Commutative Algebra
Algèbre commutative
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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.

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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.

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