

JAKE KETTINGER

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RESEARCH INTERESTS

My research interests are in the intersection of algebraic geometry with combinatorics, dynamics, and number theory. I have researched asymptotic resurgence of symbolic powers of ideals of point configurations with Brian Harbourne and Frank Zimmitti. I have also researched oriented Steiner triple systems and their applications to dynamics and linear algebra with Chris Peterson. Right now I am interested in geproci configurations of points in projective space, configurations of lines and hyperplanes in projective space, and the groupoids that arise therefrom. My research is both over $\mathbb{C}$ and fields of positive characteristic. I have found new configurations of geproci sets of a kind that does not exist in characteristic 0, and I have applied quasi-elliptic fibrations to the study of geproci sets in characteristic 2. I am also interested in studying configurations of points whose ideals provide counterexamples to the Harbourne conjecture.

EDUCATION

University of Nebraska - Lincoln *May 2023*
PhD in Mathematics
Thesis Advisor: Brian Harbourne
Thesis Title: On the superabundance of singular varieties in positive characteristic

University of Nebraska - Lincoln *May 2019*
Masters in Mathematics

University of Wisconsin - Madison *May 2017*
Bachelors in Mathematics

AWARDS

I am a US Junior Oberwolfach Fellow.

I have been awarded the NSF travel grant DMS-2230648 to speak at a conference on Asymptotic Invariants of Linear Systems and Homogeneous Ideals with Symmetries in Oberwolfach, Germany.

I have been awarded the Linda Bors Fellowship Award in the Fall of 2021. Awarded annually to 3 UNL graduate students based on scholarship.

PAPERS AND PREPRINTS

On the algebraic properties of the Böröczky configuration *with Shahriyar Roshan-Zamir, Journal of Algebra* 713. 10.1016/j.jalgebra.2026.07.023 (2026), 20 pp.

The dynamics of the Hesse derivative on the j -invariant, *Journal of Computational Algebra* 17 (2026), 7 pp. DOI <https://doi.org/10.1016/j.jaca.2026.100043>.

The geproci property in positive characteristic. *Proceedings of the American Mathematical Society* 152 (2024) 3229-3242, 15 pp. DOI <https://doi.org/10.1090/proc/16809>

Extreme values of the resurgence for homogeneous ideals in polynomial rings *with Brian Harbourne and Frank Zimmitti. J. Pure Appl. Algebra* 226 (2022), no. 2, Paper No. 106811, 16 pp.

The classification of quasi-elliptic fibrations and unexpected plane cubics in characteristics 2 and 3. arXiv:2510.06365 (2025), 29 pp. Accepted for publication by *Advances in Geometry*.

Collinearly complete sets and finite subgroups from configurations of skew n -planes in $\mathbf{P}_K^{2n+1}$. arXiv:2607.11259 (2026), 22 pp. Submitted to the *Mediterranean Journal of Mathematics*.

Finite groupoids of configurations of lines in $\mathbb{P}_{\mathbb{C}}^3$. arXiv:2511.05454 (2025), 24 pp. Submitted to the *Indagationes Mathematicae*.

Oriented Steiner Triple Systems, Steiner Products, and Dynamics with Chris Peterson. arXiv:2507.09396 (2025), 24 pp. Submitted to the *International Journal of Algebra and Computation*.

TALKS AS INVITED SPEAKER

Hyperplane Configurations, Subtractive Sets, their Groupoids, and their Blowups. *September 2026*
Mini Workshop in Asymptotic Invariants of Linear Systems and Homogeneous Ideals with Symmetries at Oberwolfach, Germany.

Groupoids of Configurations of Lines. *March 2026*
AMS Spring Western Sectional Meeting, Special Session on Commutative Algebra, Algebraic Geometry and Applications in Boise, ID

Groupoids of Configurations of Lines. *November 2025*
Algebra and Combinatorics Seminar, at Tulane University

Groupoids of Configurations of Lines. *June 2025*
Workshop on Weak and Strong Lefschetz Properties across Mathematics, at the Sophus Lie Conference Center in Nordfjordeid, Norway

The Dynamincs of the Hesse Derivative on the j -invariant *October 2024*
Front Range Number Theory Day, hosted by Colorado State University

New Perspectives on Geproci Sets *July 2024*
UMI AMS Joint Meeting in the session on Configurations in projective spaces and related research in commutative algebra and algebraic geometry at Università degli Studi di Palermo

New Perspectives on Geproci Sets *June 2024*
The workshop on Algebraic Geometry, Computational Commutative Algebra and their effectiveness applications at Galatasaray University, Istanbul, Turkey

New Perspectives on Geproci Sets *May 2024*
AMS 2024 Spring Western Sectional Meeting in San Francisco, CA

New Perspectives on Geproci Sets *April 2024*
Invited to speak at New Mexico State University

New Perspectives on Geproci Sets *October 2023*
Special Session on Varieties with Unexpected Hypersurfaces, Geproci Sets and their Interactions, AMS Fall Central Sectional Meeting in Omaha, NE

COMMUNITY INVOLVEMENT

I have refereed papers for the *Journal of Algebraic Combinatorics*.

I have started and organized a Math in Spanish seminar at Colorado State University, where graduate students can practice giving and listening to math talks in Spanish.

I presented a poster at the Uwefest conference at Notre Dame University held in honor of Uwe Nagel in August 2024.

I presented a colloquium talk at Boise State University in January 2024.

I presented a poster at the Brianfest conference at UNL held in honor of Brian Harbourne in August 2023.

I have attended every KUMUNU and URiCA conference (formerly known as KUMUNU Jr.) between 2018 and 2023.

CSU TEACHING EXPERIENCE: INSTRUCTOR OF RECORD

DSCI 369: Linear Algebra for Data Science With an emphasis on Python and Matlab	<i>Fall 2025</i>
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MATH 360: Information Theory and Cryptography With an emphasis on SAGE	<i>Fall 2025</i>
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DSCI 369: Linear Algebra for Data Science (2 sections) With an emphasis on Python and Matlab	<i>Spring 2025</i>
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MATH 369: Linear Algebra I	<i>Fall 2024</i>
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MATH 369: Linear Algebra I (2 sections)	<i>Spring 2024</i>
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MATH 160: Calculus for Physical Scientists	<i>Fall 2023</i>
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UNL TEACHING EXPERIENCE: INSTRUCTOR OF RECORD

Math 221/821: Differential Equations	<i>Spring 2023</i>
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Math 106: Calculus I	<i>Fall 2022</i>
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Math 302: Math Modeling (For Pre-Service Teachers)	<i>Fall 2021</i>
Math 103: College Algebra & Trigonometry	<i>Spring 2021</i>
Math 203: Contemporary Math	<i>Fall 2020</i>
Math 107: Calculus II	<i>Summer 2020</i>
Math 102: College Trigonometry	<i>Spring 2020</i>
Math 103: College Algebra & Trigonometry	<i>Fall 2019</i>
Math 104: Applied Calculus	<i>Summer 2019</i>
Math 101: College Algebra	<i>Spring 2019</i>
Math 101: College Algebra	<i>Fall 2018</i>

TEACHING EXPERIENCE: ASSOCIATE CONVENER

Associate Convener and Graduate Teaching Assistant, Math 107: Calculus II	<i>Spring 2022</i>
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The Associate Convener is responsible for coordinating recitation instructors, leading weekly instructor meetings, and organizing the course materials.

TEACHING EXPERIENCE: GRADUATE TEACHING ASSISTANT

Recitation Leader, Math 107: Calculus II	<i>Summer 2018</i>
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Recitation Leader, Math 107: Calculus II	<i>Spring 2018</i>
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Recitation Leader, Math 107: Calculus II	<i>Fall 2017</i>
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I have employed an Active Learning strategy when teaching my recitation sections.

COMPUTER LANGUAGES

I am proficient in coding in Python, Matlab, SAGE, HTML, Javascript, and Macaulay2.

SERVICE AND INVOLVEMENT

I have given a talk at CSU's Math Day about combinatorial and geometric configurations of points and lines.

I have volunteered to help organize a bilingual math festival called Cafecito con Matemática at Irish Elementary Escuela Bilingüe in Fort Collins, CO.

AMS Chapter President for the Academic Year Fall 2020 - Spring 2021 at University of Nebraska - Lincoln.

I have run the workshop to prepare graduate students to take the abstract algebra qualifying exam in January 2021 and Summer 2022.

Ran New Student Enrollment for the UNL Math Department in Summers of 2021 and 2022.

I have run a reading course in Algebraic Curves for graduate students at UNL in the 2021-2022 school year.

I have run the Commutative Algebra Reading Seminar at UNL for the 2021-2022 school year.

Each year at UNL I volunteered for UNL Math Day, where high school students from across Nebraska visit UNL's campus to participate in math competitions.

Every year at UNL I tutored undergraduate students taking calculus and pre-calculus courses at UNL's Math Resource Center.

MENTORING

In Fall 2022, I mentored an undergraduate about elliptic curves in a Directed Reading Program.

In Spring 2020, I mentored an undergraduate about p -adic numbers in a Directed Reading Program, where we met weekly.

TALKS AT CSU

Hilbert Functions of Algebraic Sets Number Theory Lab, Colorado State University	<i>October 2024</i>
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Una Historia de la Lógica Seminario de las Matemáticas en Español, Colorado State University	<i>September 2024</i>
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The Dynamincs of the Hesse Derivative on the j -invariant Number Theory Lab, Colorado State University	<i>February 2024</i>
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Una Historia de la Notación Matematica Seminario de las Matemáticas en Español, Colorado State University	<i>January 2024</i>
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TALKS AT UNL

Enumeration Puzzles in Geometry Commutative Algebra Reading Seminar, University of Nebraska - Lincoln	<i>April 2023</i>
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New Perspectives on Geprociness Commutative Algebra Seminar, University of Nebraska - Lincoln	<i>November 2022</i>
Unexpected Curves Commutative Algebra Reading Seminar, University of Nebraska - Lincoln	<i>March 2022</i>
The Geometry of Elliptic Fibrations Part 2 Commutative Algebra Reading Seminar, University of Nebraska - Lincoln	<i>November 2021</i>
The Geometry of Elliptic Fibrations Commutative Algebra Reading Seminar, University of Nebraska - Lincoln	<i>October 2021</i>
The Geometry of Elliptic Fibrations Graduate Students Talking in Groups, Semigroups, and Topology, University of Nebraska - Lincoln	<i>September 2021</i>
Exploring the Wonderful World of Divisors Commutative Algebra Reading Seminar, University of Nebraska - Lincoln	<i>March 2021</i>
Colored Graphical Models and Their Symmetries Graduate Algebraic Geometry Assembly, University of Nebraska - Lincoln	<i>February 2021</i>
The Internal Language of Toposes Commutative Algebra Reading Seminar, University of Nebraska - Lincoln	<i>November 2020</i>
Differential Forms and De Rham Cohomology Graduate Algebraic Geometry Assembly, University of Nebraska - Lincoln	<i>September 2020</i>
Automorphism Groups of Curves and Surfaces Commutative Algebra Reading Seminar, University of Nebraska - Lincoln	<i>March 2020</i>
Triangulated Categories and Derived Functors Commutative Algebra Reading Seminar, University of Nebraska - Lincoln	<i>October 2019</i>
Vector Bundles and Projective Modules Math Literature Seminar, University of Nebraska - Lincoln	<i>June 2018</i>