



OT02

Combinatorial Algebra and Geometry

Álgebra y Geometría Combinatoria

Organizers

Mario González-Sánchez

(Universidad de Valladolid)

Javier Sendra-Arranz

(Tübingen Univ. / CUNEF Univ.)

Organizadores

Luis José Santana Sánchez

(Univ. Valladolid / Univ. La Laguna)

Raquel Tapia-Ramos

(Universidad de Cádiz)

Antolatzaileak

Description

Combinatorial algebraic geometry and commutative algebra are two interconnected and active areas of research that use combinatorial tools to approach theoretical, applied, and computational problems in algebra and geometry. These synergies between algebra, geometry, and combinatorics have been useful for developments in these fields, leading to significant advances in toric geometry, enumerative geometry, invariant theory, semigroup algebras, free resolutions, and more. In this session, some recent advancements in combinatorial algebra and geometry will be presented.

La geometría algebraica combinatoria y el álgebra conmutativa son dos áreas de investigación interconectadas y activas que utilizan herramientas combinatorias para abordar problemas teóricos, aplicados y computacionales en álgebra y geometría. Estas sinergias entre álgebra, geometría y combinatoria han sido vitales para desarrollar estos campos, dando lugar a avances significativos en geometría tórica, geometría enumerativa, teoría de invariantes, álgebras de semigrupos, resoluciones libres, y más. En esta sesión, se presentarán algunos avances recientes en álgebra y geometría combinatoria.

Descripción

Deskribapena

MSC Codes**Códigos MSC****MSC Kodeak**

05E40

(primary)

05E14; 14N10; 20M14

(secondary)

Slots**Bloques****Blokeak**

1.C (Aula 1.12); 2.A (Aula 1.12); 2.B (Aula 1.12)

QR Code**Código QR****QR Kodea****Session Schedule****Horario de la Sesión****Saioaren Ordutegia**

M14 | 17:30-17:50 | 1.12

Multigraded regularity for solving 0-dimensional projections**Carles Checa** (University of Copenhagen)

M14 | 18:00-18:20 | 1.12

Minimal and cellular free resolutions from involutive bases**Rodrigo Iglesias** (Universidad de La Rioja)

M14 | 18:30-18:50 | 1.12

Some results on bounded negativity conjecture**Elvira Pérez-Callejo** (Universitat Jaume I)

M14 | 19:00-19:20 | 1.12

General $2^{\times n}$ tensors are not identifiable for $n \neq 3$ **Pablo Mazón** (Università di Trento)

J16 | 11:00-11:20 | 1.12

Standard monomials in characteristic two

Laura Casabella (MPI MiS Leipzig)

J16 | 11:30-11:50 | 1.12

Prime ideals of Moh and the characteristic of the field

Laura González (Universitat Politècnica de Catalunya)

J16 | 12:00-12:20 | 1.12

Studying invariants of C -semigroups

Raquel Tapia-Ramos (Universidad de Cádiz)

J16 | 12:30-12:50 | 1.12

Edge-bicolored graphs and critical points of polynomials

Chiara Meroni (ETH Institute for Theoretical Studies)

J16 | 16:30-16:50 | 1.12

KP Solitons: Tropical Curves meet Grassmannians

Claudia Fevola (Inria Saclay)

J16 | 17:00-17:20 | 1.12

A combinatorial approach to the Tjurina algebra of a complete intersection monomial curve

Patricio Almirón (Universidad de Granada)

J16 | 17:30-17:50 | 1.12

On the finite generation of the effective cone and the Cox ring of a rational surface

Carlos Jesús Moreno-Ávila (Universidad de Extremadura)

J16 | 18:00-18:20 | 1.12

On the Hilbert scheme of points on a singular curve

Ángel David Ríos Ortiz (Université Paris Saclay)

Tuesday 14
17:30-17:50
[Room 1.12]

Martes 14
17:30-17:50
[Aula 1.12]

Asteartea 14
17:30-17:50
[Gela 1.12]

Multigraded regularity for solving 0-dimensional projections

Carles Checa

(University of Copenhagen)

Systems with multihomogeneous structure can be described using multigraded invariants. We consider multihomogeneous polynomial systems such that the projection to one group of variables is 0-dimensional. In our work, we show that one can rely on the partial regularity region we introduced in a previous article and construct multiplication matrices whose eigenvalues correspond to evaluating the points 0-dimensional projection in linear forms.

Joint work with Matías R. Bender, Laurent Busé and Elias Tsigaridas.

Tuesday 14
18:00-18:20
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Minimal and cellular free resolutions from involutive bases

Rodrigo Iglesias

(Universidad de La Rioja)

Involutive bases are a special kind of Gröbner bases with additional combinatorial properties. These bases induce free resolutions with nice combinatorial properties. Although these free resolutions are generally far from the minimal, we study the different classes of monomial ideals that lead to minimal resolutions and also to cellular resolutions. We give cellular structures for these cellular resolutions as well as a constructive algorithm that reduces them to the minimal one.

Joint work with Eduardo Sáenz De Cabezón.

[arXiv:2401.13788](https://arxiv.org/abs/2401.13788)

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Some results on bounded negativity conjecture

Elvira Pérez-Callejo

(Universitat Jaume I)

The bounded negativity conjecture is an old conjecture that states that there is a lower bound for the self-intersection of reduced and irreducible curves on a smooth complex projective surface that depends only on the surface. In this talk, we present two approaches to this problem by giving bounds that are either linear or quadratic with respect to its intersection with some nef divisor.

Joint work with Carlos Galindo and Francisco Monserrat.

Tuesday 14
 19:00-19:20
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General $2^{\times n}$ tensors are not identifiable for $n \neq 3$

Pablo Mazón

(Università di Trento)

A tensor is identifiable if it admits a unique decomposition as a sum of rank-one tensors. An interesting family consists of $2 \times \dots \times 2$ (n times) tensors since they appear frequently in Bayesian networks, tensor network states, latent-class models, and binary games with multiple players. In this talk, we show that, for every $n \neq 3$, a general tensor in $\mathbb{C}^2 \otimes \dots \otimes \mathbb{C}^2 = (\mathbb{C}^2)^{\otimes n}$ is not identifiable.

Joint work with Elisa Postinghel.

Thursday 16

11:00-11:20

[Room 1.12]

Jueves 16

11:00-11:20

[Aula 1.12]

Osteguna 16

11:00-11:20

[Gela 1.12]

Standard monomials in characteristic two**Laura Casabella**

(MPI MiS Leipzig)

Over a field of characteristic zero, De Concini, Eisenbud and Procesi developed a theory of standard monomials, which are a basis for determinantal ideals and provide a tool to study many of their properties, exploiting tableaux combinatorics. In this talk, we present our contribution to a new standard monomial theory in characteristics p modulo a Frobenius power, examining the case $p = 2$. A main feature of this investigation is given by analogs of semistandard Young tableaux in this new context.

Joint work with Teresa Vu.

[arXiv:2311.05530](https://arxiv.org/abs/2311.05530)

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Prime ideals of Moh and the characteristic of the field**Laura González**

(Universitat Politècnica de Catalunya)

In this talk, we will see that the minimal number of generators of the prime ideals of Moh, defined in the power series ring in three variables over a field, may change when the characteristic of the field changes. This contradicts a statement of Sally and leaves as an open problem to find families of prime ideals in $K[[x, y, z]]$ with an unbounded minimal number of generators, when K has characteristic other than zero.

Joint work with Francesc Planas-Vilanova.

[arXiv:2407.21692](https://arxiv.org/abs/2407.21692)

Thursday 16

12:00-12:20

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[Gela 1.12]

Studying invariants of \mathcal{C} -semigroups

Raquel Tapia-Ramos

(Universidad de Cádiz)

Let \mathcal{C} be an integer cone. We say that an affine semigroup $S \subseteq \mathcal{C}$ is a \mathcal{C} -semigroup if the complement of S in \mathcal{C} is finite. We present a study of \mathcal{C} -semigroups, exploring their properties. Additionally, we develop algorithms for counting \mathcal{C} -semigroups with fixed invariants, such as genus and Frobenius elements.

Joint work with José Carlos Rosales and Alberto Vigneron-Tenorio.

[arXiv:2409.06376](https://arxiv.org/abs/2409.06376)

Thursday 16

12:30-12:50

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12:30-12:50

[Gela 1.12]

Edge-bicolored graphs and critical points of polynomials

Chiara Meroni

(ETH Institute for Theoretical Studies)

We show that a class of bivariate integrals can be seen as generating functions of labeled edge-bicolored graphs. Based on this, we prove an effective algorithm to compute the number of such graphs, and an asymptotic formula for the number of regular edge-bicolored graphs with arbitrary weights assigned to different vertex structures. The phase transitions for the asymptotic formulas correspond to critical points of a specific polynomial. We will discuss examples, computation, and conjectures.

Joint work with Michael Borinsky and Maximilian Wiesmann.

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16:30-16:50

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[Gela 1.12]

KP Solitons: Tropical Curves meet Grassmannians**Claudia Fevola**

(Inria Saclay)

The KP equation, a partial differential equation describing nonlinear wave motion, has solutions linked to algebraic curves. Solitons, a special class of solutions, arise from rational nodal curves. Kodama and Williams explored real regular solitons and their connection to totally positive Grassmannians. Building on Abenda and Grinevich's work, I discuss the relationship between real regular solitons, dual graphs of singular curves, Le-graphs, and cells in the totally positive Grassmannian.

Joint work with Simonetta Abenda, Türkü Özlüm Çelik, and Yelena Mandelshtam.

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A combinatorial approach to the Tjurina algebra of a complete intersection monomial curve**Patricio Almirón**

(Universidad de Granada)

Complete intersection monomial curves (CIMC) illustrate the interplay between curve singularities and the combinatorics of semigroup values from intersection multiplicities with the curve.

This talk will show how a characterization given by Delorme in 1976 helps study the miniversal deformation of CIMCs and provides a decomposition result for its basis.

We will also explore the connection with the moduli space of curves.

Joint work with J.J. Moyano Fernández.

[arXiv:2310.20394](https://arxiv.org/abs/2310.20394)

Thursday 16

17:30-17:50

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Jueves 16

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Osteguna 16

17:30-17:50

[Gela 1.12]

*On the finite generation of the efective cone and the Cox ring of a rational surface***Carlos Jesús Moreno-Ávila**

(Universidad de Extremadura)

Let X be a rational surface obtained from a Hirzebruch surface by a sequence of blowups centered at closed points. We see conditions which imply, on the one hand, that the efective cone of X is polyhedral and minimally generated and, on the other hand, the finite generation of the Cox ring of X . Moreover, we provide a set of generators of the nef cone of X in these cases.

Joint work with C. Galindo and F. Monserrat.

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*On the Hilbert scheme of points on a singular curve***Ángel David Ríos Ortiz**

(Université Paris Saclay)

The Hilbert scheme of points on a variety parametrizes how points behave when they collide. In the case of smooth curves their structure is well understood, whereas for singular curves the general expectation is that is impossible to know. I will report on a work with Javier Sendra Arranz about a class of singular curves for which we describe the irreducible components and their behavior when we increase the number of points and a particularly nice combinatorial description emerging from them.

Joint work with Javier Sendra Arranz.