Commutative Algebra
Algèbre commutative
(Org: **Giulia Gaggero**, **Lisa Seccia** and/et **Adam Van Tuyl** (McMaster University))

KIERAN BHASKARA, McMaster University

MICHAEL BURR, Clemson University

ENRICO CARLINI, Politecnico di Torino
Minimal apolar subsest to homogeneous polynomials

We will briefly recall some basic facts about sum of powers decompositions, Waring rank, and apolarity. Then we will explore some recent results with Bhat-Dubey-Masuti on minimal apolar subsests to some reducible quartics. In particular, we will see how spiders and butterflies can explain the geometry of sum of powers decompostions of $x^2(z_1^2 + \ldots + z_m^2)$ and of $(x^2 + y^2)(z_1^2 + \ldots + z_m^2)$.

SUSAN COOPER, University of Manitoba

SELVI KARA, Bryn Mawr College
Edge ideals of gapfree graphs with matching number 3

Powers of edge ideals often reflect the combinatorics of the underlying graph. Nevo and Peeva conjectured that sufficiently high powers of the edge ideal of a gapfree graph have linear resolutions. Previous work on this conjecture has often imposed additional algebraic hypotheses. In this talk, I will discuss an approach based instead on combinatorial restrictions, using the matching number to organize the problem. We focus on gapfree graphs with matching number three and show that every power of their edge ideals starting with the second has linear quotients and hence a linear resolution. Building on our previous work, we combine graph-theoretic reductions with operations that preserve linear quotients to reduce the proof to 26 graphs on at most seven vertices. I will explain these reductions and discuss how this approach may guide further progress on the conjecture. This is joint work with Nursel Erey, Tài Huy Hà, Takayuki Hibi, and Susan Morey.

GRAHAM KEIPER, University of Catania

BRETT NASSERDEN, McMaster University

NAVEENA RAGUNATHAN, McMaster University
The Lefschetz Properties of Artinian Rings Associated to the van der Waerden Simplicial Complex

The Lefschetz Properties are a well-studied characteristic of Artinian rings, with its history tracing back to Stanley's study of the Lefschetz Properties on complete intersections. In this talk, I will discuss the occurrence of the Lefschetz Properties on Artinian rings created from the Stanley-Reisner ring of the van der Waerden simplicial complex, further quotiented out by the squares of all variables. These simplicial complexes, defined on positive integers n>k, are generated by all arithmetic progressions of size k on n variables. We prove that for the smallest and largest possible values of k, namely k=1,2, and n-1, we always have the occurrence of the Weak Lefschetz Property. We also examine the first occurrence of failure at k=3, and prove that this failure propagates for all higher n values. I will also give a complete characterization of when our simplicial complex is a pseudo-manifold, and the implications this has on the occurrence of the Weak Lefschetz Property in certain degrees. Finally, I will present some recent ideas from joint work with Dr. Brett Nasserden, in which we generalize the failure of the k=3 case to all odd values of k, and examine the case of characteristic p.

REBECCA RG, George Mason University
Classifying neural codes using algebraic tools

The neural ideal was introduced by Curto, Itskov, et al in 2013 to study the spatial firing patterns of a set of neurons, turning problems in neuroscience and coding theory into algebraic questions. In this talk I will show how homological invariants such as Betti numbers can be applied to study and classify neural ideals. This work is joint with Hugh Geller, Alexandra Seceleanu, and Nora Youngs.

OLIVIA STRAHAN, University of New Mexico
Local cohomology in t-Stanley-Reisner rings

There is a profound relationship between the algebraic invariants of Stanley-Reisner rings and the topological data of the associated simplicial complex. Hochster's formula, which describes the local cohomology modules in terms of the simplicial cohomology of links, is one of many famous theorems built on this relationship. This talk will introduce a mixed-characteristic analogue of Stanley-Reisner theory and the adaptation of Hochster's formula to this new setting. The adaptation uses "cellular sheaf cohomology," wherein different coefficients are assigned to each face. These and related results are from a joint paper with Mel Hochster.

KESAVAN MOHANA SUNDARAM, University of Nebraska-Lincoln

VASU TEWARI, University of Toronto