics (FPSAC)
- 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: Eloísa Grifo)
- Co-organizer of the student/postdoc seminar at ICERM at Brown University for the Spring 2023 semester on discrete optimization
- Reviewer for Combinatorial Theory [1], the SIAM Journal of Discrete Mathematics (SIDMA) [3], Integer Programming and Combinatorial Optimization (IPCO) [1], Operations Research Letters [1], and Mathematics of Operations Research [1]
- 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)