Contents

Plenary talks

Plenary talk - July 25, 11:30 – 12:20

Hopf-Lie theory on hyperplane arrangements

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The braid hyperplane arrangement plays a central role in the study of various important notions in general algebra. This role may not be immediately apparent, but when it is made explicit, one discovers that these notions can be extended to a new setting in which an arbitrary real hyperplane arrangement takes center stage. This results in a new theory with strong connections with geometric combinatorics, semigroup theory and other areas of classical algebra. This theory has been the focus of my attention for the past few years and I have been working on it in close collaboration with Swapneel Mahajan. I will start by discussing a few basic notions pertaining to real hyperplane arrangements, focusing on the Tits product of faces. Then I will try to support the central claim by defining extensions of the notion of Hopf algebra, Lie algebra, and operads. I will mention extensions of a few selected results such as a theorem of Joyal, Klyachko and Stanley (relating the free Lie algebra to the partition lattice), the Cartier-Milnor-Moore theorem (relating Hopf and Lie algebras), and concepts such as Koszul duality. The conclusion is that much of this classical theory admits an extension relative to a real hyperplane arrangement.

Joint work with Swapneel Mahajan (Indian Institute of Technology Mumbay, India).

Plenary talk - July 27, 11:30 – 12:20

Arithmetic geometry of toric varieties

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There is a very rich theory linking the algebraic geometry of toric varieties with combinatorial properties. For instance, to a toric variety X provided with an ample divisor D we can associate a lattice polytope Δ. We can recover the variety and the divisor from the polytope and many properties of (X, D) can be read from this polytope. For instance the degree of D is given by $n!$ times the volume of the polytope ($n = \dim(X)$) and a basis of the global sections of $\mathcal{O}(D)$ is given by the integral points of the polytope. In a join project with P. Philippon and M. Sombra we have extended this toric dictionary to the Arakelov theory of toric varieties. Each toric variety has a canonical model over $\mathbb{Z}$. To a semipositive hermitian metric on $\mathcal{O}(D)$, invariant under the action of the compact torus, we associate a concave function ϑ on Δ. Called the roof function. The objective of this talk is to convince you that the roof function can be seen as an extended polytope that codifies most of the Arakelovian properties of X. For instance we can compute from it the height of X, the arithmetic volume of X, the essential and absolute minima and whether there is equidistribution of Galois orbits of small points.

Joint work with Martin Sombra (ICREA and Universitat de Barcelona), Patrice Philippon (CNRS and Institut de Mathématiques de Jussieu), Atsushi Moriwaki (University of Kyoto) and Juan Rivera-Letelier (University of Rochester).

Plenary talk - July 29, 10:00 – 10:50

Sum-product estimates in finite fields

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The sum-product phenomenon, due to Erdös and Szemerédi, asserts, roughly speaking, that for any set A of integers either the sum set $A+A$ or the product set AA has the cardinality significantly larger than the cardinality of A. A finite field analogue of this problem was solved in 2003 by Bourgain, Katz and Tao. The sum-product estimate and its versions have found important applications in various areas of mathematics.

In this talk I will discuss sum-product estimates in finite fields and show some of their applications.

Plenary talk - July 28, 10:30 – 11:20

A_∞-algebras in representation theory and homological algebra

Estanislao Herscovich
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In this talk I will recall the basic theory of A_∞-algebras, which were introduced by J. Stasheff in 1963. Even though they appeared within the realm of algebraic topology, I will present several examples of their use in representation theory and in homological algebra. In particular, in the last part of the talk I will show that the torsion theory of A_∞-algebras naturally allows to compute the cup and cap products on Hochschild cohomology and homology of any nonnegatively graded connected algebra, respectively.

Plenary talk - July 28, 9:00 – 9:50

Subgroups of the interval exchange transformation group.

Kate Juschenko
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I will discuss several classes of subgroups of interval exchange transformation group (IET). These subgroups come from topological full groups of corresponding rotations. Amenability and absence of free subgroups are the main questions we are going to discuss with relation to the subgroups of IET.

Plenary talk - July 28, 11:30 – 12:20

Cluster algebras and quantum affine algebras

Bernard Leclerc
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Quantum affine algebras have a rich theory of finite-dimensional representations, with important applications to integrable systems in statistical mechanics and quantum field theory. In 2008, it was discovered that the Grothendieck rings of certain monoidal categories of representations have the natural structure of a cluster algebra, such that all cluster monomials are classes of irreducible representations.

Since then the theory has developed a lot. It now covers all untwisted quantum affine algebras and larger classes of representations. One recent application is a geometric formula for the q-character of a product of Kirillov-Reshetikhin modules, in terms of Euler characteristics of certain new types of quiver varieties.

I will give a survey of the main results and conjectures, and if time allows, I will mention some recent extension of the theory to some infinite-dimensional representations of Borel subalgebras of quantum affine algebras.

Joint work with David Hernandez (Université Paris 7, France).

Plenary talk - July 26, 9:00 – 9:50

Elliptic fibrations and K3 surfaces

Cecília Salgado
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Among algebraic surfaces, those that have an elliptic fibration, i.e., that are endowed with a proper morphism to a smooth curve whose fibers are, almost all, elliptic curves, play a special role: they can be regarded as an elliptic curve over the function field of the base curve and as a family of curves over the base curve. This two folded description makes such objects simultaneously intriguing and simpler to treat.

If one classifies algebraic surfaces by Kodaira dimension, one finds elliptic surfaces in all (Kodaira) dimensions but for $\kappa = 2$. But the only subclass that might admit more than one elliptic fibration with a section is that of K3 surfaces. It is therefore natural to search for a classification of elliptic fibrations on K3 surfaces.

I this talk I will introduce the definitions above and discuss the classification of elliptic fibrations on K3 surfaces, focusing, towards the end, in a special class given by the ones endowed with a non-symplectic involution.

Joint work with Alice Garbagnati (Univ. Milano).

Plenary talk - July 27, 10:00 – 10:50

On new applications of noncommutative rings

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We will mention some open questions and results in noncommutative ring theory related to other research areas; for example, related to resolutions of noncommutative singularities, superpotential algebras, Jacobi algebras, noncommutative projective algebraic geometry and group theory. Some new ring theoretic approaches for studying differential polynomial rings and tensor products $A \otimes A$ and $A \otimes A^{opp}$ will be

mentioned within the context of coalgebras, Hopf algebras and Lie algebras. These methods are related to the Golod-Shafarevich theorem.

We will also look at a ring theoretic approach to the Yang-Baxter equation, which explores the connection between braces and nilpotent rings. Braces are a generalisation of Jacobson radical rings, and have been introduced by Rump as a tool for investigating non degenerate involutive set-theoretic solutions of the Yang-Baxter equation. We will present both old and new results from this area, together with a gentle introduction to the subject. No previous knowlege of braces, braided groups nor of the Yang-Baxter equation is assumed.

Plenary talk - July 26, 11:30 – 12:20

Tame topology and Complex Analytic Geometry

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In early 1980's logicians L. van den Dries, A. Pillay and C.Steinhorn introduced o-minimal structures that can be viewed as a Model Theoretic solution to Grothendieck's program of developing tame topology.

In this talk we start with a brief discussion of Grothendick's idea of tame topology. As examples we consider semi-algebraic and sub-analytic geometries. We will also demonstrate as the tameness of sub-analytic sets can be used in the context of Complex Analytic Geometry.

Joint work with Y.Peterzil.

Plenary talk - July 29, 11:30 – 12:20

Tensors and their Eigenvectors

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Eigenvectors of square matrices are central to linear algebra. Eigenvectors of tensors are a natural generalization. The spectral theory of tensors was pioneered by Lim and Qi a decade ago, and it has found numerous applications. We present an introduction to this theory, with focus on results on eigenconfigurations due to Abo, Cartwright, Robeva, Seigal and the author. We also discuss a count of singular vectors due to Friedland and Ottaviani.

Plenary talk - July 26, 10:30 – 11:20

Topological methods to solve equations over groups

Andreas Thom
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We present a large class of groups (no group known to be not in the class) that satisfy the Kervaire-Laudenbach Conjecture about solvability of non-singular equations over groups. We also show that

certain singular equations with coefficients over groups in this class are always solvable. Our method is inspired by seminal work of Gerstenhaber-Rothaus, which was the key to prove the Kervaire-Laudenbach Conjecture for residually finite groups. Exploring the structure of the p-local homotopy type of the projective unitary group, we manage to show that many singular equations with coefficients in unitary groups can be solved in the unitary group.

Joint work with Anton Klyachko.

Plenary talk - July 25, 10:00 – 10:50

Cluster Theory

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Cluster algebras were introduced by Fomin and Zelevinsky in 2000 in the context of Lie theory to deal with the total positivity and Lustig's dual canonical basis. Cluster algebras are commutative algebras generated by cluster variables which are obtained in a very particular way, using mutations guided by sequences of skew symmetrizable matrices, which are also mutated in the process.

After the introduction of cluster algebras, there was a large amount of mathematics developed connecting cluster algebras to many fields of mathematics: representation theory of finite dimensional algebras, Auslander-Reiten theory, combinatorics, Poisson geometry, Teichmuller theory, tropical geometry, integrable systems and more.

Already at the early stages, additive categorification was introduced for acyclic cluster algebras, i.e. for those cluster algebras which correspond to the quivers with no oriented cycles. Cluster categories were defined as certain orbit categories of the derived categories of the categories of quiver representations. It was shown that there is a beautiful correspondence between the fundamental notions of cluster algebras: cluster variables, clusters, cluster mutations and, the notions in the associated cluster category: indecomposable rigid objects, cluster tilting objects and tilting mutations.

Since the original motivation for the introduction of cluster categories was giving categorical interpretation to the combinatorics of the cluster algebras, in this talk I will mostly concentrate on this relation between cluster algebras and cluster categories.

Session S01
Computational Algebra and Applications of Algebra

Chair: Alicia Dickenstein – Collaborators: Carina Curto, Luis David Garcia-Puente

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S01 - July 28, 16:00 – 16:25

Resultants modulo p

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Several problems in elimination theory involving arithmetic over the integers (like resultants, the Nullstellensatz, etc) have as an outcome an integer number which if it is not zero modulo a prime p, often imply that classical results over the complex number (dimension, number of zeroes, etc.) "descend" to the residual field. But what happens when p does divide this number? In this talk, we will show that in the case of multivariate resultants, if the input system has a finite number of zeroes modulo p, then p powered to this cardinality (counted with multiplicities) divides the resultant.

Joint work with Martin Sombra (ICREA & Universitat de Barcelona).

S01 - July 28, 19:00 – 19:25

Computational algebra for the working mathematician

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We show how computational algebra can be a powerful tool for the working mathematical scientist through several short stories from theoretical neuroscience, tensor analysis, and algebraic statistics. We also speculate about the future of algebra on a computer.

S01 - July 29, 15:00 – 15:25

Dowker complex, convex codes, and detecting hidden matrix factorizations.

Vladimir Itskov
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Detecting low-rank structure is often key for understanding data. This task, however, is particularly challenging in the presence of an unknown nonlinearity — i.e., where one must detect the existence of a factorization $C_{il} = f(\sum_{a=1}^{d} A_{ia}B_{al})$ with small d, where $f(x)$ is an unknown monotone nonlinearity.

It turns out that homological features of the Dowker complex associated to the matrix C can be used to detect such a factorization, but the reason is somewhat mysterious. To understand why this works,

we consider the relationship between the Dowker complex of C and a convex code associated to the factors A and B. A convex code is a subset of $2^{[n]}$ that arises from intersection patterns of convex sets in some Euclidean space - in this case, the codewords correspond to selected chambers of a hyperplane arrangement. I will give a short introduction to the connection between Dowker complexes, convex codes, and matrix factorizations, reviewing our recent results and some open problems.

Joint work with Chad Giusti (University of Pennsylvania).

S01 - July 29, 17:30 – 17:55

On computational aspects of the generalized differential Lüroth's theorem

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Let $\mathcal{F}$ be a differential field of characteristic 0, $\mathbf{t} = t_1, \ldots, t_m$ a set of differential indeterminates over $\mathcal{F}$, and $\mathcal{F}\langle\mathbf{t}\rangle$ the field of differential rational functions. The generalized differential Lüroth's theorem proposed by Kolchin states that, for every differential subfield $\mathcal{G}$ of $\mathcal{F}\langle\mathbf{t}\rangle$ such that the extension $\mathcal{G}/\mathcal{F}$ has differential transcendence degree 1, there exists $v \in \mathcal{F}\langle\mathbf{t}\rangle$ with $\mathcal{G} = \mathcal{F}\langle v\rangle$. This result generalizes the differential Lüroth theorem proved by Ritt for $m = 1$.

We will discuss effectivity issues of the generalized differential Lüroth theorem. If $\mathcal{G}$ is generated by a finite family of differential rational functions in $\mathcal{F}\langle\mathbf{t}\rangle$ of bounded orders and degrees, we will present upper bounds for the order and the degree of any Lüroth generator v of $\mathcal{G}$ over $\mathcal{F}$. These are the first known bounds for arbitrary m and, in the case $m = 1$, they improve the previous degree bounds. In addition, we will show that a Lüroth generator can be computed by means of classical techniques from computer algebra applied to a polynomial ideal associated with the given generators. Finally, we will show how to determine whether a given differentially finitely generated subfield of $\mathcal{F}\langle\mathbf{t}\rangle$ has differential transcendence degree 1 over $\mathcal{F}$.

Joint work with Lisi D'Alfonso (Universidad de Buenos Aires, Argentina) and Pablo Solernó (Universidad de Buenos Aires - CONICET, Argentina).

S01 - Poster

Unimodular lattices via $\mathbb{Q}(\zeta_{2^r p} + \zeta_{2^r p}^{-1})$ for $p = 3$ and $p = 5$

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A lattice Λ is a discrete additive subgroup of $\mathbb{R}^n$. Lattices have a range of applications in different areas, especially in information theory and more recently in cryptography. Special algebraic lattice constructions can be used to derive certain parameters which are usually difficult to calculate for general lattices such as diversity and minimum product distance, which are important parameters related to the signal transmission error probability over Rayleigh fading channels [3]. In this work we approach algebraic constructions of full diversity unimodular lattices via the twisted embedding, introduced in [1,2], applied to the ring of the integers of $\mathbb{Q}(\zeta_{2^r p} + \zeta_{2^r p}^{-1})$ for $p = 3$ and $p = 5$ and calculate their minimum product distances. The lattices obtained here are direct sums of rotated versions of the lattices $\mathbb{Z}^8$ and E_8.

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[1] E. Bayer-Fluckiger, Lattices and number fields, Contemporary Mathematics, vol. 241, pp. 69-84, 1999.

[2] E. Bayer-Fluckiger, Ideal lattices, Proceedings of the conference Number theory and Diophantine Geometry, Zurich, 1999, Cambridge Univ. Press, pp. 168-184, 2002.

[3] E. Bayer-Fluckiger, F. Oggier, E. Viterbo, New Algebraic Constructions of Rotated $\mathbb{Z}^n$-Lattice Constellations for the Rayleigh Fading Channel, IEEE Transactions on Information Theory, vol. 50, no. 4, pp. 702-714, 2004.

Joint work with Agnaldo José Ferrari (Sao Paulo State University, Brazil).

S01 - July 28, 17:30 – 17:55

Computing the Homology of Real Projective Sets

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We describe and analyze a numerical algorithm for computing the homology of real projective varieties. Its cost depends on the condition of the input as well as on its size: it is singly exponential in the number of variables (the dimension of the ambient space) and polynomial in the condition and the degrees of the defining polynomials.

Joint work with Felipe Cucker (City University of Hong Kong, China) and Michael Shub (City University of New York, USA).

S01 - July 29, 18:30 – 18:55

Tropical Graph Curves

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We study a tropical analogue of the notion of graph curves. Given a connected 3-regular graph G, we define a notion of tropical graph curve associated to G and show their existence when G is a 3-regular, three-connected planar graph. Furthermore, we realize these tropical graph curves as tropicalizations of graph curves. As an application, for smooth curves with a 3-regular, three-connected planar graph as their Berkovich skeleton, we construct canonical embeddings whose tropicalization preserves the topology of a Berkovich skeleton.

S01 - July 28, 18:00 – 18:25

Critical points via Monodromy and Numerical Algebraic Geometry

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In statistics and other applications, we usually have data collected from an experiment or an observation, and we expect this data to follow a model. Many of these models can be interpreted as solutions to a polynomial system, and a fundamental problem is to find the point in the model that best explains the data. In statistics, this is the point that maximizes the Likelihood function.

It is usually a challenge to find solutions to a polynomial equation that are meaningful to the original problem in applications. A common approach is to relax the original problem to allow complex solutions, as in this cases, many algebraic methods can be used.

In this talk, I will introduce an algorithm that uses tools from Numerical Algebraic Geometry to find the critical points of a distance function, and discuss other implications concerning its real solutions.

Joint work with Jose I. Rodriguez (University of Chicago, USA).

S01 - July 28, 15:00 – 15:25

Waring decompositions of a general polynomial vector

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Weierstrass canonical form expresses a pair of general quadratical forms as a sum of powers of the same linear forms. It is one of the many displays of the well known Spectral Theorem. The uniqueness is remarkable because it does not hold for a single quadratical form, but it holds for four quadratical forms in three variables. These are called (symultaneous) Waring decompositions, and when uniqueness holds they are canonical. The term identifiable is equivalently used in the applied setting. A classical (sometimes forgotten) Theorem by Roberts gives a similar canonical form for a pair given by two forms of degrees 2 and 3 in three variables, this result has a natural Euclidean meaning. We have found another canonical form, likely the last one, for three forms of degrees 3, 3, 4 in three variables.

Joint work with Elena Angelini (Università di Siena, Italy), Francesco Galuppi (Università di Ferrara, Italy) and Massimiliano Mella (Università di Ferrara, Italy).

S01 - July 29, 16:30 – 16:55

The structure of MESSI biological systems

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We introduce a general framework for biological systems that describe Modifications of type Enzyme-Substrate or Swap with Intermediates, which we call MESSI systems. Many post-translational modification networks are MESSI systems. For example: the motifs in Feliu and Wiuf (2012), sequential distributive and processive multisite phosphorylation networks, phosphorylation cascades, or the bacterial EnvZ/OmpR network. We prove that, under mass-action kinetics, MESSI systems are conservative. We simplify the study of steady states of these systems by explicit elimination of intermediate complexes and we define an important subclass of MESSI systems with toric steady states. We show, for MESSI systems with toric steady states, an algorithm that determines whether the system has the capacity for multistationarity, and when it does, it shows two positive steady states and reaction rate constants that witness multistationarity.

Joint work with Alicia Dickenstein (Universidad de Buenos Aires).

S01 - July 28, 18:30 – 18:55

Numerically computing Galois groups

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The Galois/monodromy group of a family of equations (or of a geometric problem) is a subtle invariant that encodes the structure of the solutions. In this talk, we will use numerical algebraic geometry to compute Galois groups. Our algorithm computes a witness set for the critical points of our family of equations. With this witness set, we use homotopy continuation to construct a generating set for the Galois group. Examples from optimization will be stated (maximum likelihood estimation and formation shape control).

Joint work with Jonathan Hauenstein (University of Notre Dame) and Frank Sottile (Texas A&M).

S01 - July 29, 16:00 – 16:25

Algebraic signatures of convex and non-convex neural codes

Anne Shiu
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Neural codes allow the brain to represent, process, and store information about the world. Combinatorial codes, comprised of binary patterns of neural activity, encode information via the collective behavior of populations of neurons. A code is called convex if its codewords correspond to regions defined by an arrangement of convex open sets in Euclidean space. Convex codes have been observed experimentally in many brain areas, including sensory cortices and the hippocampus, where neurons exhibit convex receptive fields. What makes a neural code convex? That is, how can we tell from the intrinsic structure of a code if there exists a corresponding arrangement of convex open sets? This talk describes how to use tools from combinatorics and commutative algebra to uncover a variety of signatures of convex and non-convex codes.

Joint work with Carina Curto (Pennsylvania State University), Elizabeth Gross (San Jose State University), Jack Jeffries (University of Michigan), Katherine Morrison (University of Northern Colorado), Mohamed Omar (Harvey Mudd College), Zvi Rosen (University of Pennsylvania) and Nora Youngs (Harvey Mudd College).

S01 - July 29, 18:00 – 18:25

Arithmetical structures of graphs.

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Given a graph $G = (V, E)$, its generalized Laplacian matrix is the square matrix given by

$$L(G, X_G)_{u,v} = \begin{cases} x_u & \text{if } u = v, \\ -m_{uv} & \text{if } u \neq v, \end{cases}$$

where $X_G = \{x_u | u \in V(G)\}$ is the set of indeterminates indexed by the vertices of G and m_{uv} is the number of edges between u and v. For any $\mathbf{d} \in \mathbb{N}^V$, let $L(G, \mathbf{d})$ be the integer matrix that result by making $x_u = \mathbf{d}_u$ on $L(G, X_G)$. An arithmetical graph is a triplet $(G, \mathbf{d}, \mathbf{r})$ given by a multidigraph G and a pair of vectors $(\mathbf{d}, \mathbf{r}) \in \mathbb{N}_+^V \times \mathbb{N}_+^V$ such that $\gcd(\mathbf{r}_v \,|\, v \in V(G)) = 1$ and

$$L(G, \mathbf{d})\mathbf{r}^t = \mathbf{0}^t.$$

Given an arithmetical graph $(G, \mathbf{d}, \mathbf{r})$ we say that the pair $(\mathbf{d}, \mathbf{r})$ is an arithmetical structure of G. The concept of arithmetical graphs was introduced by Lorenzini as some intersection matrices that arise in the study of degenerating curves in algebraic geometry.

Under certain hypothesis, it can be prove that the number of arithmetical structures of G is finite. In this way, let

$$\mathcal{A}(G) = \{(\mathbf{d}, \mathbf{r}) \in \mathbb{N}_+^{V(G)} \times \mathbb{N}_+^{V(G)} \,|\, (\mathbf{d}, \mathbf{r}) \text{ is an arithmetical structure of } G\}.$$

In this talk we present a survey of the recent results obtained on arithmetical graphs. For instance we present how behaves $\mathcal{A}(G)$ under some operations of graphs like subdivision of edges, duplication of vertices, etc.

These results allows to compute $\mathcal{A}(G)$ for some families of graphs. For instance it can be prove that the number of arithmetical structures of a path P_n with n vertices is equal to the Catalan number C_{n-1}.

S01 - July 28, 16:30 – 16:55

Sums of squares and the geometry of syzygies

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Let $X \subseteq \mathbb{P}^n$ be a reduced scheme over the reals defined by an ideal I_X. We show that the number of steps for which the minimal free resolution of I_X is linear is a lower bound for the next-to-minimal rank of extreme rays of the cone dual to the sums of squares in X. As a consequence, we obtain:

(1) A complete classification of totally real reduced schemes for which nonnegative quadratic forms are sums of squares.

(2) New certificates of exactness for semidefinite relaxations of polynomial optimization problems on projective varieties.

Joint work with Greg Blekherman (Georgia Tech, USA) and Rainer Sinn (Georgia Tech, USA).

S01 - July 28, 15:30 – 15:55

Varieties of apolar subschemes of toric surfaces

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The variety of sums of powers associated to a homogeneous polynomial describes the additive decompositions of the polynomial into powers of linear forms. These polynomial decompositions appear in several areas such as representation theory, coding theory, signal processing, data analysis, and algebraic statistics.

One of the most useful tools to study varieties of sums of powers is apolarity. This notion is originally related to the action of differential operators on the polynomial ring. It can be generalized in terms of the Cox ring of a variety, and in this way varieties of sum of powers are a special case of varieties of apolar schemes. In this talk I will present this generalization and examples of such varieties in the case of toric surfaces, when the Cox ring is particularly well-behaved.

Joint work with Kristian Ranestad (University of Oslo, Norway) and Matteo Gallet (RICAM-Austrian Academy of Sciences).

S01 - July 29, 15:30 – 15:55

Toric ideals of neural codes

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A neural code is a collection of codewords (binary vectors) of a given length n; it captures the co-firing patterns of a set of neurons. A neural code is convexly realizable if there exist n convex sets in some $\mathbb{R}^d$ so that each codeword in the code corresponds to a unique intersection carved out by the convex sets. There are some methods to determine whether a neural code is convexly realizable; however, these methods generally do not describe how to draw a realization. In this work, we construct toric ideals from neural codes, and we show how these and the related neural ideals are helpful in applying the theory of piercings from the field of information visualization.

Joint work with Elizabeth Gross (San Jose State University) and Nida Obatake (San Jose State University).

Session S02
Commutative Algebra and Algebraic Geometry

Chair: Eduardo Esteves – Collaborators: Antonio Laface, Leticia Brambila-Paz

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S02 - Poster

Rank two Vector bundles with first cohomology module generated by two elements and applications

Charles Aparecido Almeida
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We present a family of monads whose cohomology are μ-stable vector bundles of small rank on $\mathbb{P}^3$, whose first module of cohomology is generated by two elements, then study the geometrical properties of this family on the moduli space of stable vector bundles over $\mathbb{P}^3$. We use these results to show that the moduli space of stable rank two vector bundles with zero first Chern class and five second Chern class has exactly 3 irreducible components.

Joint work with Marcos Jardim (University of Campinas).

S02 - July 26, 15:40 – 16:10

The Birational Geometry of $\overline{M}_{0,6}$

Martha Bernal
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We give relations among the Castravet's generators of the Cox ring of $\overline{M}_{0,6}$ and describe the maps represented by those relations.

S02 - July 25, 18:50 – 19:20

Shapes of the simplest minimal free resolutions in $\mathbb{P}^1 \times \mathbb{P}^1$

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The study of graduate syzygies for the standard case 3 homogeneous polynomials is now well known, but the general context (especially in the multihomogeneous case) is of greater interest but involves further difficulties and is very much unknown.

In 2007, Cox, Dickenstein and Schenck have analysed in depth, from both a geometric and an algebraic perspective, the minimal free resolution of an ideal given by 3 bihomogeneous polynomials of bidegree $d = (2, 1)$ in $R = k[X_1, X_2][X_3, X_4]$. In particular, an accurate description of the non-Koszul syzygies is

obtained from an application of the Künneth formula and the Serre duality for $\mathbb{P}^1$; see the 1994 paper by Weyman and Zelevinsky on the subject.

In this talk, our goal is to give a detailed description of the (multi)graded minimal free resolution of an ideal I of R, generated by 3 bihomogeneous polynomials defined by $\mathbf{f} = (f_1, f_2, f_3)$ with bidegree (d_1, d_2), $d_i > 0$ and such that $V(I)$ is empty in $\mathbb{P}^1 \times \mathbb{P}^1$. We will precise the shape of the resolution in degree $d = (1, n)$, and explain how non-genericity (factorization) of the f_i's determine the resolution.

Joint work with Alicia Dickenstein (Universidad de Buenos Aires, Argentina) and Hal Schenck (University of Illinois, USA).

S02 - July 26, 15:00 – 15:30

Graded rings associated to valuations

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Suppose that K is a field with a valuation v and R is a local ring of K which is dominated by v. We discuss various graded rings associated to the valuation on R which provide fundamental information about birational properties of the ring. We consider especially differences between characteristic zero and positive characteristic and the question of finite generation and relative finite generation in a finite extension.

S02 - Poster

Intersections of Amoebas

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Given an Laurent polynomial $f \in \mathbb{C}[z_1^{\pm 1}, \ldots, z_n^{\pm 1}]$ the amoeba $\mathcal{A}(f)$ (introduced by Gelfand, Kapranov, and Zelevinsky '94) is the image of its variety $\mathcal{V}(f) \subseteq (\mathbb{C}^*)^n = (\mathbb{C} \setminus \{0\})^n$ under the $\mathrm{Log}|\cdot|$-map

$$\mathrm{Log}|\cdot| : (\mathbb{C}^*)^n \to \mathbb{R}^n, \quad (z_1, \ldots, z_n) \mapsto (\log|z_1|, \ldots, \log|z_n|).$$

Amoebas have amazing structural properties; they are related to various mathematical subjects like complex analysis, the topology of real algebraic curves, nonnegativity of polynomials, dynamical systems, and particularly tropical geometry.

While amoebas of hypersurfaces have been studied intensively during the last years, the non-hypersurface case is not understood so far. Here, we investigate intersections of amoebas of n hypersurfaces in $(\mathbb{C}^*)^n$, which are canonical supersets of amoebas given by non-hypersurface varieties. As a main result we present an amoeba analog of the classical Bernstein Theorem from combinatorial algebraic geometry providing an upper bound for the number of connected components of such intersections.

We also show how the order map for hypersurface amoebas can be generalized in a natural way to intersections of amoebas. Particularly, analogous to the case of amoebas of hypersurfaces, the restriction of this generalized order map to a single connected component of the intersection is still 1-to-1.

For further information see http://arxiv.org/abs/1510.08416.

Joint work with Martina Juhnke-Kubitzke (Universität Osnabrück).

S02 - July 25, 16:20 – 16:50

A Surface Coming from an Arithmetic Question

Homero Gallegos-Ruiz
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We study a surface in $\mathbb{P}^6$, which is a complete intersection of four quadrics coming from the rational distance problem: given a unit square on the plane, is there a point on the plane whose distances to the four points are all rational?

Joint work with Martha Bernal (CONACyT - Universidad Autonoma de Zacatecas, Mexico.).

S02 - July 26, 18:10 – 18:40

The algebraic density property for affine toric varieties

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In this talk we generalize the algebraic density property to notnecessarily smooth affine varieties relative to some closed subvariety containing the singular locus. This property implies the remarkable approximation results for holomorphic automorphisms of the Andersén-Lempert theory. We show that an affine toric variety X satisfies this algebraic density property relative to a closed T-invariant subvariety Y if and only if the complement of Y in X is different ffrom T. For toric surfaces we are able to classify those which posses a strong version of the algebraic density property (relative to the singular locus). The main ingredient in this classification is our proof of an equivariant version of Brunella's famous classification of complete algebraic vector fields in the affine plane.

Joint work with Frank Kutzschebauch (Bern Universität, Switzerland) and Matthias Leuenberger (Bern Universität, Switzerland).

S02 - July 26, 16:20 – 16:50

Bernstein–Sato polynomials for ideals in semigroup rings

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We extend the Budur–Mustaţă–Saito definition of Bernstein–Sato polynomials for varieties, to the context of ideals in normal semigroup rings. In the special case of monomial ideals in normal semigroup rings, we also provide a correspondence between certain roots of the Bernstein–Sato polynomial and certain jumping coefficients of the corresponding multiplier ideals.

Joint work with Jen-Chieh Hsiao (National Cheng Kung University, Taiwan).

S02 - Poster

Rational Harnack Curves on Toric Surfaces

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Harnack curves are a family of real algebraic curves who are distinguished because their topology is well understood, meaning that Hilbert's 16th problem is solved for these curves. Let f be a 2 variable real polynomial whose Newton polygon is Δ and let C be the curve defined as the zeros of f inside the toric variety X_Δ. The original definition of Harnack curves by Mikhalkin states that the real part of C, $\mathbb{R}C \subseteq \mathbb{R}X_\Delta$, is a Harnack curve if and only if the following conditions are satisfied:

1. The number of connected components of $\mathbb{R}C$ is maximal, that is $g+1$, where g is the arithmethic genus of C.

2. Only one component O intersects the axes of $\mathbb{R}X_\Delta$.

3. Let $l_1, \ldots, l_n$ be the axes of X_Δ ordered in a way such that it agrees with the cyclical order of their corresponding sides of Δ and let $d_1, \ldots, d_n$ be the integer lengths of the corresponding sides. Then O can be divided into disjoint arcs $\alpha_1, \ldots \alpha_n$ such that $\alpha_i \cap l_i = d_i$ and $\alpha_i \cap l_j = 0$ when $j \neq i$.

These curves have several different characterizations, for example, its amoeba (the image of C under the map $(z,w) \mapsto (\log|z|, \log|w|)$) is of maximal area. These curves have applications to physics through dimer theory. In this poster we focus on rational Harnack curves, which are Harnack curves of genus 0 and we show how these curves can be explicitly parametrized using the homogeneous coordinates of X_Δ.

Joint work with Mauricio Velasco (Universidad de los Andes, Colombia).

S02 - July 25, 15:40 – 16:10

Tannaka duality for algebraic groups

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The Chevalley's structure theorem states that any connected algebraic group over an algebraically closed field is the extension of an abelian variety by a connected affine algebraic group. In view of this result, the theory of algebraic groups has been developed along two directions: the study of linear (affine) algebraic groups and that of abelian varieties. The representation theory of affine algebraic groups plays an important role in their study: the (classical) Tannaka duality theorem guarantees that an affine algebraic group can be recovered from its category or representations.

In this talk we propose a representation theory for arbitrary algebraic groups, as follows: let G be an algebraic group G consider its Chevalley decomposition $1 \to G_{aff} \to G \to A \to 0$. A representation of G is a homogeneous vector bundle $E \to A$ together with regular action $\varphi : G \times E \to E$, linear on the fibres and such that the induced morphism $\widetilde{\varphi} : A \times A \to A$ is the product in A (recall that $A \times A$ is the Albanese variety of $G \times E$). We will define the category of representations of G, and prove that a generalisation of Tannaka duality theorem is valid in this context, therefore allowing us to recover an algebraic group from its category of representations.

This is an ongoing joint work, partially financed by CSIC-Udelar and ANII (Uruguay).

Joint work with Pedro Luis del Ángel (CiMat, México).

S02 - July 25, 17:30 – 18:00

Algebras with a negation map

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In tropical mathematics, as well as other mathematical theories involving semirings, when trying to formulate the tropical versions of classical algebraic concepts for which the negative is a crucial ingredient, such as determinants, Grassmann algebras, Lie algebras, Lie superalgebras, and Poisson algebras, one often is challenged by the lack of negation. Following an idea originating in work of Gaubert and the Max-Plus group and brought to fruition by Akian, Gaubert, and Guterman, we study algebraic structures, called systems in the context of universal algebra, leading to more viable (super)tropical versions of these algebraic structures. Some basic results are obtained in linear algebra, linking determinants to linear independence. This approach also is applied to other theories, such as hyper

fields.

Formulating the structure axiomatically enables us to view the tropicalization functor as a morphism, thereby further explaining the mysterious link between classical algebraic results and their tropical analogs. Next, we use this functor to analyze some tropical structures and propose tropical analogs of classical algebraic notions.

S02 - July 26, 17:30 – 18:00

Mod 2 cohomology rings of moduli stacks of Real vector bundles

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The rational cohomology ring of the moduli stack of holomorphic vector bundles of fixed rank and degree over a compact Riemann surface was studied by Atiyah and Bott using tools of differential geometry and algebraic topology: they found generators of that ring and computed its Poincaré series. In joint work with Chiu-Chu Melissa Liu, we study in a similar way the mod 2 cohomology ring of the moduli stack of Real vector bundles of fixed topological type over a compact Riemann surface with Real structure. The goal of the talk is to explain the principle of the computation, emphasizing the analogies and differences between the Real and complex cases, and discuss applications of the method. In particular, we provide explicit generators of mod 2 cohomology rings of moduli stacks of vector bundles over a real algebraic curve.

S02 - July 25, 15:00 – 15:30

Ideals of fat points: subhomaloidal types and symbolic powers

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The subject theme relates to the intertwinning between plane Cremona maps and ideals of plane fat points, taking up both algebraic and geometric developments. The classical terminology "homaloidal types" refers to the virtual multiplicities of the base points of a Cremona map, while the ones on the title

are closely related thereof and the associated ideal of fat points has interesting properties. The notion binding the two types together is that of the (second) symbolic power. The talk will give a glimpse of the homological facet involved as well as the relation to the classical Bordiga—White varieties.

Joint work with Zaqueu Ramos (Universidade Federal de Sergipe, Brazil).

S02 - July 25, 18:10 – 18:40

How to identify Milnor fibers of smoothings of quotient sigularities

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This is part of my joint paper "Milnor fibers and symplectic fillings of quotient surface singularities" (arXiv:1507.06756) with Heesang Park, Dongsoo Shin and Jongil Park. I will explain how MMP is used to identify the Milnor fiber of a smoothing of a 2-dimensional quotient singularity. This is used to give a geometrical one-to-one correspondence between Milnor fibers and certain zero continued fractions, for the case of cyclic quotient singularities, which recovers the correspondence of Kollár-Shepherd-Barron, Christophersen-Stevens, and Lisca (connecting Milnor fibers with symplectic fillings). The MMP used is a small part of a bigger explicit MMP for families of surfaces described in my joint paper "Flipping surfaces" with Paul Hacking and Jenia Tevelev.

Joint work with Heesang Park (Konkuk University, South Korea), Dongsoo Shin (Chungnam National University, South Korea) and Jongil Park (Seoul National University, South Korea).

S02 - Poster

Orthogonal instanton bundles of higher rank on $\mathbb{P}^3$

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In this work we provide a bijection between equivalence classes of orthogonal instanton bundles over $\mathbb{P}^3$ and symmetric forms. Using such correspondence, we prove the non-existence of orthogonal instanton bundles on $\mathbb{P}^3$, with second Chern class equals to one or two, and we also provide examples of orthogonal instanton bundles of second Chern classes three and four on $\mathbb{P}^3$.

Joint work with Simone Marchesi (University of Campinas, Brazil).

Session S03
Hopf Algebras

Chair: Vladislav Kharchenko – Collaborators: Iván Angiono

S03 - July 25, 15:00 – 15:50

Nichols algebras of finite Gelfand-Kirillov dimension over abelian groups

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I will give an overview of the classification of Nichols algebras of finite GK-dimension over abelian groups, including numerous new examples.

Joint work with Iván Angiono (Universidad Nacional de Córdoba) and István Heckenberger (Universität Marburg).

S03 - Poster

Representation of weak Hopf algebra arising from fusion double groupoids

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Let $\Bbbk$ be a field and $\operatorname{Rep}\Bbbk\mathcal{T}$ be the category of finite dimensional representations of the weak Hopf algebra $\Bbbk\mathcal{T}$ associated to a finite fusion double groupoid $\mathcal{T}$. In this work we study proprieties of $\operatorname{Rep}\Bbbk\mathcal{T}$. More precisely, we investigate when this category is group-theoretical.

Joint work with Nicolás Andruskiewitsch (Universidad Nacional de Córdoba, Argentina) and Daiana Flôres (Universidade Federal de Santa Maria).

S03 - July 26, 15:00 – 15:50

On Hopf orders and Kaplansky's sixth conjecture

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A theorem of Frobenius states that the degree of any complex irreducible representation of a finite group G divides the order of G. This is proved using the following specific property of the group algebra $\mathbb{C}G$: it is defined over $\mathbb{Z}$ or, in other words, the group ring $\mathbb{Z}G$ is a Hopf order of $\mathbb{C}G$.

Kaplansky's sixth conjecture predicts that Frobenius Theorem holds for complex semisimple Hopf algebras. There are several partial results in the affirmative. Compared to the case of groups, the main difficulty to prove this conjecture (if true) is that it is not guaranteed that a complex semisimple Hopf

algebra H is defined over $\mathbb{Z}$ or, more generally, over a number ring. If it would be so, Larson proved that H satisfies Kaplansky's sixth conjecture. The question whether every complex semisimple Hopf algebra can be defined over a number ring has always been behind this conjecture.

In this talk we will answer this question in the negative. The family of examples that we will handle, constructed by Galindo and Natale, are Drinfeld twists of certain group algebras. The key fact is that the twist contains a scalar fraction, which makes impossible to define such Hopf algebras over a number ring.

The results that will be presented are part of a joint work with Ehud Meir (University of Hamburg) published in Trans. Amer. Math. Soc. and available at arXiv.org.

S03 - July 25, 18:30 – 18:55

A d.g. Hopf algebra associated to a set theoretical solution of the Yang-Baxter equation and cohomology

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For a set theoretical solution of the Yang-Baxter equation (X, r), we define a d.g. Hopf algebra $B = B(X, r)$ containing the group algebra $k[G]$, where $G = \langle x \in X : xy = zt \text{ if } r(x, y) = (z, t)\rangle$, in such a way that $k \otimes_G B \otimes_G k$ and $\mathrm{Hom}_{G-G}(B, k)$ are respectively the homology and cohomology complexes computing quandle/rack homology and cohomology, as defined by knot theorists (Carter, Saito, Jelsovskyb, ElHamadi) and other generalizations of cohomology (e.g. twisted rack cohomology, or Yang-Baxter cohomology). This algebraic structure allow us to show the existence of an associative product in Yang-Baxter cohomology, and a comparison map with Hochschild (co)homology of k[G], that factors trough the Nichols algebra associated to $(X, -r)$.

Joint work with Juliana Garcia Galofre (Universidad de Buenos Aires, Argentina)..

S03 - July 25, 18:00 – 18:25

The five-term exact sequence for Kac cohomology

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The set of equivalence classes of abelian extensions of Hopf algebras associated to a matched pair of finite groups turns out to be a group. This group was described by Kac in the 60's as the second cohomology group of a double complex, whose total cohomology is known as the Kac cohomology. Masuoka generalized this result and used it to construct and classify semisimple Hopf algebra extensions. Since Kac cohomology is defined as the total cohomology of a double complex, there is an associated spectral sequence. We compute the second page of this spectral sequence and the five-term exact sequence associated. Through some examples we show how this new exact sequence is very useful to compute the group of abelian extensions.

Joint work with Yiby Morales (Universidad de los Andes).

S03 - July 26, 18:00 – 18:25

Pointed and copointed Hopf algebras over dihedral groups

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Let k be an algebraically closed field of characteristic 0 and let D_m be the dihedral group of order $2m$ with $m = 4t$; $t \geq 3$. This talk will be based on joint work with Fernando Fantino and Mitja Mastnak [FG], [GM] and [FGM] where we classify all finite-dimensional pointed and copointed Hopf algebras whose group of group-likes is D_m by means of the lifting method and 2-cocycle deformations. As a byproduct we obtain new examples of finite-dimensional pointed and copointed Hopf algebras.

Among many useful tools for constructing new Hopf algebras is the use of multiplicative 2-cocycles for deforming the multiplication of a given Hopf algebra (and the dual notion of deforming its coproduct by using a twist). With this in mind, it is interesting to ask whether some non-isomorphic Hopf algebras might be cocycle deformations of each other. It has been proven by different methods that all known families of finite-dimensional pointed and copointed Hopf algebras over abelian and non-abelian groups can be constructed by deforming the multiplication of bosonizations of Nichols algebras.

It turns out that it is also the case for all pointed and copointed Hopf algebras over D_m. We show this result by giving explicitly the family of 2-cocycles that give the deformation. Besides introducing these families of Hopf algebras, I will describe how to produce such cocycles and give the appropriate setting where the construction applies.

References

[FG] F. Fantino and G. A. García, On pointed Hopf algebras over dihedral groups. Pacific J. of Math. Vol. 252 (2011), no. 1, 69–91.

[FGM] F. Fantino, G. A. García and M. Mastnak, On copointed Hopf algebras over dihedral groups. In preparation.

[GM] G. A. García and M. Mastnak, Deformation by cocycles of pointed Hopf algebras over non-abelian groups, Math. Res. Lett. 22 (2015), 59–92.

Joint work with Fernando Fantino (Universidad Nacional de Córdoba, Argentina) and Mitja Mastnak (St. John's University, Canada).

S03 - Poster

Quantum Subgroups of Simple Twisted Quantum Groups at Roots of One

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Let G be a connected, simply connected simple complex algebraic group and let ϵ be a primitive ℓth root of unity with ℓ odd and coprime with 3 if G is of type G_2. We determine all Hopf algebra quotients of the twisted multiparameter quantum function algebra $\mathcal{O}_\epsilon^\varphi(G)$ introduced by Costantini and Varagnolo. This extends the results of Andruskiewitsch and the first author, where the untwisted case is treated.

Joint work with Gastón Andrés García (Universidad Nacional de La Plata).

S03 - July 25, 16:30 – 16:55

On rigidity of Nichols algebras

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Nichols algebras have become one of the main objects in the theory of Hopf algebras. In particular, Nichols algebras of diagonal type play a central role in the classification program for pointed Hopf algebras, which are obtained by the two-step process of bosonization and graded deformation (so called "lifting") from these Nichols algebras.

It turns out that if the first step of this process is omitted then there may well be no graded deformations. More precisely, certain wide classes of graded braided bialgebras, including finite-dimensional Nichols algebras of diagonal type, positive parts of quantum groups, and finite-dimensional symmetric algebras of braided vector spaces whose braiding comes from the (co)action of a finite-dimensional (co)triangular Hopf algebra, do not admit nontrivial graded deformations.

Joint work with Iván Angiono (Universidad Nacional de Córdoba, Argentina) and Mitja Mastnak (Saint Mary's University, Canada).

S03 - July 26, 17:30 – 17:55

Non-associative exponentials and the Baker–Campbell–Hausdorff formula

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An exponential map is a power series in one variable that sends the set of primitive elements in a complete Hopf algebra to the set of its group-like elements, and whose linear term has coefficient 1. While the exponential map is unique in the associative setting, in the non-associative case there are infinitely many exponential maps.

In this talk I will describe the set of all non-associative exponential maps as a torsor for a certain residually nilpotent group. I will also talk about the problem of constructing the non-associative version of the Dynkin form of the Baker-Campbell-Hausdorff formula; that is, expressing $\log(\exp(x)\exp(y))$, where x and y are non-associative variables, in terms of the Shestakov-Umirbaev primitive operations.

Joint work with J.M. Pérez Izquierdo (Universidad de la Rioja, España) and I.P. Shestakov (Universidade de São Paulo, Brasil).

S03 - Poster

Examples of finite-dimensional Hopf algebras with the dual Chevalley property.

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We present examples of Hopf algebras with the dual Chevalley property, that is, a Hopf algebra whose coradical is a Hopf subalgebra. For this, we determine all semisimple Hopf algebras Morita-equivalent to

a group algebra over a finite group, for a list of groups supporting a non-trivial finite-dimensional Nichols algebra.

Joint work with A. Andruskiewitsch (Universidad Nacional de Córdoba, Argentina) and C. Galindo (Universidad de los Andes, Colombia).

S03 - July 25, 17:30 – 17:55

Partial actions of Hopf algebras: how it all started

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This talk is a survey about the development of the study of partial Hopf actions since its beginning.

S03 - July 26, 18:30 – 18:55

Tropical Hopf algebras and weak Hopf algebras

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Recently tropical versions of Lie algebras have been developed. In this talk we discuss a general method of tropicalizing algebraic structures, and present the foundation of the tropical Hopf theory (over the max-plus algebra), and more generally Hopf algebras over semirings.

S03 - Poster

Hopf automorphisms and twisted extensions

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In this poster, I will describe some applications of a Hopf algebra constructed from a group acting on another Hopf algebra A as Hopf automorphisms, namely Molnar's smash coproduct Hopf algebra. I will also describe connections between the exponent and Frobenius–Schur indicators of a smash coproduct and the twisted exponents and twisted Frobenius-Schur indicators of the original Hopf algebra A.

Joint work with Susan Montgomery (University of Southern California, United States) and Sarah Witherspoon (Texas A&M University, United States).

S03 - July 25, 16:00 – 16:25

The classification of Nichols algebras

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Nichols algebras appear in several branches of mathematics going from Hopf algebras and quantum groups, to Schubert calculus and conformal field theories. In this talk we review the main problems related to Nichols algebras and we discuss some classification theorems. The talk is mainly based on joint works with I. Heckenberger.

Joint work with István Heckenberger (Philipps-Universität, Marburg, Germany).

S03 - July 26, 16:00 – 16:25

Universal quantum groups associated to a pair of preregular forms

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I will discuss recent joint work with Alexandru Chirvasitu and Xingting Wang (arXiv:1605.06428), where we define the universal quantum group $\mathcal{H}$ that preserves a pair of Hopf comodule maps whose underlying vector space maps are preregular forms defined on dual vector spaces. This generalizes the construction of Bichon and Dubois-Violette (2013), where the target of these comodule maps are the ground field. We also recover the quantum groups introduced by Dubois-Violette and Launer (1990), by Takeuchi (1990), by Artin, Schelter, and Tate (1991), and by Mrozinski (2014), via our construction. As a consequence, we obtain an explicit presentation of a universal quantum group that coacts simultaneously on a pair of N-Koszul Artin-Schelter regular algebras with arbitrary quantum determinant.

Joint work with Alexandru Chirvasitu (University of Washington, Seattle, United States) and Xingting Wang (Temple University, United States).

S03 - July 26, 16:30 – 16:55

Noncommutative discriminants via Poisson primes

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Discriminants play a key role in various settings in algebraic number theory, algebraic geometry, combinatorics, and noncommutative algebra. In the last case, they have been computed for very few algebras. We will present a general method for computing discriminants of noncommutative algebras which is applicable to algebras obtained by specialization from families, such as quantum algebras at roots of unity. It builds a connection with Poisson geometry and expresses the discriminants as products of Poisson primes.

Joint work with Bach Nguyen and Kurt Trampel (Louisiana State University).

Session S04
Operator Algebras

Chair: Severino Toscano do Rego Melo

S04 - July 26, 17:30 – 18:20

Applications of ternary rings to C^*-algebras

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Given a *-algebra, it is often possible to endow it with different C*-norms, thus giving rise to different C*-algebras after completion. This situation arises, for example, when dealing with any sort of crossed products. On the other hand, an important tool in the theory of operator algebras is the so called Morita-Rieffel equivalence of C*-algebras. In our talk we will exhibit pairs of *-algebras such that any C*-norm on one of them induces a C*-norm on the other one, in such a way that the corresponding completions are Morita-Rieffel equivalent. Applications will be given to tensor products of C^*-algebras and to cross-sectional algebras of Fell bundles over groups.

Joint work with Damián Ferraro (Universidad de la República, Uruguay).

S04 - July 25, 15:00 – 15:50

Invariants of Operator Systems

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Operator systems are unital, selfadjoint, subspaces of $B(H)$. They form a category with unital completely positive maps as their morphisms. The problem of classifying these structures is very hard, even in the finite-dimensional case; in fact, there is still no classification in the 3-dimensional case! We will show some positive classification results, both of an abstract and a concrete flavour.

S04 - July 26, 16:00 – 16:50

Groupoid fibrations and their C*-algebras

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Fibrations of groupoids describe actions of groupoids on other groupoids by equivalences. A fibration from a topological groupoid L to another topological groupoid H is a functor $F\colon L \to H$ with some properties. The kernel of this functor is another topological groupoid G, called the fibre of F. We interpret L as a

transformation groupoid "$G \rtimes H$" for an action of H on G by (partial) equivalences. Classical actions by automorphisms and groupoid extensions are particular cases of fibrations. Several properties, as for instance, (local) Hausdorffness or compactness and amenability are preserved by groupoid fibrations in the sense that L has the property if G and H have it.

Our main result shows that a crossed product by L can be written as an iterated crossed product, first by G and then by H, that is, $A \rtimes L \cong (A \rtimes G) \rtimes H$.

Joint work with Ralf Meyer (University of Göttingen, Germany).

S04 - July 26, 15:00 – 15:50

Nonarchimedean bornological algebras and their cyclic homology

Guillermo Cortiñas
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Let V be a complete discrete valuation domain with maximal ideal πV, fraction field $K = V[\pi^{-1}]$, and residue field $k = V/\pi V$. We are interested in developing a bivariant cohomology theory for k-algebras which takes values in K-vector spaces and has all the good properties (homotopy invariance, Morita invariance, excision, agreement with the relevant variant of de Rham cohomology in the commutative case, etc.). We assume that K has characteristic zero, but make no assumption on the characteristic of k; in fact the main case for us is $\mathrm{char}(k) = p > 0$. The general idea is to associate to each k-algebra A a (pro-) K-algebra $T(A)$ and take (some variant of) the periodic cyclic homology of $T(A)$. Such a construction already exists for commutative k-algebras of finite type; it yields Bertherlot's rigid cohomology, which is the correct variant of de Rham cohomology in this setting. In this talk I will explain a result we have interpreting rigid cohomology (made 2-periodic) of a commutative k-algebra A of finite type as the periodic cyclic homology of a certain pro-complete bornological K-algebra $T(A)$. Along the way I will discuss bornological V and K-algebras,

Joint work with Joachim Cuntz (Universität Münster) and Ralf Meyer (Universität Göttingen).

S04 - July 25, 17:30 – 18:10

Globalizations of partial actions and Imprimitivity Theorems

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The final goal of this talk is to show how some of the well known imprimitivity theorems (as Raeburn's Symmetric Imprimitivity Theorem) can be extended to partial actions. To that end we define proper partial actions following Buss-Echterhoff and Meyer's definitions of proper actions on C*-algebras. After that we construct, starting from a "proper" partial action α of G on A, a fixed point algebra $\mathcal{F}^\alpha(A)$ and a $\mathcal{F}^\alpha(A) - A \rtimes_\alpha G$ equivalence bimodule X_α.

Under suitable assumptions, given a C*-partial action β of H on A commuting with α, there exists a unique partial action $\widetilde{\beta}$ of H on $\mathcal{F}^\alpha(A)$ cannonically induced by β. Using F. Abadie's notion of Morita equivalence of partial actions (as done by Curto, Muhly and Williams for global actions) we show $\mathcal{F}^\alpha(A) \rtimes_{\widehat{\beta}} H$ is Morita equivalent to $\mathcal{F}^\beta(A) \rtimes_{\widehat{\alpha}} G$.

In the seccond part of the talk we relate our imprimitivity theorems for partial actions to the problem of constructing a globalization for a given partial action on C*-algebra (or a Hilbert module). We present a necessary and sufficient condition for the existence of globalizations and, finally, we use it to investigate to what extent our imprimitivity theorems can be obtained by using Buss-Echterhoff's theorems and globalizations of partial actions.

Joint work with Fernando Abadie (Advisor, Universidad de la República, Uruguay) and Alcides Buss (Advisor, Universidade Federal de Santa Catarina, Brasil)..

S04 - July 25, 16:00 – 16:50

Free path groupoid grading on Leavitt path algebras

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In this talk we realize the Leavitt path algebra associated to a graph as a partial skew groupoid ring. We then use this grading to characterize free path groupoid graded isomorphisms (that preserve generators) between Leavitt path algebras.

S04 - July 25, 18:15 – 18:55

On the simplicity and K-theory of the L^p operator algebras $\mathcal{O}^p(Q)$

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For $p \in [1, \infty)$ and a row finite graph Q, we define a class of representations ρ of the Leavitt algebra $L(Q)$ on spaces of the form $L^p(X, \mu)$, which we call the spatial representations. We prove that for fixed p and Q such that $L(Q)$ is simple and purely infinite, the L^p operator algebra $\mathcal{O}^p(Q) = \overline{\rho(L(Q))}$ is the same for the all spatial representations ρ. When the graph Q is the rose with d petals, we recover the results given by C. Phillips in 2012, in particular for $p = 2$ the Cuntz algebra $\mathcal{O}_d$ appears.

We give conditions for the simplicity of $\mathcal{O}^p(Q)$ as L^p operator algebra and we calculate its K-theory.

Joint work with Guillermo Cortiñas (Universidad de Buenos Aires, Argentina).

Session S05
Rings and Algebras

Chair: Iryna Kashuba

S05 - July 28, 18:00 – 18:25

On finite generation and presentation of algebras

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The talk will focus on finite generation and presentation of associative and Lie algebras with idempotent conditions.

Joint work with Hamed Alsulami.

S05 - Poster

Abelian Group Codes

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Let F be a finite field and n, a non negative integer. A linear code C of length n is a subspace of F^n. A (left) group code of length n is a linear code which is the image of a (left) ideal of a group algebra via an isomorphism $FG \to F^n$ for any G, a finite group with $|G| = n$. In this case C, is a (left) G-code. In [1], Bernal, del Río and Simón obtain a criterion to decide when a linear code is a group code in terms of the group of permutation automorphisms of C, $PAut(C)$. Sabin and Lomonaco, in [4], have proved that if C a G-code with G a semidirect product of cyclic groups, then C is an abelian group code. As an application of criterion and extending the result of Sabin and Lomonaco, in [1], they provide a family of groups for which every two-sided group code is an abelian group code. Pillado, González, Martínez, Markov e Nechaev describe some classes of groups and fields for which all group codes are abelian in [2]. Motivated by [3], they have shown that there exist a non-Abelian G-code over F. In order to extend the result on groups with abelian decompotition, we explore some conditions to determine a group G which can written as a product of abelian subgroups, such that the G-codes with $G \in \mathcal{G}$ will be abelian group code.

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Joint work with Thierry Petit Lobão (Universidade Federal da Bahia, Brasil).

S05 - July 29, 15:45 – 16:10

Graded algebras and polynomial identities

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Connections (or "bridges") between PI theory (polynomial identities) and group gradings on associative algebras are quite well known for more than 30 years. For instance, Kemer applied the theory of "super algebras" in order to solve the famous Specht problem for nonaffine PI algebras. Our interest is in the opposite direction. We apply PI theory in order to solve a conjecture of Bahturin and Regev on "regular G-gradings" on associative algebras where G is a finite abelian group. Moreover, we show how to extend it to nonabelian groups. As a second application, we present a Jordan's like theorem on G-gradings on associative algebras.

Joint work with Ofir David (Technion, Israel).

S05 - Poster

Semiclean Rings

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A ring R with unity is said to be clean if every element in the ring can be written as the sum of a unit and an idempotent of the ring. These rings were introduced by Nicholson, [**?**], in his study of lifting idempotents and exchange rings. The division rings, boolean rings and local rings are examples of clean rings.

In the article [**?**], a new class of rings is defined; semiclean rings . A ring R with unity is called semiclean if, every $x \in R$, $x = u + a$ with $u \in \mathcal{U}(R)$ where a is periodic element, i.e., $a^k = a^l$ with $k, z \in \mathbb{Z}$ and $k \neq z$. Therefore, every semiclean ring is a clean ring, because the idempotents elements of ring are periodics. Nicholson e Han, [**?**], demonstrated that group ring $Z_{(7)}C_3$ is not a clean ring. Yuanqing Ye showed, in the article [**?**], that the group ring $Z_{(p)}C_3$ is an semiclean ring. This result assures that the two classes, clean and semiclean, are different.

Motivated by the article [**?**], we intend to investigate if the Yuanging Ye's demonstration can be generalized, as in the cases $Z_{(11)}C_5$ and $Z_{(p)}C_5$, in search of a possible answer about the ring $Z_{(p)}C_q$ with p and q relatively primers.

Joint work with Elen Deise Assis Barbosa(Universidade Federal da Bahia, Brasil).

S05 - Poster

The Normalizer Property and its Relation with Extensions of Groups

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The determination of the normalizer of the basis group in the group of units of the associated group ring is a question that naturally imposes by itself. In integral group rings, in particular, it has been observed that, for important classes of finite groups, this normalizer is minimal, in other words, $\mathcal{N}_{\mathcal{U}}(G) = G \cdot Z$. When this occurs, we say that the group in question and its integral group ring satisfy the normalizer property. This property, also known as (Nor), has recently gained great importance when Mazur, in [Ma95], noticed an interesting relation with the famous problem of isomorphism in integral group rings also known as (Iso). Exploring this connection, Hertweck in [He01] found an example of a finite group that does not satisfy (Nor), and indirectly, by the relation mentioned above, obtained a counterexample to (Iso). Given that the counter example of Hertweck to (Nor) consists of an extension given by a semidirect product, but [LPS99] proves that extensions given by direct products are solutions (Nor), it is important to investigate which other other extensions of finite groups answer the property. Recently, Petit Lobão e Sehgal in [PeS03] demonstrated the validity of (Nor) for the class of complete monomial groups; in other words, a wreath extension of a finite nilpotent group with the symmetric group on m letters. Zhengxing Li e Jinke Hai in a series of articles, among which we have [HL12], [HL12b], HL11], also obtained interesting solutions of this property. The purpose of this work is to verify the relation between (Nor) and extensions of groups, where such component groups are solutions (Nor), in order to obtain necessary and sufficient conditions to find positive solutions to the property in question.

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Joint work with Thierry Petit Lobão (Universidade Federal da Bahia).

S05 - July 28, 18:30 – 18:55

Automorphisms of ideals of polynomial rings

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Let R be a commutative integral domain with unit, f be a nonconstant monic polynomial in $R[t]$, and $I_f \subset R[t]$ be the ideal generated by f. Such ideal may be considered as an R-algebra. In this talk we present recent results obtained with T. Macedo [arXiv:1604.08531], concerning the group $Aut(I_f)$, of R-algebra automorphisms of I_f. We will show that $Aut(I_f)$ can be obtained by analyzing some symmetries of the roots of f in the algebraic closure of the quotient field of R (counted with multiplicities). In particular, we show that, under certain mild hypothesis, if f has at least two different roots in the algebraic closure of the quotient field of R, then $Aut(I_f)$ is a cyclic group and its order can be completely determined by analyzing the roots of f.

Supported by Fapesp and CNPq

Joint work with Tiago Macedo (Universidade Federal de São Paulo).

S05 - Poster

Involution inverting gradings on matrix algebras

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Let F be an algebraically closed field of characteristic zero, and G be a finite abelian group. If $M_n(F)$ is an algebra with involution $*$, we describe G-gradings $M_n(F) = A = \oplus_{g\in G} A_g$ on A, satisfying $(A_g)^* \subseteq A_{g^{-1}}$, for all $g \in G$.

Joint work with Luís Felipe Gonçalves Fonseca (Universidade Federal de Viçosa).

S05 - Poster

GENERATION OF SULLIVAN DECOMPOSABLE ALGEBRAS VIA CERTAIN PDEs

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In this work we investigate properties of certain commutative differential graded algebras naturally associated to submanifolds of a infinite Jet manifold determined by finite systems of finite-order PDEs, particularly those inspired by the study of linear gauge complexes and by one-forms associated to equations of pseudo-spherical type. More explicitly, we identify linear gauge complexes as a particular type of certain twisted complexes, and we generate Sullivan decomposable algebras using hierarchies of equations of pseudo-spherical type.

Joint work with Enrique Reyes García (Universidad de Santiago de Chile, Chile).

S05 - July 29, 18:00 – 18:25

Partial actions and subshifts

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An arbitrary (one-sided) subshift X over a finite alphabet Λ with n letters can be naturally endowed with a partial action θ of the free group $\mathbb{F}_n$ with n free generators $g_\lambda, (\lambda \in \Lambda)$, such that g_λ maps x to λx, where x is an element in X for which $\lambda x \in X$. Naturally g_λ^{-1} removes λ from λx. We call θ the standard partial action, and it is a starting point to constract a C^*-algebra $\mathcal{O}_X^*$ associated with X, as well as an abstract algbera $\mathcal{O}_X^K$ over an arbitrary field K of characteristic 0. Both $\mathcal{O}_X^K$ and $\mathcal{O}_X^*$ are defined in a fairly similar way: using the standard partial action we construct a partial representation u of $\mathbb{F}_n$ into an appropriate algebra (which depends on whether the case is abstract or C^*) and then define $\mathcal{O}_X^K$ (or $\mathcal{O}_X^*$) as the subalgebra (respectively, a C^*-subalgebra) generated by $u(\mathbb{F}_n)$. Then using a general procedure (see [4,Proposition 10.1] we obtain a partial action τ of $\mathbb{F}_n$ on a commutative subalgebra $\mathcal{A}$ and prove that $\mathcal{O}_X^K$ is isomorphic to the crossed product $\mathcal{A} \rtimes_\tau \mathbb{F}_n$. In the C^* case (see [3,Theorem 9.5]), due to an amenability property, $\mathcal{O}_X^*$ is isomorphic to both the full and the reduced crossed product: $\mathcal{O}_X^* \cong \mathcal{D} \rtimes_\tau \mathbb{F}_n \cong \mathcal{D} \rtimes_\tau^{\rm red} \mathbb{F}_n$, where $\mathcal{D}$ is a commutative C^*-algebra defined in a similar way as $\mathcal{A}$. This gives a possibility to study algebras related to subshifts using crossed products by partial actions. It turns out that $\mathcal{O}_X^*$ is isomorphic to the C^*-algebra defined by T. M. Carlsen in [1] in a somewhat different way (see [3,Theorem 10.2]). In particular, if X is a Markov subshift, then $\mathcal{O}_X^*$ is isomorphic to the Cuntz-Krieger algebra defined in [2]. The C^* version is elaborated in the preprint [3], in which, amongst several related results, a criterion is given for simplicity of $\mathcal{O}_X^*$ (see [3,Theorem 14.5]).

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Joint work with Ruy Exel (Universidade Federal de Santa Catarina, Brazil).

S05 - July 28, 15:00 – 15:45

Octonions in low characteristics

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Some special features of Cayley algebras, and their Lie algebras of derivations, over fields of low characteristics will be presented. As an example, over fields of characteristic two, the isomorphism class of the Lie algebra of derivations of a Cayley algebra does not depend on the Cayley algebra itself.

S05 - July 28, 15:45 – 16:10

Polynomial identities, codimensions and a conjecture of Regev

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Let A be an algebra over a field F of characteristic zero and $Id(A)$ its T-ideal of identities. The space of multilinear polynomials in n fixed variables modulo $Id(A)$ is a representation of the symmetric group S_n and its degree is called the nth codimension of A. As soon as A is associative and satisfies a non-trivial identity, its sequence of codimensions is exponentially bounded and, following a conjecture of Amitsur regarding its exponential growth, Regev made a conjecture about the precise asymptotics of such sequence. I will talk about the results around this conjecture also in the case of non associative algebras.

S05 - July 28, 16:35 – 17:00

Free groups in a normal subgroup of the field of fractions of a skew polynomial ring

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Let $k(t)$ be the field of rational functions over the field k, let σ be a k-automorphism of $K = k(t)$, let $D = K(X;\sigma)$ be the ring of fractions of the skew polynomial ring $K[X;\sigma]$, and let $D^\bullet$ be the multiplicative group of D. We show that if N is a non central normal subgroup of $D^\bullet$, then N contains a free subgroup.

S05 - Poster

Anticommutativity of Symmetric and Skew-symmetric Elements under Generalized Oriented Involutions

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Given an involution $*$ in a group ring RG, we can define the sets $(RG)_* = \{\alpha \in RG : \alpha^* = \alpha\}$ and $(RG)_*^- = \{\alpha \in RG : \alpha^* = -\alpha\}$, called the set of symmetric and skew-symmetric elements, respectively. Under certain conditions in R, G, or the involution in RG, many authors proved that some identities satisfied in these sets could be lifted to the entire group ring, and, in some cases, given the impossibility of such lifting, they describe the basic structures of the group ring RG.

Generalizing the results found in [GP13a, GP13b, GP14], using a group homomorphism $\sigma : G \to \mathcal{U}(R)$, we will define and explore the involution $\sigma* : RG \to RG$, called generalized oriented involution, exposing the group structures, as well as the ring conditions, such that $(RG)_{\sigma*}$ or $(RG)_{\sigma*}^-$ be anticommutative.

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Joint work with Thierry Petit Lobao (Universidade Federal da Bahia, Brazil).

S05 - July 28, 17:30 – 17:55

Non-commutative algebraic geometry of semi-graded rings

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In this short talk we introduce the semi-graded rings, which generalize graded rings and skew PBW extensions. For this new type of non-commutative rings we will study some basic problems of non-commutative algebraic geometry. In particular, we will discuss the Serre-Artin-Zhang-Verevkin theorem about non-commutative schemes.

Joint work with Edward Latorre (Universidad Nacional de Colombia, Bogotá, Colombia).

S05 - July 29, 17:30 – 17:55

On D algebras.

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Consider an algebraic function z of n variables $x_1, x_2, \ldots, x_n$. Denote by $D(z)$ a subalgebra of the field $\mathbb{C}(x_1, x_2, \ldots, x_n)[z]$ which is generated by $x_1, x_2, \ldots, x_n$; z and all partial derivatives of z. I am interested in properties of algebras $D(z)$.

In my talk I will discuss the following conjectural dichotomy:

If $z \in \mathbb{C}[x_1, \ldots, x_n]$ then (obviously) $D(z) = \mathbb{C}[x_1, \ldots, x_n]$, but if $z \notin \mathbb{C}[x_1, \ldots, x_n]$ then $D(z)$ cannot be embedded into a polynomial ring.

S05 - Poster

$*$ - Clean Group Algebras

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An element of a(n associative) ring (with 1) is clean if it is the sum of a unit and an idempotent. A ring is clean if every element in it is clean. The property of cleanness was formulated by Nicholson [4] in the course of his study of exchange rings. From then on, several related concepts were proposed: uniquely clean rings, strongly clean rings, weakly clean rings, $*$ - clean rings, r - clean rings, nil - clean rings, to cite a few. In the realm of group rings, these properties have been studied from 2001 [2] on with the aim of characterizing the rings R and groups G such that the group ring RG is clean.

In 2010 Vas proposed the definition of a $*$ - clean ring ("star"- clean) [5]: a $*$ - ring (i.e., rings with an involution) in which every element may be written as a sum of a unit and a projection. Clearly, every $*$-clean ring is a *star* - ring and is a clean ring. In [5], Vas asked: when is a $*$ - ring clean, but not $*$-clean?

Every group G having an element g $\neq 1$, with $|\langle g \rangle| \neq 2$, is endowed with the classical involution $g \mapsto g^{-1}$. Because of that, group rings RG are almost always $*$ - rings: if R is a commutative rings, for instance, an involution in RG is obtained from the R - linear extension of the classical involution in G (and is also called the classical involution in RG). The $*$-cleanness of group rings was first approached in 2011 [3]. Even though some instances of group rings are answers to Vas's question [1], very little is still known about conditions under which a group ring with the classical involution is $*$-clean (not even the case of the group ring RG, where R is a commutative ring and G is a cyclic group, is fully stablished!).

In this talk, I present some recent results [1]. Let R be a commutative local ring. I will present RS_3 as an answer to Vas 's question, and I will provide necessary and sufficient conditions for the group ring RQ_8 to ber $*$ - clean, where Q_8 is the quaternion group of 8 elements.

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S05 - Poster

Irreducible components of varieties of Jordan algebras

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In 1968, F. Flanigan proved that every irreducible component of a variety of structure constants must carry an open subset of nonsingular points which is either the orbit of a single rigid algebra or an infinite union of orbits of algebras which differ only in their radicals.

In the context of the variety Jor_n of Jordan algebras, it is known that, up to dimension four, every component is dominated by a rigid algebra. In this work, we show that the second alternative of Flanigan's theorem does in fact occur by exhibiting a component of $JorN_5$ which consists of the Zariski closure of an infinite union of orbits of five-dimensional nilpotent Jordan algebras, none of them being rigid.

Joint work with Iryna Kashuba (Universidade de São Paulo, Brazil).

S05 - Poster

Construction of Rota^m-Algebras and Ballot^m-Algebras from Associative Algebras with a Rota-Baxter morphism and a Rota-Baxter Operator of Weights Three and Two

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We give a generalization of Rota-Baxter Operators and introduce the notion of a Ballot^m-algebra. Free Rota-Baxter algebras on a set can be constructed from a subset of planar rooted forests with decorations on the angles. We give similar constructions for obtaining an associative algebra in terms of planar binary trees with a modified Rota-Baxter Operator, and so we construct a Ballot^m-algebra.

We introduce the concepts of a Rota-Baxter Morphism, Dyck^m-algebra and Rota^m-algebra. An element u is said to be idempotent with respect to product $\cdot$ in the algebra if: $u \cdot u = u$, and it is a left identity if $x \cdot u = x$ for all element x in the algebra. Associative algebras with a left identity that simultaneously is a element idempotent, permit us to present examples of a Rota-Baxter Morphism and so we can construct a Rota^m-algebra.

We stress that the construction of Ballot^m-algebras and Rota^m-algebras from associative algebras with a generalitation of Rota-Baxter Operators are some of the main results of this work.

S05 - Poster

Clean rings and clean group rings

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A ring is said to be clean if each element in the ring can be written as the sum of a unit and an idempotent of the ring. The notion of a clean ring was introduced in 1977 by Nicholson in his study of lifting idempotents and exchange rings, and these rings have since been studied by many different authors.

In this poster, we present some properties and examples of clean rings, and then we classify the rings that consist entirely of units, idempotents, and quasiregular elements and we also consider the problems of classifying the groups G whose group rings RG are clean for any clean ring R.

Joint work with Rodrigo Lucas Rodrigues (Universidade Federal do Ceará).

S05 - July 29, 16:35 – 17:00

Lie algebras of slow growth

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We discuss rather old and recent constructions of Lie algebras and superalgebras of slow growth. In particular, we obtain examples of finitely generated (self-similar) (restricted) Lie (super)algebras of slow polynomial growth with a nil p-mapping.

By their properties, these restricted Lie (super)algebras resemble Grigorchuk and Gupta-Sidki groups. We discuss different properties of these algebras and their associative hulls.

S05 - Poster

On the max-plus algebra of non-negative exponent matrices

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An integer $n \times n$-matrix $A = (\alpha_{pq})$ is called exponent if all its diagonal entries are equal to zero and for all possible i, j and k the inequality $\alpha_{ij} + \alpha_{jk} \geqslant \alpha_{ik}$ holds. The study of exponent matrices is important because of their crucial role in the theory of tiled orders.

We show that the set $\mathcal{T}$ of minimal non-negative exponent $n \times n$-matrices can be described as follows. The matrix $T = (t_{ij}) \in \mathcal{E}_n$ belongs to $\mathcal{T}$ if and only if $t_{ij} \in \{0, 1\}$ for all i, j and there exists a proper subset $\mathcal{I}$ of $\{1, \ldots, n\}$ such that $t_{ij} = 1$ is equivalent to $i \in \mathcal{I}$ and $j \notin \mathcal{I}$.

Let $\oplus$ be the element-wise maximum of matrices and let $\otimes$ be a sum of matrices. Clearly, $A \otimes (B \oplus C) = (A \otimes B) \oplus (A \otimes C)$ for all A, B, $C \in \mathcal{E}_n$, whence $\mathcal{E}_n$ can be considered as an algebra $(\mathcal{E}_n, \oplus, \otimes)$, with respect to operations $\oplus$ and $\otimes$.

We prove the following result.

Theorem. *For any non-zero $A \in \mathcal{E}_n$ there exist a decomposition*

$$A = B_1 \otimes \ldots \otimes B_l \oplus \ldots \oplus C_1 \otimes \ldots \otimes C_m,$$

where all matrices $B_1, \ldots, C_m$ belong to $\mathcal{T}$ and as usual $\otimes$ performed prior to $\oplus$.

Thus, $\mathcal{T}$ can be considered as a basis of $(\mathcal{E}_n, \oplus, \otimes)$. This basis is unique. Nevertheless, there is no uniqueness of the decomposition of $A \in (\mathcal{E}_n, \oplus, \otimes)$ into the max-plus expression of matrices from $\mathcal{T}$.

The work is supported by FAPESP.

Joint work with Mikhailo Dokuchaev (University of São Paulo, Brasil), Volodymyr Kirichenko (Taras Shevchenko National University of Kyiv, Ukraine) and Ganna Kudryavtseva (University of Ljubljana, Slovenia).

S05 - July 28, 16:10 – 16:35

Essencial idempotents in group algebras and coding theory

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We introduce the concept of essencial idempotents in group algebras, a notion inspired in coding theory. We shall give some criteria to identify which primitive idempotents are essential, and discuss some applications. Among these, we show that every minimal non-cyclic abelian code is a repetition code, and that every minimal abelian code is combinatorially equivalent to a cyclic code of the same lenth. Also, we shall give an example showing that a non minimal abelian code of lenth p^2 with p a prime integer, can be more convenient than any cyclic code of that length.

S05 - Poster

Commutative power-associative nilalgebras and Albert's problem

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Albert's problem ask if every commutative power-associative nilalgebra is solvable. We proof that commutative power-associative nilalgebras of dimension n and nilindex $n-3$ over a field algebraically closed of characteristic zero are solvable. Finally, we study commutative power-associative nilalgebras of dimension 9 and we proof that they are solvable too.

Joint work with Juan Carlos Gutierrez Fernandez (IME - USP).

S05 - July 29, 18:30 – 18:55

Identities of finitely generated alternative and Malcev algebras

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We prove that for every natural number n there exists a natural number $f(n)$ such that every multilinear skew-symmetric polynomial on $f(n)$ variables which vanishes in the free associative algebra vanishes as well in any n-generated alternative algebra over a field of characteristic 0. Similarly, for any n there exists $g(n)$ such that every multilinear skew-symmetric polynomial on $g(n)$ variables vanishes in any n-generated Malcev algebra over a field of characteristic 0. Before a similar result was known only for a series of skew-symmetric polynomials of special type on $2m+1$ variables constructed by the author, where $m > \frac{C_n^1+C_n^2+C_n^3}{2}$.

S05 - July 29, 16:10 – 16:35

Color involutions of primitive graded rings.

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Kaplansky's Theorem [2] characterizes involutions of primitive rings with a nonzero socle in terms of hermitian and alternate forms. In 1997 M.L.Racine [3] constructed similar structure theory for primitive associative superalgebras. And Yu.A. Bakhturin, M. Bresar, M. Kochetov [1] obtained similar results for graded rings with graded involutions.

We present analogous characterizations of primitive graded rings in terms of twisted pairing. This implies the extension of Kaplansky's Theorem for primitive graded rings with a color involution in case of a grading by a cyclic group of a prime order. We also obtain some corollaries on color involutions of finite dimensional simple graded algebras. In particular, these results generalise the corresponding theorems of [2].

The work is partially supported by CNPq, CAPES.

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Joint work with Keidna Cristiane Oliveira Souza (University of Brasilia, Brazil).

S05 - Poster

A study on clean rings

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A ring is said to be clean if every element can be written as sum of a unit and an idempotent. These rings were defined by Nicholson [5], while studying exchange rings. The class of clean rings is located among other well known classes of rings [3]. In the realm of group rings, these properties have been studied from 2001 [2] on with the aim of characterizing the rings R and groups G such that the group ring RG is clean.

The study of $*$-clean rings was motivated by a question made by T. Y. Lam at the Conference on Algebra and Its Applications, in March 2005, at the Ohio University: which von Neumann algebras are clean as rings? Since von Neumann algebras are $*$-rings (i.e., rings with an involution), it is more natural to work with projections (idempotents that are symmetric under the ring involution) than with idempotents.

So, in 2010 Vaš defined $*$-clean rings [6]: a $*$-ring in which every element may be written as a sum of a unit and a projection. Clearly, every $*$-clean ring is a $*$-ring and is a clean ring.

Every group G is endowed with the classical involution $g \mapsto g^{-1}$. If R is a commutative ring, for instance, the R-linear extension of the classical involution in G is the classical involution in RG. $*$-clean group rings were first studied in 2011 [4]. However very little is still known about when a group ring is $*$-clean (not even the case of the group ring RG, where R is a commutative ring and G is a cyclic group, is fully stablished!).

In this talk, we present clean rings, their relationship with other types of rings [3] and some recent results [1]. Let R be a commutative local ring. I will provide necessary and sufficient conditions for the group rings RC_3 and RC_4 to be $*$-clean, where C_n denote the cyclic group with n elements.

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S05 - July 29, 15:00 – 15:45

Finitely presented Lie and Jordan algebras

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We will consider important examples of Lie and Jordan algebras and address the question when they can be presented by finitely many defining relations.

Session S06
Algebraic Combinatorics

Chair: Ernesto Vallejo – Collaborators: Rosa Orellana

S06 - July 25, 16:30 – 16:55

Cotas para la energía de Nikiforov sobre digrafos

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La energía de un grafo G se define como $E(G) = \sum_{i=1}^{n} |\lambda_i|$, donde $\lambda_1, \lambda_2, \ldots, \lambda_n$ son los valores propios de la matriz de adyacencia de G. Este concepto fue extendido de varias maneras para digrafos: $\mathcal{E}(D) = \sum_{i=1}^{n} |\mathrm{Re}(z_i)|$, $\mathcal{S}(D) = \sum_{i=1}^{n} |z_i|$ y $\mathcal{N}(D) = \sum_{i=1}^{n} \sigma_i$, donde D es un digrafo con n vértices, valores propios $z_1, \ldots, z_n$ y valores singulares $\sigma_1, \ldots, \sigma_n$. En este trabajo hallamos cotas superiores e inferiores para $\mathcal{N}$ sobre el conjunto de digrafos. También mostramos que $\mathcal{E}(D) \leq \mathcal{S}(D) \leq \mathcal{N}(D)$ para todo digrafo D y caracterizamos los digrafos donde se da la igualdad. Como consecuencia, deducimos nuevas cotas superiores e inferiores para $\mathcal{E}, \mathcal{S}$ y $\mathcal{N}$ las cuales son obtenidas de cotas inferiores de $\mathcal{E}$ y cotas superiores de $\mathcal{N}$.

Joint work with Juan Pablo Rada (Universidad de Antioquia, Medellín, Colombia).

S06 - July 26, 15:00 – 15:25

Integral hyperplane arrangements

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Consider an arrangement of linear hyperplanes integral with respect to a given lattice. The lattice gives rise to a torus and the arrangement to a subdivision of the torus. We are interested in the combinatorics of this subdivision. We will describe questions and results for particular lattices associated to root systems and arrangements associated to graphs.

Joint work with Swee Hong Chan (Cornell University).

S06 - July 26, 16:30 – 16:55

On trees with the same restriction of the chromatic symmetric function and solutions to the Prouhet-Tarry-Escott problem

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On the one hand, the Prouhet-Tarry-Escott problem asks, given k be a positive integer, whether there exist integer sequences $a = (a_1, \ldots, a_n)$ and $b = (b_1, \ldots, b_n)$, distinct up to permutation, such that

$$a_1^\ell + \ldots + a_n^\ell = b_1^\ell + \ldots + b_n^\ell \quad \text{for all } 1 \leq \ell \leq k.$$

This is an old problem in number theory (Prouhet 1851), and solutions are known to exist for every k.

On the other hand, the chromatic symmetric function was introduced by Stanley in 1995 as a symmetric function generalization of the chromatic polynomial of a graph. It is an open problem to know whether there exist non-isomorphic trees with the same chromatic symmetric function.

In this talk, we show how to encode solutions of the Prouhet-Tarry-Escott problem as non-isomorphic trees having the same restriction of the chromatic symmetric function. As a corollary, we find a new class of trees that are distinguished by the chromatic symmetric function up to isomorphism.

Joint work with Anna de Mier (Universidad Politécnica de Cataluña, España) and José Zamora (Universidad Andres Bello, Chile).

S06 - July 26, 16:00 – 16:25

A proof of the peak polynomial positivity conjecture

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Given a permutation $\pi = \pi_1\pi_2\cdots\pi_n \in \mathfrak{S}_n$, we say an index i is a peak if $\pi_{i-1} < \pi_i > \pi_{i+1}$. Let $P(\pi)$ denote the set of peaks of π. Given any set S of positive integers, define $P_S(n) = \{\pi \in \mathfrak{S}_n : P(\pi) = S\}$. In 2013 Billey, Burdzy, and Sagan showed that for all fixed subsets of positive integers S and sufficiently large n, $|P_S(n)| = p_S(n)2^{n-|S|-1}$ for some polynomial $p_S(x)$ depending on S. They gave a recursive formula for $p_S(n)$ involving an alternating sum, and they conjectured that the coefficients of $p_S(x)$ expanded in a binomial coefficient basis centered at $\max(S)$ are all nonnegative. In this talk we will share a different recursive formula for $p_S(n)$ without alternating sums, and we use this recursion to prove that their conjecture is true.

Joint work with Alexander Diaz-Lopez, Swarthmore College, Erik Insko, Florida Gulf Coast University and Mohamed Omar, Harvey Mudd College.

S06 - July 26, 17:30 – 17:55

Pieri rules for the Macdonald polynomials in superspace and the 6-vertex model

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The Macdonald polynomials in superspace are symmetric polynomials involving commuting and anticommuting variables that generalize the Macdonald polynomials. We will describe how the combinatorics of the Macdonald polynomials extends to superspace. We will focus in particular on how the partition function of the 6 vertex model arises in the Pieri rules for the Macdonald polynomials in superspace.

Joint work with Jessica Gatica (PUC, Chile), Camilo Gonzalez (Universidad de Talca, Chile) and Miles Jones (University of California, San Diego, USA).

S06 - July 25, 17:30 – 17:55

Lopsided amoebas and effective amoeba approximation

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The amoeba $A(f)$ of a polynomial f is the image of its zero set under the log-absolute-value map. The amoeba captures combinatorial information about f: for instance, the normal fan of the Newton polytope of f determines the asymptotics of $A(f)$.

In 2008, Purbhoo introduced the lopsided amoeba $L(f)$ of f, and showed that $A(f)$ is the limit as $r \to \infty$ of $L(f_r)$, where f_r is constructed from f by a process of iterated resultants.

I will introduce lopsided amoebas geometrically, show how to efficiently compute the resultants involved, and outline some combinatorial challenges in this area.

Joint work with Jens Forsgård, Nathan Mehlhop and Timo de Wolff (all at Texas A&M University, USA).

S06 - July 25, 15:00 – 15:25

Of antipodes and involutions

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Let H be a graded, connected Hopf algebra. Then Takeuchi's formula gives an expression for the antipode of H. But this alternating sum usually has lots of cancellation. We will describe a method using sign-reversing involutions to obtain cancellation-free formulas for various H. This technique displays remarkable similarities across the Hopf algebras to which it has been applied. No background about Hopf algebras will be assumed.

Joint work with Carolina Benedetti (Fields Institute, Canada).

S06 - July 26, 15:30 – 15:55

The generalized lifting property of Bruhat intervals

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The so called "lifting property" characterizes the Bruhat order of a Coxeter group, as V. V. Deodhar proved in 1977. E. Tsukerman and L. Williams in the article "Bruhat interval polytopes" (Advances in Mathematics, 2015) prove a "generalized lifting property" of the Bruhat order for the symmetric group. We investigate the case of an arbitrary Coxeter group.

Joint work with Fabrizio Caselli (Università di Bologna, Italy).

S06 - July 25, 16:00 – 16:25

Counting arithmetical structures of a graph and their sandpile groups.

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Given a graph $G = (V, E)$ and $\mathbf{d} \in \mathbb{N}$, the *Laplacian matrix* of the pair $(G, \mathbf{d})$ is the square matrix given by

$$L(G, \mathbf{d})_{u,v} = \begin{cases} \mathbf{d}_u & \text{if } u = v, \\ -m_{uv} & \text{if } u \neq v, \end{cases}$$

where m_{uv} is the number of edges between u and v. An *arithmetical structure* of G is a pair $(\mathbf{d}, \mathbf{r})$ such that $(\mathbf{d}, \mathbf{r}) \in \mathbb{N}_+^V \times \mathbb{N}_+^V$, $\gcd(\mathbf{r}_v \,|\, v \in V(G)) = 1$ and

$$L(G, \mathbf{d})\mathbf{r}^t = \mathbf{0}^t.$$

The concept of arithmetical graphs was introduced by Lorenzini as some intersection matrices that arise in the study of degenerating curves in algebraic geometry. If G is strongly connected, then

$$\mathcal{A}(G) = \{(\mathbf{d}, \mathbf{r}) \in \mathbb{N}_+^{V(G)} \times \mathbb{N}_+^{V(G)} \,|\, (\mathbf{d}, \mathbf{r}) \text{ is an arithmetical structure of } G\}.$$

is finite. Our goal is to describe and count the arithmetical structures and their associated sandpile groups of some simple graph, like the path, cycle, complete, etc. For instance we prove that the number of arithmetical structures of a path P_n with n vertices is equal to the Catalan number C_{n-1}.

S06 - July 25, 18:00 – 18:25

The Dehn–Sommerville Relations and the Catalan matroid

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The f-vector of a d-dimensional polytope P stores the number of faces of each dimension. When P is simplicial the Dehn–Sommerville relations imply that to determine the f-vector of P, we only need to know approximately half of its entries. This raises the question: Which $(\lceil \frac{d+1}{2} \rceil)$-subsets of the f-vector of a general simplicial polytope are sufficient to determine the whole f-vector? We prove that the answer is given by the bases of the Catalan matroid.

Joint work with Anastasia Chavez (University of California at Berkeley).

S06 - July 26, 18:00 – 18:25

Irreducible characters of the symmetric group as symmetric functions

Mike Zabrocki
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I will introduce a basis of the symmetric functions that are the irreducible characters of the symmetric group realized as permutation matrices. Just as the Schur functions are the irreducible characters of the general linear group, the elements of this new basis are functions in the eigenvalues of a permutation matrix.

Symbolically, if Ξ_μ are the eigenvalues of a permutation matrix of cycle type μ, then $\tilde{s}_\lambda[\Xi_\mu]$ will be the irreducible symmetric group character $\chi^{(|\mu|-|\lambda|,\lambda)}(\mu)$.

This basis has (outer) product structure coefficients given by the reduced Kronecker coefficients and it also has positive coproduct structure coefficients. There is analogously a second basis of the induced trivial characters of the symmetric group and together these bases encode the combinatorics of multisets and multiset valued tableaux.

Joint work with Rosa Orellana (Dartmouth College).

Session S07
Finite Fields

Chair: Fernando Torres – Collaborators: Antonio Cafure, Daniel Panario

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S07 - Poster

On the Densest Lattices from Number Fields and Division Algebras

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Algebraic lattices are lattices obtained via the ring of integers, $\mathcal{O}_{\mathbb{F}}$, of a number field $\mathbb{F}$. They can be constructed considering geometric representations of integral ideals in $\mathcal{O}_{\mathbb{F}}$. This latter method was successfully used by Craig to construct the Leech lattice from a properly chosen integral ideal $\mathcal{I}$ in $\mathbb{Z}[\zeta_{39}]$, the ring of integers of the cyclotomic field $\mathbb{F} = \mathbb{Q}(\zeta_{39})$. In addition to the Leech lattice, Craig showed that the lattices D_4, E_8, K_{12}, and Λ_{16} can all be obtained from properly chosen integral ideals in rings of cyclotomic integers. Bayer-Fluckiger showed that E_8 can be obtained via a ideal $\mathcal{I}$ in $\mathcal{O}_{\mathbb{F}}$, $\mathbb{F} = \mathbb{Q}(\zeta_{15})$, $\mathbb{Q}(\zeta_{20})$, $\mathbb{Q}(\zeta_{24})$. Versions of dense lattices are of interest from the practical viewpoint as they are suitable for data transmission. More recently, the need for higher data transmission has led to consider communication channels using multiple antennas at both transmitter and receiver ends (MIMO). In the case of space-time codes, it is natural to consider a lattice from an ideal of a maximal order of the division algebra. Codewords are usually (in narrow band systems) built over the complex field. However for ultra wideband communication, one needs to design them over the real field. Thus, having the construction of lattices as our goal, in this work we present constructions of dense lattices from maximal orders of the division algebras over a totally real number field.

Joint work with Sueli I.R. Costa (Institute of Mathematics, University of Campinas, Campinas-SP, Brazil, sueli@ime.unicamp.br). and Cintya W. O. Benedito (Institute of Mathematics, University of Campinas, Campinas-SP, Brazil, cwinktc@hotmail.com).

S07 - Poster

New constructions of algebraic lattices

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In algebraic number theory, it is better known the ring of integers of the cyclotomic field and the ring of integers of their maximal real subfield. An important result of this area, the Kronecker-Weber Theorem, states that every abelian number field is contained in a cyclotomic field. Thinking about this, we can ask ourselves what is the ring of integers of each abelian number field and if this ring of integers has a power basis, this is, if the ring of integers is generated by an element over Z. In this line, to construct lattices in odd dimensions, we can not use cyclotomic fields, but we can use their subfields. Also, the maximal real cyclotomic subfields are not suficient to solve the problem of find algebraic lattices that has better center density. Trying to solve this problem mainly in odd dimensions, we are using abelian number fields.

For this task we need the ring of integers of abelian number fields, which is presented by the Leopoldt's Theorem (1959) or its version given by Lettl (1990). In this work, we intend to present the Leopoldt's Theorem in the version of Lettl and elucidate why it can be useful to construct algebraic lattices with better center desnsity.

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Joint work with Robson Ricardo de Araujo. Department of Mathematics, State University of Campinas, Campinas - SP, Brasil.

S07 - July 28, 16:00 – 16:25

On the second lowest Hamming weight of binary projetive Reed-Muller codes

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Projective Reed-Muller codes were introduced by Lachaud, in 1988 and their dimension and minimum distance were determined by Serre and Sorensen in 1991. In coding theory one is also interested in the higher Hamming weights, to study the code performance. Yet, not many values of the higher Hamming weights are known for these codes, not even the second lowest weight (also known as next-to-minimal weight) is completely determined. In this talk we will present all the values of the next-to-minimal weight for the binary projective Reed-Muller codes, and we will also comment on their relation to the next-to-minimal weight of generalized (affine) Reed-Muller codes.

Joint work with Victor G.L. Neumann (Universidade Federal de Uberlandia).

S07 - July 28, 16:30 – 16:55

Some remarks on the asymptotic behavior of cyclic AG-codes

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It was proved in [St06] and [B06] that several classes of algebraic geometry codes, such as transitive codes, self-dual codes and quasi transitive codes among others, are asymptotically good over finite fields with square and cubic cardinality. Similar results were proved in [BBGS14] for general non-prime fields. In fact, some of them attain the well known Tsfasman-Vladut-Zink bound and also improvements for another well known bound of Gilbert-Varshamov were given. These results were achieved by considering

algebraic geometry codes associated to asymptotically good towers of function fields over suitable finite fields.

Remarkably few things are known, so far, with regard to the asymptotic behavior of the class of cyclic codes. Perhaps the most interesting result in this direction is the one due to Castagnoli who proved in [Ca89] that the class of cyclic codes whose block lengths have prime factors belonging to a fixed finite set of prime numbers is asymptotically bad. This result implies that the construction of cyclic AG-codes in the standard way, would lead to a sequence of codes asymptotically bad.

In this talk we will discuss how different the situation is when dealing with the asymptotic behavior of transitive (or quasi transitive) AG-codes and cyclic AG-codes, which are particular cases of transitive AG-codes, [CPT16]. We will conclude that towers with only totally ramified places in the tower, which are nice candidates for good asymptotic behavior, have to be discarded for the construction of potentially good sequences of cyclic AG-codes, if we want to use all the techniques and results that were successful in the transitive case. All of this, together with Castagnoli's result, provide some good reasons to think that towers of function fields may not be adequate to address the problem of the asymptotic behavior of cyclic codes, as long as the sequence of cyclic AG-codes is constructed using automorphisms of the function fields in the tower. It is clear that the design of new methods to produce cyclic AG-codes is an interesting and challenging problem with potential consequences in the study of the asymptotic behavior of cyclic codes.

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Joint work with Ricardo Podestá (Centro de Investigación y Estudios de la Matemática (UNC-CONICET), Argentina) and Ricardo Toledano (Facultad de Ingeniería Química (UNL), Argentina).

S07 - Poster

Gröbner bases for Generalized Hermitian codes.

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In recent years the theory of Gröbner bases have been largely applied to solve problems in Code Theory. In particular, in 1995 Heegard, Little and Saints found an efficient and interesting decoding method using Gröbner bases, but it has a very high computational cost.
Little, Heegard and Saints found a method to reduce the computational cost and they applied to the Hermitian curve, and then it was applied the same method to the Norm-Trace curve by Farran, Sepulveda, Tizziotti, Torres.
In this talk I want to show how it is possible to extend these results to the curve $x^{q^r+1} = y^q + y$ over the

finite field $\mathbb{F}_{q^{2r}}$ (studied by Kondo, Katagiri and Ogihara) and to the curve $x^m = y^q + y$, with $m|q+1$, over the finite field $\mathbb{F}_{q^2}$ (studied by Matthews), determining the so-called Root-Diagram of a curve.

Joint work with This work was supervised by G.Tizziotti and F.Torres.

S07 - July 28, 18:00 – 18:25

The distribution of points on families of curves over finite fields

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We give an overview of a general trend of results that say that the distribution of the number of $\mathbb{F}_q$-points of certain families of curves of genus g is asymptotically given by a sum of $q+1$ independent identically distributed random variables as g goes to infinity. In particular, we discuss the distribution of the number of $\mathbb{F}_q$-points for cyclic ℓ-covers of genus g. This work generalizes previous results in which only connected components of the moduli space were considered.

S07 - Poster

Similarity between the algebraic structure associated with projective space and combinatorial design via Hasse diagram

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Combinatorial design is an important combinatorial structure having a high degree of regularity and which is related to the existence and construction of systems of sets with finite cardinality, [1]. As examples we mention the existing relationship between error-correcting codes in the Hamming space and combinatorial design, where the codewords of weight 3 of the Hamming code form a triple Steiner system STS(7), a projective plane of order 2, known as the Fano plane, [2], as well as q-analogs of a code whose codewords have constant Hamming weight in the Hamming space, a code belonging to a Grassmannian in the projective space, [3,4]. Projective space of order m over a finite field $\mathbb{F}_p$, denoted by $\mathcal{P}(\mathbb{F}_p^m)$, (note that $\mathbb{F}_{p^m}$ is isomorphic to $\mathbb{F}_p^m$), is the set of all the subspaces in the vector space $\mathbb{F}_p^m$. The projective space endowed with the subspace distance $d(X,Y) = dim(X) + dim(Y) - 2dim(X \cap Y)$ is a metric space. Hence, the subspace code $\mathcal{C}$ with parameters (n, M, d) in the projective space is a subset of $\mathcal{P}(\mathbb{F}_p^m)$ with cardinality M with a subspace distance at least d between any two codewords, [5]. In this paper we show the existing similarity between the Hasse diagram of an Abelian group consisting of the product of multiplicative finite Abelian groups $\mathbb{Z}_p^m$ and the Hasse diagram of the projective space $\mathcal{P}(\mathbb{F}_p^m)$, with the aim to provide the elements that may be useful in the identification and in the construction of good subspaces codes, [6].

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Joint work with Reginaldo Palazzo Jr. (FEEC/UNICAMP) e-mail: palazzo@dt.fee.unicamp.br.

S07 - Poster

Projective Nested Cartesian Codes

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In this work we introduce a new type of code, called projective nested cartesian code. It is obtained by the evaluation of homogeneous polynomials of a fixed degree on the set

$$[A_0 \times A_1 \times \cdots \times A_n] := \{(a_0 : \cdots : a_n) |\, a_i \in A_i \text{ for all } i\} \subset \mathbb{P}^n(\mathbb{F}_q),$$

where $A_0, A_1, \ldots, A_n$ is a collection of non-empty subsets of $\mathbb{F}_q$ such that for all $i = 0, \ldots, n$ we have $0 \in A_i$, and for every $i = 1, \ldots, n$ we have $A_j A_{i-1} \subset A_j$ for $j = i, \ldots, n$. These codes may be seen as a generalization of the so-called projective Reed-Muller codes. We calculate the length and the dimension of such codes, a lower bound for the minimum distance and the exact minimum distance in the special case where the sets A_i are subfields of $\mathbb{F}_q$ (so it includes the projective Reed-Muller codes).

Joint work with Cícero Carvalho (Universidade Federal de Uberlândia, Brasil) and Hiram López (Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional, México).

S07 - July 28, 17:30 – 17:55

Estimates for polynomial systems defining irreducible smooth complete intersections

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In this talk we shall consider algebraic varieties defined as the set of zeros of a "typical" sequence of multivariate polynomials over a finite field. We shall consider varios types of "nice" varieties: set-theoretic and ideal-theoretic complete intersections, absolutely irreducible one, and nonsingular ones. For these types, we shall present a nonzero "obstruction" polynomial of bounded degree in the coefficients of the sequence that vanishes if its variety is not of the type. This in particular yields bounds on the number of such sequences. Further, we shall show that most sequences (of at least two polynomials) define a degenerate variety, namely an absolutely irreducible nonsingular hypersurface in some linear projective subspace.

Joint work with Joachim von zur Gathen (B-IT, Universität Bonn, Germany).

S07 - July 28, 18:30 – 18:55

Finite Field Constructions of Combinatorial Arrays

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Finite fields play a fundamental role in the construction of combinatorial designs. In our article of the same title in Designs, Codes and Cryptography (2016), we survey constructions of combinatorial arrays using finite fields. These combinatorial objects include orthogonal arrays, covering arrays, ordered orthogonal arrays, permutation arrays, frequency permutation arrays, hypercubes and Costas arrays.

In this talk, I briefly discuss finite field constructions of various types of combinatorial arrays. Then, I focus on constructions of orthogonal arrays and related objects such as variable strength orthogonal arrays, ordered orthogonal arrays and covering arrays. An orthogonal array (and its variants) is an array with q^t rows and k columns on an alphabet with q symbols such that its projection into specific t-subsets of columns give subarrays where each t-tuple of the alphabet occurs once as one of its rows. The orthogonal array variants differ in which t-subsets of columns are required to have this "coverage property". A common theme on several of the recent constructions we discuss is the use of linear feedback shift register sequences of maximum period (m-sequences) to build arrays attaining a high number of t-subsets of columns with the "coverage property". The structure of coverage in the arrays built from intervals of length $(q^t-1)/(q-1)$ of these sequences reveal interesting relationships with finite geometry. I will mention different constructions I have worked on with André Castoldi, Sebastian Raaphorst, Daniel Panario, Brett Stevens and Georgios Tzanakis.

Joint work with Gary Mullen and Daniel Panario.

S07 - July 29, 16:30 – 16:55

A problem of Beelen, Garcia and Stichtenoth on an Artin-Schreier tower

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A *tower of function fields* over $\mathbb{F}_q$ is a sequence of algebraic function fields $\mathcal{F} = \{F_i\}_{i=0}^{\infty}$ such that for all $i \geq 0$ $F_i \subsetneq F_{i+1}$, F_{i+1}/F_i is a separable finite extension, $\mathbb{F}_q$ is algebraically closed in F_i and there exists F_j with genus greater than one.

A tower $\mathcal{F}$ is called *asymptotically good* if $\gamma(\mathcal{F}) < \infty$ and $\nu(\mathcal{F}) > 0$ where

$$\gamma(\mathcal{F}) := \lim_{i\to\infty} g(F_i)/[F_i : F_0] \quad \text{and} \quad \nu(\mathcal{F}) := \lim_{i\to\infty} N(F_i)/[F_i : F_0],$$

$g(F_i)$ is the genus of F_i and $N(F_i)$ is the number of rational places of F_i. Otherwise, $\mathcal{F}$ is called *asymptotically bad*.

In 2006 Beleen, Garcia and Stichtenoth proved that any recursive tower of function fields over $\mathbb{F}_2$ defined by $g(Y) = f(X)$ with $g(T), f(T) \in \mathbb{F}_2(T)$ and $\deg f = \deg g = 2$ is defined by the Artin-Schreier equation

$$Y^2 + Y = \frac{1}{(1/X)^2 + (1/X) + b} + c, \tag{1}$$

with $b, c \in \mathbb{F}_2$. They checked that all the posible cases were already considered in previous works, except when $b = c = 1$. In fact, they left as an open problem to determine whether or not this tower is asymptotically good over $\mathbb{F}_{2^s}$ for some positive integer s.

In this talk we will show that the recursive tower defined by equation (1) with $b = c = 1$ is asymptotically bad over $\mathbb{F}_{2^s}$ when s is odd and where the main difficulty arises in the study of this tower when s is even.

Joint work with Ricardo Toledano (Universidad Nacional del Litoral-IMAL) and María Chara (Universidad Nacional del Litoral-IMAL).

S07 - July 28, 15:30 – 15:55

The generalized Hamming weights of Castle codes

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Castle codes are algebraic geometry one-point codes on Castle curves. This family contains some of the most important algebraic geometry codes among those studied in the literature to date. The generalized Hamming weights of these codes can be bounded by using the orden bound, whose main tools is the notion of well-behaving pairs. This bound is successful and usually gives very good results for the minimum distance (this bound gives the true minimum distance for Hermitian codes) but for weights higher dimension is difficult to compute.

In this talk will present a new way to get the exact value of certain Hamming weights of Castle codes. I will then introduce a notion of regular-behaving pairs and describe your properties in terms of the Weierstrass semigroup associated with the curve. In particular, I will show that for Hermitian codes these Hamming weights are all satisfying the generalized Singleton bound, i.e. are $t-$th rank MDS. Finally, I will propose a new lower bound for the minimum distance of Castle codes.

S07 - July 29, 18:30 – 18:55

Iterating Redei Functions over Finite Fields

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The dynamics of iterations of polynomials and rational functions over finite fields have attracted much attention in recent years, in part due to their applications in cryptography and integer factorization methods like Pollard rho algorithm. In this talk we study the action of Redei functions over non-binary finite fields. Redei functions have been applied in several areas including pseudorandom number generators and cryptography. They are defined as $R_n(x, a) = \frac{N(x,a)}{D(x,a)}$ over $\mathbb{D}_q^a = \mathbb{P}^1(\mathbb{F}_q) \setminus \{\pm\sqrt{a}\}$, where $\mathbb{P}^1(\mathbb{F}_q) :=$

$\mathbb{F}_q \cup \{\infty\}$, $a \in \mathbb{F}_q$, and $N(x,y), D(x,y)$ are given by $(x+\sqrt{y})^n = N(x,y) + D(x,y)\sqrt{y}$. We completely characterize the functional graph of these actions.

For $x_0 \in \mathbb{F}_q$, we define the orbit of x_0 under f to be the sequence $(x_n)_n$ given by $x_n = f(x_{n-1})$, for $n \geq 1$. It is clear that there exists $c, t \geq 0$ such that $x_{c+t} = x_t$; the least such integers are the cycle length and the tail length of x_0, denoted by $c_q(x_0)$ and $t_q(x_0)$, respectively. We obtain average values for $c_q(x) = c_{n,a,q}(x)$ and $t_q(x) = t_{n,a,q}(x)$ over all $x \in \mathbb{D}_q^a$; we denote these quantities by $C(n,a,q)$ and $T(n,a,q)$. We then obtain analogous results for the number of periodic points, that is, for the number of elements $x \in \mathbb{D}_q^a$ such that $t_{n,a,q}(x) = 0$, denoted by $T_0(n,a,q)$, and for the number of cycles of $R_n(x,a)$ as a map over $\mathbb{P}^1(\mathbb{F}_q)$; this is denoted by $N(n,a,p)$.

If time allows, we give asymptotic estimates as N approaches infinity for the average value of $T_0(n,a,p)$ and $T(n,a,p)$ over all prime numbers $p \leq N$; these quantities are denoted $S_0(n,a,N)$ and $S(n,a,N)$, respectively. These latter results follow closely work by Chou and Shparlinski (2004) for iterations of exponentiations.

Joint work with Claudio Qureshi (Unicamp), and with Rodrigo Martins (UTFPR) and Claudio Qureshi (Unicamp).

S07 - July 29, 16:00 – 16:25

Asymptotically good 4-quasi transitive AG-codes over prime fields

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It is known, by works of Stichtenoth and Bassa, that several classes of algebraic geometry codes, such as transitive codes, self-dual codes and quasi transitive codes among others, are asymptotically good over finite fields with square and cubic cardinality. Similar results were proved by Bassa, Beelen, Garcia and Stichtenoth for general non-prime fields.

Remarkably, few things are known with respect to the behavior of families of AG-codes over prime fields with some additional structure besides linearity. We will show that there are asymptotically good 4-quasi transitive codes over prime fields $\mathbb{F}_p$ for infinte prime numbers of a given form (for instance of the form $p = 220k + 1$).

Joint work with María Chara (Universidad Nacional del Litoral) and Ricardo Toledano (Universidad Nacional del Litoral).

S07 - July 29, 18:00 – 18:25

Estimates on the average cardinality of the value set of general families of univariate polynomials over a finite field

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The aim of this work is to estimate the average cardinality of the value set of a general family of monic univariate polynomials with coefficients in a finite field. This is a classical combinatorial problem with several applications in coding theory, interpolation problems and the analysis of the cost of algorithms for computing $\mathbb{F}_q$-rational zeros of multivariate polynomials with coefficients in a finite field, among others.

Let $\mathbb{F}_q$ be the finite field of $q = p^k$ elements and let $\mathcal{P}_d$ be the set of monic polynomials of degree d with coefficients in $\mathbb{F}_q$. For $f \in \mathcal{P}_d$ we denote by $\mathcal{V}(f) := |\{f(c) : c \in \mathbb{F}_q\}|$ the cardinality of the value set of f. Let $\mathcal{A} \subset \mathcal{P}_d$ be a general family, namely the set of elements of $\mathcal{P}_d$ whose coefficients belong to an $\mathbb{F}_q$–algebraic variety. S. D. Cohen studied the particular case when $\mathcal{A}$ is a linear family and proved that if $p > d$ and $\mathcal{A}$ satisfies certain technical conditions, the average cardinality $\mathcal{V}(\mathcal{A})$ of the value set in $\mathcal{A}$ is

$$\mathcal{V}(\mathcal{A}) = \mu_d q + \mathcal{O}(q^{1/2}),$$

where $\mu_d := \sum_{j=1}^{d} (-1)^{j-1}/j!$.
In our work we significantly generalize this result to rather general (eventually nonlinear) families $\mathcal{A} \subset \mathcal{P}_d$. We establish conditions on $\mathcal{A}$ which allow us to obtain an explicit version of this estimate. Our result provides an expression for the constant underlying the $\mathcal{O}$-notation in terms of d. We obtain a combinatorial expression for $\mathcal{V}(\mathcal{A})$ in terms of certain "interpolating sets" $\mathcal{S}_r^{\mathcal{A}}$ $(1 \leq r \leq d)$ and we associate to each $\mathcal{S}_r^{\mathcal{A}}$ an $\mathbb{F}_q$–algebraic variety Γ_r. We reduce the question to estimate the number of $\mathbb{F}_q$–rational points of Γ_r. We also exhibit linear and non linear families of polynomials which satisfy our requirements. In the particular case of linear families we improve the estimate given by Cohen in several aspects.

Joint work with Guillermo Matera (Instituto del Desarrollo Humano, UNGS, Argentina) and Mariana Pérez (Instituto del Desarrollo Humano, UNGS, Argentina).

S07 - July 29, 17:30 – 17:55

Arithmetic Mirror Symmetry of K3 Surfaces and Hypergeometric Functions.

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Mirror symmetry predicts surprising geometric correspondences between distinct families of algebraic varieties. In some cases, these correspondences have arithmetic consequences. Among the arithmetic correspondences predicted by mirror symmetry are correspondences between point counts over finite fields. In particular, we explore closed formulas for the point counts for our alternate mirror families of K3 surfaces, their relation to their Picard-Fuchs equations and hypergeometric functions.

Joint work with Charles Doran (University of Alberta, Canada), Tyler Kelly (University of Cambridge, UK), Steven Sperber (University of Minnesota, USA), John Voight (Dartmouth College, USA) and Ursula Whitcher (University of Wisconsin, Eau Claire, USA).

S07 - July 29, 15:00 – 15:25

Galois geometries and Random network coding

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Presently, a new direction in coding theory, called Random network coding, receives a lot of attention.

In random network coding, information is transmitted through a network whose topology can vary. A classical example is a wireless network where users come and go.

R. Kotter and F. Kschischang proved in an inspiring article that a very good way of transmission is obtained in networks if subspace codes are used. Here, the codewords are k-dimensional vector subspaces of the n-dimensional vector space $V(n,q)$ over the finite field of order q.

To transmit a codeword, i.e. a k-dimensional vector space, through the network, it is sufficient to transmit a basis of this k-dimensional vector space. But a k-dimensional subspace has different bases. Kotter and Kschischang proved that the transmission can be optimalized if the nodes in the network transmit linear combinations of the incoming basis vectors of the k-dimensional subspace which represents the codeword.

These ideas led to many new interesting problems in coding theory and in Galois geometries. For instance, it leads to the study of sets C of k-dimensional subspaces of $V(n,q)$, where two different k-dimensional subspaces of C pairwise intersect in at most a t-dimensional subspace, for some specified parameter t.

Since the k-dimensional subspaces of $V(n,q)$ define $(k-1)$-dimensional projective subspaces of the projective space $\mathrm{PG}(n-1,q)$, this problem can also be investigated in a projective setting. Hence, Galois geometries can contribute to random network coding.

In this talk, we present a number of geometrical results on random network coding, thereby showing how Galois geometries can contribute to this new area in coding theory.

S07 - July 29, 15:30 – 15:55

Weierstrass semigroup and Automorphism group of the curves $X_{n,r}$

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In this talk, we determine the Weierstrass semigroup $H(P_\infty)$ and the full automorphism group of a certain family of curves, denoted by $X_{n,r}$, which was recently introduced by H. Borges and R. Conceição.

Joint work with Herivelto Borges (Universidade de Sao Paulo) and Alonso Sepúlveda (Universidade Federal de Uberlandia).

S07 - July 28, 15:00 – 15:25

Castle curves and codes

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Algebraic Geometry (AG) Codes were introduced by Goppa around 1980, and since then, there have been quantitative and qualitative advances in Coding Theory. The game is to find families of curves having a reasonable easy handling from which codes with excelent parameters could be construced. For instance, we single out the following type of curves. A nonsigular, projective, geometrically irreducible pointed curve $(\mathcal{X}, P)$ over the finite field $\mathbb{F}$ of order q is called *Castle* if $\#\mathcal{X}(\mathbb{F})$ attains the Lewittes bound, namely $1+q\rho$, where ρ is the multiplicity of the Weierstrass semigroup $H(P)$ at P with $H(P)$ being symmetric. For instance, Deligne-Lusztig curves (Hermitian, Suzuki, Ree curves) are oustanding examples of such curves; as a matter of fact, many well-known examples of AG codes arise from Castle curves.

Moreover, Euclidian and Hermitian self-orthogonality properties on AG codes based on Castle curves are often easy to describe and handle; thus one can apply the CSS method in order to produce good quantum codes.

Joint work with Carlos Munuera (Universidad de Valladolid, España) and Wanderson Tenório (IMECC/UNICAMP, Brasil).

Session S08
Lie Groups and Representations

Chair: Vyacheslav Futorny – Collaborators: Carina Boyalian

S08 - July 29, 18:30 – 18:50

Lie subalgebras of the matrix quantum pseudo differential operators

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We give a complete description of the anti-involutions that preserve the principal gradation of the algebra $S_{q,N}$ of $N \times N$ matrix quantum pseudodifferential operators and we describe the Lie subalgebras of its minus fixed points. We obtain, up to conjugation, two families of anti-involutions that show quite different results when $n = N$ and $n < N$. Finally, we give a geometric realization of each of these anti-involutions and show their corresponding subalgebras are of classical type.

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Joint work with Carina Boyallian (CIEM-Famaf).

S08 - Poster

Equidimensionality of some Gelfand-Tsetlin varieties

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S. Ovsienko proved in 2003 that the Gelfand-Tsetlin variety for $gl(n)$ is equidimensional, i.e., all its irreducible components had the same dimension, in that case, such dimension is the dimension of affine space minus the number of equations. This result allows:

1. It guarantees the existence of irreducible modules in $gl(n)$ which are parameterized by the maximal espectrum of the Gelfand-Tsetlin subalgebra for $gl(n)$.

2. The universal enveloping algebra of $gl(n)$ is free as left and right module over its Gelfand-Tsetlin subalgebra.

In this poster, we will show the Gelfand-Tsetlin variety for $gl(n)$, the version for the quantum group Restricted Yangian of gl(n) and its equidimesionality.

S08 - July 29, 18:10 – 18:30

Gröbner bases for local Weyl modules for generalized current $\mathfrak{sl}_2$-algebras

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We use the theory of Gröbner bases for ideals to construct linear bases for the local Weyl modules for a generalized current algebra $\mathfrak{sl}_2 \otimes_{\mathbb{C}} \mathbb{C}[t_1, \ldots, t_n]$ associated to the finite-dimensional complex simple Lie algebra $\mathfrak{sl}_2$ and the polynomial algebra $\mathbb{C}[t_1, \ldots, t_n]$ with $n = 1, 2, 3$.

The main result is an explicit construction of linear bases for these important families of modules. In particular, we obtain some formulas to express the dimension of such modules. It is related to some works of Chari-Loktev, Chari-Pressley, Feigin-Loktev, and Loktev.

S08 - July 28, 15:40 – 16:20

Representation ring of Levi subgroups versus cohomology ring of flag varieties

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Recall the classical result that the cup product structure constants for the singular cohomology with integral coefficients of the Grassmannian of r-planes coincide with the Littlewood-Richardson tensor product structure constants for $GL(r)$. Specifically, the result asserts that there is an explicit ring homomorphism $\phi : \mathrm{Rep}_{poly}(GL(r)) \to H^*(Gr(r,n))$, where $Gr(r,n)$ denotes the Grassmannian of r-planes in $\mathbb{C}^n$ and $\mathrm{Rep}_{poly}(GL(r))$ denotes the polynomial representation ring of $GL(r)$.

This work seeks to achieve one possible generalization of this classical result for $GL(r)$ and the Grassmannian $Gr(r,n)$ to the Levi subgroups of any reductive group G and the corresponding flag varieties.

S08 - July 28, 17:30 – 18:10

Positivity of parabolic Kazhdan-Lusztig polynomials

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We give diagrammatic categorifications of the spherical and of the anti-spherical modules for any Coxeter group. Our main theorem gives a "light leaves" basis of morphisms in these categorifications. We deduce that all flavours of parabolic Kazhdan-Lusztig polynomials have positive coefficients (for arbitrary choices of subsets of simple reflections).

Joint work with Geordie Williamson (Max Planck Institut).

S08 - July 28, 15:00 – 15:40

2-representations of Soergel bimodules

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The aim of this talk is to describe recent progress in the study of 2-representations of the 2-category of Soergel bimodules over the coinvariant algebra of a finite Coxeter group. For finite Weyl groups this 2-category is biequivalent to the 2-category of projective functors on the principal block of the BGG category O associated with the corresponding finite dimensional simple complex Lie algebra. In many cases, it turns out that simple transitive 2-representations of the 2-category of Soergel bimodules have Lie-theoretic interpretation, which we will try to explain. Finally, we will also explain an ADE-type classification of certain integral matrices which poped up in the study of Soergel bimodules for general dihedral groups.

Joint work with Tobias Kildetoft (Uppsala University), Marco Mackaay (University of Algarve) and Jakob Zimmermann (Uppsala University).

S08 - July 28, 16:20 – 17:00

On the Demazure Type Structure of Graded Limits of Representations of Quantum Affine Algebras

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The finite-dimensional representation theory of quantum affine algebras has been subject of intense study for the past two decades motivated originally by the mathematical-physics literature. Although the irreducible representations have been classified in the early days of the development of the theory, unraveling their structure in general remains a chalenging problem. Recently, the character of several important classes of irreducible modules have been computed by relating them to Demazure modules. We shall discuss recent results in this direction. In particular, we present a result showing that Demazure modules of level 2 appear as the graded limits of representations in the subcategories introduced by Hernandez-Leclerc in connection to monoidal categorification of certain cluster algebras.

Joint work with Matheus Brito (UC Riverside) and Vyjaynthi Chari (UC Riverside).

S08 - July 28, 18:10 – 18:30

Tensor products of minimal affinizations in type A

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For a quantum affine algebra of type A, we describe the irreducible factors of the tensor product of a general minimal affinization with a Kirillov-Reshetikhin module associated to an extreme node of the Dynkin diagram of the underlying simple Lie algebra. More precisely, we give conditions on the Drinfeld polynomials for the tensor product of the corresponding irreducible modules to be irreducible. In the reducible case we show that the product has exactly two factors and describe them.

Joint work with Adriano Moura (Universidade Estadual de Campinas, Brazil) and David Hernandez (Université Paris-Diderot Paris 7, France).

S08 - July 29, 15:00 – 15:40

Belavin-Drinfeld Lie bialgebras and quantum groups (Galois cohomology considerations)

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In the study of Lie bialgebra structures over C[[t]] certain "cohomology theories" were introduced by B. Kadets, E. Karolinsky, I Pop and A. Stolin. We will explain how these theories can be explained/reformulated in terms of Galois cohomology. By doing so we will be able to establish some open conjectures.

Joint work with A. Stolin (Gothenburg, Sweden).

S08 - Poster

G_2 holonomy manifolds are superconformal.

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We discuss the chiral the Rham complex (CDR) over a manifold M with holonomy G_2. We will show how the vertex algebra of global sections of the CDR associated to M contains two commuting copies of the Shatashvili-Vafa G_2 superconformal algebra.

S08 - Poster

Structure and Representations of Diferenttial Operators on the Torus

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We discuss a noncommutative version of Noether's Problem to the ring of differential opertors on the torus, in the case the finite group is the symmetric group or a Weyl group of the families B and D. We also discuss some facts about simple weight modules of the invariants of the differential operator ring under the action of such groups.

Joint work with Vyacheslav Futorny, (USP, Brasil).

S08 - July 29, 15:40 – 16:20

cohomology of finite, algebraic, and quantum groups

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I will discuss some interrelated topics in the cohomology and Ext groups for finite groups of Lie type, algebraic groups, and quantum groups. Of interest are 1)the negative solution to an old (1961) conjecture on maximal subgroups of finite groups, via counterexamples due to Frank Luebeck and a student of mine, Tim Sprowl, using Kazhdan-Lusztig polynomials and algebraic groups cohomology. 2)three conjectures by myself and Brian Parshall, on the interrelationship of Kazhdan-Lusztig polynomials and cohomology/Ext groups for modules in the algebraic groups case which come from irreducible modules for quantum groups. 3) the solution of the third of the above conjectures by a student, Hankyung Ko, of Parshall. One consequence is the calculation of all Ext^n groups between irreducible modules for quantum groups in type A at a root of unity, even with singular highest weights.

S08 - July 28, 18:30 – 18:50

K-groups in the theory of symmetric spaces

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The structure of symmetric spaces is very well encoded into an algebraic structure closely related to C*-algebras. Using this relationship to define K-theory for (hermitian, non-compact) symmetric spaces permits to replace root systems by K-groups in their classification. Classification beyond well-known results exist for inductive limits.

Joint work with Dennis Bohle (Amsterdam).

S08 - Poster

Chiral De Rham Complex Structure for Witt algebras

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The Chiral de Rham complex in the case of a torus $\mathbb{T}^N$, is a tensor product of two vertex super algebras: $V^+_{Hyp} \otimes V_{\mathbb{Z}^N}$, one is the hyperbolic latice vertex algebra and the other is the euclidean latice vertex algebra. The space $M_{Hyp}(\gamma) \otimes V^k_{\mathbb{Z}^N}$ has a structure of a module for the Witt algebra, , where $M_{Hyp}(\gamma)$ is a module for the hyperbolic latice vertex algebra and $V^k_{\mathbb{Z}^N}$ is the subspace of fermionic degree k. These modules exhaust all exceptional generalized highest weight modules for this Lie algebra.

Session S09
Logic and Universal Algebra

Chair: Alf Onshuus – Collaborators: Manuela Busaniche

S09 - July 26, 18:30 – 18:55

An optimal axiomatization of the set of central elements

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We say that a variety $\mathcal{V}$ with $\vec{0}$ and $\vec{1}$ has "definable factor congruences" if there exists a first-order formula defining every factor congruence in every algebra $\mathbf{A} \in \mathcal{V}$ in terms of its associated *central elements*. When there is a $(\bigwedge p = q)$-formula satisfying this condition we say that $\mathcal{V}$ has "equationally definable factor congruences". We denote by $Z(\mathbf{A})$ the set of central elements of $\mathbf{A}$. In "Varieties with equationally definable factor congruences II" we give an axiomatization of $Z(\mathbf{A})$ for varieties with equationally definable factor congruences which is optimal in the sense of its quantificational complexity. The given axiomatization is not a set of positive formulas nor a set of Horn formulas. There are several examples which show that in the general case, varieties with equationally definable factor congruences do not admit an axiomatization of $Z(\mathbf{A})$ by a set of positive formulas. However, as we will see, there is an axiomatization of $Z(\mathbf{A})$ which is a set of Horn formulas with the optimal quatificational complexity, which evidences the already known fact that central elements are preserved by direct products.

Joint work with Diego Vaggione (Universidad Nacional de Córdoba).

S09 - July 25, 15:00 – 15:50

Monadic Gödel algebras are functional

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Monadic Heyting algebras where introduced by Monteiro and Varsavsky (1957) as an algebraic counterpart of the one variable fragment of quantified monadic intuitionistic logic, generalizing monadic Boolean algebras introduced by Halmos (1955) with a similar purpose for classical logic. They were found to interpret also the intuitionistic analogue of the modal system $S5$ and have been extensively studied since. Answering a question put by Monteiro, Bezhanishvili and Harding (2002) proved that any monadic Heyting algebra is functional; that is, it may be embedded in an algebra of functions $(H^X, \triangle, \nabla)$, where H is a complete Boolean algebra, the Heyting operations are defined pointwise, and the monadic operators $\triangle$ and ∇ are interpreted as $\triangle f = \inf_{x \in X} f(x)$, $\nabla f = \sup_{x \in X} f(x)$, respectively. Apart from the variety of boolean algebras for which Halmos proved a similar result, the situation is unknown for other familiar varieties of Heyting algebras. We solve this problem for monadic Gödel algebras, which interpret the one variable fragment of monadic predicate logic with values in the standard Gödel chain [0,1] (or in all linear Heyting algebras, Horn, 1969; Baaz et al, 2007). These are the monadic Heyting algebras satisfying the prelinearity axiom and the identity $\triangle(\triangle a \vee b) = \triangle a \vee \triangle b$ corresponding to the quantifier shift law

$\forall x(\forall x\varphi \vee \psi) \leftrightarrow \forall x\varphi \vee \forall x\psi$, and constitute also the algebraic semantics of the Gödel analogue of S5 (Hájek, 2010, C. & Rodríguez 2012). Any monadic Gödel algebra may be embedded in an algebra of functions H^X where H is a complete Gödel algebra. For countable algebras, H may be chosen to be $[0, 1]$.

S09 - July 26, 16:30 – 16:55

Epic subalgebras and primitive functions

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S09 - July 26, 17:30 – 18:20

Stonean residuated lattices

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By a Stonean residuated lattice I mean a bounded integral residuated lattice-ordered commutative monoid satisfying the equation

$$\neg x \vee \neg\neg x = \top.$$

I will show that stonean residuated lattices are characterized by triples $\langle \mathbf{B}, \mathbf{D}, \varphi \rangle$ where $\mathbf{B}$ is a Boolean algebra, $\mathbf{D}$ is an unbounded residuated lattice and φ is an order reversing homomorphism from $\mathbf{B}$ into the lattice of implicative filters of $\mathbf{D}$.

Joint work with Manuela Busaniche (Universidad Nacional del Litoral, Argentina).

S09 - July 26, 15:00 – 15:50

MV-álgebras monádicas y l-grupos monádicos

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En esta charla presentamos una definición de los l-grupos monádicos con unidad fuerte y algunas propiedades básicas de esta clase de álgebras. Luego mostramos una equivalencia entre la categoría de los l-grupos monádicos y la categoría de las MV-álgebras monádicas que extiende a la equivalencia dada por D. Mundici con el funtor ?. Estudiamos las congruencias de un l-grupo monádico y las caracterizamos por medio de ciertos l-ideales monádicos. Probamos que el retículo de l-ideales monádicos es isomorfo al retículo de l-ideales de E(G). A partir de esta caracterización de las congruencias mostramos que todo l-grupo monádico es producto subdirecto de una familia de l-grupos monádicos G_i donde E(G_i) es una cadena para todo i. Para finalizar damos algunas aplicaciones de la equivalencia demostrada y comentaremos algunos de los avances en el estudio de los l-grupos monádicos como variedad .

S09 - July 25, 16:30 – 16:55

A new setting for duals of canonical extensions of lattices

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We consider properties of the graphs that arise as duals of bounded lattices in Ploscica's representation via maximal partial maps into the two-element set. We introduce TiRS graphs which abstract those duals of bounded lattices. We demonstrate their one-to-one correspondence with so–called TiRS frames which are a subclass of the class of RS frames introduced by Gehrke to represent perfect lattices. This yields a dual representation of finite lattices via finite TiRS frames, or equivalently finite TiRS graphs, which generalises the well-known Birkhoff dual representation of finite distributive lattices via finite posets. By using both Ploscica's and Gehrke's representations in tandem we present a new construction of the canonical extension of a bounded lattice. We present two open problems that can be of interest to researchers working in this area.

S09 - July 25, 17:30 – 18:20

MV-álgebras separables.

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Recordaremos la definición de objeto SEPARABLE en una categoría COEXTENSIVA, demostraremos que la categoría de MV-álgebras es coextensiva y caracterizaremos sus objetos separables. Además, enfatizaremos la analogía con el caso de anillos y explicaremos la naturaleza geométrica de los resultados.

Joint work with Vicenzo Marra (Università degli Studi di Milano).

S09 - July 25, 16:00 – 16:25

Model theoretic properties of pseudo real closed fields.

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In this talk we will study the class of pseudo real closed fields (PRC-fields) from a model theoretical point of view. PRC-fields are a generalization of real closed fields and pseudo algebraically closed fields, where we admit having several orders. Prestel showed that the theory of PRC-fields can be axiomatized in the language of rings. We will explain some of the principal model-theoretic results of this theory, for example the form of the definable sets, the model-theoretic definable and algebraic closure, amalgamation of types and some new results obtained with Alf Onshuus and Pierre Simon about the definable groups.

S09 - Poster

Límites inversos de estructuras compactas

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Una estructura de primer orden A se dice atómicamente compacta si cualquier conjunto de fórmulas atómicas con constantes en A que sea finitamente satisfactible en A, es satisfactible en A. Si A es un álgebra las atómicas son igualdades de polinomios. En [2] se prueba que esta noción es equivalente a que A sea retracto de cualquier extensión pura. Es fácil ver que si A es compacta, es decir, tiene una topología compacta de Hausdorff que hace a las operaciones continuas y a las relaciones cerradas, entonces A es atómicamente compacta. Por lo tanto cualquier límite inverso de estructuras compactas es atómicamente compacto. En [1] se muestra que cualquier límite inverso de un sistema inversamente dirigido de estructuras finitas es retracto de un ultraproducto en estas estructuras. En el poster que proponemos se muestra que el mapa natural del límite inverso de un sistema de estructuras compactas en un ultraproducto de estas estructuras es puro. Esto sumado a que el límite inverso es atómicamente compacto da una prueba de un resultado mas general que el de [1]

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Joint work with Xavier Caicedo (Universidad de los Andes, Colombia).

S09 - July 25, 18:30 – 18:55

Fuzzy Neighborhood Semantics

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Our starting point is that the framework of classical logic is not enough to reason with vague concepts or with modal notions such as belief, uncertainty, knowledge, obligations, time, etc. Many-valued logical systems under the umbrella of mathematical fuzzy logic (in the sense of Hájek [1]) appear as a suitable logical framework to formalize reasoning with vague or gradual predicates, while a variety of modal logics address the logical formalization to reason about different notions as the ones mentioned above. Therefore, if one is interested in a logical account of both vagueness and some sorts of modality, one is led to study systems of many-valued modal logic.

The basic idea of this presentation is to systematically introduce modal extensions of many-valued or fuzzy logics. These logics, under different forms and contexts, have appeared in the literature for different reasoning modeling purposes. For instance, in [2], Fitting introduces a modal logic on logics valued on finite Heyting algebras, and provides a satisfactory justification to study such modal systems to deal with opinions of experts with a dominance relationship among them. In [3] and [4], the authors have proposed to extend Gödel fuzzy logic with modal operators. They provide a systematic study of this Gödal modal logic, which has been completmented in [5]. In [6], a detailed description of many-valued modal logics (with a necessity operator) over finite residuated lattice is proposed. In [7], a modal extension of Lukasiewicz logic is developed following an algebraic approach. Finally, in [8], a general approach to modal expansions of t-norm based logics is also introduced with the help of rational constants and possibly infinitary inference rules.

In most of these mentioned papers, many-valued modal logics are endowed with a Kripke-style semantics, generalizing the classical one, where propositions at each possible world, and possibly accessibility relations

between worlds as well, are valued in a residuated lattice. The natural next step in this line of research is to axiomatize such semantics. However, this has turned apparently to be a considerable overall challenge because it is difficult to transfer some usual techniques from Boolean algebras to residuated lattices. For instance, the K axiom $(\Box(\varphi \to \psi) \to (\Box\varphi \to \Box\psi))$ plays a central role in the construction of the canonical models in order to prove completeness in the classical case. However, except for either Gödel modal logic or many-valued modal logics defined from Kripke frames with crisp accessibility relations, the K axiom is not sound.

In order to overcome this difficulty, we propose to study an alternative semantics which is a generalization of the classical *neighborhood semantics*. This will be elaborated based on two preliminary workshop papers by the same authors ([9] and [10]). At this moment, it is worth mentioning some works from other authors which consider a generalization of neighborhood semantics in the same way we have done it. Namely, Kroupa and Teheux consider in [11] a neighborhood semantics for playable L_n-valued effectivity function. They want to characterize the notion of coalitional effectivity within game form models. Also we must mention a very recent paper by Cintula et al. ([12]) where the authors explore a fuzzified version of the classical neighborhood semantics and prove a relationship between fuzzy Kripke and neighborhood semantics in a very precise way (much better than the one proposed in our previous work). In fact, the authors of this paper propose to attack the problem of characterizing the modal extensions of MTL logics under a neighborhood semantics with algebraic tools. According to their algebraic approach, they characterize a global MTL modal logic, leaving open the case of characterizing the local consequence relation.

In summary, in this presentation, we will mainly focus on the development of a theoretical and general framework. Considering our motivation, our main goal, at large, is a systematic presentation of the minimum many-valued modal logics and their extensions. In this sense, we will firstly present minimum many-valued modal logics with necessity and possibility operators, $\Box, \Diamond$, defined on top of logics of residuated lattices under a neighborhood semantics.

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Joint work with Lluis Godo (IIIA-CSIC, Spain).

S09 - July 26, 16:00 – 16:25

On hemi-implicative semilattices

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In this talk we introduce and study classes of algebras that properly include varieties of interest for logic. These algebras are obtained by weakening the main features of Heyting algebras but retaining most of their algebraic consequences. To be more precise, we give the following definition.

Definition: An algebra $(H, \wedge, \to, 1)$ of type $(2, 2, 0)$ is a *hemi-implicative semilattice* if the following conditions hold:

$H1$: $(H, \wedge, 1)$ is a bounded semilattice.

$H2$: For every $a, b, c \in H$, if $c \leq a \to b$ then $a \wedge c \leq b$.

$a \to a = 1$ for every $a \in H$.

An algebra $(H, \wedge, \vee, \to, 0, 1)$ of type $(2, 2, 2, 0, 0)$ is said to be a *hemi-implicative lattice* if $(H, \wedge, \vee, 0, 1)$ is a bounded distributive lattice and $(H, \wedge, \to, 1)$ is a hemi-implicative semilattice.

If $(H, \wedge)$ is a semilattice with a binary operation $\to$, then H satisfies the condition (H2) if and only if it holds the inequality $a \wedge (a \to b) \leq b$ for every $a, b \in H$. Thus, the condition (H2) is a kind of modus ponens rule. Moreover, the class of hemi-implicative semilattices is a variety and the class of hemi-implicative lattices is also a variety.

Implicative semilattices introduced by Nemitz are examples of hemi-implicative semilattices. Some examples of hemi-implicative lattices are the semi-Heyting algebras, which were introduced by H.P. Sankappanavar in as an abstraction of Heyting algebras, and the RWH-algebras, which were introduced by Celani and Jansana in as another possible generalization of Heyting algebras.

S09 - Poster

The ring $\prod_{n=1}^{\infty} F_{p_i}$

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This poster presents the structure of the ring $\prod_{n=1}^{\infty} F_{p_i}$, where p_i is the i^{th} prime, $p_1 = 2; p_2 = 3; \ldots$, and details a relationship of principal ideals within the ring with subsets of the natural numbers.

We try to understand the ring by determining if it is finitely generated, a Von Neumman regular ring, and the relationship with the weak direct product. We examine first order definable sets in this ring and attempt to topologyze it using dictionary order. Also we present the elements with torsion and cyclotomic polynomials.

Joint work with Sergio Palomo (City University of New York).

Session S10
Homological Methods

Chair: Paul Bressler – Collaborators: Erik Backelin

S10 - July 28, 17:30 – 18:00

Title: Invariant theory of Milnor algebras

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Given a non-degenerate homogeneous form f on $\mathbb{C}^n$ of degree d, the Milnor algebra of f is defined as the quotient of the polynomial ring $\mathbb{C}[x_1, ..., x_n]$ by the ideal $J(f)$ of first order partials of f. For each integer k, one can define the kth Hilbert point of the Milnor algebra as the subspace of degree k polynomials contained in $J(f)$. When $k = n(d-2)$, this Hilbert point is classically called a Macaulay inverse system. We study the invariant theory of the these Hilbert points viewed as points in the corresponding Grassmanians. We will then be able to resolve a conjecture of Eastwood and Isaev which is related to the well-known Mather-Yau theorem for isolated hypersurface singularities.

Joint work with Alex Isaev (Australian National University) and Maksym Fedorchuk (Boston College).

S10 - July 28, 18:30 – 19:00

Applications of volume to commutative algebra

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We give general conditions under which volumes and volume like functions exist and some applications to problems in commutative algebra. We give some examples where volumes and volume like functions do not exist.

S10 - July 29, 15:00 – 15:30

Nonsymmetric operads, associative algebras, and the Lagrange inversion

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I shall discuss a construction of a functor from associative algebras to nonsymmetric operads which has good homological and homotopical properties. As a consequence, I shall give a new categorical context for the Lagrange inversion formula. Another consequence I shall mention concerns various examples and counterexamples in Koszul duality for operads.

S10 - July 29, 17:30 – 18:00

BV-algebra Structures and Hochschild (Co)homology

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In this talk we will recall the BV-algebra structures of the Hochschild cohomology of symmetric algebras and its relation with string topology. We will present the calculations of these structures for the group ring of finitely generated abelian groups. If time permits, we will present the notion of Hochschild Tate cohomology defined by Buchweitz and the BV-algebra structure defined by Wang for self-injective algebras. As an example, we will show the calculations for the group ring of cyclic groups.

Joint work with Andrés Angel (Universidad de los Andes, Colombia).

S10 - July 29, 16:30 – 17:00

Isomorphism conjectures with proper coefficients

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Let G be a group and $\mathcal{F}$ a nonempty family of subgroups of G, closed under conjugation and under subgroups. Also let E be a functor from small $\mathbb{Z}$-linear categories to spectra, and let A be a ring with a G-action. Under mild conditions on E and A one can define an equivariant homology theory $H^G(-, E(A))$ of G-simplicial sets such that $H^G_*(G/H, E(A)) = E(A \rtimes H)$. The strong isomorphism conjecture for the quadruple $(G, \mathcal{F}, E, A)$ asserts that if $X \to Y$ is an equivariant map such that $X^H \to Y^H$ is an equivalence for all $H \in \mathcal{F}$, then $H^G(X, E(A)) \to H^G(Y, E(A))$ is an equivalence. We introduce an algebraic notion of $(G, \mathcal{F})$-properness for G-rings, modelled on the analogous notion for G-C^*-algebras, and show that the strong $(G, \mathcal{F}, E, P)$ isomorphism conjecture for $(G, \mathcal{F})$-proper P is true in several cases of interest in the algebraic K-theory context.

Joint work with Guillermo Cortiñas (Universidad de Buenos Aires, Argentina).

S10 - July 29, 16:00 – 16:30

Homología cíclica de productos cruzados débiles (Cyclic homology of weak crossed products)

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Primero revisamos el concepto de productos cruzados débiles presentado en [1] y [2]. Este concepto generaliza al presentado en [3] y contiene al de productos cruzados de álgebras por álgebras de Hopf débiles. Luego estudiamos las homologías de Hochschild y cíclica de estos productos cruzados. En primer lugar construímos una resolución para los productos cruzados débiles que es más simple que la canónica y luego la usamos para obtener complejos que calculen su homología y cohomología de Hochschild respectivamente. Finalmente, usando el lema de perturbación, obtenemos un complejo mezclado que da las homologías cíclica, periódica y negativa de estas álgebras.

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First we review the concept of weak crossed products introduced in [1] and [2]. This concept generalizes to that introduced in [3] by Brzeziński and it contains the crossed products of algebras by weak Hopf algebras. Then we study the Hochschild and cyclic homology of these crossed products. First, for the weak crossed products, we built a resolution that is simpler than the canonical one and then we use it for obtain complexes that calculate their Hochschild homology and cohomology respectively. Finally, using the perturbation lemma, we get a mixed complex that gives the cyclic, periodic and negative homologies of these algebras.

Joint work with Juan José Guccione (Universidad de Buenos Aires) y Christian Valqui (Pontificia Universidad Católica de Perú).

S10 - July 28, 18:00 – 18:30

Relative Igusa-Todorov functions

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We develop the theory of the $\mathcal{E}$-relative Igusa-Todorov functions in an exact IT-context $(\mathcal{C}, \mathcal{E})$. In the case when $\mathcal{C} = \text{mod}\,(\Lambda)$ is the category of finitely generated left Λ-modules, for an artin algebra Λ, and $\mathcal{E}$ is the class of all exact sequences in $\mathcal{C}$, we recover the usual Igusa-Todorov functions. We use the setting of the exact structures and the Auslander-Solberg relative homological theory to generalise the original Igusa-Todorov's results. Furthermore, we introduce the $\mathcal{E}$-relative Igusa-Todorov dimension and also we obtain relationships with the relative global and relative finitistic dimensions and the Gorenstein homological dimensions.

Joint work with Octavio Mendoza (Universidad Nacional Autónoma de México).

S10 - July 28, 15:30 – 16:00

Codimension two A-hypergeometric systems

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A-hypergeometric systems are systems of partial differential equations associated to toric ideals, introduced by Gelfand, Graev, Kapranov and Zelevinsky in the late 1980s. Homological methods have proved exceedingly effective in studying hypergeometric equations, and provide the only known way of computing the dimension of the solution space of a hypergeometric system. However, homological considerations have so far failed to explain how the solutions themselves behave.

I will explain an approach towards bridging this gap in the case of codimension two lattice ideals. Using the combinatorial minimal free resolutions of codimension two lattice ideals constructed by Peeva and

Sturmfels, I will present Ext and local cohomology computations, which, taken together, control the behavior of the corresponding A-hypergeometric functions. Along the way, we give an explicit combinatorial formula for the graded local duality isomorphisms in this case.

Joint work with Roberto Barrera (Texas A&M University, USA) and Christine Berkesch Zamaere (University of Minnesota, USA).

S10 - July 28, 16:30 – 17:00

The syzygies of some thickenings of determinantal varieties

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The space of m x n matrices admits a natural action of the group GL_m x GL_n via row and column operations on the matrix entries. The invariant closed subsets are the determinantal varieties defined by the (reduced) ideals of minors of the generic matrix. The minimal free resolutions of these ideals are well-understood by work of Lascoux and others. There are however many more invariant ideals which are non-reduced, and they were classified by De Concini, Eisenbud and Procesi in the 80s. I will explain how to determine the syzygies of a large class of these ideals by employing a surprising connection with the representation theory of general linear Lie superalgebras.

Joint work with Jerzy Weyman (University of Connecticut).

S10 - July 29, 15:30 – 16:00

Hochschild homology and cohomology of down-up algebras

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We have computed Hochschild homology and cohomology of homogeneous down-up algebras in the generic case and in the Calabi-Yau case.

Let K be a fixed field. Given parameters $(\alpha, \beta, \gamma) \in K^3$, the associated down-up algebra $A(\alpha, \beta, \gamma)$ is defined as the quotient of the free associative algebra $K\langle u, d\rangle$ by the ideal generated by the relations

$$\begin{aligned} d^2u - (\alpha dud + \beta ud^2 + \gamma d), \\ du^2 - (\alpha udu + \beta u^2 d + \gamma u). \end{aligned} \tag{2}$$

This family of algebras was introduced by G. Benkart and T. Roby. As typical examples we have that $A(2, -1, 0)$ is isomorphic to the enveloping algebra of the Heisenberg-Lie algebra of dimension 3, and, for $\gamma \neq 0$, $A(2, -1, \gamma)$ is isomorphic to the enveloping algebra of $\mathfrak{sl}(2, K)$. Moreover, Benkart proved that any down-up algebra such that $(\alpha, \beta) \neq (0, 0)$ is isomorphic to one of Witten's 7-parameter deformations of $U(sl(2, K))$.

E. Kirkman, I. Musson and D. Passman proved that $A(\alpha, \beta, \gamma)$ is noetherian if and only it is a domain, which is tantamount to the fact that the subalgebra of $A(\alpha, \beta, \gamma)$ generated by ud and du is a polynomial algebra in two indeterminates, that in turn is equivalent to $\beta \neq 0$. Under either of the previous situations,

$A(\alpha, \beta, \gamma)$ is Auslander regular and its global dimension is 3. On the other hand, it was proved by Cassidy and Shelton that, if K is algebraically closed, then the global dimension of $A(\alpha, \beta, \gamma)$ is always 3. Moreover, Benkart and Roby also proved that the Gelfand-Kirillov dimension of a down-up algebra is 3, independently of the parameters.

If $\gamma = 0$, the down-up algebra can be regarded as nonnegatively graded, where the degree of u and d is 1. In this case, the algebra is 3-Koszul and Artin-Schelter regular.

Joint work with Sergio Chouhy. IMAS-CONICET, Argentina and Estanislao Herscovich. Universidad de Buenos Aires and Institut Joseph Fourier, Grenoble, France.

S10 - July 28, 16:00 – 16:30

On Unimodality of Hilbert Function Graded Algebras

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We will survey the problem of determining Unimodality of Hilbert Functions especially for graded algebras of small codimensions. Let $R = \oplus R_n$ be a standard graded algebra over a field k an I be a homogeneous ideal so that $S = R/I = \oplus S_n$ is a graded algebra of dimension zero. Then the Hilbert function of R/I, denoted by $h_I(n) = h_S(n) = dim_k S_n$ is a function such that $h_S(0) = 1, h_S(1) = e$, the embedding dimension of S and $h_S(n) = 0$, for $n > s$, where s is the socle degree of S. Hilbert function is called unimodal if $h_0 \leq h_1 \leq \cdots \leq h_{t-1} \leq h_t \geq h_{t+1} \geq cdots \geq h_s \geq h_{s+1} = 0$ for some t. Hilbert functions of Gorenstein algebras are also symmetric. So, if they are unimodal, $t = s/2$ or $(s+1)/2$. It is known that Hilbert function of Goresntein algebras are unimodal in codimensio three and it is as yet open in codimension 4. There are examples of non unimodal Cohen Macaulay algebras codimension 3 and Gorenstein algebras in codimension 5 and higher. We will discuss the problem and some recent resutls in Codimension 3 level algebras and Gorenstein algebras of codimension 4.

S10 - July 28, 15:00 – 15:30

Nearest Points on Toric Varieties

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We determine the Euclidean distance degree of a projective toric variety. This extends the formula of Matsui and Takeuchi for the degree of the A-discriminant in terms of Euler obstructions. The primary goal of the project is the development of reliable algorithmic tools for computing the points on a real toric variety that are closest to a given data point. In this lecture we emphasise the role played by characteristic classes such as the Chern-Mather class.

Joint work with Martin Helmer (UC Berkeley, USA).

Session S11
Representations of Algebras

Chair: María Julia Redondo

S11 - Poster

Representation of Twisted Tensor Products

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We obtain a faithful representation of the twisted tensor product $B \otimes_\chi A$ of unital associative algebras, when B is finite dimensional. This generalizes the representations of [C] where $B = K[X]/ < X^2 - X >$, [GGV] where $B = K[X]/ < X^n >$ and [JLNS] where $B = K^n$. Furthermore, we establish conditions to extend twisted tensor products $B \otimes_\chi A$ and $C \otimes_\psi A$ to a twisted tensor product $(B \times C) \otimes_\varphi A$.

[A] J. Arce. Representation of twisted tensor Products. arXiv:1505.01232 [math.RA] 6 may 2015.

[C] C. Cibils. Non-commutive duplicates of finite sets. J. Algebra Appl , 5(3):361–377, 2006.

[GGV] A. Guccione, J. J. Guccione and C. Valqui, Non commutative truncated polynomial extensions.

[JLNS] Jara, J. López Peña, G. Navarro and D. Stefan, On the classification of twisting maps between $K^n and K^m, arXiv : 0805.2874v3[math.RA]24Sep2009$.

Joint work with .

S11 - July 25, 15:00 – 15:50

Partial relation extensions

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It is well-known that cluster-tilted algebras introduced by Buan, Marsh and Reiten can equivalently be described as relation extensions, that is, trivial extensions of a tilted algebra C by its relation bimodule E. Also, any complete slice in modC embeds as a local slice in the module category of the cluster tilted algebra.

The objective of this talk is to introduce an intermediate class of algebras, called partial relation extensions, where E is replaced by one of its direct summands E'. Our main results show how one can compute the bound quiver and the module category of a partial relation extension. We also prove that a complete slice in modC embeds as local slice in the module category of its partial relation extensions.

Joint work with Juan Carlos Bustamante (Université de Sherbrooke), Julie Dionne (Cégep de Sherbrooke), Patrick Le Meur (Université Paris-Diderot) and David Smith (Bishop's University).

S11 - Poster

Análisis del espectro de Grafos Jahangir

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La energía de un grafo se define como la suma de los valores absolutos de los autovalores de su matriz de adyacencia. Por otro lado su espectro como el conjunto de los autovalores considerando sus multiplicidades. A partir de ello, matemáticos tales como McClelland, Koolen y Moulton entre otros, han definido expresiones algebraicas en función del número de aristas y vértices de un grafo para permitir estimar cotas inferiores y superiores de la energía de los mismos. Por otro lado, otros autores han definido con gran éxito la expresión algebraica de los autovalores de la matriz asociada a grafos tales como Caminos y Ciclos. El presente trabajo, refleja algunas de la conclusiones que se arribaron sobre la expresión algebraica de algunos de los autovalores en ciertos integrantes de la familia de los grafos Rueda, particularmente de Jahangir. Para ello se muestran algunos procedimientos, que se podrían extender para grafos Abanico, que involucran modelos generados por softwares, particiones equitativas de grafos hasta aplicaciones de teoremas de álgebra lineal en matrices vinculada a subgrafos inducidos y teorema de entrelazados de Cauchy.

Joint work with Wilsmar dos Santos (CFE, CETP, CES, Uruguay).

S11 - July 26, 15:00 – 15:50

Maximal Green Sequences

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Recently a lot of progress has been made in the study of maximal green sequences. In this talk I will give an overview of, first the definition from many points of view using pictures and other figures, second what the major questions are, and third what progress has been made. I will also explain some of the key ideas of Brustle-Dupont-Perotin, Thomas-Todorov-Reiten, Garver-McConville that were used in my work with Gordana Todorov, Thomas Brustle and Steve Hermes on some of these problems.

Joint work with Gordana Todorov, Thomas Brustle and Stephen Hermes.

S11 - July 26, 18:00 – 18:20

About sums of compositions of irreducible morphisms

Nicolás Llodra Schat
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We consider A an artin algebra, and $\operatorname{mod} A$ the category of finitely generated right A-modules.

In this talk, we present some results about sums of compositions of irreducible morphisms between indecomposable A-modules in relation with the powers of the radical of its module category.

The notion of degree of an irreducible morphism, introduced by S. Liu [L], played a fundamental role to obtain such results.

In particular, we give a characterization of when the sums of compositions of irreducible morphisms of length exactly n, for $n = 2, 3, 4$ and 5 belong to $\Re^{n+1}$.

References

[L] S. Liu, *Degree of irreducible maps and the shapes of Auslander-Reiten quivers*, Journal of London Math. Soc. 2, 45, (1992), 32-54.

Joint work with Claudia Chaio (Universidad Nacional de Mar del Plata, Argentina).

S11 - July 25, 17:30 – 18:10

On the representation theory of the partition algebra

Rosa Orellana
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The partition algebra was defined independently by Martin and Jones in the mid 1990s. In this talk I will discuss the representation theory of this algebra and how it connects to the representation theory of the symmetric group. In particular, I will show how the representation theory of the partition algebra is connected to the problem of decomposing the tensor product of irreducible representations of the symmetric group into irreducibles.

S11 - July 26, 17:30 – 17:50

The blob algebra in positive characteristic and the p-Kazhdan-Lusztig polynomials.

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In 2003, Martin and Woodcock observed that, over a field of characteristic zero, the decomposition numbers for the blob algebra are given by certain evaluations at 1 of the Kazhdan-Lusztig polynomials associated to the infinite dihedral group W_∞.

In this talk, we prove that in characteristic $p > 0$ the decomposition numbers for the blob algebra are given by evaluations at 1 of the p-Kazhdan-Lusztig polynomials associated to W_∞. These polynomials arise as the entries of the change of basis matrix from the basis of the Hecke algebra $\mathcal{H} = \mathcal{H}(W_\infty)$ of W_∞ obtained by decategorifying the corresponding indecomposable Soergel bimodules to the standard basis of $\mathcal{H}$.

In general, to calculate the p-Kazhdan-Lusztig polynomials is a very hard task. However, for W_∞, we are able to provide an easy algorithm to compute them.

S11 - Poster

Hochshild homology and cohomology of super Jordan plane

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We compute the Hochschild homology and cohomology of the algebra $A = \Bbbk\langle x, y | x^2, y^2x - xy^2 - xyx\rangle$, known as super Jordan plane. This algebra has Gelfand-Kirillov dimension equal to 2, and it is also known as the Nichols algebra $B(V(-1, 2))$. We also describe the algebra structure of the Hochschild cohomology.

Joint work with Andrea Solotar(Universidad de Buenos Aires, Argentina).

S11 - July 26, 16:00 – 16:50

A little bit of extra functoriality for Ext and the computation of the Gerstenhaber bracket

Mariano Suárez-Álvarez
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We show that the action of the Lie algebra $HH^1(A)$ of outer derivations of an associative algebra A on the Hochschild cohomology $HH^\bullet(A)$ of A given by the Gerstenhaber bracket can be computed in terms of an arbitrary projective resolution of A as an A-bimodule, without having recourse to comparison maps between the resolution and the bar resolution.

S11 - July 25, 16:00 – 16:50

Split t-structures and torsion pairs in hereditary categories

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We give necessary and sufficient conditions for torsion pairs in a hereditary category to be in bijection with t-structures in the bounded derived category of that hereditary category. We prove that the existence of a split t-structure with nontrivial heart in a semiconnected Krull-Schmidt category implies that this category is equivalent to the derived category of a hereditary category. We construct a bijection between split torsion pairs in the module category of a tilted algebra having a complete slice in the preinjective component with corresponding t-structures. Finally, we classify split t-structures in the derived category of a hereditary algebra.

Joint work with Ibrahim Assem (Universidad de Sherbrooke, Canadá) and María José Souto Salorio (Universidad de la Coruña, España).

S11 - July 25, 18:15 – 18:55

Gerstenhaber bracket via arbitrary resolution

Yury Volkov
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Hochschild cohomology is an interesting derived invariant of an algebra. It is well known that it has a structure of a Gerstenhaber algebra, which includes the cup product and the Gerstenhaber bracket.

There are some well known formulas for cup product via an arbitrary bimodule projective resolution of an algebra under consideration. One interesting formula for the Gerstenhaber bracket appeared recently in a work of C. Negron and S. Witherspoon. There the correctness of this formula is proved for a resolution with some restrictive properties. In the current talk we will see how to modify this formula in such a way that it becomes correct for any bimodule projective resolution. Also we represent some other interesting formulas and algorithms for computing the Gerstenhaber bracket on Hochschild cohomology of an algebra.

Session S12
Group Theory

Chair: Andrés Navas – Collaborators: Nancy Guelman, Leandro Vendramin

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S12 - July 28, 15:30 – 15:55

Groups of circle homeomorphisms with invariant laminations.

Juan Alonso
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Together with H. Baik and E. Samperton, we study subgroups of $Homeo^+(S^1)$ according to the laminations they preserve. Our most specific goal is to characterize the main examples that arise from hyperbolic geometry of surfaces and 3-manifolds.

I will give an overview of this topic, focusing on the Tits alternative for groups preserving two transverse laminations.

Joint work with Hyungryul Baik (Rheinische Friedrich-Wilhelms-Universität Bonn) and Eric Samperton (UC Davis).

S12 - July 28, 18:30 – 18:55

Flexibility of representations of $\pi_1(\Sigma)$ into the space of orentation preserving homeomorphisms or the line.

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This is a joint work with Juan Alonso and Cristobal Rivas. Let Σ be a closed hyperbolic surface and $Hom(\pi_1(\Sigma), Homeo_+())$ the space of representations of its fundamental group into the group of orientation preserving homeomorphisms of the line. We showed that there are no locally rigid representations in this space. With this perturbation techniques we were also able to show

The space of representation without global fixed points is connected. ($x \in$ is a global fixed point for the action ρ if $\rho(g)(x) = x$ for every $g \in \pi_1(\Sigma)$) In fact there exists a representation without global fixed points whose conjugacy class is dense in $Hom(\pi_1(\Sigma), Homeo_+())$.

Any representation can be approximated by another without global fixed points.

The space of left invariant orders in $\pi_1(\Sigma)$ is a Cantor set.

Joint work with Juan Alonso (Universidad de la República, Uruguay) and Cristobal Rivas (Usach, Chile).

S12 - July 29, 15:00 – 15:25

Towards algebraic Nielsen-Thurston classification for braids

Matthieu Calvez
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We attach to the braid group (more generally to any Garside group) a Gromov-hyperbolic graph on which the group acts by isometries: the additional length graph. For braids, this is meant to be an algebraic analog of the curve complex attached to the Mapping Class Group of the punctured disk. We will present positive results and open questions on a conjectured dictionary between Nielsen-Thurston classification and the classification of isometries of the additional length graph as a hyperbolic space.

Joint work with Bert Wiest (université de Rennes 1).

S12 - July 28, 15:00 – 15:25

The relative stable category

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Let G be a finite group and k an algebraically closed field of of characteristic $p > 0$. Let $\mathcal{H}$ be a collection of p-subgroups of G. We investigate the relative stable category $\mathbf{stmod}_{\mathcal{H}}(kG)$ of finitely generated modules modulo $\mathcal{H}$-projective modules. Triangles in this category correspond to $\mathcal{H}$-split sequences. Hence, compared to the ordinary stable category there are fewer triangles and more thick subcategories. Our interest is in the spectrum of this category and its relationship to the induction functor. Of particular note is that in some cases, the spectrum of the category is not Noetherian.

S12 - July 28, 16:30 – 16:55

Large scale geometry of Heintze groups

Matias Carrasco
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Negatively curved homogeneous manifolds where characterized by Heintze. Each such manifold is isometric to a solvable Lie group X_α equipped with a left invariant metric, and the group is a semi-direct product $N \rtimes_\alpha \mathbb{R}$ where N is a connected, simply connected, nilpotent Lie group, and α is a derivation of $\mathrm{Lie}(N)$ whose eigenvalues all have positive real parts. Such a group is called a Heintze group.

An important conjecture regarding the large scale geometry of (purely) real Heintze groups states that two such groups are quasi-isometric if, and only if, they are isomorphic.

In this talk I will describe some quasi-isometry invariants, defined by L^p-cohomology methods, and I will show how they can be used in order to understand the quasi-isometry classes of Heintze groups.

Joint work with Emiliano Sequeira (Universidad de la República, Uruguay).

S12 - July 29, 17:30 – 18:20

Connectedness of generating sets for finite groups

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Suppose G is a finitely-generated group, and X and Y are two generating sets for G with $|X| = |Y|$. Under what conditions can X be 'transformed' to Y by a sequence of single-element replacements? This very general question relates to a number of things, including the product replacement algorithm, T-systems for finite groups, and expansion in Cayley graphs. Some recent progress will be described, especially in the case of 2-generator finite groups.

S12 - July 29, 18:30 – 19:20

Multifraction reduction in Artin-Tits groups

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A classical result of Ore says that, if M is a cancellative monoid and any two elements of M admit a least common multiple, that every element of the enveloping group U(M) of M can be represented by a unique irreducible fraction on M. We extend this result by showing that, when common multiples need not exist but a certain "3-Ore condition" is satisfied, every elements of U(G) can be represented by a unique irreducible iterated fraction, leading to a solution of the Word Problem reminiscent of the Dehn algorithm for hyperbolic groups. This applies in particular to Artin-Tits groups of FC-type and, conjecturally, to all Artin-Tits groups.

S12 - Poster

Braces, generalizations and applications to the Yang-Baxter equation

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Braces were introduced by Rump as a generalization of radical rings to study non-degenerate involutive set-theoretic solutions of the Yang-Baxter equation. We generalize Rump's braces to the non-commutative setting and use this new structure to study not necessarily involutive non-degenerate set-theoretical solutions of the Yang-Baxter equation. Based on results of Bachiller and Catino and Rizzo, we develop an algorithm to enumerate and construct classical and skew braces of small size (up to isomorphism). With this algorithm we were able to produce a database of classical and skew braces of small size. We present several open problems and conjectures. See arXiv:1511.03171.

Joint work with Leandro Vendramin (Universidad de Buenos Aires).

S12 - July 29, 16:30 – 16:55

Cryptosystems using subgroup distortion

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We propose cryptosystems based on subgroup distortion in hyperbolic groups. We also include examples of Hyperbolic groups with exponentially and exp(exp) distorted subgroups that would be useful for the protocols.

Joint work with Indira Chatterji (University of Nice, France) and Ni Lu (CUNY Graduate Center, USA).

S12 - July 29, 16:00 – 16:25

On set-theoretic solutions to the Yang-Baxter equation

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Since the seminal work of Drinfel'd, the study of set-theoretic solutions to the Yang-Baxter equation (with we will simply call solutions) has always remained a dynamic research area. To any solution, one can associate a group, which opens the way for applying group-theoretic tools to the study of the YBE. This construction is classical and well explored. In this talk, to any solution we will associate another type of structure, called a shelf. This is a set with a binary operation $*$ satisfying the self-distributivity relation $(a * b) * c = (a * c) * (b * c)$. The associated shelf captures many properties of the original solution, and in particular contains information about its associated group. Thus to understand the group-theoretic aspects of solutions, it is instructive to look at their shelves, which are much easier to deal with. These ideas are also fruitful in the study of the (co)homology of solutions.

Joint work with Leandro Vendramin (Universidad de Buenos Aires, Argentina).

S12 - Poster

Pro-p Completions of Poincare Duality Groups

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We consider some suficient conditions for the pro-p completion of an orientable Poincare duality group of dimension $n \leq 3$ to be a virtually pro-p Poincare duality group of dimension at most $n \leq 2$. This is a work published in Israel Journal of Mathematics (2014).

Joint work with D.H. Kochloukova (University of Campinas, Brazil) and J.A. Hillman (University of Sydney, Australia).

S12 - July 28, 16:00 – 16:25

Simple groups of intermediate growth

Volodymyr Nekrashevych
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We will describe a construction transforming an arbitrary non-free minimal action of the infinite dihedral group on the Cantor set into a finitely generated infinite periodic group. If the associated action has low complexity (is linearly repetitive), then the group is of intermediate growth. In particular, we construct the first examples of simple groups of intermediate growth.

S12 - July 28, 17:30 – 18:20

Word maps on finite simple groups

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The theory of word maps on finite non-abelian simple groups has attracted much recent attention over recent years. In particular, maps for certain words have been proved surjective on all finite simple groups. We will report on results and illustrate techniques of proof.

S12 - July 29, 15:30 – 15:55

Circular orderings on the free group

Cristobal Rivas
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We discuss the space of circular orders of a group. We give a characterization of orderings that are isolated in term of its dynamical realization. As an application, we show that the free group on two or more generators admits infinitely many conjugacy classes of isolated orderings.

Joint work with Kathryn Mann (University of California, USA).

Session S13
Number Theory

Chair: Roberto Miatello – Collaborators: Gonzalo Tornaria

S13 - Poster

Conjuntos de Sidon en intervalos

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Un conjunto $\mathbb{A}$ en un grupo abeliano (G,+) es un conjunto de Sidon si todas las diferencias no nulas a-a', con a,a' $\in \mathbb{A}$ son distintas. Nos preguntamos ¿Cuál es el mayor tamaño que puede tener un conjunto de Sidon en [1:n]?. En este trabajo se presenta una respuesta asintótica al problema planteado en 1932 por el analista Simón Sidon. Además, damos a conocer algunos de los problemas sin resolver sobre los conjuntos de Sidon en intervalos. Por último, presentamos algunas de las aplicaciones que tienen los conjuntos de Sidon en el área de las telecomunicaciones.

Joint work with Mijael Hancco(Universidad Nacional de San Agustin) and Jhon Huarachi(Universidad Nacional de San Agustin).

S13 - July 25, 18:05 – 18:35

Overconvergent Eichler-Shimura isomorphisms for Shimura curves

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We will discuss the p-adic variation of the Eichler-Shimura isomorphism in the context of Shimura curves. In particular, we describe the finite slope part of the space of overconvergent modular symbols in terms of the finite slope part of the space of overconvergent modular forms. As an application we will explain how to attach Galois representations to certain overconvergent modular forms.

Joint work with Shan Gao (Concordia University).

S13 - Poster

Propiedades de las p-extensiones elementales abelianas sobre $\mathbb{F}_{p^r}(T)$

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Se presentan varias propiedades para una p-extensión elemental abeliana sobre el cuerpo de funciones racionales $k = \mathbb{F}_{p^r}(T)$ con $\mathbb{F}_{p^r}$ el cuerpo finito de p^r elementos, p un entero primo. Entre las propiedades

a presentar están la ramificación, la inercia y la descomposición de los lugares asociados al cuerpo k, el cálculo de índice de ramificación de dichos lugares utilizando las técnicas de Q. Wu y R. Scheidler en su artículo 'The ramification groups and different of a compositum of Artin-Schreier extensions' y de A. Garcia y de H. Stichtenoth en 'Elementary Abelian p-extensions of algebraic function fields'. También se presentan varios ejemplos que ilustran los resultados presentados.

Joint work with Martha Rzedowski Calderón (Centro de Investigación y de Estudios Avanzados del I.P.N.).

S13 - Poster

Primos de Wilson, Mersenne y Wieferich en el anillo $\mathbb{F}_q[T]$

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En el 2011, D. Thakur en su artículo "Binomial and factorial congruences for $\mathbb{F}_q[T]$" presentó tres formas diferentes de definir factorial y coeficiente binomial para el anillo $\mathbb{F}_q[T]$. Además, demostró que existen ciertos análogos a los bien conocidos teoremas de Lucas y de Wilson. Este último teorema permite definir una familia de primos llamados primos de Wilson para $\mathbb{F}_p[T]$ para p un primo entero. La caracterización de estos primos no se realizó por completo para cualquier anillo de polinomios con coeficientes en un cuerpo finito. Tiempo después el mismo D. Thakur en su artículo "Differential characterization of Wilson primes for $\mathbb{F}_q[T]$ " presenta una caracterización completa de dichos primos utilizando la derivada usual. Con estos dos artículos como referencia, en el 2014 Dong Quan en el artículo " Carlitz module analogues of Mersenne primes, Wieferich primes, and certain prime elements in cyclotomic function fields" presenta, en la misma dirección que D. Thakur, una nueva familia de primos de Mersenne y Wieferich para el módulo de Carlitz.

En este trabajo se pretende presentar algunos conceptos y los argumentos utilizados por los autores citados anteriormente, para comprender los artículos. Algunos de éstos son: el módulo de Carlitz, los cuerpos de funciones ciclotómicos y los análogos a los teoremas de Lucas y de Wilson en el anillo $\mathbb{F}_q[T]$. También se harán algunas observaciones y se sugerirán trabajos futuros en esta línea de investigación.

Joint work with Martha Rzedowski Calderón (Centro de Investigación y de Estudios Avanzados del I.P.N.).

S13 - July 26, 15:50 – 16:20

Bounding the argument of zeta on the Riemann hypothesis

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Let $S(t)$ denote the argument of the Riemann zeta-function at the point $1/2 + it$. Let $S_n(t)$ be the n-th antiderivative of $S(t)$ (adding a suitable constant c_n at each step). In 1924, J. Littlewood established, under the Riemann hypothesis, that

$$S_n(t) \ll \frac{logt}{(\log logt)^{n+1}}$$

and this estimate has never been improved in its order of magnitude over the last 92 years. The efforts have focused in improving the implicit constant in this estimate. In this talk we will show how to obtain the best (up to date) form of all of these estimates. This involves the use of certain special entire functions of exponential type.

S13 - Poster

Formas Cuadráticas y el teorema de los 15

Juanita Duque
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Una forma cuadrática entera es un polinomio $f(x_1, \ldots, x_n) \in \mathbb{Z}[x]$, homogéneo y de grado 2. Diremos que $f(x_1, \ldots, x_n)$ representa a un entero m si existe $\vec{a} \in \mathbb{Z}^n$ tal que $f(\vec{a}) = m$. Nuestro objetivo será explicar con detalle una demostración del *"teorema de los 15" de Conway-Schneeberger* (1993). Explicaremos los detalles de la prueba publicada por Bhargava (2000). El teorema afirma: *si una forma cuadrática entera definida positiva representa a todo entero positivo hasta 15, entonces representa a todos los enteros positivos.* Una forma que cumpla esto último se denomina *universal*.

A partir de este punto, el término forma cuadrática se referirá a una forma cuadrática definida positiva. Para demostrar el teorema se utilizará la relación que existe entre retículos y formas cuadráticas. Denote como *ausente* al mínimo entero que una forma cuadrática no universal no representa. Una *escalada* de un retículo no universal L es el retículo generado por L y un vector de norma el ausente de L. Un *retículo escalado* es una sucesión de escaladas partiendo del retículo cero dimensional. Se mostrará que todo retículo escalado de dimensión cinco es universal, hallando directamente todos los retículos escalados de dimensión menor o igual a 5. Después, se probará que toda forma cuadrática es universal si y solo si posee un subretículo escalado cuatro o cinco dimensional universal. Luego, toda forma cuadrática es universal si representa a los ausentes de los retículos escalados de dimensión 0 hasta 4. El nombre del teorema se debe a que estos ausentes son menores o iguales que 15.

Joint work with Yacir Ramirez (Universidad de los Andes, Colombia).

S13 - July 25, 15:00 – 15:40

Sharp lower bounds for regulators of small-degree number fields

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Minimal discriminants of number fields are presently known for 22 signatures. Using a combination of analytic and geometric techniques, for 20 of these we are able to find the minimal regulator. Except in the totally complex case, in each signature we find that the field with the minimal discriminant has the minimal regulator.

Joint work with Sergio Astudillo (Weston Academy, Quilicura, Chile) and Francisco Diaz y Diaz (U. Bordeaux, retired).

S13 - July 26, 15:00 – 15:40

La criba de Eratóstenes en menos espacio

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Digamos que queremos una lista de todos los números primos de 1 hasta N, o factorizar todos los enteros del 1 hasta N. Muchos aprendimos la criba de Eratóstenes en la primaria. Con ciertos trucos estándar, esta criba puede hacerse en espacio aproximadamente $\sqrt{N}$, en vez de N. Veremos cómo modificar la criba de Eratóstenes para que funcione en espacio $N^{1/3}(\log N)^{2/3}$ y tiempo aun esencialmente linear en N.

La inspiración principal viene de trabajos de índole combinatoria (Voronoi-Sierpinski) sobre el método del circulo; hay en esto una conexión con la versión de Galway (2000) de la criba de Atkin, que también utiliza espacio esencialmente $N^{1/3}$. La ventaja de la criba de Eratóstenes es que se puede utilizar para factorizar o para calcular diversas funciones aritméticas, y no sólo para producir números primos.

S13 - July 25, 17:30 – 18:00

Heegner point constructions

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In this talk we will show how to construct certain special points on rational elliptic curves in situations where the so-called "Heegner hypothesis" does not hold. More concretely, given a rational elliptic curve with conductor divisible by the square of a prime p, we show how to construct points associated to an imaginary quadratic field K regardless of the factorization of p in K.

Joint work with Ariel Pacetti (Universidad de Buenos Aires-Warwick).

S13 - July 25, 16:25 – 16:55

The Mahler measure of elliptic curves

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The Mahler measure of a multivariable polynomial or rational function P is given by the integral of $\log|P|$ where each of the variables moves on the unit circle and with respect to the Haar measure. In 1998 Boyd made a systematic numerical study of the Mahler measure of many polynomial families and found interesting conjectural relationships to special values of L-functions of elliptic curves. We will discuss some recent advances on Boyd's conjectures.

S13 - July 26, 16:25 – 16:55

Equidistribución p-ádica de órbitas de Hecke y aplicaciones diofantinas

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Es sabido que las órbitas por correspondencias de Hecke en la curva modular de nivel 1 se equidistribuyen con respecto a la medida hiperbólica. Recientemente, Habegger ha utilizado este principio para establecer que el conjunto de valores del invariante j de curvas elípticas con multiplicación compleja ("singular moduli") que son unidades algebraicas es finito.

En esta charla explicaremos un análogo p-ádico del resultado de equidistribución de órbitas de Hecke. Si el tiempo lo permite, explicaremos también cómo adaptar la estrategia de Habegger para establecer que, dado un conjunto finito de primos S que satisfacen ciertas congruencias, el conjunto de los singular moduli que son S-unidades es finito.

Joint work with Sebastián Herrero (Pontificia Universidad Católica de Chile, Chile) and Juan Rivera-Letelier (Rochester University, EEUU).

S13 - July 26, 17:30 – 18:00

CM-points on straight lines

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A CM-point (or special point) is a point of the form $(j(\tau_1), j(\tau_2))$ where both τ_1, τ_2 are imaginary quadratic numbers. In this talk we will show that, with "obvious" exceptions, a CM-point cannot belong to a straight line in $\mathbb{C}^2$ defined over $\mathbb{Q}$.

Joint work with Bill Allombert (Université de Bordeaux) and Yuri Bilu (Université de Bordeaux).

S13 - July 25, 15:50 – 16:20

Waldspurger formulas for Hilbert modular forms

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Computing central values of L-functions attached to modular forms is interesting because of the arithmetic information they encode. These values are related to Fourier coefficients of half-integral weight modular forms and the Shimura correspondence, as shown in great generality by Waldspurger.

In this talk we will show an explicit Waldspurger type formula for Hilbert modular forms, which is valid under rather mild hypotheses.

Joint work with Gonzalo Tornaría (Universidad de la República).

S13 - July 26, 18:10 – 18:40

On the paramodular conjecture

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In this talk we will recall the statement of the paramodular conjecture by Brumer and Kramer, and we will show recent work with Brumer and Pacetti which proves the first known examples.

Joint work with Armand Brumer (Fordham University) and Ariel Pacetti (Universidad de Buenos Aires).
