Contents

Abstracts

Graded identities of matrix algebras and the universal graded algebra.

Eli Aljadeff
Israel Institute of Technology, Israel

Consider the algebra $A = M_n(\mathbb{C})$ of $n \times n$ matrices over the field of complex numbers, graded by a finite group G. There are two basic ways to grade such an algebra, namely elementary grading and fine grading (the grading is called elementary if elementary matrices e_{ij} are homogeneous and is called fine if each component is of dimension 0 or 1 as a vector space over $\mathbb{C}$). It was shown by Bahturin and Zaicev that any G-grading on A is obtained as a suitable composition of these two type of gradings. In this lecture we consider only fine gradings and their corresponding graded identities. Among the main results we show that the T-ideal of graded identities is finitely generated. In addition we construct a Universal algebra (which is Azumaya over its center) which may be specialized precisely to all G-graded forms of A (in the sense of the theory of descent) (Joint work with Haile and Natapov). Parts of this theory have far reaching generalizations to the theory of H-Hopf Galois extensions (joint work with C. Kassel).

Enveloping actions for partial Hopf actions.

Marcelo Muniz Silva Alves
UFPR, Brazil

Partial actions of Hopf Algebras were introduced by Caenepeel and Janssen in 2006, as a consequence of an investigation of generalized smash products of a Hopf algebra H by a k-algebra A. This extends the concept of partial actions of groups on algebras, as defined by R.Exel, in the sense that every partial action of a group G on the algebra A determines a partial Hopf action of the group algebra kG on A. This fact suggests that one should investigate whether properties that hold for partial group actions might hold as well for partial Hopf actions. In this direction, we present here two results for partial Hopf actions, obtained in a joint work with Eliezer Batista, that extend previous ones by R. Exel and M. Dokuchaev concerning partial group actions. Firstly, we show that if B is an H-module algebra and A is a right ideal of B with unity, then A acquires a partial action, which we call the partial Hopf action induced by B. In analogy with partial group actions, we define enveloping actions and we prove that every partial action has an enveloping action; in other words, modulo isomorphisms, every partial Hopf action is induced. The second result that we will present requires two extra hypotheses: the antipode of H must be invertible and A must be a bilateral ideal of the enveloping action B. Under these conditions, we prove that there is a Morita context between the partial smash product $\underline{A\#H}$ and the smash product $B\#H$.

Classification of finite-dimensional pointed Hopf algebras.

Nicolás Andruskiewitsch
Universidad Nacional de Córdoba, Argentina

In this talk, a state of the art on the classification of finite-dimensional pointed Hopf algebras with non-abelian group will be presented.

In the first part, joint work with F. Fantino, S. Zhang and L. Vendramin, it will be explained how to prove infinite-dimensionality of certain pointed Hopf algebras over families of finite groups as an application of results of Heckenberger on Nichols algebras of diagonal type.

In the second part, joint work with I. Heckenberger and H.-J. Schneider, it will be shown how to attach a generalized Cartan matrix and a Weyl groupoid to any semisimple Yetter-Drinfeld module over a non-abelian group. In the particular case called "standard", we prove: if the Nichols algebra is finite, then the generalized Cartan matrix is of finite type (in the sense of V. Kac's book).

As an application, we finish the classification of the finite-dimensional pointed Hopf algebras with group S3, and the classification of the finite-dimensional Nichols algebras over the group S4.

Closed and prime ideals in partial skew group rings of abelian groups.

Jesus Avila Guzman
UFRGS, Brazil

In this work we study partial actions of abelian groups on R (denoted by (R, α)), with enveloping action (T, β). We construct the Martindale α-quotient ring $\mathcal{Q}$ and we extend the partial action (R, α) to $\mathcal{Q}$. Among other results we prove that there exists a one-to-one correspondence between the closed and prime ideals of $R \star_\alpha G$ and $Q \star_\alpha G$.

Recent achievements in the theory of group gradings of algebras.

Yuri Bahturin
Memorial University of Newfoundland, Canada and Moscow State University, Russia

In this talk we would like to present a number of new results in the theory of group graded algebras. This time our stress will be made on the new techniques that have been developed very recently: Hopf algebra approaches and Affine group schemes. Another feature is the expansion of the theory to infinite-dimensional locally finite algebras.

Partial co-actions of Hopf algebras.

Eliezer Batista
UFSC, Brazil

The study of partial group actions on algebras and rings from a purely algebraic point of view raised a great interest in the past few years. Very much of the theory of partial group actions can be extended to the context of Hopf algebras as well, giving rise to the theory of partial Hopf actions. As an offspring of dual contructions in Hopf algebra theory, one can get the notion of partial coaction of a Hopf algebra on an unital algebra.

In this work we show how to construct partial coactions of a Hopf algebra H from H-comodule algebras. We also analyse the interconnection between the partial action and the partial coaction of two dually paired Hopf algebras H and K on an unital algebra A. Finally, the conditions for the existence of an enveloping coaction of a given partial coaction.

Partial group actions and partial group representations applied to the study of crystals and quasicrystals.

Giuliano Boava
IMPA, Brazil

In 1982, the Israeli physicist Dany Shechtman synthetized a mettalic alloy whose particles didn't hold a periodic settling. Unlike the crystals, which are periodic structures, Schectman's discovery was named a quasicrystal.

Inspired in the PhD thesis *C*-algèbres des quasi-représentations d'un groupe discret et quasi-cristaux*, by Edouard Contensou, the aim of this work is to study the C*-algebra generated by crystals and quasicrystals. Taking into account that there is a partial group representation associated to this algebra, the theory of partial group actions and partial group representations was chosen to treat the problem.

The biggest part of this text is dedicated to the study of the C*-algebra generated by a compression, which is a generalized form of the C*-algebra of a crystal or a quasicrystal. Among the main results obtained there is the identification of the C*-algebra generated by a compression as a partial crossed product and as a partial group C*-algebra with a determined set of relations. Moreover, some characterizations of the spectrum of the abelian sub-C*-algebra contained in the C*-algebra of a compression are found.

Wedderga — Wedderburn decomposition of group algebras, a GAP package.

Osnel Broche Cristo
UFL, Brazil

Wedderga is the GAP package to compute the simple components of the Wedderburn decomposition of semisimple group algebras of finite groups over finite fields and over subfields of finite cyclotomic extensions of the rationals. It also contains functions that produce the primitive central idempotents of semisimple group algebras. Other functions of Wedderga allow to construct crossed products over a group with coefficients in an associative ring with identity and the multiplication determined by a given action and twisting.

(http://www.gap-system.org/Packages/wedderga.html).

A right normed basis for free Lie algebras.

Evgeny Chibrikov
IME-USP, Brazil

In this paper we construct a basis of a free Lie algebra that consists of right normed words, i.e. the words that have the following form: $[a_{i_1}[a_{i_2}[\ldots[a_{i_{t-1}}a_{i_t}]\ldots]]]$, where a_{i_j} are free generators of the Lie algebra.

Partial skew polynomial rings over semisimple Artinian rings.

Wagner Cortes
UFRGS, Brazil

Let R be a semisimple Artinian ring with a partial action α of $\mathbb{Z}$ on R and let $R[x;\alpha]$ be the partial skew polynomial ring.

By the classification of the set E of all minimal central idempotents in R into three different types, a complete description of the prime radical of $R[x;\alpha]$ is given. Moreover it is shown that any nonzero prime ideal of $R[x;\alpha]$ is maximal and is either principal or idempotent.

In the case where α is of finite type, it is shown that $R[x;\alpha]$ is a semiprime hereditary ring and the maximal ideals form a cycle which is implicitly obtained in terms of the minimal central idempotents of R, in the case where the set of minimal central idempotents of R has a unique partial orbit under α.

The subgroup of the Schur group generated by cyclic cyclotomic algebras.

Ángel del Río
Universidad de Murcia, Spain

Let K be a number field. If L/K is a finite Galois extension of K, $G = \mathrm{Gal}(L/K)$ and $\tau\colon G \times G \to L^*$ is a 2-cocycle then the algebra $(L/K, \tau) = \oplus_{g \in G} L u_g$, with product given by $ag \cdot bh = ag(b)\tau(g,h)gh$, $a, b \in L$, $g, h \in G$ is a central simple K algebra, called a crossed product over K, and hence it represent an element of the Brauer group of K. A cyclic algebra over K (respectively, a cyclotomic algebra) is a crossed product $(L/K, \tau)$ such that L/K is a cyclic extension (respectively, L/K is a cyclotomic extension and $\tau(g,h)$ is a root of unity for every $g, h \in \mathrm{Gal}(L/K)$). A cyclic cyclotomic algebra is a cyclotomic algebra $(L/K, \tau)$ with L/K a cyclic extension. It is well known that every element of the Brauer group of K is represented by a crossed product and, if K is a number field, then every element of the Brauer group of K is represented by a cyclic algebra over K. The Schur group of K is the subgroup $S(K)$ of $Br(K)$ formed by classes containing an algebra generated over K by a finite group. By the Brauer-Witt Theorem every element of $S(K)$ is represented by a cyclotomic algebra over K. Thus, if K is a number field then every element of $S(K)$ is represented by a cyclic and a by a cyclotomic algebra. However, it is easy to show that not every element of $S(K)$ can be represented by a cyclic cyclotomic algebra. Let $CC(K)$ be the subgroup of $S(K)$ generated by classes containing cyclic cyclotomic algebras. We prove that $CC(K)$ has a decomposition which Janusz proved that $S(K)$ does not have in general [G. J. Janusz, The Schur group of an algebraic number field, Annals of Math. 103 (1976), 253–281]. This proves that, in general, $CC(K) = S(K)$ even for abelian number fields. This raised the question of deciding how far is $CC(K)$ from $S(K)$. We present a criteria to decide for a given abelian number fields K, if $CC(K)$ has finite index in $S(K)$. This criteria is expressed in terms of some arithmetic properties of the Galois group of an specific cyclotomic extension of K. Joint work with Allen Herman and Gabriela Olteanu.

On a class of $*$-minimal algebras with involution.

Onofrio Mario Di Vincenzo
Università di Bari, Italy

Let $(A,*)$ be an associative F-algebra with involution $*$ over a field F of characteristic zero and let $F\langle X,*\rangle$ be the free associative algebra with involution generated over F by a countable set of indeterminates X. We consider the set $T_*(A)$ of $*$-polynomial identities satisfied by A. It is well known that $T_*(A)$ is an ideal of $F\langle X,*\rangle$ which is invariant under all endomorphisms commuting with the involution of the free algebra. Shortly, it is called a T_**-ideal* of $F\langle X,*\rangle$. In order to obtain some information about $T_*(A)$, it is of interest to describe the behavior of the $*$-codimension sequence $\left(c_m(A,*)\right)_{m \text{ in } \mathbb{N}}$ of A. Here $c_m(A,*)$ denotes the dimension of the vector spaces $P_m(A,*)$ of all multilinear $*$-polynomials of degree m in $x_1, x_1^*, \ldots, x_m, x_m^*$ in the relatively free algebra. When $T_*(A) \neq 0$ it has been proved that the sequence of $*$-codimensions is exponentially bounded [2]. If in addition A is finite dimensional then the limit

$$\lim_{m\to\infty} \sqrt[m]{c_m(A,*)}$$

does exist and is an integer, called the $*$-PI exponent of A and denoted $\exp(A,*)$ (see [3]). It provides a kind of measure on how big $T_*(A)$ is. Then it is a natural question to investigate which T_*-ideals have edge-valued $*$-PI exponent. With different words, which are the algebras $(A,*)$ such that if $T_*(A) \subsetneqq T_*(B)$ then $\exp(B,*) \lneqq \exp(A,*)$. These edge algebras are called $*$-*minimal* algebras with involution. The problem of classifying the finite dimensional $*$-minimal algebras up to $*$-PI equivalence has been recently faced in [1]. Essentially, if A is a finite dimensional $*$-minimal algebra then there exists an n-tuple $(A_1,\ldots,A_n)$ of $*$-simple algebras allowing the construction of a block-matrix algebra $R = UT_*(A_1,\ldots,A_n)$ which is $*$-PI equivalent to A, that is $T_*(A) = T_*(R)$. In the present talk we prove that for any finite dimensional $*$-simple algebra A then the corresponding algebra $UT_*(A,\ldots,A)$ is really $*$-minimal. This is a joint work with E. Spinelli.

REFERENCES

[1] O. M. Di Vincenzo, R. La Scala, *Minimal algebras with respect to their ast-exponent*, J. Algebra **317** (2007), 642–657.

[2] A. Giambruno, A. Regev, *Wreath products and P.I. Algebras*, J. Pure Appl. Algebra **35** (1985), 133–149.

[3] A. Giambruno, M. Zaicev, *Involution codimensions of finite-dimensional algebras and exponential growth*, J. Algebra **222** (1999), no. 2, 471–484.

Semisimple and maximal subalgebras of $gl(\infty)$.

Ivan Dimitrov
Queen's University, Canada

In this talk I will present recent results which can be viewed as the natural analogs of the classical Dynkin theorems for finite dimensional semisimple Lie algebras. First, all locally semisimple subalgebras of $gl(\infty)$ are described - we determine their isomorphism classes as well as their embeddings into $gl(\infty)$. Using this description we prove that every maximal subalgebra of $gl(\infty)$ is either a maximal parabolic subalgebra, i.e. the stabilizer of a single subspace of the natural representation of $gl(\infty)$, or is $sl(\infty)$, $so(\infty)$, or $sp(\infty)$.

This is a joint work with Ivan Penkov.

Globalization of twisted partial actions.

Michael Dokuchaev
IME-USP, Brazil

One of the most natural problems about partial actions asks to give a criteria which permits to decide whether or not a given partial action of a group on some structure can be seen as a restriction of a global action. This was already studied by various authors in diverse situations including partial actions on topological spaces, semi-lattices, celular 2-complexes and rings. The concept of a twisted partial action was introduced by Ruy Exel in the Theory of Operator Algebras in order to create an approach to study important classes of C^*-algebras characterizing them as more general crossed products. We shall discuss our recent result obtained in colaboration with Ruy Exel and Juan Jacobo Simón on globalization of twisted partial actions of groups on rings.

Tight representations of semilattices and inverse semigroups.

Ruy Exel Filho
UFSC, Brazil

By a *Boolean inverse semigroup* we mean an inverse semigroup whose semilattice of idempotents is a Boolean algebra. We study representations of a given inverse semigroup S in a Boolean inverse semigroup which are *tight* in a certain well defined technical sense. These representations are supposed to preserve as much as possible any trace of *Booleannes* present in the semilattice of idempotents of S.

After observing that the Vagner-Preston representation is not tight, we exhibit a canonical tight representation for any inverse semigroup with zero, called the *regular representation*. We then tackle the question as to whether this representation is faithful, but it turns out that the answer is often negative. The lack of faithfulness is however completely understood as long as we restrict to it continuous inverse semigroups, a class generalizing the E^*-unitaries.

Central units in integral group rings.

Raul Antonio Ferraz
IME-USP, Brazil

This talk will be divided in 2 parts. In this first one I intend to expose some general results about central units. After I shall present some results concerning central units in the integral group rings of metacyclic groups, which were obtained in a joint work with J.J. Simón from Universidad de Murcia, Spain.

Jordan elementary maps on alternative algebras.

João Carlos da Motta Ferreira
UFABC, Brazil

We prove that if $\mathcal{R}$ and $\mathcal{R}^{'}$ are arbitrary alternative algebras over a field $\mathcal{F}$ of characteristic $\neq 2$ where $\mathcal{R}$ is a prime nondegenerate algebra containing a non-trivial idempotent and $M : \mathcal{R} \longrightarrow \mathcal{R}^{'}$ and $M^{*} : \mathcal{R}^{'} \longrightarrow \mathcal{R}$ are surjective maps such that

$$\begin{cases} M(xM^{*}(y)x) = M(x)yM(x) \\ M^{*}(yM(x)y) = M^{*}(y)xM^{*}(y), \end{cases}$$

for all $x \in \mathcal{R}$ and $y \in \mathcal{R}^{'}$, then both M and M^{*} are additive.

The Hilbert series of Hopf-invariants of a free algebra.

Vitor Ferreira
IME-USP, Brazil

We look into the problem of determining the Hilbert series of the subalgebra of invariants of a free associative algebra of finite rank under a linear action of a finite dimensional Hopf algebra. The case of group gradings will we treated as a special case in comparison with the already established result of Dicks and Formanek (1982) for the case of group actions by automorphisms. This is a joint work with Lucia Murakami.

Monoidal categories of comodules for coquasi Hopf algebras.

Walter Ferrer
Universidad de La Republica, Uruguay

We study the basic monoidal properties of the category of Hopf modules for a coquasi Hopf algebra H. In particular we discuss the so called fundamental theorem that establishes a monoidal equivalence between the category of comodules and the category of Hopf modules. We use the above mentioned results in order to present a categorical proof of Radford's S^4 formula for the case of a finite dimensional coquasi Hopf algebra, by establishing a monoidal isomorphism between certain double dual functors.

Fixed rings on partial actions.

Miguel Ferrero
UFRGS, Brazil

Given a partial action α on a ring R having an enveloping action, we study the transfer between properties of the rings R, the fixed ring R^α and the partial skew group ring $R \star_\alpha G$.

The result of the paper of this exposition has been obtained in collaboration with Jesús Ávila Guzmán, Miguel Ferrero and João Lazzarin.

Recursive formulae for hyperbolic surface groups.

Marcelo Firer
IMECC-UNICAMP, Brazil

Hyperbolic groups are known to have exponential growth. Considering hyperbolic Coxeter groups and fundamental groups of compact hyperbolic surfaces, in a previous work [1] we gave upper and lower bounds for the exponential growth of those groups. In this work we give a recursive formula for the growth of those groups, obtained by systematic counting of fundamental domains of its action in the hyperbolic plane.

This is a joint work with K. B. Couto and E. B. Silva.

References

[1] Silva, E. B.; Firer, M.; Palazzo, R., Jr. - *Counting domains in p, q tessellations*. Appl. Math. Lett. 16 (2003), no. 3, 323–328.

Skew group structure of W-algebras.

Vyacheslav Futorny
IME-USP, Brazil

Finite W-algebras were introduced by Kostant in his study of Whittacker modules over finite-dimensional Lie algebras. On the other hand they can be constructed via quantum hamiltonian reduction as was shown by Kac, Roan and Wakimoto. We will discuss the structure of the corresponding skew group ring and the Gelfand-Kirillov conjecture for W-algebras based on joint results with A. Molev and S. Ovsienko.

Super-cocharacters, star-cocharacters and their multiplicities.

Antonio Giambruno
Università di Palermo, Italy

Let A be an algebra over a field of characteristic zero with an additional structure of superalgebra or algebra with involution. The ordinary representation theory of the hyperoctahedral group $\mathbb{Z}_2 \wr S_n$ is exploited in order to study the super-identities or the star-identities of A. One associates to A a sequence $\chi_n^{\mathbb{Z}_2}(A), n = 1, 2, \ldots,$ of $\mathbb{Z}_2 \wr S_n$-characters and one of the main objective of the theory is to determine their decomposition into irreducibles. Very recently we have classified the super-identities and the star-identities in case the corresponding multiplicities are bounded by one. This is strictly related to the varieties of algebras whose lattice of subvarieties is distributive.

Algebraic elements as free factors in simple artinian rings.

Jairo Z. Gonçalves
IME-USP, Brazil

(Joint work with Mazi Shirvani, from U. Alberta.)

Let R be a simple artinian ring with uncountable center K, and let a be a noncentral, invertible, algebraic element of R. We show that a is a free factor in various free products in $PGL(R)$.

Jordan loop rings and Jordan loops.

Edgar Goodaire

Memorial University of Newfoundland, Canada

We discuss the problems associating with lifting identities from a loop to its loop ring, in particular, the Jordan identity $(x^2y)x = x^2(yx)$, and describe various constructions of Jordan loops including some which indeed produce Jordan loop rings. One construction in particular involves the solution of a certain functional equation on a Latin square.

Conjectures arising from Gilmer's Theorem.

Laura Cristina Rodrigues Goulart
UESB, Brazil

Gilmer's Theorem characterizes the finite local commutative rings with cyclic maximal ideals. We will display this result and many questions arising from Gilmer's Theorem.

We characterize the group of units of group rings whose groups are S_3 and Q_8 where the basis ring comes from Gilmer's Theorem.

Weight modules of Lie algebras.

Dimitar Grantcharov
University of Texas, Arlington, USA

In the early 20th century H. Weyl classified all finite-dimensional representations of the classical Lie algebras in terms of the so-called character formula. Following works of G. Benkart, D. Britten, S. Fernando, V. Futorny, F. Lemire, A. Joseph and others, in 2000, O. Mathieu achieved a major breakthrough in the representation theory by obtaining an infinite dimensional analog of Weyl's result for the so called weight modules. In this talk we will discuss the recent developments of Mathieu's ideas and methods. More precisely, results related to the structure of the indecomposable weight modules will be presented.

Filtered multiplicative bases of restricted enveloping algebras.

Alexandre Grichkov
IME-USP, Brazil

We consider the existence problem of a filtered multiplicative basis in restricted enveloping algebras. We describe the correspondence between restricted enveloping algebras and filtered multiplicative basis in the case of 2-nilpotent $p-$Lie algebras.

On some abelian group codes.

Marinês Guerreiro
UFV, Brazil

In this talk we propose techniques for the calculation of minimal abelian codes and their parameters inside group algebras of abelian groups of type $C_p \times C_q$, for p and q distinct prime numbers over a field of characteristic two, under some restrictions. The main idea extends previous work done by F. C. Polcino Milies and R. A. Ferraz.

This is a joint work with R. A. Ferraz, C. P. Milies and A. G. Chalom from IME-USP.

Hyperbolicity of semigroup algebras.

Edson Ryoji Okamoto Iwaki
UFABC, Brazil

Let A be a finite-dimensional $\mathbb{Q}$-algebra and $\Gamma \subseteq A$ a $\mathbb{Z}$-order. We classify those A with the property that $\mathbb{Z}^2$ does not embed in Γ and refer to this as the hyperbolic property. We apply this in case $A = KS$ is a semigroup algebra, with $K = \mathbb{Q}$ or $K = \mathbb{Q}(\sqrt{-d})$. A complete classification is given when KS is semi-simple and also when S is a non-semi-simple semigroup. Here $\mathbb{Z}^2$ denotes a free abelian group of rank two.

This is a joint work with S. O. Juriaans and A. C. Souza Filho.

Groups and group algebras and the Yang-Baxter equation.

Eric Jespers
Vrije Universiteit Brussel, Belgium

In 1992 Drinfeld posed the question of finding the set theoretic solutions of the Yang-Baxter equation. Recently, Gateva-Ivanova and Van den Bergh and Etingof, Schedler and Soloviev have hown a group theoretical interpretation of involutive non-degenerate solutions. Namely, there is a one-to-one correspondence between involutive non-degenerate solutions on finite sets and groups of I-type. A group G of I-type is a group isomorphic to a subgroup of the semidirect product of the free abelian group F_n of rank n and the symmetric group S_n (with the natural action of S_n on F_n) so that the projection onto the first component is a bijective map. The projection of G onto the second component S_n is called an involutive Yang-Baxter group (IYB group). A submonoid of G so that the projection onto the free abelian monoid FM_n is bijective is called a monoid of I-type. A group of I-type is a Bieberbach group and hence a monoid of I-type is embedded in a polycyclic-by-finite group.

In the first part of this talk we present a survey on recent results on the algebraic structure of (semi)groups S of I-type and their algebras KS. The algebras have a structure that resembles that of polynomial algebras in commuting variables. In general a characterization has been obtained when KS is a prime Noetherian maximal order for S a submonoid of a polycyclic-by-finite group. These results are joint work with Goffa and Okninski.

In the second part, we explain some recent results on describing the IYB groups (hence we deal with one aspect of Drinfeld's problem). It is known that every IYB groups is solvable and we state some results supporting the converse of this property. More precisely, we show that some classes of groups are IYB groups. We also give a non-obvious method to construct infinitely many groups of I-type (and hence infinitely many involutive non-degenerate set theoretic solutions of the Yang-Baxter equation) with a prescribed associated IYB group. This work is joint with Cedo and Del Rio.

Some results about the algebra $M_2(E)$.

Sandra Mara Alves Jorge
PUC-Minas, Brazil

We describe a method to construct central polynomials for F-algebras where F is a field of characteristic zero. The main application deals with the verbally prime algebra $M_2(E)$, where E is the infinite-dimensional Grassmann algebra over F. The method is based on the explicit decomposition of the group algebra FS_n and it uses the representation theory of the symmetric group S_n. Moreover, by considering the algebra $\mathcal{M} = M_2(E)$ with the Z_2-grading $\mathcal{M} = \begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} \oplus \begin{pmatrix} 0 & E \\ E & 0 \end{pmatrix}$, we determine all the graded identities of degree ≤ 5 using the representation theory of the general linear group and we describe the space of the graded central polynomials modulo the ideal of the graded identities of $\mathcal{M}$.

The Colombeau Quaternion Algebra.

Stanley Orlando Juriaans
IME-USP, Brazil

In this talk we shall introduce the Colombeau Quaternion Algebra and show some of its properties.

This algebra is useful in studying applications of the Colombeau Theory.

Indecomposable representations of Jordan algebras of matrix type.

Iryna Kashuba
IME-USP, Brazil

This a joint work with V. Serganova. The talk is devoted to the problem of the classification of indecomposable Jordan bimodules over finite dimensional Jordan algebras of matrix type. We study the indecomposable representations of such algebras using the Tits-Kantor-Koecher construction and the representation theory of corresponding Lie algebras.

On weakly prime semiperfect rings.

Maryna Khybyna
Kyiv, Ukraine

Let A be an associative ring with $1 \neq 0$ and R be the Jacobson radical of A. A ring A is called weakly prime if the product of any two nonzero ideals not contained in R is nonzero.

Any prime ring is weakly prime. If e is a nonzero idempotent of a weakly prime ring A, then the ring eAe is weakly prime.

We write $SPSD$-ring for a semiperfect semidistributive ring. If A is a weakly prime Noetherian $SPSD$-ring, then the quiver $Q(A)$ of A is simply laced, i.e., $Q(A)$ has no multiple arrows and multiple loops. Let Q be an arbitrary simply laced and strongly connected quiver without loops. There exists a weakly prime semidistributive Artinian ring B such that $Q(B) = Q$.

For any simply laced and strongly connected quiver Q with n vertices and with a loop in each vertex, and for any field k there exists a weakly prime $(n^2 + n)$-dimensional algebra B over k such that $Q(B) = Q$.

For any simply laced and strongly connected quiver Q with a loop in each vertex there exists a weakly prime Noetherian (but non-Artinian) $SPSD$-ring A such that $Q(A) = Q$ and A is not prime.

Minimal generators of annihilators of neat even elements of the exterior algebra.

Cemal Koc
Dogus University, Turkey

Let V be a finite dimensional vector space over a field F, and let $E(V)$ be the exterior algebra on V. An element $\xi \in E(V)$ is called a decomposable $m-$vector if $\xi = x_1 \wedge x_2 \wedge \cdots \wedge x_m$ for some $x_1, x_2, \cdots, x_m \in V$. A sum $\mu = \xi_1 + \xi_2 + \cdots + \xi_s$ of decomposable elements of $E(V)$ is said to be neat if $\xi_1 \wedge \xi_2 \wedge \cdots \wedge \xi_s \neq 0$ This amounts to say that if we let $M_k = \{x_{k1}, x_{k2}, \cdots, x_{kn_k}\}$ be the set of factors of $\xi_k = x_{k1} \wedge x_{k2} \wedge \cdots \wedge x_{kn_k}$ for each $k \in \{1, 2, \ldots, s\}$, then $M = \bigcup_{k=1}^{s} M_k$ is linearly independent. In [1] we proved that when F is a field of characteristic zero the annihilator of μ is generated as an ideal by products of the form

$$\begin{aligned}(\xi_{i_1} - \xi_{j_1}) \cdots (\xi_{i_r} - \xi_{j_r}) u_{k_1} \ldots u_{k_t} \quad \text{where} \quad u_{k_l} &\in M_{k_l} \\ \text{and } \{i_1, \ldots, i_r; j_1, \ldots, j_r; k_1, \ldots, k_t\} &= \{1, 2, \ldots, s\}.\end{aligned}$$

and we conjectured that this result is true for any base field of characteristic $p > \frac{s+1}{2}$. The aim of this talk is three-fold:

(i) To pove our conjecture,

(ii) To determine minimal generators for all characteristics,

(iii) To describe the vector space structure of both the principal ideal (μ) and its annihilator $Ann(\mu)$ in $E(V)$ by using stack-sortable polynomials introduced in [2].

References

[1] C.Koç and S.Esin, Annihilators of Principal Ideals in the Exterior Algebra, *Taiwanese Journal of Mathematics*, Vol. 11, No. 4, pp. 1021-1037, Sept. 2007

[2] İ.Ş. Güloğlu and C.Koç, Stack-sortable permutations and polynomials, *Turkish Journal of Mathematics (to appear).*

Graded algebras and graded identities.

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Let K be an infinite field and let G be a group. We consider G-graded algebras over K and their graded polynomial identities. We shall survey two kinds of recent results in the study of the graded algebras and their graded identities. If A and B are G-graded and if there exists a graded embedding of A into B then clearly A satisfies all graded identities of B (and possibly some more). Of course this condition is necessary but not sufficient for the existence of such an embedding. We discuss several important algebras, for the PI theory, such as $M_n(E)$ and $M_{a,b}(E)$ where E stands for the infinite dimensional Grassmann algebra. When one studies embeddings of matrix algebras (over the base field) one considers embeddings into matrices over some extensions of the field to a commutative algebra over K. Since the above algebras are defined over E one has to consider graded embedding over supercommutative algebras. We present several sufficient conditions for the existence of such embeddings and also some negative results, just to add some flavour.

In the second direction we shall discuss graded tensor products of algebras (also called tensor products with commutation factors). We shall study such tensor products of T-prime algebras. All of them are naturally graded and we stick to these natural gradings. We show that the behaviour of such tensor products in characteristic 0 is quite similar to that of the ordinary tensor products (as described by Kemer) while in positive characteristic there are significant differences.

Sigma-invariants of the Richard Thompson group F.

Dessislava Kochloukova
IMECC-UNICAMP, Brazil

We will discuss some new results obtained together with R. Geoghegan (Binghimton) and R. Bieri (Frankfurt) about the Sigma-invariants of the R. Thompson group F, all the invariants are completely calculated in their homological and homotopical forms.

The Sigma-invariants were invented in sequel of papers by R. Bieri, R. Strebel. B. Renz and B. Neumann and are linked with homological and homotopical properties of subgroups above the commutator. The Richard Thompson group F was consideder first in logic but later on was studied extensively because of its many interesting properties : it is the first example of a torsion-free group of type FPinfinity and all cohomological groups $H^i(F, ZF) = 0$ for any i, the commutator of F is simple and F has infinite cohomological dimension. The group F does not contain a free subgroup of rank 2 but it is still not known whether it is amenable.

If the time permits we can discuss briefly Sigma-theory and main properties of the R. Thompson group F.

Gorenstein matrices and Frobenius rings.

Volodymyr Kyrychenko
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We use results and notions from M. Hazewinkel, N. Gubareni and V. V. Kirichenko, Algebras, Rings and Modules, Vol. 1, Kluwer Academic Publishers, 2004, 380 p. and from M. Hazewinkel, N. Gubareni and V. V. Kirichenko, Algebras, Rings and Modules, Vol. 2, Springer, 2007, 400 p.

Definition 1. *Denote by $M_n(\mathbb{Z})$ the ring of all square $n \times n$-matrices over the ring of integers $\mathbb{Z}$. Let $\mathcal{E} \in M_n(\mathbb{Z})$. We shall call a matrix $\mathcal{E} = (\alpha_{ij})$ the* **exponent matrix** *if $\alpha_{ij} + \alpha_{jk} \geq \alpha_{ik}$ for $i, j, k = 1, \ldots, n$ and $\alpha_{ii} = 0$ for $i = 1, \ldots, n$. A matrix $\mathcal{E}$ is called a* **reduced exponent matrix** *if $\alpha_{ij} + \alpha_{ji} > 0$ for $i, j = 1, \ldots, n$ and $i \neq j$.*

Let $\mathcal{E} = (\alpha_{ij})$ be a reduced exponent matrix. Set $\mathcal{E}^{(1)} = (\beta_{ij})$, where $\beta_{ij} = \alpha_{ij}$ for $i \neq j$ and $\beta_{ii} = 1$ for $i = 1, \ldots, n$; and $\mathcal{E}^{(2)} = (\gamma_{ij})$, where $\gamma_{ij} = \min\limits_{1 \leq k \leq n} (\beta_{ik} + \beta_{kj})$. Obviously, $[Q] = \mathcal{E}^{(2)} - \mathcal{E}^{(1)}$ is a $(0, 1)$-matrix. We have the following assertion.

Theorem 2. *The matrix $[Q] = \mathcal{E}^{(2)} - \mathcal{E}^{(1)}$ is an adjacency matrix of the strongly connected simply laced quiver $Q = Q(\mathcal{E})$.*

Definition 3. *The quiver $Q(\mathcal{E})$ shall be called the* **quiver of the reduced exponent matrix** *$\mathcal{E}$.*

Definition 4. *A reduced exponent matrix $\mathcal{E} = (\alpha_{ij}) \in M_n(\mathbb{Z})$ shall be called* **Gorenstein** *if there exists a permutation $\sigma(\mathcal{E})$ of $\{1, 2, \ldots, n\}$ such that $\alpha_{ik} + \alpha_{k\sigma(i)} = \alpha_{i\sigma(i)}$ for $i, k = 1, \ldots, n$.*

Main Theorem. *Let $A = \{\mathcal{O}, \mathcal{E}(A)\}$ be a reduced prime Noetherian SPSD-ring with exponent matrix $\mathcal{E}(A) = (\alpha_{ij}) \in M_n(\mathbb{Z})$. Then $inj.dim_A A_A = 1$ if and only if the matrix $\mathcal{E}(A)$ is Gorenstein. In this case $inj.dim_{_{AA}} A = 1$.*

Definition 5. *The* **index** *(inx $\mathcal{E}$) of a reduced exponent matrix $\mathcal{E}$ is the maximal real eigenvalue of the adjacency matrix $[Q(\mathcal{E})]$ of $Q(\mathcal{E})$.*

Theorem 6. *For every integer $1 \leq \lambda \leq n-1$ there exists a Gorenstein matrix G_λ with inx $G_\lambda = \lambda$.*

Theorem 7. *A reduced tiled order A is Gorenstein if and only if the quotient ring $B = A/\pi A$ is Frobenius. In this case $\sigma(\mathcal{E}(A)) = \nu(B)$, where $\nu(B)$ is the Nakayama permutation of B.*

Supervarieties and *-varieties of algebras of polynomial growth.

Daniela La Mattina
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Let A be an associative algebra over a field F of characteristic zero and let $c_n(A), n = 1, 2, \ldots,$ be its sequence of codimensions. It is well known that the sequence of codimensions of a PI-algebra either grows exponentially or is polynomially bounded. In this note we are interested in the case of polynomial growth. For this case it is well known that $c_n(A)$ asymptotically behaves as $c_n(A) \approx qn^k$, for some rational number q. Moreover if A is a unitary algebra and $k > 1$,

$$\frac{1}{k!} \leq q \leq \sum_{j=2}^{k} \frac{(-1)^j}{j!} \to \frac{1}{e}, \quad k \to \infty,$$

where $e = 2,71\ldots$.

The purpose of this note is to construct PI-algebras realizing the smallest and the largest value of q.

We also generalize this construction in the setting of superalgebras and algebras with involution. In this case one studies the sequence of φ-codimensions, where φ is an automorphism or antiautomorphism of order 2.

Jørgensen's inequality for Cayley algebras.

Guilherme Leal
UFRJ, Brazil

The famous Jørgensen's Inequality presents a necessary condition for a non elementary subgroup of Möbius transformations to be discrete.

In its original form it states that if f and g are Möbius transformations that generate a discrete non elementary group, then

$$|tr^2(f) - 4| + |tr(fgf^{-1}g^{-1}) - 2| \geq 1$$

where tr is the transformation's trace.

We present similar result for Cayley algebras, the difficulty here is the lack of associativity of Cayley numbers that impedes the definition of an action, we overcame this problem with a careful study of the algebra's automorphisms.

References

[1] A.F. Beardon, *The geometry of discrete groups*, Springer, 1983.
[2] J. Elstrodt, F. Grunewald and J. Mennicke, *Groups acting on hyperbolic space* (Harmonic analysis and number theory), Springer, 1998.
[3] N. Jacobson, *Composition algebras and their automorphisms* Rend. Circ. Mat. Palermo (2) 7 (1958) 55-80.
[4] G. J. Martin, *On Discrete Möbius groups in all dimensions: A generalization of Jørgensen's Inequality*, Acta Math. 163 (1989) 253-289.
[5] Zhevlakov, Slin'ko, Shestakov and Shirshov. "Rings that are nearly associative". Academic Press, New York, 1982.

Subsums of a zero-sum free subset of an abelian group.

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Let G be an additively written finite abelian group, and let S be a nonempty subset of G. We say S is zero-sum free if S contains no nonempty subset with sum zero. For each positive integer k, in 1972, Eggleton and Erdős first considered the problem of determining the number $f(S)$ of non-zero elements of which each can be expressed as the sum of a nonempty subset of S and the the minimal number $F(k) = \min_{S,G} f(S)$, where G runs over all abelian groups which contain a zero-sum free subset of k distinct elements and S runs over all zero-sum free subsets of k distinct elements in G. For any given k, they showed that $F(k) \leq \left\lfloor \frac{1}{2}k^2 \right\rfloor + 1$, in particular, $F(6) \leq 19$. Very little is known about the exact value of $F(k)$. Eggleton and Erdős determined $F(k)$ for all $k \leq 5$ and they also conjectured that $F(6) = 19$. In this talk, we will prove that if S is any zero-sum free subset of 6 distinct elements in G, then $f(S) \geq 19$, confirming the above conjecture.

This is a joint work with Weidong Gao, Jiangtao Peng and Fang Sun.

Circle groups and the normalizer problem in integral group rings.

Thierry Petit Lobão
UFBA, Brazil

The understanding that there is a relation between the isomorphism and the normalizer problems provided a way to set up counterexamples to both these, up until then, conjectures (M. Hertweck, 2001). Such counterexamples deal with suitable extensions of groups, in particular, semidirect products. S. K. Sehgal has asked about the relation between these questions and semidirect decompositions as well. In this work, we shall show that circle groups of finite rings, which satisfy the isomorphism problem, as it has been proved by R. Sandling (1974), also satisfy the normalizer question. Moreover, in the case of non radical rings, they are semidirect products.

Rational power series, sequential codes and periodicity of sequences.

Sergio R. Lopez-Permouth
Ohio University, USA

Let R be a commutative ring. A power series $f \in R[[x]]$ with (eventually) periodic coefficients is rational. We show that the converse holds if and only if R is an integral extension over Z_m for some positive integer m. For a field F we provide conditions equivalent to rationality in $F[[x_1, \ldots, x_n]]$. We extend Kronecker's criterion for rationality in $F[[x]]$ to $F[[x_1, \ldots, x_n]]$. We introduce the notion of sequential code, a natural generalization of the concepts of cyclic and even constacyclic codes over a (not necessarily finite) field. A truncation of a cyclic code over F is both left and right sequential (bisequential). We prove that the converse holds if and only if F is algebraic over F_p for some prime p. Finally, we show that all sequential codes are obtained by a simple and explicit construction.

Joint with Xiang-Dong Hou and Benigno Parra.

On finite-state automorphisms of the binary tree.

Arnaldo Mandel
IME-USP, Brazil

We show how to decide whether a finite-state automorphism of the infinite binary tree is of finite order.

Representations of commutative and power associative algebras.

Lucia Satie Ikemoto Murakami
IME-USP, Brazil

We investigate the structure of irreducible commutative and power associative modules in two opposite cases: for simple algebras and for algebras with zero multiplication.

On the one hand, except in some minor cases, simple commutative and power associative algebras are Jordan. The existence of non-Jordan commutative power associative modules for simple Jordan algebras will be discussed.

On the other hand, modules for a zero multiplication algebra are related to the Albert Problem concerning the existence of finite dimensional commutative power associative nil algebras wich are not solvable. This connection and also the classification of irreducible modules for two dimensional algebras will be presented.

Elementary amenable groups of type FP_∞.

Brita Nucinkis
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In the proposed talk we will discuss the following structural theorem for elementary amenable groups of type FP_∞ and some of its cohomological implications.

Theorem 1 (Kropholler, Martínez-Pérez, Nucinkis)**.** *Let G be an elementary amenable group of type* FP_∞*. Then G is either polycyclic-by-finite or G has a normal subgroup K such that G/K is an Euclidean crystallographic group and each subgroup $L \geq K$ with L/K finite is a strictly ascending HNN-extension with finitely generated virtually nilpotent base.*

We say a group is of type FP_∞ if the trivial $\mathbb{Z}G$-module $\mathbb{Z}$ has a resolution with finitely generated projective modules. A group is of type FP if $\mathbb{Z}$ admits a finite length resolution with finitely generated projectives. On the other hand there is the purely group theoretic condition of constructability. The class of constructible groups is the smallest class of groups closed under forming amalgamated products, HNN-extensions and finite extensions. These groups are finitely presented and of type FP_∞ (Baumslag-Bieri). It was established by Gildenhuys-Strebel and Kropholler that virtually torsion-free soluble groups are constructible if and only if they are virtually of type FP. Subsequently it was shown by Kropholler that soluble groups of type FP_∞ are virtually of type FP and work by Hillman and Linnell made it possible to extend these results to elementary amenable groups. These results actually imply that one can reduce the problem to nilpotent-by-abelian-by-finite groups of type FP_∞.

The proof of the above theorem relies on a careful analysis of the Bieri-Strebel σ-invariants for nilpotent-by-abelian-by-finite groups and builds on their result that G is constructible if and only if $\sigma(G)$ is contained in an open hemisphere. The crucial observation to make is the fact that for an admissible pair (N, H) of subgroups of G, the finite group G/H stabilizes $\sigma(G)$. The proof now follows on from previous work by Martínez-Pérez and Nucinkis, where it was shown that centralizers of finite subgroups are of type FP_∞.

The above theorem has a number of interesting corollaries such as:

Corollary 2. *Let G be an elementary amenable group of type* FP_∞*. Then G admits a cocompact model for a proper classifying space.*

This means, in particular, that as far as cohomological finiteness conditions both in ordinary cohomology and in Bredon cohomology, the algebraic mirror to proper classifying spaces, there are no surprises within the class of elementary amenable groups. In particular:

Corollary 3. *Every elementary amenable group of type FP admits a finite Eilenberg- Mac Lane space.*

This result was previously unknown even in the class of soluble groups.

When is a crossed product by a twisted partial action Azumaya?

Antonio Paques
UFRGS, Brazil

In this talk we will discuss under what conditions a crossed product $S = R \star_{\alpha} G$ by a twisted partial action α of a finite group G on a ring R is separable over its center.

Levi and parabolic subalgebras of finitary locally finite Lie algebras.

Ivan Penkov
Jacobs University Bremen, Germany

Finitary locally finite Lie algebras are subalgebras of $\mathrm{gl}(\infty)$. As a step in a long-term structure theory program, we give a description of parabolic subalgebras of finitary Lie algebras. The main difficulty here is to describe all parabolic subalgebras of $\mathrm{sl}(\infty), \mathrm{so}(\infty)$ and $\mathrm{sp}(\infty)$. In this talk we solve this problem by introducing taut couples of generalized flags, a new concept suited ideally for the description of parabolic subalgebras of $\mathrm{sl}(\infty)$. This builds on previous work of E. Dan-Cohen, I. Dimitrov and the author. Using the parabolic subalgebras we are also able to show the existence of a Levi component of any finitary Lie algebra. The results in this talk are joint work with Elizabeth Dan-Cohen.

Nuclear elements in the free alternative algebra.

Luiz Antonio Peresi
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As usual, we denote by (x, y, z) the associator $(xy)z - x(yz)$ and by $[x, y]$ the commutator $xy - yx$.

Let p be an element of the free nonassociative algebra in generators $X = \{x_1, \ldots, x_n\}$. We say that p is an element in the nucleus of the free alternative algebra in generators X if, in the free alternative algebra in generators $X \cup \{x_{n+1}, x_{n+2}\}$, we have $(p, x_{n+1}, x_{n+2}) = 0$.

We prove that, in the free alternative algebra over $\mathbb{Z}_{103}$, the elements of smallest degree in the nucleus have degree 5. Furthermore, we prove that, in the free alternative algebra over $\mathbb{Z}_{103}$ on generators $\{a, b, c, d, e\}$, all the nuclear elements of degree 5 are consequences of the alternative laws of degree 3 and the nuclear element $([a, b][a, c])a - (a[a, b])[a, c]$.

We construct five new elements of degree 6 in the nucleus of the free alternative algebra over $\mathbb{Z}_{103}$. We prove that these five new elements and four known elements form a basis for nuclear elements of degree 6.

References

[1] I. R. Hentzel, L. A. Peresi, The nucleus of the free alternative algebra, Experimental Mathematics 15:445-454 (2006).

[2] I. R. Hentzel, L. A. Peresi, Nuclear elements of degree 6 in the free alternative algebra, Experimental Mathematics, accepted (2008).

Engel groups of units in tiled rings.

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We consider Engel subgroups of units in basic tiled rings A, over local rings O which satisfy a weak commutativity condition. Tiled rings are generalizations of both tiled orders and incidence rings. If, in addition, O is artinian then we give a complete description of the maximal Engel subgroups of the unit group of A up to conjugacy. This is joint work with M. Dokuchaev and V. Kirichenko.

Dialgebras, Rota-Baxter algebras and triple systems.

Alexander Pozhidaev
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Recall that a dialgebra over a field F is a vector space equipped with two associative binary operations $\dashv$ and $\vdash$ such that

$$\begin{aligned}(x \dashv y) \dashv z &= x \dashv (y \vdash z),\\ (x \vdash y) \dashv z &= x \vdash (y \dashv z),\\ (x \dashv y) \vdash z &= x \vdash (y \vdash z).\end{aligned}$$

Dialgebras were introduced by J.-L.Loday [1], and he proved that every Leibniz algebra may be obtained from a certain dialgebra. Dialgebras serve also as a source of different algebraical systems. In this talk we discuss connection of dialgebras with Rota-Baxter algebras and some triple systems that are nearly associative [2].

References

[1] *Loday J.-L., Frabetti A., Chapoton F., Goichot F.*, Dialgebras and related operads, Lecture Notes in Mathematics. 1763. Berlin: Springer. (2001) 133p.

[2] *Pojidaev A.P.*, Dialgebras and related triple systems, Sib. Math. J., 49, 3 (2008).

A Richard Thompson group and the homotopical Sigma invariant.

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In this project we study one of the Richard Thompsons group F and its homotopical m-dimensional Sigma invariant. The Richard Thompson group F is very known by its interesting homological and homotopical properties, for example, it is of type FP_∞ (this result was proved in K. S. Brown, R. Geoghehan, An infinite-dimensional torsion-free FP_∞ group, Invent. Math. 77, no 2 (1984), 367-381). Also, F has the property of being defined in several distinct ways. The Sigma Invariant Theory was developed in last decades of twentieth century by R. Bieri, J. Groves, R. Geoghegan, H. Meinert, R. Strebel and others and is related to FP_m properties of groups. The $\Sigma^1(F)$ was obtained in R. Bieri, W. D. Neumann, R. Strebel, A geometric invariant of discrete groups, Invent. Math. 90 , no. 3 (1987), 451-477 and recently the general case of $\Sigma^m(F)$, $m \geq 2$, was described by R. Bieri, R. Geoghegan and D. Kochloukova.

A note on a problem due to Zelmanowitz.

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UFSC, Brazil

The notions of compressible module (a module is compressible if it can be embedded in any of its nonzero submodules) and critically compressible module (a compressible module is called critically compressible if it can not be embedded in any proper factor module) appeared in the the theory of primitive rings in an attempt to extend the Jacobson density theorem. In [8] and [9], Zelmanowitz claimed that a "compressible uniform module whose nonzero endomorphisms are monomorphisms would be critically compressible". Later, in [10], he said that he was unable either to prove or to disprove the statement. In [3], the authors called the above statement "Zelmanowitz's Conjecture".

This is a joint work with Alveri Sant'Ana (IM - UFRGS) in which we present a new approach to the Zelmanowitz's Conjecture. Especifically, we reformulate its hypotheses thereby extending some known results in the literature to a larger class of modules where the conjecture holds. We introduce a weak notion of M-faithfulness proving that in the class of quasi-projective modules the same holds.

Finally, we present some examples where compressible and critically compressible are equivalent which implies that the conjecture is true, we can say that in the category $Rat({}_{C^*}\mathcal{M})$ (the left C^*-rational modules) and in the class of comodules over an R-coring C (${}^*C$-modules) with certain properties, the above concepts coincide and the conjecture holds.

References

[1] Ferrero, M., Rodrigues, V., *"On Prime and Semiprime Modules and Comodules"*, J. Algebra Appl., vol. 5, no. 5, pp. 681-694, 2006.

[2] Hernández, J.L.G., Pardo, J.L.G., *"Self-injective and PF endomorphism rings"*, Israel J. Math., vol. 58, no. 3, pp. 324-350, 1987.

[3] Jeong, J-W., Rim, S-H., *"On critically compressible modules"*, thesis submitted to the committee of the graduate School of Kyungpook National University in partial fulfillment for the degree of Master of Science in June, 1998.

[4] Limarenko, S.V., *"Compressible Modules"*, Moscow Univ. Math. Bull., vol. 60, no. 3, pp. 26-29, 2005.

[5] Limarenko, S.V., *"Weakly primitive superrings"*, J. Math. Sci., vol. 139, no.4, pp. 6723-6752, 2006.

[6] Wisbauer, R., *"Foundations of Module and Ring Theory"*, Algebra, Logic and Applications Series 3 (Gordon and Breach Science Pu., Philadelphia - Reading - Paris - Montreux - Tokyo - Melbourne, 1991).

[7] Wisbauer, R., *"Modules and Algebras - Bimodule Structure and Group Actions on Algebras"*, Pitman Monographs and Surveys in Pure and Appl. Math., 81 (Addison-Wesley, Longman, Harlow, 1996).

[8] Zelmanowitz, J., *"An extension of the Jacobson density theorem"*, Bull. Amer. Math. Soc., vol. 82, no. 4, pp. 551-553, 1976.

[9] Zelmanowitz, J., *"Dense rings of linear transformations"*, in Ring Theory II, Proceedings of the Second Oklahoma Conference, Marcel Dekker, New York, pp. 281-294, 1977.

[10] Zelmanowitz, J., *"Weakly primitive rings"*, Comm. Algebra, 9(1), pp. 23-45, 1981.

[11] Zelmanowitz, J., *"Correspondences of closed submodules"*, Proc. Amer. Math. Soc., vol. 124, no. 10, pp. 2955-2960, 1996.

On noncommutative ϕ-rings.

Alveri Alves Sant'Ana
UFRGS, Brazil

Ayman Badawi and his colaborators had introduced the class of ϕ-rings as being the class of commutative rings with 1 and such that $Nil(R)$ is a waist, to study properties of Prüfer, Bezout, Dedekind, Krull and Mori domains in rings with zero divisors. If we denote by $\mathcal{P}$ one of the Prüfer, Bezout, etc. properties, then the above mentioned authors showed that R is a $\phi - \mathcal{P}$ ring if and only if $\phi(R)$ is a $\mathcal{P}$-ring if and only if $R/Nil(R)$ is a $\mathcal{P}$ domain, where $\phi : R \to R_{Nil(R)}$ given by $\phi(r) = \dfrac{r}{1}$ is the canonical homomorphism. Moreover, some of these ϕ-rings are a kind of pullback.

In this work, which is a joint work with Christian Lomp and Paula Carvalho (Universidade do Porto - Portugal), we propose a noncommutative version to the class of ϕ-rings. Among other results, we showed that if R is a right ϕ-ring then $\phi(R)$ is a pullback of a local ring T with maximal ideal $J(T)$ and a right Ore domain D such that $T/J(T)$ is the right skew field of fraction of D. Also, if R is a right ϕ-distributive (ϕ-Bezout) ring, then $R_{N_g(R)}$ is a right chain ring and $\dfrac{R}{N_g(R)}$ is a right distributive (Bezout) domain. The converse is true under a natural additional hypothesis.

t-structures in the bounded derived category of a commutative Noetherian ring.

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The concept of t-structure in a triangulated category is the analogue in the 'triangulated world' of what a (hereditary) torsion pair is in the 'abelian world'. The problem of classifying the t-structures in the bounded derived category of coherent sheaves on an affine space $\mathbf{X} = Spec(R)$ is open. We shall approach the Noetherian case, by showing that if R is a commutative Noetherian ring then we can assign to every t-structure in $D^b_{fg}(R)$ a uniquely determined decreasing filtration $\phi : \mathbf{Z} \longrightarrow \mathcal{P}(Spec(R))$ satisfying the following two conditions:

(1) $\phi(i)$ is stable under specialization, for every $i \in \mathbf{Z}$

(2) ϕ satisfies the weak Cousin condition: if $\mathbf{p} \subset \mathbf{q}$ is an inclusion of prime ideals, with $\mathbf{p}$ maximal under $\mathbf{q}$ and $\mathbf{q} \in \phi(j)$, then $\mathbf{p} \in \phi(j-1)$

We will finally show that if R has a dualizing complex, then the above assignment is exhaustive and, hence, establishes a bijection between t-structures in $D^b_{fg}(R)$ (equivalently in $D^b(coh\mathbf{X})$ for $\mathbf{X} = Spec(R)$) and filtrations $\phi : \mathbf{Z} \longrightarrow \mathcal{P}(Spec(R))$ satisfying properties 1 and 2.

Verma type modules over an extended affine Lie algebra of type A1.

Anliy Sargeant
UFL, Brazil

We studied the structure of the submodules and found an irreducibility criterion of Verma type modules over an EALA of type A1, obtained from a semi-lattice.

Hartley's Conjecture and developments.

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Brian Hartley conjectured around 1980 that if the unit group $\mathcal{U}(KG)$ of the group algebra KG of a torsion group G over an infinite field K satisfies a group identity then KG satisfies a polynomial identity ($\mathcal{U} \in GI \Rightarrow KG \in PI$). The conjecture was proved for semiprime case by Giambruno-Jespers-Valenti and completed by Giambruno-Sehgal-Valenti. The referee remarked that the "conjecture is too weak". Consequently, a lot of activity issued. Passman proved that $\mathcal{U}(KG) \in GI$ if and only if $KG \in PI$ and G' is of bounded p-power exponent, when char $K = p$, with the above conditions on G and K. Then more general groups and fields were considered. Liu and Passman gave a classification of torsion groups G so that $\mathcal{U}(KG) \in GI$ for arbitrary fields K. Then Giambruno-Sehgal-Valenti classified when $\mathcal{U}(KG) \in GI$ if K is infinite or G has an element of infinite order. Then questions arose to consider smaller subsets of KG and certain special identities. Let us denote by

$$(KG)^+ = \{\gamma \in KG | \gamma^* = \gamma\}, \quad (KG)^- = \{\gamma \in KG | \gamma^* = -\gamma\},$$

where $*$ is the classical involution induced by $g \mapsto g^{-1}$, $g \in G$. These results are applications of the above classifications. A. Bovdi classified groups G so that $\mathcal{U}(KG)$ is solvable. Giambruno-Sehgal-Valenti classified groups G so that $\mathcal{U}^+(KG) \in GI$. Giambruno-Polcino-Sehgal classified when $(KG)^-$ is Lie nilpotent. The same was done for $(KG)^+$ by G. Lee. The groups with $\mathcal{U}^+(KG)$ solvable was handled by Lee-Sehgal-Spinelli. They also described when $(KG)^+$ is Lie solvable. More general involutions have been considered by Broche, Jespers, Dooms, Ruiz Marin and Polcino. They obtained many interesting results.

The Chevalley and Kostant Theorems for Malcev algebras.

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(Joint work with V.N.Zhelyabin, Sobolev Institute of Mathematics.)

The centers of universal envelopes of Malcev algebras are considered. It is proved that the center of the universal envelope of a semisimple Malcev algebra M over a field of characteristic 0 is isomorphic to the polynomial algebra on a number of variables equal to the dimension of the Cartan subalgebra of M. Besides, the universal envelope algebra is a free module over the center.

Varieties of groups and the Restricted Burnside Problem.

Pavel Shumyatsky
UnB, Brazil

A variety is a class of groups defined by equations. Zelmanov's solution of the Restricted Burnside Problem shows that the class of locally finite groups of exponent n is a variety. We consider the following problem.

PROBLEM 1. *Let $n \geq 1$ and w a group-word. Consider the class of all groups G satisfying the identity $w^n \equiv 1$ and having the verbal subgroup $w(G)$ locally finite. Is that a variety?*

Zelmanov proved that the answer is positive if $w = x$. We show that the answer is positive for many other words w.

On commutativity and finiteness in groups.

Said Sidki
UnB, Brazil

We proved in 1980 the following finiteness criterion for groups :

Let H, K be finite groups having equal orders n and let $f : H \to K$ be a bijection which fixes the identity. Then for any two maps $a : H \to K, b : H \to H$, the group

$$G(H, K; f, a, b) = \left\langle H, K \mid hh^f = h^a h^b \text{ for all } h \in H \right\rangle$$

is finite of order at most $n \exp(n-1)$.

The interaction between H and K in this criterion is a weak form of permutability. An particular instance is the notion of weak commutativity formalized by the groups

$$G(H, K; f) = \left\langle H, K \mid hh^f = h^f h \text{ for all } h \in H \right\rangle.$$

This class originated in connection with our conjecture from 1976, which was answered recently by Aschbacher, Guralnick and Segev:

If a finite group G contains a non-trivial elementary abelian 2-group A such that every involution in G commutes with some involution from A then $A \cap O_2(G)$ is non-trivial.

We will discuss in this lecture old and new results regarding the nature of $G(H, K; f)$. The material is based in part on joint work with Ricardo Oliveira.

Central polynomials in the Grassmann algebra.

Elida Silva
UFG, Brazil

This is joint work with Plamen Koshlukov and Alexei Krasilnikov.

Let H be an infinite dimensional non-unitary Grassmann algebra over an infinite field of a prime characteristic $p > 2$. Let $\mathcal{C}$ be the vector space of the central polynomials of H. Our main result is as follow: $\mathcal{C}$ is not finitely generated as a T-space. This is the first example of an associative algebra whose central polynomials have no finite set of generators.

Let

$$P = (x_1, x_2) + T(H), (x_{j_1}, x_{j_2})...(x_{j_{2q-1}}, x_{j_{2q}})x_{j_1}^{p-1}...x_{j_{2q}}^{p-1} + T(H) \mid q \in \mathbb{N},$$

where $T(H)$ stands for the T-ideal of the polynomial identities of H. We have proved that the set P generates $\mathcal{C}$ as a T-space. In 2000 Shchigolev proved that the T-space generated by P is not finitely generated. It was not known, and we show this here, that this T-space generated by P coincides with $\mathcal{C}$.

On $\mathbb{Z}_2$-gradings of the Grassmann algebra.

Viviane Silva
UFMG, Brazil

Let E be the infinite-dimensional Grassmann algebra over a field F of characteristic zero and consider L the F-vector space spanned by all generators of E. Let φ_l be any fixed automorphism of E of order 2 such that L is an homogeneous subspace. In this talk, we present the $\mathbb{Z}_2$-graded codimensions and the $S_r \times S_{n-r}$-cocharacters associated to φ_l.

Crossed products by twisted partial actions.

Juan Jacobo Simón Pinero
Universidad de Murcia, Spain

Twisted partial actions of groups and corresponding crossed products were introduced in the theory of operator algebras, which permit to characterize important classes of algebras generated by partial isometries as such partial crossed products. We give a purely algebraic version of this concept, defining a twisted partial action α of a group G on a non-necessarily unital, associative ring A as a collection of commuting idempotent two-sided ideals A_g of A $(g \in G)$, ring isomorphisms $\alpha_g : A_{g^{-1}} \to A_g$ $(g \in G)$ and invertible multipliers (the twisting) $w_{g,h}$ of $A_g \cdot A_{gh}$ $(g, h \in G)$, such that natural compatibility conditions with the group operation are satisfied, as well as a partial version of the 2-cocycle equality on the w's. This definition makes it possible to construct the crossed product $A \rtimes_\alpha G$ which we prove to be associative.

Given a G-graded k-algebra $B = \oplus_{g \in G} B_g$ with the mild restriction of homogeneous non-degeneracy, a criteria is established for B to be isomorphic to the crossed product $B_1 \rtimes_\alpha G$ for some twisted partial action of G on B_1. The equality $B_g B_{g^{-1}} B_g = B_g; (\forall g \in G)$ is one of the ingredients of the criteria, and if it holds and, moreover, B has enough local units, then it is shown that B is stably isomorphic to a crossed product by a twisted partial action of G.

On hyperbolicity of groups and algebras.

Antonio Calixto de Souza Filho
CEFETSP, Brazil

We present some results on classifying algebraic structures such as group rings, semigroup algebras and alternative algebras which for any Z-order its unit group, or unit loop, is hyperbolic or quasi-hyperbolic, respectively.

Semi-homogeneous trees.

Humberto Luiz Talpo
UFABC, Brazil

There are many works studying the structure of *homogeneous trees* (trees in which all vertices have the same degree) or *semi-homogeneous trees* (trees in which vertices have two different degrees and the vertices x and y have the same degree iff $d(x, y) \equiv 0 \bmod 2$). J. Tits [4] proved that automorphism groups (without inversion) of locally finite homogeneous or semi-homogeneous trees are simple. Znoiko [5] proved that automorphism groups of homogeneous trees (of degree $n > 2$) are complete. In this work, we prove that automorphism groups of semi-homogeneous trees are complete. Moreover, we explore the concept of *reflection in tree,* introduced in [3], in the class of semi-homogeneous trees and study the structure of the group generated by reflections in semi-homogeneous trees.

Joint work with Marcelo Firer.

References

[1] Gawron, P.W., Nekrashevych, V. V., Sushchansky, V. I. - *Conjugation in tree automorphism groups* - Int. J. Algebra and Computation Vol. 11, n^o 5 (2001).

[2] Möller, R. - *The automorphism groups of regular trees* - J. London Math. Soc. Vol. 2, n^o 43 (1991).

[3] Talpo, H. L. and Firer, M., *Trees and Reflection Groups*, Electr. Journal of Combinatorics, vol. 12 (2005), R. 16.

[4] Tits, J. - *Sur le groupe des automorphismes d'un arbre* - Essays on topology and related topics (Mémoires Dédiés à Georges de Rhem), Springer-Verlag, Berlin and New York, 1970.

[5] Znoiko, D. V. - *The automorphism groups of regular trees* - Math. USSR Sb. 32 (1977).

Local fields.

Eduardo Tengan
ICMC-USP, Brazil

Local field is the name given to any finite field extension of either the field of p-adic numbers $\mathbf{Q}_p$ or the field of Laurent power series $\mathbf{F}_p((t))$. Local fields help us better understand the arithmetic of global fields such as $\mathbf{Q}$ and $\mathbf{F}_p(t)$. The classical example is the famous Haße-Minkowski theorem: a quadratic form over $\mathbf{Q}$ represents zero non-trivially if and only if it does so over $\mathbf{R}$ and over each $\mathbf{Q}_p$ for all primes p.

In this course, we cover the basic results about local fields, with a view towards applications in Number Theory, Central Simple Algebras and Quadratic Forms. Some of the topics include: Hensel's lemma, the structure of the multiplicative group of a local field, extensions of local fields, in particular abelian extensions. We concentrate on local fields themselves, but mention some of the interactions with global fields, such as the Haße-Minkowski theorem above and the Kronecker-Weber theorem.

Bicyclic units, special units and free groups.

Paula Murgel Veloso
IME-USP, Brazil

Necessary and sufficient conditions under which the group of units $\mathcal{U}(KG)$ of the group ring KG does not contain a free subgroup of rank 2 are established in [1]. Let G be a finite group. If K is a field of characteristic zero, then $\mathcal{U}(KG)$ does not contain a free subgroup of rank 2 if and only if G is abelian. In the case of a field K of positive characteristic π, $\mathcal{U}(KG)$ does not contain a free subgroup of rank 2 if and only if either G is abelian, or K is algebraic over its prime subfield $GF(\pi)$, or $G/\mathbb{O}_\pi(G)$ is abelian, where $\mathbb{O}_\pi(G)$ denotes the largest normal π-subgroup of G.

In this work, we consider under what conditions the group of units $\mathcal{U}(KG)$ of the group ring KG contains a free subgroup of rank 2 generated by a bicyclic unit and a *special unit* (according to the definition in [2]). We use tools proposed in [3], and previously explored to construct free subgroups generated by a pair of Bass cyclic units in $\mathcal{U}(\mathbb{Z}G)$ [3], and by a pair of special units in in $\mathcal{U}(KG)$ [2].

References

[1] J. Z. Gonçalves, *Free subgroups of units in group rings*, Canad. Math. Bull., Vol. 27 (1984), No. 3, 309 – 312.
[2] J. Z. Gonçalves and D. S. Passman, *Free Unit Groups in Group Algebras*, Journal of Algebra 246, 226 – 252 (2001).
[3] J. Z. Gonçalves and D. S. Passman, *Linear groups and group rings*, Journal of Algebra 295, 94 – 118 (2006).

On some subalgebras of upper triangular matrices.

Ana Vieira
UFMG, Brazil

In this talk we will present some results about the codimensions and cocharacters of a particular subalgebra of upper triangular matrices. The sequence of codimensions were given by Giambruno, La Mattina and Petrogradsky in 2007 and it has polynomial growth. Here we will determine the sequence of cocharacters by using proper polynomials.

Identities of finite dimensional Jordan algebras.

Mikhail Zaicev
Moscow State University, Russia

Numerical characteristics play an important role in the studying of identities of associative and non-associative algebras. One of these characteristics is the sequence of codimensions of multilinear identities. It is well-known that for anyfinite dimensional algebra the sequence of codimensions is exponentially bounded. In the talk we will discuss an asymptotic behavior of codimensions of finite dimensional Jordan algebras algebras.

Virtually free pro-p groups and p-adic representations.

Pavel Zaleski
UnB, Brazil

Connections between virtually free pro-p groups and integral p-adic representations of finite p-groups will be discussed.

Asymptotic properties of infinite groups and algebras.

Efim Zelmanov
University of California, San Diego, USA

We will discuss various types of growth and isoperimetric behavior of infinite groups and infinite dimensional algebras focusing on polynomial growth, amenability and, at the other end of the spectrum: property T.