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 superabunance 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 received the Linda Bors Fellowship Award in the Fall of 2021. This is awarded annually to three UNL graduate students based on scholarship.

PAPERS AND PREPRINTS

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

On the algebraic properties of the Böröczky configuration *with Shahriyar Roshan-Zamir*. arXiv:2510.17029 (2025), 18 pp. Submitted to the *Journal of Algebra*.

The classification of quasi-elliptic fibrations and unexpected plane cubics in characteristics 2 and 3. arXiv:2510.06365 (2025), 29 pp. Submitted to the *Transactions of the American Mathematical Society*.

Oriented Steiner Triple Systems, Steiner Products, and Dynamics *with Chris Peterson*. arXiv:2507.09396 (2025), 24 pp. Submitted to the *Beiträge zur Algebra und Geometrie*.

The dynamics of the Hesse derivative on the j-invariant. arXiv:2408.04117 (2024), 17 pp. Accepted for publication by the *Journal of Computational Algebra*.

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.

TALKS AS INVITED SPEAKER

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

New Perspectives on Geproci-ness *April 2023*
Commutative Algebra with Connections to Combinatorics and Geometry at the AMS Spring Central Sectional Meeting in Cincinnati, OH

COMMUNITY INVOLVEMENT

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 — *Fall 2025*
With an emphasis on Python and Matlab

MATH 360: Information Theory and Cryptography — *Fall 2025*
With an emphasis on SAGE

DSCI 369: Linear Algebra for Data Science (2 sections) — *Spring 2025*
With an emphasis on Python and Matlab

MATH 369: Linear Algebra I — *Fall 2024*

MATH 369: Linear Algebra I (2 sections) — *Spring 2024*

MATH 160: Calculus for Physical Scientists — *Fall 2023*

UNL TEACHING EXPERIENCE: INSTRUCTOR OF RECORD

Math 221/821: Differential Equations — *Spring 2023*

Math 106: Calculus I — *Fall 2022*

Math 302: Math Modeling (For Pre-Service Teachers) — *Fall 2021*

Math 103: College Algebra & Trigonometry — *Spring 2021*

Math 203: Contemporary Math — *Fall 2020*

Math 107: Calculus II — *Summer 2020*

Math 102: College Trigonometry — *Spring 2020*

Math 103: College Algebra & Trigonometry — *Fall 2019*

Math 104: Applied Calculus — *Summer 2019*

Math 101: College Algebra — *Spring 2019*

Math 101: College Algebra — *Fall 2018*

TEACHING EXPERIENCE: ASSOCIATE CONVENER

Associate Convener and Graduate Teaching Assistant, Math 107: Calculus II *Spring 2022*

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 *Summer 2018*

Recitation Leader, Math 107: Calculus II *Spring 2018*

Recitation Leader, Math 107: Calculus II *Fall 2017*

I have employed an Active Learning strategy when teaching my recitation sections.

COMPUTER LANGUAGES

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

SERVICE AND INVOLVEMENT

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 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 Mathemática 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 *October 2024*
Number Theory Lab, Colorado State University

Una Historia de la Lógica *September 2024*
Seminario de las Matemáticas en Español, Colorado State University

The Dynamincs of the Hesse Derivative on the j-invariant *February 2024*
Number Theory Lab, Colorado State University

Una Historia de la Notacíon Matematica *January 2024*
Seminario de las Matemáticas en Español, Colorado State University

TALKS AT UNL

Enumeration Puzzles in Geometry *April 2023*
Commutative Algebra Reading Seminar, University of Nebraska - Lincoln

New Perspectives on Geproci-ness *November 2022*
Commutative Algebra Seminar, University of Nebraska - Lincoln

Unexpected Curves *March 2022*
Commutative Algebra Reading Seminar, University of Nebraska - Lincoln

The Geometry of Elliptic Fibrations Part 2 *November 2021*
Commutative Algebra Reading Seminar, University of Nebraska - Lincoln

The Geometry of Elliptic Fibrations *October 2021*
Commutative Algebra Reading Seminar, University of Nebraska - Lincoln

The Geometry of Elliptic Fibrations *September 2021*
Graduate Students Talking in Groups, Semigroups, and Topology, University of Nebraska - Lincoln

Exploring the Wonderful World of Divisors *March 2021*
Commutative Algebra Reading Seminar, University of Nebraska - Lincoln

Colored Graphical Models and Their Symmetries *February 2021*
Graduate Algebraic Geometry Assembly, University of Nebraska - Lincoln

The Internal Language of Toposes *November 2020*
Commutative Algebra Reading Seminar, University of Nebraska - Lincoln

Differential Forms and De Rham Cohomology *September 2020*
Graduate Algebraic Geometry Assembly, University of Nebraska - Lincoln

Automorphism Groups of Curves and Surfaces *March 2020*
Commutative Algebra Reading Seminar, University of Nebraska - Lincoln

Triangulated Categories and Derived Functors *October 2019*
Commutative Algebra Reading Seminar, University of Nebraska - Lincoln

Vector Bundles and Projective Modules *June 2018*
Math Literature Seminar, University of Nebraska - Lincoln