Dylan C. Beck

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EDUCATION

The University of Kansas
Ph.D, mathematics ..... May 2022
Ph.D advisor: Hailong Dao
Ph.D thesis: *Combinatorial and Homological Aspects of Monomial Algebras and Numerical Semigroups*

M.A., mathematics ..... Aug 2018

Missouri State University
B.S. with Honors, mathematics (minor in German) ..... May 2016
GPA: 4.00/4.00; member of Kappa Mu Epsilon (Mathematics Honors Society)

EMPLOYMENT

Baker University

Visiting Assistant Professor of Mathematics ..... Aug 2022 to present

Fall 2022

- ⋄ MA090 (Intermediate Algebra)
- ⋄ MA146 (Trigonometry)
- ⋄ MA281 (Introduction to Linear Algebra)
- ⋄ MA383 (Introduction to Modern Algebra)

Spring 2023

- ⋄ MA145 (College Algebra)
- ⋄ MA172 (Calculus II)
- ⋄ MA291 (Introduction to Higher Math)
- ⋄ MA345 (Problem Seminar in Mathematics)
- ⋄ MA445 (Senior Seminar in Mathematics)

The University of Kansas

Graduate Teaching Assistant in Mathematics ..... Aug 2016 to May 2022

An asterisk (∗) denotes instructor of record.

- ⋄ MATH 002 (Intermediate Algebra)
- ⋄ MATH 101 (College Algebra)
- ⋄ MATH 104 (Precalculus)*
- ⋄ MATH 105 (Intro to Topics in Mathematics)*
- ⋄ MATH 115 (Applied Calculus I)*
- ⋄ MATH 125 (Calculus I)
- ⋄ MATH 126 (Calculus II)
- ⋄ MATH 127 (Calculus III)

Leader, Algebra Ph.D Qualifying Exam Study Group ..... Aug 2018 to May 2022

Organizer, Graduate Student Algebra Seminar ..... Aug 2021 to May 2022

Leader, Probability and Statistics Ph.D Qualifying Exam Study Group ..... Aug to Dec 2018

Missouri State University

Undergraduate Teaching Assistant in Mathematics ..... June 2015 to Aug 2016

- ◇ MTH 101 (Intermediate Algebra A)

Mathematics Tutor, Bear CLAW (Center for Learning and Writing) ..... Aug 2013 to Aug 2016

- ◇ MTH 103 (Intermediate Algebra)
- ◇ MTH 135 (College Algebra)
- ◇ MTH 138 (Precalculus)
- ◇ MTH 181 (Trigonometry)
- ◇ MTH 261 (Calculus I)
- ◇ MTH 280 (Calculus II)
- ◇ MTH 287 / 288 (Applied Calculus I / II)
- ◇ MTH 302 (Calculus III)

AWARDS

Teaching

finalist, Florence Black Award for Excellence in Teaching ..... Apr 2021

Academic

John Bunce Memorial Award ..... Apr 2022

Elbert Walker Graduate Scholarship in Mathematics ..... May 2021

Rashleigh Family Graduate Scholarship in Mathematics ..... May 2020

May Landis Graduate Scholarship in Mathematics ..... May 2019

U.G. Mitchell Graduate Scholarship in Mathematics ..... May 2019

first place in mathematics, MOState CNAS Undergraduate Research Symposium ..... May 2014

RESEARCH

Research Interests

commutative algebra and its connections to combinatorics and additive number theory

Publications

Canonical blow-up of one-dimensional singularities (with Hailong Dao), in progress

ABSTRACT. We study the canonical blow-up $B(\omega_R)$ of an analytically unramified one-dimensional Cohen-Macaulay local ring $(R, \mathfrak{m}, k)$ with infinite residue field k and canonical ideal ω_R. If $B(\omega_R)$ is Gorenstein, we say that R has the *Gorenstein canonical blow-up* (GCB) property. We provide equivalent conditions for GCB rings, and we show Arf rings, nearly Gorenstein rings of minimal multiplicity, far-flung Gorenstein rings, and numerical semigroup rings of multiplicity three are GCB. We study related numerical semigroup rings and give examples.

On a generalization of two-dimensional Veronese subrings, in progress

ABSTRACT. If a is a positive integer and k is a field, then the ath Veronese subring of the two-dimensional polynomial ring $k[x, y]$ is the monomial subring $k[x, y]^{(a)} = k[x^i y^{a-i} \mid 1 \leq i \leq a]$. We demonstrate that for any nonempty subset $A \subseteq [a] = \{0, 1, \ldots, a\}$, the properties of the monomial subring $k[x, y]^{(A)}$ are intimately intertwined with the properties of the r-fold sumsets of A.

On the threshold properties of the n-fold sums of a numerical semigroup (with Srishti Singh), in progress

ABSTRACT. If S is a numerical semigroup with maximal ideal $S^* = S \setminus \{0\}$, the n-fold sums of S are the numerical semigroups $\Sigma_n(S) = nS^* \cup \{0\}$ indexed by the positive integers n. We investigate when

a property $\mathcal{P}$ of S holds for its n-fold sums $\Sigma_n(S)$. If $\mathcal{P}$ holds for $\Sigma_n(S)$ for all integers $n \geq 2$ then we say that $\mathcal{P}$ is an *inherited* property; if there exists an integer $k \gg 0$ such that $\mathcal{P}$ holds for $\Sigma_n(S)$ for all integers $n \geq k$, then we say that $\mathcal{P}$ is a *threshold* property. We demonstrate that Arfness and saturatedness are inherited properties. We prove also that the divisiveness of a numerical semigroup generated by an interval or of maximal embedding dimension is inherited.

The radius and the n-fold sums of a numerical semigroup, in progress

Abstract. We introduce several new objects and invariants related to the maximal ideal S^* of a numerical semigroup S and its Hilbert function. Explicitly, we consider the minimum number of minimal generators of S such that $S^* + S^*$ is completely determined; we refer to this number as the *radius* of S. We prove that the radius of a numerical semigroup generated by a generalized arithmetic sequence is two. We study also the numerical semigroups $\Sigma_n(S) = nS^* \cup \{0\}$ induced by the n-fold sum of S^* for each integer $n \geq 1$. We demonstrate that $\Sigma_n(S)$ has maximal embedding dimension for all integers $n \geq \mathrm{e}(S) - 1$. Last, we provide equivalent conditions for $\Sigma_2(S)$ to possess maximal embedding dimension when S is generated by a generalized arithmetic sequence.

Some new invariants of Noetherian local rings (with Souvik Dey), arXiv: 2205.01658

Abstract. We introduce two new invariants of a Noetherian (standard graded) local ring $(R, \mathfrak{m})$ that measure the number of generators of certain kinds of reductions of $\mathfrak{m}$, and we study their properties. Explicitly, we consider the minimum among the number of generators of ideals I such that either $I^2 = \mathfrak{m}^2$ or $I \supseteq \mathfrak{m}^2$ holds. We investigate subsequently the case that R is the quotient of a polynomial ring $k[x_1, \ldots, x_n]$ by an ideal I generated by homogeneous quadratic forms, and we compute these invariants. We devote specific attention to the case that R is the quotient of a polynomial ring $k[x_1, \ldots, x_n]$ by the edge ideal of a finite simple graph G.

Academic Talks

Some New Invariants of Noetherian Local Rings (URiCA, May 2022)

Canonical Modules (Graduate Student Algebra Seminar, Mar 2022)

Some New Invariants of Edge Rings of Finite Simple Graphs (KU Combinatorics Seminar, Feb 2022)

A Small Survey of Topics in Commutative Algebra (Graduate Student Seminar, Feb 2022)

The Basics of Homological Algebra (Graduate Student Algebra Seminar, weekly from Feb to Apr 2022)

The Canonical Blow-Up of a Numerical Semigroup (KS Math Graduate Student Conference, Dec 2021)

Canonical Blow-Up of One-Dimensional Singularities (KU Local Algebra Conference, Nov 2021)

Serre's Condition and Cohen-Macaulayness (Graduate Student Algebra Seminar, Oct 2021)

Depth, Dimension, and Cohen-Macaulayness (Graduate Student Algebra Seminar, Oct 2021)

Numerical Semigroup Rings (Commutative Algebra Regional Expository Seminar, Feb 2021)

Loewy Length and the Rees Property (Graduate Student Algebra Seminar, Mar 2020)

Gorenstein Rings and the Canonical Module (Graduate Student Algebra Seminar, Nov 2019)

Cohen-Macaulay Rings and Their Properties (Graduate Student Algebra Seminar, Nov 2019)

Connecting Depth, Ext, and Projective Dimension (Graduate Student Algebra Seminar, Apr 2019)

Banach-Tarski Paradox and Equidecomposable Sets (Graduate Student Seminar, Nov 2018)

Cohen-Macaulay Rings, Depth, and Regular Sequences (Graduate Student Algebra Seminar, Oct 2018)

Ethics in Mathematics: a History of Mathematical Proofs (Graduate Student Seminar, Feb 2018)

Paradoxical Decompositions and the Banach-Tarski Paradox (Graduate Student Seminar, Oct 2016)

On a Quadratic Variant of a Problem of Berzsenyi (Missouri State University College of Natural and Applied Sciences Undergraduate Research Symposium, May 2014)

Conferences Attended

KUMUNU Commutative Algebra Conference (The University of Nebraska, Oct 2022)

KUMUNU Commutative Algebra Conference (The University of Nebraska, May 2022)

URiCA: Upcoming Researchers in Commutative Algebra (The University of Nebraska, May 2022)

Kansas Mathematics Graduate Student Conference (The University of Kansas, Dec 2021)

KU Local Algebra Conference (The University of Kansas, Nov 2021)

KUMUNU Commutative Algebra Conference (The University of Nebraska, Sep 2019)

KUMUNUjr Commutative Algebra Conference (The University of Nebraska, Mar 2019)

Southwest Local Algebra Meeting (SLAM) (The University of Texas at El Paso, Feb 2019)

KUMUNU Commutative Algebra Conference (The University of Kansas, Oct 2018)

Great Plains Combinatorics Conference (GPCC) (Kansas State University, Apr 2018)

Graduate Student Combinatorics Conference (GSCC) (The University of Texas at Dallas, Apr 2018)

KUMUNU Commutative Algebra Conference (The University of Kansas, Oct 2017)

The Midwest Combinatorics Conference (University of Minnesota, May 2017)