Alexander Black

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APPOINTMENTS

Bowdoin College Jul 2025 –
Assistant Professor (Tenure Track)

ETH Zürich Sep 2024 – Jul 2025
Hermann Weyl Instructor

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

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, S. Borgwardt, and M. Brugger *Short circuit walks in fixed dimesion* Accepted at the 2026 Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), 2026 accessible at arXiv:2510.01916

2. A. Black, S. Borgwardt, and M. Brugger *On the circuit diameter conjecture for counterexamples to the Hirsch conjecture* Discrete Optimization (2025) accessible at arXiv:2302.03977

3. A. Black *Exponential lower bounds for many pivot rules for the simplex method* Integer Programming and Combinatorial Optimization (IPCO) (2025), accessible at arXiv:2403.04886

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

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

6. 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.

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

8. 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

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

10. **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

11. M. Bechtloff Weising and **A. Black** *Saturation for non-symmetric Macdonald polynomials* (2025), accessible at arXiv:2508.00336

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

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

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

INVITED TALKS

NP-Hardness of Finding Short Paths on Polytopes (The Simplex Method: Theory, Complexity, and Applications at FU Berlin)	Jun 2025
Shadows of Polytopes (London School of Economics Seminar)	Mar 2025
Shadows of Polytopes (Polytopes and Friends at KTH Stockholm)	Dec 2024
Exponential Lower Bounds for Many Pivot Rules for the Simplex Method (Freie Universität Berlin Discrete Geometry Seminar)	Nov 2024
On the Shadow Simplex Method (TU Munich Seminar)	Oct 2024
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 Augmentation at the University of Colorado Denver)	May 2023
Random Shadows of Fixed Polytopes (Institue for Computational and Experimental Research Methods (ICERM) at Brown Unversity)	May 2023
The Polyhedral Geometry of Pivot Rules (University of Washington Seattle Combinatorics Seminar)	Apr 2023
Smooth Torus Orbit Closures in Flag Varieties (Otto-von-Guericke-University (OVGU) Magdeburg Algebra Seminar)	Dec 2022
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 Algebra Seminar)	Sep 2022

	Small Shadows of Lattice Polytopes (Technische Universität (TU) Munich Optimization Seminar)	Sep 2022
	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 Combinatorics Seminar)	Oct 2021
	Modifications of the Shadow Vertex Pivot Rule (Hausdorff Institute of Mathematics at Bonn - Trimester on Geometry of Linear Programming)	Sep 2021
CONTRIBUTED TALKS	Circuit Augmentation in Fixed Dimension (Cargese Workshop on Combinatorial Optimization)	Sep 2025
	Exponential Lower Bounds for Many Pivot Rules for the Simplex Method (26th Conference on Integer Programming and Combinatorial Optimization (IPCO 2025))	Jun 2025
	Exponential Lower Bounds for Many Pivot Rules for the Simplex Method (Oberwolfach Workshop on Combinatorial Optimization)	Nov 2024
	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) — Feb 2024
  Scholarship funds of $90,000 CAD for two years of postdoctoral study in mathematics
- 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 Oustanding Presentation Award — Jul 2017
  Award given to the top 10% of undergraduate presenters at MAA Mathfest

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

- Organizer for the 2025 Mixed Integer Programming Workshop European Edition
- Poster Competition Judge at Integer Programming and Combinatorial Optimization (IPCO) 2025
- Reviewer for Journal of Optimization Theory and Applications [1], Annals of Combinatorics [1], Mathematical Programming [1], TheoretiCS [1], the Symposium on Discrete Algorithms (SODA) [2], Combinatorial Theory [1], the SIAM Journal of Discrete Mathematics (SIDMA) [3], Integer Programming and Combinatorial Optimization (IPCO) [2], Operations Research Letters [1], Mathematics of Operations Research [1], Symposium on the Theory of Computing (STOC) [1], Discrete and Computational Geometry [1], Formal Power Series in Algebraic Combinatorics (FPSAC) [1], and the Bulletin of the London Mathematical Society [1]
- 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
- 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)