

# ERIC KATZ

Office Address: Department of Mathematics  
Ohio State University  
231 W. 18th Avenue  
Columbus, OH 43210

Email Address: [katz.60@osu.edu](mailto:katz.60@osu.edu)

## Employment

- 2016 – Assistant Professor, Department of Mathematics, The Ohio State University
- 2016 – 2016 Associate Professor, Department of Combinatorics & Optimization, University of Waterloo
- 2015 – 2016 Assistant Professor, Department of Pure Mathematics, cross-appointed, University of Waterloo
- 2011 – 2016 Assistant Professor, Department of Combinatorics & Optimization, University of Waterloo
- 2010 – 2011 NSF Institutes Postdoc, Mathematical Sciences Research Institute, taken at University of Texas-Austin
- 2009 – 2009 Postdoctoral Member, Mathematical Sciences Research Institute
- 2007 – 2010 Lecturer/RTG Postdoc, University of Texas-Austin
- 2004 – 2007 Assistant Research Professor, Duke University

## Grants and awards

- 2017 Current Events Bulletin talk by Matt Baker at the Joint Mathematics Meeting on work with Adiprasito and Huh, entitled *Hodge Theory in Combinatorics*.
- 2015 – 2020 Ontario Early Research Award, *Tropical Geometry: Structure and Degeneration*, \$150,000, declined after 2016.
- 2012 – 2017 NSERC Discovery Grant, *Tropical Geometry: Foundations and Combinatorial Applications*, \$100,000, declined after 2016.
- 2011 – 2014 University of Waterloo Start-up Grant, \$30,000
- 2010 – 2011 National Science Foundation Institutes Postdoc
- 2010 Faculty Excellence Award for mentorship in the Ronald E. McNair Post-baccalaureate Achievement Program. Awarded for mentoring of José Rodríguez, University of Texas. Resulted in senior thesis published in *Journal of Number Theory*.

## Education

- 2004 Ph.D. Stanford University, Mathematics
- 1999 B.S. The Ohio State University, Mathematics

## Research interests

Tropical geometry, arithmetic geometry, algebraic geometry, combinatorial algebraic geometry, matroid theory, rational points, enumerative geometry, moduli spaces, geometric combinatorics, intersection theory, toric varieties, deformation theory

## Publications

1. *Periods of Abelian Varieties, Fontaine Rings, and Buium–Manin theory* (with Taylor Dupuy, Daniel Litt, Joseph Rabinoff, and David Zureick-Brown), in preparation.
2. *Total  $p$ -differentials, Deligne–Illusie classes, and Gauss–Manin connections* (with Taylor Dupuy, Joseph Rabinoff, and David Zureick-Brown), in preparation.
3. *Higher Cycle Operations and a Unipotent Torelli theorem for graphs* (with Raymond Cheng), [arXiv:1709.01175](https://arxiv.org/abs/1709.01175).
4. *What is Tropical Geometry?*, Notices of the AMS, **64**:380–382, 2017.
5. *Hodge Theory of Matroids* (with Karim Adiprasito and June Huh), Notices of the AMS, **64**:26–30, 2017.
6. *Newton–Okounkov Bodies over Discrete Valuation Rings* (with Stefano Urbinati), [arXiv:1609.06036](https://arxiv.org/abs/1609.06036), Int. Math. Res. Not., accepted pending revisions.
7. *Diophantine and tropical geometry, and uniformity of rational points on curves* (with Joseph Rabinoff and David Zureick-Brown), [arXiv:1606.09618](https://arxiv.org/abs/1606.09618), by invitation to the Proceedings volume of AMS 2015 Summer Research Institute on Algebraic Geometry, accepted.
8. *Hodge theory on combinatorial geometries* (with Karim Adiprasito and June Huh), [arXiv:1511.02888](https://arxiv.org/abs/1511.02888), submitted.
9. *Uniform bounds for the number of rational points on curves of small Mordell–Weil rank* (with Joseph Rabinoff and David Zureick-Brown). Duke Math. J., **165**:3189–3240, 2016.
10. *Tropical geometry, the motivic nearby fiber and limit mixed Hodge numbers of hypersurfaces (with Alan Stapledon)*. Research in the Mathematical Sciences **3**:10, 2016.
11. *Local  $h$ -polynomials, invariants of subdivisions, and mixed Ehrhart theory* (with Alan Stapledon). Adv. Math., **286**:181–239, 2016.
12. *Matroid theory for algebraic geometers*, [arXiv:1409.3503](https://arxiv.org/abs/1409.3503), Simons Symposium volume, accepted, 74pp.
13. *A non-abelian analogue of Whitney’s 2-isomorphism theorem*. J. Algebraic Combinatorics, **39**:683–690, 2014.
14. *The Chabauty–Coleman bound at a prime of bad reduction and Clifford bounds for geometric rank functions*. (with David Zureick-Brown) Compositio Math., **149**:1818–1838, 2013.
15. *Tropical Realization Spaces for Polyhedral Complexes*. Proceedings of the Workshop on Tropical Geometry. Contemp. Math., **589**:235–251, 2013.
16. *Lifting Tropical Curves in Space and Linear Systems on Graphs*. Adv. Math., **230**:853–875, 2012.
17. *Obstructions to Lifting Tropical Curves in Hypersurfaces* (with Tristram Bogart). SIAM J. Discrete Math., **26**:1050–1067, 2012.
18. *Log-concavity of characteristic polynomials and the Bergman fan of matroids*(with June Huh). Math. Ann., **354**:1103–1116, 2012.

19. *Tropical Geometry and the Motivic Nearby Fiber* (with Alan Stapledon). *Compositio Math.*, **148**:269–294, 2012.
20. *Monodromy Filtrations and the Topology of Tropical Varieties* (with David Helm). *Canadian Journal of Math.*, **64**:845–868, 2011.
21. *Realization Spaces for Tropical Fans* (with Sam Payne). *Combinatorial Aspects of Commutative Algebra and Algebraic Geometry*, vol. 6, 2011.
22. *Tropical Intersection Theory from Toric Varieties*. *Collect. Math.*, **63**:29–44, 2012.
23. *The tropical  $j$ -invariant* (with Hannah Markwig and Thomas Markwig). *LMS J. Comput. Math.*, **12**:275–294, 2009.
24. *A Tropical Toolkit*. *Expo. Math.*, **27**:1–36, 2009.
25. *The  $j$ -invariant of a plane tropical cubic* (with Hannah Markwig and Thomas Markwig). *Journal of Algebra*, **320**:3832–3848, 2008.
26. *Piecewise polynomials, Minkowski weights, and localization on toric varieties* (with Sam Payne). *Algebra Number Theory*, **2**:135–155, 2008.
27. *An Algebraic Formulation of Symplectic Field Theory*. *Journal of Symplectic Geometry*, **5**:385–437, 2007.

### Conferences and Seminars Organized

- 2014 Dec Canadian Mathematical Society Winter Meeting, Scientific Session, Toric and Combinatorial Algebraic Geometry (with Jihyeon Jessie Yang)
- 2014 Mar Banff International Research Station: Workshop on Specialization of Linear Series for Algebraic and Tropical Curves (with Matthew Baker, Lucia Caporaso, Maria Angelica Cueto, and Sam Payne)
- 2012 June Society for Industrial and Applied Mathematics Discrete Math 12 Meeting, Halifax: Mini-symposium on Combinatorial Algebraic Geometry
- 2005 Spr Duke University: Tropical Geometry Seminar (with Christian Haase).

### Invited Talks

- 2017 June Arithmetic Aspects of Explicit Moduli Problems, Banff, Canada: *Buium-Manin theory and periods of Abelian varieties*
- May Simons Symposium, Non-Archimedean and Tropical Geometry, Elmau, Germany: *Uniform bounds on torsion points on curves*.
- Apr University of Vermont, Number theory seminar: *Uniform bounds on rational and torsion points on curves*.
- 2016 Dec Tata Institute for Fundamental Research, Mumbai, India: *Uniform bounds on rational and torsion points on curves*.
- Dec International Conference of The Indian Mathematics Consortium (TIMC), Varanasi, India: *Hodge theory in Combinatorics*.
- Nov University of Texas, Algebraic Geometry Seminar,: *Hodge theory in Combinatorics*.

- Oct AMS Special Session on Chip-Firing and Divisors on Graphs and Complexes, Minneapolis, MN: *Okounkov bodies and linear systems on graphs*.
- Oct Fields Institute Workshop on Convexity in Algebraic Geometry, Toronto, ON: *Okounkov bodies and tropical geometry*.
- Apr University of Rochester, Wing Colloquium: *Hodge theory on matroids*.
- Apr University of Rochester, Number Theory Seminar: *Uniform bounds on rational points on curves of low Mordell-Weil rank*.
- Mar MFO Workshop on Toric Varieties, Oberwolfach: *Hodge theory in combinatorics*.
- Mar Special Session on Interactions Between Algebraic and Tropical Geometry, Spring Southeastern Sectional Meeting, Athens, GA: *Tropical geometry and torsion point bounds*.
- Feb Emory University, Algebra Seminar: *Hodge theory on matroids*.
- Jan Mini-conference on Hodge theory and Matroids, Atlanta, GA, Lecture series: *Hodge theory on matroids*.
- Jan Georgia Tech, Colloquium: *Hodge theory on matroids*.
- Jan AMS Special Session on Algebraic and Topological Methods in Combinatorics, Joint Math Meetings, Seattle, WA: *Hodge theory on matroids*.
- 2015 Oct York University, Applied Algebra Seminar: *Hodge theory on matroids*.
- Sep University of Maryland, Colloquium: *Hodge theory on matroids*.
- Aug University of Oregon, Workshop on Positivity in Combinatorial Algebraic Geometry, Lecture series: *Hodge theory for matroids*
- July AMS 2015 Summer Research Institute on Algebraic Geometry, Salt Lake City, UT: *Uniform bounds on rational points on curves of low Mordell-Weil rank*. Invited to submit to the **Proceedings** volume.
- July Rational Points 2015, Schney, Germany: *Uniform bounds on rational points on curves of low Mordell-Weil rank*.
- June University of Padova, Number Theory Seminar: *Uniform bounds on rational points on curves of low Mordell-Weil rank*.
- June University of Padova, Lecture series: *Introduction to Tropical Geometry*.
- May Tropical Geometry in the Tropics, IMPA, Rio de Janeiro: *Hodge theory in combinatorics*.
- Apr Cornell University, Number Theory Seminar: *Geometric rank functions and rational points on curves*.
- Apr Cornell University, Discrete Geometry and Combinatorics Seminar: *Hodge theory in combinatorics*.
- Feb Georgia Tech, Algebra Seminar: *Uniform bounds on rational points on curves of low Mordell-Weil rank*.
- Feb Emory University, Algebra Seminar: *Lattice point counting and the Hodge theory of degenerating hypersurfaces*.
- Feb MFO Workshop on Geometric and Algebraic Combinatorics, Oberwolfach: *Tropical Laplacians and Curve Arrangements on Surfaces*.

- Jan Combinatorial Algebra meets Algebraic Combinatorics, Kingston, ON: *Tropical Laplacians and Curve Arrangements on Surfaces*.
- 2014 Oct AMS Special Session on Combinatorics and Algebraic Geometry, San Francisco, CA, *Ehrhart theory of subdivisions and mixed Hodge theory*.
- Oct Topological Combinatorics and Combinatorial Commutative Algebra Conference, San Francisco State University, *Log-concavity of Characteristic Polynomials and toric intersection theory*.
- Feb Emory University, Algebra Seminar, *Lifting tropical curves and linear systems on graphs*.
- Feb Georgia Tech, Algebra Seminar, *Tropical Laplacians and the Colin de Verdiere number of graphs*.
- Jan AMS Special Session on Tropical and Nonarchimedean Analytic Geometry, Joint Math Meetings, Baltimore, MD: *p-adic integration on curves in the bad reduction case*.
- 2013 Oct AMS Special Session on Algebraic Cycles and Coherent Sheaves, St. Louis, MO: *The Hodge Theory of Degenerating Hypersurfaces*.
- Aug Society for Industrial and Applied Mathematics Conference on Applied Algebraic Geometry, Ft. Collins, CO, *Tropical Geometry and the Hodge theory of hypersurfaces*.
- May University of Maryland, Algebra Seminar, *Log-concavity of Characteristic Polynomials and toric intersection theory*.
- Apr Simons Symposium, Non-Archimedean and Tropical Geometry, St. John, USVI. *Matroids in tropical geometry*.
- Mar The Ohio State University, Combinatorics Seminar, *Log concavity of characteristic polynomials and Bergman complexes*.
- Feb Emory University, Algebra Seminar, *The non-Abelian Whitney theorem and the Higher Pairing on Graphs*.
- Feb Georgia Tech, Algebra Seminar, *Log-concavity of Characteristic Polynomials and toric intersection theory*.
- Feb Yale University, Algebraic and Tropical Geometry Seminar, *Log concavity, the Hodge index theorem, and combinatorial Okounkov bodies*.
- Jan AMS Special Session on Tropical Geometry, Joint Math Meetings, San Diego, CA: *Geometric rank functions and rational points on curves*.
- 2012 Oct Colloquium, Western University: *Combinatorial Abstractions and Tropicalization*.
- Sep Algebraic Geometry Seminar, University of Utah: *Lifting Tropical Curves and Linear Systems on Graphs*.
- Jul Third Workshop on Graphs and Matroids, Maastricht, the Netherlands: *Ardila-Klivans Classes for Matroids*.
- Jun SIAM Discrete Math '12, Halifax, NS: *Log-Concavity of Characteristic Polynomials and Tropical Intersection Theory*.
- Apr Stony Brook University, Algebra Geometry and Physics Seminar: *Lifting Tropical Curves and Linear Systems on Graphs*.
- Apr ICMS Tropical Geometry Workshop, Edinburgh, Scotland: *Geometric rank functions and rational points on curves*.

- Mar AMS Special Session on Combinatorics, Tampa, FL: *Log-concavity of Characteristic Polynomials and tropical intersection theory.*
- Feb Emory University, Algebra Seminar: *Log-concavity of Characteristic Polynomials and toric intersection theory.*
- 2011 Dec Workshop on Tropical Geometry, Castro Urdiales, Spain: *Log-concavity of Characteristic Polynomials and tropical intersection theory.*
- Nov University of Waterloo: *Log-concavity of characteristic polynomials and intersection theory on toric varieties.*
- Oct North Carolina State University, Algebraic and Combinatorics Seminar: *Log-concavity of Characteristic Polynomials and tropical intersection theory.*
- Oct Queen's University, Algebraic Geometry Seminar: *Log-concavity of Characteristic Polynomials and toric intersection theory.*
- Apr Johns Hopkins University, Algebraic Geometry and Number Theory Seminar: *Lifting Tropical Curves and Linear Systems on Graphs.*
- Jan AMS Special Session on Combinatorial Algebraic Geometry, New Orleans, LA: *Lifting Tropical Curves and Linear Systems on Graphs.*
- 2010 Dec University of California-Berkeley, Mirror Symmetry Working Group: *The Combinatorics of Kontsevich-Soibelman Wall-Crossing.*
- Nov San Francisco State University, Geometry Seminar: *Lifting Tropical Curves and Linear Systems on Graphs.*
- Nov AMS Session on Applications of Non-Archimedean Geometry, Richmond, VA: *Lifting Tropical Curves and Linear Systems on Graphs.*
- Oct Georgia Tech, Tropical Geometry Seminar: *Lifting Tropical Curves.*
- Sep Texas A&M University, Algebraic Geometry Seminar: *Lifting Tropical Curves and Linear Systems on Graphs.*
- Sep University of Texas, Geometry Seminar: *Lifting Tropical Curves and Linear Systems on Graphs*
- Aug Australian National University, Seminar: *Lifting Tropical Curves in Hypersurfaces.*
- Jul Australian National University, Mathematics and Physics on the Borderline between Algebraic and Differential Geometry: *Lifting Tropical Curves and Linear Systems on Graphs.*
- Jun SIAM Discrete Math '10, Austin, TX: *Lifting Tropical Curves.*
- Apr University of British Columbia, Algebraic Geometry Seminar: *Lifting Tropical Curves.*
- Mar Texas A&M University, Algebraic Geometry Seminar: *Lifting Tropical Curves in Subvarieties.*
- Feb University of Kentucky, Combinatorics Seminar: *Lifting Tropical Curves in Subvarieties.*
- Feb University of California-San Diego, Conference on Tropical Geometry and Mirror Symmetry: *Lifting Tropical Curves in Subvarieties.*
- 2009 Oct MSRI, Tropical Geometry in Combinatorics and Algebra: *Realization Spaces of Tropical Fans.*
- Sep MSRI, Tropical Program: *Counting Tropical Curves on Abelian Surfaces.*

- Apr University of Texas: *Counting Tropical Curves on Abelian Surfaces.*
- Apr The Ohio State University Undergraduate Math Club: *Tropical Geometry.*
- Apr The Ohio State University, Algebraic Geometry Seminar: *Counting Tropical Curves on Abelian Surfaces.*
- 2008 Oct University of Texas Undergraduate Math Club: *Realizability of Polytopes.*
- Jun Real and Tropical Algebraic Geometry, EPFL, Lausanne: *Tropical Geometry and Monodromy.*
- Apr University of Michigan: *Tropical Geometry and Monodromy.*
- Feb Texas A&M University: *Monodromy of Tropical Curves.*
- 2007 Dec MFO Workshop on Tropical Geometry, Oberwolfach: *Piecewise Polynomials in Tropical Geometry.*
- Nov Rice University: *The  $j$ -invariant of a Plane Tropical Cubic.*
- Oct University of Texas: *Tropical Geometry.*
- Oct AMS Session on Toric Varieties, Rutgers: *Piecewise Polynomials and Localization on Toric Varieties.*
- Jun Stanford University, New Perspectives and Challenges in Symplectic Field Theory: *An Algebraic Formulation of Symplectic Field Theory.*
- Feb North American Workshop on Tropical Geometry, Banff: *Equivariant Cohomology and Localization in Tropical Geometry.*
- 2006 Nov Stanford University: *Tropical Invariants from the Secondary Fan.*
- Sep Duke University Graduate/Faculty Seminar: *Tropical Geometry.*
- Apr Brown University: *Tropical Degree of Cones in the Secondary Fan.*
- 2005 Apr Princeton University: *Relative Gromov-Witten Invariants and Symplectic Field Theory.*
- Feb Duke University: *A Formalism for Relative Gromov-Witten Invariants.*
- 2003 Nov Stanford University: *Topological Recursion Relations by Localization.*

### Mentoring Activities

#### Postdocs Supervised

2013 – 2015 Anna Bertiger, co-supervised with Kevin Purbhoo and David Wagner.

#### Graduate Research Supervised

2014 – 2016 *Subdividing the  $cd$ -index of Eulerian posets*, Patrick Dornian, master's thesis for M.Math., University of Waterloo.

2013 – 2014 *Ehrhart Theory and polytope valuations*, Ricci Tam, master's thesis for M.Math., University of Waterloo.

2007 – 2012 *Tropical Geometry and Topological Quantum Field Theory*, Brian Katz (now an Associate Professor at Augustana College), co-supervised doctoral student, University of Texas.

#### Undergraduate Research Supervised

- 2016 *The Unipotent Torelli Theorem for Graphs*, Raymond Cheng, University of Waterloo.
- 2013 *The Hodge index theorem for small matroids*, Theo Belaire, URA, University of Waterloo.
- 2013 *The tropical rank functions for some polytopes*, Ricci Tam, URA, University of Waterloo.
- 2012 *Rank functions for polytopes*, Manuel Candales, URA, University of Waterloo.
- 2008 – 2010 *The Newton Polytope of Belyi Polynomials*, José Rodriguez (later attended graduate school at UC-Berkeley; now a postdoc at University of Chicago). Mentored under the Ronald E. McNair Post-baccalaureate Achievement Program, University of Texas.
- 2008 *Isospectral Graphs*, Peter Glaze. Summer Reading/Research Project, University of Texas.
- 2006 – 2007 *Application of discrete geometry to the construction of Laurent-rational zeros*, Charles Staats (future University of Chicago graduate student). Mentored under Program for Research for Undergraduates, Duke University.

## Teaching Activities

### Courses Designed

- 2015 *Polyhedral Combinatorics* (graduate topics course), University of Waterloo.
- 2012 *Toric Varieties* (graduate topics course), University of Waterloo.
- 2006 *Tilings, Symmetry, and Geometry* (freshman seminar), Duke University.

### Courses Taught

- 2017 *Linear Algebra*, The Ohio State University.
- 2016 *Foundations of Higher Mathematics*, The Ohio State University.  
*Introduction to Combinatorics*, University of Waterloo.
- 2015 *Combinatorial Enumeration*, University of Waterloo.  
*Calculus 3 for Honours Mathematics*, University of Waterloo.
- 2014 *Introduction to Combinatorics*, University of Waterloo.  
*Linear Algebra 1 for Honours Mathematics*, University of Waterloo.
- 2013 *Algebraic Enumeration*, University of Waterloo.  
*Introduction to Combinatorics*, University of Waterloo.
- 2012 *Combinatorial Enumeration*, University of Waterloo.  
*Introduction to Combinatorics*, University of Waterloo.
- 2010 *Linear Algebra*, University of Texas.  
*Matrix Computations*, University of Texas.
- 2009 *Introduction to Number Theory* (Moore Method), University of Texas.
- 2008 *Seq., Series, and Multi. Calc.*, University of Texas.



- 2007 *Algebraic Structures I*, University of Texas.  
*Introduction to Number Theory*, University of Texas.  
*Linear Algebra*, Duke University.
- 2006 *Multivariable Calculus*, Duke University.  
*Algebraic Topology*, Duke University.
- 2005 *Multivariable Calculus* ( $\times 2$ ), Duke University.  
*Multivariable Calculus* ( $\times 2$ ), Duke University.
- 2004 *Single Variable Calculus II*, Duke University.

### Journals Refereed

Acta Mathematica  
Advances in Geometry  
Advances in Mathematics  
Arkiv for Matematik  
Algebra Number Theory Journal  
The American Mathematical Monthly  
Annals of Combinatorics  
Bulletin of the Hellenic Mathematical Society  
Collectanea Mathematica  
Communications in Number Theory and Physics  
Compositio Mathematica  
Discrete and Computational Geometry  
Discrete Mathematics  
Duke Mathematical Journal  
European Journal of Combinatorics  
International Mathematics Research Notices  
Journal für die Reine und Angewandte Mathematik (Crelle's)  
Journal of Combinatorial Theory, Series A  
Journal of the London Mathematical Society  
manuscripta mathematica  
Portugaliae Mathematica  
Research in Mathematical Sciences

Date of CV: November 2016.