From points to complexes: a notion of unexpectedness for simplicial complexes

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In 2018, Cook, Harbourne, Migliore and Nagel introduced the concept of unexpected hypersurfaces [1], which connects the study of Lefschetz properties of artinian algebras defined by powers of linear forms, to a family of interpolation problems. In this talk, inspired by the theory of unexpected hypersurfaces, we introduce the concept of unexpected systems of parameters for squarefree monomial ideals. Similarly to the setting of points, we show that the existence of an unexpected system of parameter causes a certain algebra to fail the weak Lefschetz property. We then explore combinatorial interpretations of unexpected systems of parameters, and show that this notion is intrinsically related to the theory of balanced complexes introduced by Stanley in [2].

A consequence of our results is that the theory of Rees algebras turns out to be a powerful tool for studying the existence of systems of parameters satisfying special properties.

References

[1] D. Cook II, B. Harbourne, J. Migliore, U. Nagel, *Line arrangements and configurations of points with an unexpected geometric property.* Compos. Math, **154** (2018), no. 10, 2150-2194

[2] R. Stanley, *Balanced Cohen-Macaulay complexes* Trans. Amer. Math. Soc., **249** (1979), no. 1, 149-157