Nathan K. Pflueger

Contact

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Professional Positions

- **Amherst College**
  - Associate Professor of Mathematics 7/2024-present
  - Assistant Professor of Mathematics 7/2017-6/2024
- **Brown University**
  - Tamarkin Assistant Professor of Mathematics 9/2014-6/2017

Research interests

- Algebraic geometry, particularly algebraic curves.
- Young tableaux and applications in Brill-Noether theory.
- Tropical curves and linear series.

Education

- **Harvard University** 9/2009-5/2014
  - Ph.D. in Mathematics, May 2014.
  - Adviser: Joe Harris.
  - Thesis: *Regeneration of elliptic chains with exceptional linear series.*
- **Stanford University** 9/2005-6/2009
  - B.S. Mathematics with Honors and Minor in Computer Science, June 2009.
  - J. E. Wallace Sterling Award (for top 25 graduating students in Humanities and Sciences).
  - Spent Autumn 2007 in Hungary at Budapest Semesters in Mathematics.

Preprints and papers under review

1. *Twice-Marked Banana Graphs & Brill-Noether Generality* (with N. Solomon). 34 pages. Preprint (2022).
2. *An extended Demazure product on integer permutations via min-plus matrix multiplication.* 26 pages. Preprint (2022).
3. *(Hurwitz–)Brill–Noether general marked graphs via the Demazure product.* 14 pages. Preprint (2022).

Publications

4. *Versality of Brill-Noether flags and degeneracy loci of twice-marked curves.* 28 pages. To appear in *Algebraic Geometry,* June 2025.
5. *Weierstrass semigroups from cyclic covers of hyperelliptic curves* (with E. Cotterill and N. Zhang). Bulletin of the Brazilian Mathematical Society, New Series 54, 37 (2023).
6. *Linear series with $\rho < 0$ via thrifty lego-building.* Journal für die reine und angewandte Mathematik (Crelle), no. 797 (2023), pp. 193-228.
7. *Relative Richardson Varieties* (with M. Chan). Mathematical Proceedings of the Cambridge Philosophical Society, 175:1 (2023), 161–186.

8. *Combinatorial relations on skew Schur and skew stable Grothendieck polynomials* (with M. Chan). Algebraic Combinatorics Volume 4 (2021) no. 1 p. 175-188.
9. *Euler characteristics of Brill-Noether varieties* (with M. Chan). Transactions of the AMS 374:3 (2021) 1513-1533.
10. *Weierstrass semigroups on Castelnuovo curves.* Journal of Algebra 582 (2021) 117-135.
11. *The Gieseker-Petri theorem and imposed ramification* (with M. Chan and B. Osserman). Bulletin of the London Mathematical Society 51:6 (2019) 945-960.
12. *On non-primitive Weierstrass points.* Algebra and Number Theory 12:8 (2018) 1923-1947.
13. *Genera of Brill-Noether curves and staircase paths in Young tableaux* (with M. Chan, A. López Martìn, and M. Teixidor i Bigas). Transactions of the American Mathematical Society 370 (2018), 3405-3439.
14. *Brill-Noether varieties of k-gonal curves.* Advances in Mathematics 312 (2017) 46-63.
15. *Special divisors on marked chains of cycles.* Journal of Combinatorial Theory, Series A 150 (2017) 182-207.
16. *Bitangents of tropical plane quartic curves* (with M. Baker, Y. Len, R. Morrison, and Q. Ren). Mathematische Zeitschrift 282:3 (2016) 1017-1031.
17. *Graph reductions, binary rank, and pivots in gene assembly.* Discrete Applied Mathematics 159:17 (2011) 2117-2134.

Teaching

- **Amherst College**
  - Spring 2025:
    Math 250, Number theory
    Math 272, Linear algebra with applications
  - Fall 2024:
    Math 252, Cryptography
    Math 410, Galois theory
  - Spring 2024:
    Math 281, Combinatorics
    Math 385, Mathematical Logic
  - Fall 2023:
    Math 111, Introduction to the calculus
  - Spring 2023:
    Math 121, Intermediate calculus
    Math 252, Cryptography
  - Spring 2022:
    Math 252, Cryptography
    Math 271, Linear algebra
    Math 498, Senior honors
  - Summer and Fall 2021 (while on leave):
    Math 498, Senior Honors
  - Spring 2020: Math 220, Mathematical Reasoning and Proof
    Math 252, Cryptography
    Math 498, Senior honors
    Math 390, Independent study on group theory and puzzles
    Unofficial supervisor of a U. Mass graduate reading course on tropical geometry
  - Fall 2019: Math 350, Groups, rings, and fields
    Math 272, Linear algebra with applications

Math 498, Senior honors
  - Spring 2019: Math 272, Linear algebra with applications
    Math 252, Cryptography (new course)
    Math 490, Independent study on Commutative Algebra
  - Fall 2018: Math 350, Groups, rings, and fields
    Math 105, Calculus with algebra
  - Spring 2018: Math 272, Linear algebra with applications
    Math 121, Intermediate calculus
  - Fall 2017: Math 272, Linear algebra with applications
    Math 111, Introduction to the calculus
- **Brown University**
  - Spring 2017: Algebraic Geometry II
  - Fall 2016: Cryptography
    Algebraic Geometry I
  - Spring 2016: Algebraic Geometry II
  - Fall 2015: Cryptography
  - Spring 2015: Introduction to number theory
    Calculus I
  - Fall 2014: Calculus II for physics and engineering
- **Harvard University**
  - Fall 2013: Introduction to Calculus
    - Wrote comprehensive lecture notes, still in use by students and professors as a course accompaniment.
  - Spring 2013: Course Assistant for Tropical Geometry
  - Spring 2012: Teaching Fellow for "Fat Chance" (basic probability course for non-majors)
  - Fall 2011: Integeration, Series, and Differential Equations.
    - Wrote comprehensive lecture notes, still in use by students and professors as a course accompaniment.
- **The Math Circle** (extra-curricular math program for Boston-area children)
  - Spring 2016: taught students ages 13 to 15.
  - Academic year 2013-2014: taught students ages 13 to 18.
  - July 2014 and July 2016: co-organized a math circle teacher training institute in South Bend, IN.
  - Academic year 2012-2013: taught students ages 13 to 18.
  - Academic year 2011-2012: taught students ages 7 to 9.
- **Budapest Semesters in Mathematics**
  - 2010-2013: Coordinated and a coached teams of American students to compete in the International Mathematics Competition for University Students in Blagoevgrad, Bulgaria. Wrote detailed preparation material on the competition problems.
- **Stanford University computer science department**
  - Spring 2009: section leader for Programming Abstractions and Methodology (C++).
  - Winter 2009: section leader for Programming Abstractions (C++).
  - Fall 2008: section leader for Programming Abstractions and Methodology (C++).
  - Spring 2008: course helper for Programming Methodology (Java).
  - Winter 2008: section leader for Programming Abstractions (C++).
  - Spring 2007: section leader for Programming Methodology (Java).
- **Stanford University mathematics department**
  - 2006-2009: Tutor for linear algebra and multivariable calculus.

– 2005-2006: Course developer (wrote assignments and exams) for distance learning Calculus C course (through the Education Program for Gifted Youth).

Service

- Amherst College Fellowship Committee (2023-present; chair since 2024)
- Co-organizer for the Valley Geometry Seminar (2018-present).
- Co-organizer for the Bi-annual Tropical and Algebraic Meetings of Brown and Yale (2014-present), including serving at primary organizer of the Spring 2019 meeting at Amherst College.
- Served as referee for papers in the following mathematics journals: Advances in Mathematics; Algebra and Number Theory; Algebraic Combinatorics; Communications in Algebra; Forum of Math Pi; International Mathematics Research Notices; Inventiones Mathematicae; Journal of the American Mathematical Society; Journal for Pure and Applied Algebra; Mathematische Zeitschrift; Notices of the American Mathematical Society.
- Organizer of the Walker Prize Examination at Amherst, 2022-2023.
- Math Comprehensive exam / honors qualifying exam co-coordinator (2019-2020)
- Co-organizer of the conference "Ideals, Varieties, and Applications," including serving as Co-PI on an NSF grant funding the conference (June 2019).
- Faculty computing committee member (2019-2020).
- Title IX review committee member (2018-2019).
- Math-major advising (2018-present).
- College advising (2018-present).
- VAP Search commitee member (2019).
- Department list keeper (2018-2019)
- Co-organizer of Putnam Exam preparation / problem-solving sessions (Fall 2018 and 2019).
- Chair of Connecticut Valley Colloquium at Amherst College (Fall 2018).
- Assist in grading of Mathematics Comprehensive Exam (2018-present).
- Minutes-taker for Mathematics and Statistics department meetings (2017-2018).
- Co-organizer for the Brown algebraic geometry seminar (2014-2017).
- Served as assistant coach for the San Francisco Bay Area team to the ARML mathematics competition (2008,2009).

Invited talks

- November 2024, Georgia Tech Algebra seminar.
- September 2024, AMS Central Sectional, special sessions: A Showcase of Algebraic Geometry at Undergraduate Institutions; and Non-Archimedean, Algebraic, Tropical Geometry and applications.
- April 2024, Williams College Faculty Colloquium.
- March 2024, U. Kentucky Algebra Seminar.
- July 2023, BIRS workshop on Curves: Algebraic, Tropical, and Logarithmic, in Banff, Alberta.
- May 2023, U. Mass. Combinatorics Seminar.
- April 2023, Harvard-MIT Combinatorics Seminar.
- June 2022, Workshop on Combinatorial Algebraic Geometry, ICTS Bengaluru (virtual).
- March 2022, Special Session on Moduli Spaces in Algebraic and Tropical Geometry, AMS Eastern Sectional Meeting.
- February 2022, Goethe University Frankfurt Algebra and Geometry Seminar (virtual).
- June 2021, Three-part minicourse on Tropical Curves (hosted by Fudan U., Shanghai).
- April 2021, Algebra, Geometry, and Combinatorics Day (hosted by Notre Dame).
- November 2019, Valley geometry seminar (hosted by U. Massachusetts).
- October 2019, Stanford algebraic geometry seminar.

- April 2019, Brown algebraic geometry seminar.
- April 2019, Williams College faculty seminar.
- June 2017, U.C. Irvine number theory seminar.
- March 2017, Brown discrete math seminar.
- February 2017, Valley geometry seminar (at U. Massachusetts).
- May 2016, *Brill-Noether Special Chains of Loops.* Algebraic, Tropical, and Nonarchimedean Analytic Geometry of Moduli Spaces, Oaxaca, Mexico.
- March 2016, Georgia Tech algebraic geometry seminar.
- March 2016, Special session in Interactions Between Algebraic and Tropical Geometry, AMS Spring Sectional Meeting, Athens, GA.
- October 2015, Brown algebraic geometry seminar.
- June 2015, Special Session in Enumerative and Combinatorial Methods in Moduli Theory, AMS-EMS-SPM International Meeting, Porto, Portugal.
- October 2014, Special session on combinatorics and algebraic geometry, AMS Fall Sectional Meeting, San Francisco, CA.
- February 2014, Rice algebraic geometry seminar.
- January 2014, *Towards a tropical Castelnuovo-Severi inequality.* Special session on tropical and non-archimedean geometry, Joint Mathematics Meeting.
- November 2013, Harvard-MIT algebraic geometry seminar.
- November 2013, Brown algebraic geometry seminar.
- October 2013, U. Wisconsin algebraic geometry seminar.
- April 2013, Yale algebraic and tropical geometry seminar.

Honors and awards

- NSF Graduate Research Fellowship, 2009-2013.
- Certificate of Distinction in Teaching, Harvard University, Spring 2012.
- Barry M. Goldwater Scholarship, awarded 2007.
- Putnam Mathematics Competition: 24th place (2008)
- International Mathematics Competition for University Students (Blagoevgrad, Bulgaria): 40th place (2008).
- Google Codejam competition: advanced to semifinal round (top 500 contestants) (2009,2010,2012).
- Boothe Prize for Undergraduate Writing: Finalist (Autumn 2005, Winter 2006), 2nd place (Autumn 2005). Prize selects the best essay written for the freshman Introduction to the Humanities requirement at Stanford.
- Hester-Franklin Prize for best original paper written in first-year French (2009).

Other employment

- **University of Minnesota, Duluth** (funding from NSF) Summer 2008,2009,2010
  R.E.U. in Combinatorics Duluth, MN
  - 2009: Student participant.
  - 2010 and 2011: Graduate student research adviser.
- **D.E. Shaw and Co.** Summer 2007
  Quantitative Analyst Intern, Futures Group New York, NY
  - Researched, implemented, and tested computational methods for correlating high-frequency financial instruments.
  - Developed one chosen method into a versatile set of Java and Perl programs for use in research within the hedge fund.
  - Wrote several internal reports detailing the mathematical techniques I investigated.

- **University of Washington** (funding from National Science Foundation) Summer 2006
  R.E.U. in Inverse Problems for Electrical Networks Seattle, WA

Updated: January 21, 2025