

Abstracts of talks

1 Weak Lefschetz properties for equigenerated complete intersections and maximal hyperplane variations

Valentina Beorchia

University of Trieste
Trieste, Italy
`beorchia@units.it`

We show that any Artinian complete intersection homogeneous ideal equigenerated by forms of degree $d \geq 2$ satisfies the weak Lefschetz property (WLP) in degree $t < d + \lceil \frac{d}{n} \rceil$. Applying the result to the Jacobian ideal of a smooth hypersurface of degree $d \geq n + 3$ in $\mathbb{P}^n$, thanks to a construction of Beauville, we get that the family of hyperplane sections has maximal variation in moduli (joint work with R. M. Mirò-Roig). The result has very recently been improved to $d \geq n + 2$ by Favale and Pirola, and to hypersurfaces of lower degree with possibly isolated singularities by Ilardi, Nasrollah Nejad, and Tafazolian.

2 On the Weak Lefschetz Property for equigenerated complete intersections

Mats Boij

Kungliga Tekniska Högskolan
Stockholm, Sweden
`boij@kth.se`

For an artinian complete intersection of forms of degree d , we prove that the multiplication by a general linear form is injective up to degree $\frac{3d}{2} - 1$, independently of the number of variables. This is accomplished using algebraic and geometric properties of the union of two complete intersection curves and their general hyperplane sections. It is joint work with Juan Migliore, Rosa Maria Miró-Roig and Uwe Nagel.

3 Finite coverings of low degree

Fabrizio Catanese

Universita' di Bayreuth- Accademia dei Lincei
Bayreuth, Germany
`Fabrizio.Catanese@uni-bayreuth.de`

After recalling classical results, by Miranda, Casnati and Ekedahl on finite coverings of degree 3, 4, 5 I will talk about work in progress with Rick Miranda, and the classification of triple coverings of the plane With $q = p_g = 0$.

4 Betti numbers of ideals generated by $n + 1$ powers of general linear forms

Eric Dannetun

Stockholm University
Stockholm, Sweden
`eric.dannetun@math.su.se`

Recently, ideals generated by powers of general linear forms have been studied by many authors from different perspectives, especially regarding Lefschetz properties and the connection to ideals of fat points. In this talk we will study the Betti numbers of ideals generated by $n + 1$ powers of general linear forms (in n variables). Our main result, generalizing recent work of Diethorn et al. (who considered squares of linear forms), is that we determine the Betti numbers when at least one of the generators is a quadric. The proof relies on finding a suitable lift for the quotients by these ideals, and relating them to a finite set of projective points. As a result we find an interesting structure on the syzygies of these ideals, and moreover that a generic ideal generated by $n + 1$ forms, with at least one quadric generator, is level. If time permits we will also describe the Betti numbers of the linked Artinian Gorenstein algebras, discuss descriptions of their generators, and show that they have the strong Lefschetz property.

5 Lefschetz properties for finite geometries

Rodrigo Gondim

Universidade Federal Rural de Pernambuco
Pernambuco, Brasil
`rodrigo.gondim@ufrpe.br`

We consider plane finite geometries and the associated simplicial complex. We study Lefschetz properties for the quadratic Artinianization of the Stanley-Reisner algebra and prove that the Lefschetz properties are equivalent to a certain connectivity condition on the complex. We generalize it to rank three matroids.

6 A concept of unexpectedness for simplicial complexes

Thiago Holleben

Dalhousie University
Halifax , Canada
`hollebenthiago@dal.ca`

The study of Lefschetz properties in different areas can look very different depending on the area being considered. While in combinatorics the end goal is often proving a unimodality statement, in geometry it is often the failure that turns out to be interesting. In this talk, inspired by the notion of unexpected hypersurfaces, we introduce unexpected systems of parameters for simplicial complexes and relate them to the failure of WLP of certain monomial algebras. Our results in particular provide a probabilistic framework to prove failure of WLP of large families of monomial algebras.

7 On maximal rank properties for symmetric polynomials in a monomial complete intersection

Filip Jonsson Kling

Stockholm University
Stockholm, Sweden
email@university.edu

It is well known that a monomial complete intersection has the strong Lefschetz property in characteristic zero. This property is equivalent to the statement that any power of the sum of the variables is a maximal rank element on the complete intersection. In this talk, I will sketch what happens in some cases when this element is replaced by another symmetric polynomial, in an equigenerated complete intersection.

8 The Weak Lefschetz Property and the Eisenbud–Green–Harris Conjecture

Nikola Kuzmanovski

University of Notre Dame
Notre Dame, USA
nkuzmano@nd.edu

This presentation concerns the weak k -Lefschetz property introduced by Harima and Wachi, which generalizes the usual weak Lefschetz property by considering successive quotients by multiple linear forms. Our first result establishes this property for complete intersections within a certain range, provided that the minimal generating degree is sufficiently large and that the degrees of the elements of the regular sequence are sufficiently close to it. This result for complete intersections is a special case of a theorem for a broader class of ideals for which even the usual weak Lefschetz property has not previously been established. The proof for this broader class requires certain cases of the Eisenbud–Green–Harris conjecture, together with a generalization of Gotzmann’s persistence theorem, both of which we establish. If time permits, I will also discuss related results on Hilbert functions, graded Betti numbers, shadow minimization, and generic initial ideals.

9 The Non-Lefschetz Locus of Monomial Complete Intersections in Positive Characteristic

Adam LaClair

University of Nebraska-Lincoln
Lincoln, USA
alacclair2@unl.edu

In the 1980s, Stanley and J. Watanabe proved that over a field of characteristic zero every monomial complete intersection has the strong Lefschetz property. Determining which monomial complete intersections have the weak Lefschetz property in positive characteristic has since been the subject of extensive research. Recently, Kyomuhangi, Marangone, Raicu, and Reed gave a numerical characterization of the weak Lefschetz property for monomial complete intersections in positive characteristic. Independently, I gave a geometric description of the locus of exponent vectors corresponding to monomial complete intersections over a field of positive characteristic which fail the weak Lefschetz property. This locus is described explicitly in terms of translates of positive-orthant lattice balls in the taxicab metric. In this talk, I will explain my proof of this result.

10 Weak Lefschetz Property for Monomial Complete Intersections in Positive Characteristic

Emanuela Marangone

University of Manitoba
Winnipeg, Canada
Emanuela.Marangone@umanitoba.ca

A famous result of Stanley shows that every Artinian monomial complete intersection (CI) over a field of characteristic zero has the Strong Lefschetz Property (SLP). In positive characteristic, however, this result no longer holds: both the Strong and the Weak Lefschetz Property may fail, depending on the characteristic of the field and the degrees of the monomial generators. While Lundqvist-Nicklasson gives a complete characterization of monomial CIs with the SLP, the Weak Lefschetz Property (WLP) was still open. In this talk, I provide a complete classification of the WLP using its close relationship with the cohomology of line bundles on the incidence correspondence - the partial flag variety parametrizing pairs consisting of a point in projective space and a hyperplane containing it. This talk is based on in progress work joint with C. Raicu, A. Kyomuhangi, and E. Reed.

11 Lefschetz Properties for Hartshorne-Rao Modules of sets of general lines in $\mathbb{P}^3$

Uwe Nagel

University of Kentucky
Lexington, USA
`uwe.nagel@uky.edu`

Considering a finite union of general lines, it is shown that multiplication by small powers of a general linear form on its Hartshorne-Rao module has maximal rank. The argument uses a specialization to zero-dimensional schemes that can be written as a union of curvilinear schemes, each of a particular type, together with generic Hilbert function results for such schemes, which are of independent interest.

This is based on joint work with Juan Migliore, Chris Peterson and Ettore Teixeira Turatti.

12 Extremal Hilbert series and Gröbner bases

Matthias Orth

KU Leuven
Leuven, Belgium
`matthias.orth@kuleuven.be`

Fröberg's conjecture about the Hilbert series of an algebra with relation ideal generated by m general homogeneous polynomials of prescribed degrees in n variables is known to be true if m is at most $n+1$, and for certain other families of degree sequences. There is a strong connection to Lefschetz properties because the conjecture can be rephrased in terms of maximal rank properties for the multiplication maps induced by a general homogeneous polynomial in a standard graded Artinian algebra.

In the proposed talk, I can present recent joint work (<https://doi.org/10.1016/j.jalgebra.2026.04.012>, <https://doi.org/10.1090/btran/251>) and work in progress with Filip Jonsson Kling, Samuel Lundqvist, Fatemeh Mohammadi, and others on the reduced Gröbner bases of ideals generated by at most $n+1$ polynomials in n variables that define algebras attaining Fröberg's Hilbert series.

13 Jordan type of Perazzo algebras

Josep Pérez Díez

Universitat de Barcelona
Barcelona, Spain
jperezdiez@ub.edu

Perazzo algebras constitute a family of standard graded Artinian Gorenstein algebras over a field K . We show that the Hilbert function does not determine the weak Lefschetz property for Perazzo algebras in general. This motivates the study of finer invariants, focusing in a new family of Perazzo algebras which we call full-like Perazzo algebras. The first of these invariants is the Jordan type of a linear form, as it encodes not only the dimensions of the graded components but also the behaviour of the induced multiplication maps. We start by computing the Jordan type of any linear form in a full Perazzo algebra, and deduce the generic linear Jordan type. This allows us to compute the generic linear Jordan type of any full-like Perazzo algebra, leading to the characterization of those ones satisfying the weak Lefschetz property. This is joint work with P. Macias Marques and R. M. Miró-Roig.

14 Subarrangements of type A: the weak Lefschetz property of the Artinian Orlik-Terao algebra

Henry Schenck

Auburn university
Auburn, USA
hks0015@auburn.edu

In 1994, Orlik and Terao introduced a commutative Artinian analog $S/I(A)$ of the Orlik-Solomon algebra of a hyperplane arrangement A to answer a question of Aomoto. A central topic of investigation in the study of Artinian algebras is the Weak Lefschetz Property (WLP). We analyze WLP for the Artinian Orlik-Terao algebra of graphic arrangements. Even for chordal graphs (which give rise to Koszul algebras) WLP sometimes fails; conversely an analysis of the state polytope shows WLP can hold even when WLP fails for all possible initial ideals. More generally, for any algebra with a tensor product decomposition, we construct canonical elements in the kernel of the multiplication map, refining previous results in the literature. Joint work with N. Gaubatz

15 Weak and strong Lefschetz properties for Hartshorne-Rao modules of curves in $\mathbb{P}^3$

Ettore Teixeira Turatti

University of Warsaw
Warszawa, Poland
`e.teixeira-turatti@uw.edu.pl`

Let $C \subset \mathbb{P}^3$ be a curve and $M(C)$ its Hartshorne-Rao module. We study how the geometry of C influences the Lefschetz property of $M(C)$. In particular, we are going to focus in the cases of skew lines in a quadric surface, rational curves, and the minimal degree such that an irreducible smooth curve has $M(C)$ failing weak Lefschetz property.

16 Lefschetz Properties and determinantal Ideals

Hongmiao Yu

Politecnico di Torino
Torino, Italy
`hongmiao.yu@polito.it`

We study the weak and strong Lefschetz properties for the Stanley–Reisner ring $R/\text{in}(I_t)$, where I_t is the ideal of a polynomial ring R generated by the t -minors of an m times n matrix of indeterminates, and $\text{in}(I_t)$ denotes the initial ideal of I_t with respect to a diagonal monomial order. We show that when I_t is generated by maximal minors, that is, when $t = \min\{m, n\}$, the algebra $R/\text{in}(I_t)$ has the strong Lefschetz property for all m, n . In contrast, for $t < \min\{m, n\}$, we establish a bound such that $R/\text{in}(I_t)$ fails to satisfy the weak Lefschetz property whenever the product mn exceeds this bound.

As an application, these results yield counterexamples that provide a negative answer to a question posed by Murai regarding the preservation of Lefschetz properties under square-free Gröbner degenerations.

Abstracts of posters

17 Algebraic Properties of Invariant Ideals.

Sankhaneel Bisui

Indian Institute of Science Education and Research Bhopal
Bhopal, India
`sankhaneel@iiserb.ac.in`

Let R be a polynomial ring with mn many indeterminate over complex numbers. We can think of the indeterminates as a matrix, X of size $m \times n$. Consider the group $G = Gl(m) \times Gl(n)$. Then G acts on R via the group action $(A, B)X = AXB^{-1}$. In 1980, DeConcini, Eisenbud, and Procesi introduced the ideals that are invariant under this group action. In the same paper, they described various properties of those ideals, e.g., associated primes, primary decomposition, and integral closures. In this talk, I will describe rational and symbolic properties of these ideal. These are results with various collaborations.

18 Geproci Sets, Unexpected Cones and Lefschetz Properties

Łucja Farnik

University of the National Education Commission
Krakow, Poland
`lucja.farnik@gmail.com`

The geometry of finite sets of points in projective spaces gives rise to a variety of surprising phenomena, connecting interpolation problems, projective geometry, combinatorics and algebra. This poster surveys recent developments concerning geproci sets (finite sets whose general projection is a complete intersection), unexpected cones and Lefschetz Properties. Particular attention is devoted to recent constructions and classification results.

The poster is based on joint work with Luca Chiantini, Giuseppe Favacchio, Brian Harbourne, Juan Migliore, Tomasz Szemberg and Justyna Szpond (the POLITUS group).

19 v -number of Lovász-Saks-Schrijver Ideals and (parity) binomial edge ideals of graphs

Manohar Kumar

Indian Institute of Technology Madras
Madras, India
manhar349@gmail.com

The v -number is an important invariant in commutative algebra with connections to coding theory. Despite its significance, explicit computations of the v -number are known only for a limited number of classes of ideals.

In this talk, we present a new framework for studying localized v -numbers via a class of ideals called coordinate-saturated ideals, which naturally encompasses Lovász–Saks–Schrijver (LSS) ideals and (generalized) binomial edge ideals associated with graphs.

As an application, we obtain explicit formulas for the certain localized v -number of LSS ideals of forests over algebraically closed fields and derive corresponding bounds over the field of real numbers.

We then discuss parity binomial edge ideals, where we give combinatorial descriptions of their localized v -numbers and use these to establish upper bounds for the v -number of several families of non-bipartite graphs. Finally, we discuss powers of binomial edge ideals of closed graphs and show that their v -number is always bounded above by the Castelnuovo–Mumford regularity.

20 A Multigraded Analog to the Lefschetz Properties

Ana Podariu

University of Nebraska-Lincoln
Lincoln, USA
apodariu2@huskers.unl.edu

We will recall the definitions of the Lefschetz Properties on standard graded Artinian rings, as well as Wiebe’s 2003 result for determining whether an ideal has the Weak Lefschetz Property using the Betti numbers of its generic initial ideal. We will then introduce Bruzzo, Gondim, Holanda, and Montoya’s 2024 definition of the Toric Lefschetz Properties, an analog of the Lefschetz Properties that applies to G -graded algebras, and apply it to an N^d graded case. We will see some examples of algebras possessing these Toric Lefschetz Properties and see how Wiebe’s result transfers from the N graded case to an N^d grading using these definitions.

21 Multiplicities of families of Ideals

Parangama Sarkar

Indian Institute of Technology Palakkad

Palakkad, India

`parangama@iitpkd.ac.in`

We prove the existence of multiplicity for a weakly graded family of ideals. We explore the Minkowski inequality and Rees' criterion for equality of multiplicities in this setting.