

RAYFEST: TITLES AND ABSTRACTS

- CORY COLBERT: **Chain conditions on generalized union-closed families of sets**

The union-closed sets conjecture says that if F is a finite family of sets, not all of which are empty, and the set union operation is a binary operation on F , then there exists an element that is in at least half of the sets in F . Originally popularized by P. Frankl (indeed, it is sometimes referred to as Frankl's conjecture), this curious problem has resisted over 45+ years of efforts to prove or disprove it. The conjecture remains open. In this talk, we will give a brief survey of the known results, including a short discussion of the recent breakthrough work J. Gilmer, et al. We will also discuss the conjecture in the context of infinite families and how the classical chain conditions allow one to recover some interesting results from the finite case.

- LOUIZA FOULI: **From Codes to Matroids: Symbolic Powers through the Lens of Generalized Hamming Weights**

Generalized Hamming weights (GHWs) play a crucial role in coding theory, measuring the resilience of linear codes against erasures. In this talk, we explore the connection between GHWs and the symbolic powers of the Stanley-Reisner ideal associated with the matroid of the dual code. We extend this relationship to arbitrary matroids, demonstrating how GHWs can be interpreted through the initial degrees of the symbolic powers of the corresponding Stanley-Reisner ideal. Our investigation uncovers structural links between coding theory and related algebraic invariants, including the Waldschmidt constant, resurgence, and other properties of symbolic powers. This is joint work with Michael DiPasquale, Arvind Kumar, and Ștefan O. Tohăneanu.

- CRAIG HUNEKE: **Finding the nilradical**

How does one compute the nilradical of an ideal I in a polynomial ring S ? What issues are involved? This talk will introduce various aspects of this problem; it is intended to be accessible for students who have taken a beginning course in commutative algebra. One new algorithm will be given, based on old work of Levin and Vasconcelos.

- DAVID JORGENSEN: **Tor, Complete Intersections and Minors**

In this talk we will describe an arc of mathematical research under the influence of the mathematics of Ray Heitmann.

- **SUSAN LOEPP: My Favorite Results that use Heitmann-Type Constructions**

The construction Heitmann uses to build a UFD in his 1993 paper “Characterizations of completions of unique factorization domains” can be generalized to other settings. In this talk, we give examples of results proved using this kind of Heitmann-type construction.

- **SUSAN MOREY: Extremal ideals and Properties of Square-free Monomial Ideals**

This talk will focus on a concretely defined class of ideals, called *extremal ideals*. For each positive integer q , there is an extremal ideal with q generators. Understanding algebraic properties of an extremal ideal provides information for all square-free monomial ideals with q generators. For instance, the betti numbers of the extremal ideals provide an upper bound for the betti numbers of any square-free monomial ideal with the same number of generators. In honor of the work Ray was doing while I was his postdoc, the talk will have the viewpoint of seeing an extremal ideal as a somewhat technical and complicated example that shed light on many important things. It will also discuss how these ideals relate to associate primes, which was a topic I focused on while learning from Ray.

- **KARL SCHWEDE: Ideal closure operations in characteristic zero via resolution of singularities**

A big story in commutative algebra over the past 45 years has been a connection between the measures of singularities associated to Frobenius and tight closure theory in characteristic p with those coming out of birational algebraic geometry via resolution of singularities and associated vanishing theorems in characteristic zero. Recently, this was extended to mixed characteristic, and Ray Heitmann’s work on such mixed characteristic closures related to tight closure, both historically and recently, has played a central role. However, there was no known “closure operation” in characteristic zero whose tight-closure-like properties were derived from resolution of singularities. In this talk, I will introduce such an operation, which we call Koszul-Hironaka (KH) closure. We show it has many similar properties to tight closure (colon capturing, a version of the Briancon-Skoda theorem, behavior under finite maps etc) but at the same time differs in other key ways (in some ways that are quite advantageous, and others which are not). This is joint work with Neil Epstein, Peter McDonald, and Rebecca R.G.

- **SYLVIA WIEGAND: Prime ideals in Noetherian rings**

We study partially ordered sets of prime ideals in Noetherian rings, in particular, low-dimensional polynomial and power series rings. Most of this work is joint with Ela Celikbas, Christina Eubanks-Turner, William Heinzer, Christel Rotthaus, and Roger Wiegand. We also mention Heitmann’s work.