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em Matemática Pura, Aplicada e Estatística

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Session: Representações de Álgebra

Organized by German Alonso Benitez (Universidade Federal do Amazonas)
and Luis Enrique Ramirez (Universidade Federal do ABC)

Schedule

Wednesday, December 12

- 9:00 - 9:30 Opening
- 9:30 - 10:30 Plenary talk 1
- 10:30 - 11:00 Coffee break
- 11:00 - 11:30 ASHISH MISHRA (UFPA)
On representations of dual rook monoid algebra
- 11:30 - 12:00 Antonio Marcos Duarte de França (UnB)
Graded Algebras whose Neutral Component Satisfies a Polynomial Identity of Degree 2
- 12:00 - 13:30 Lunch
- 13:30 - 14:30 Plenary talk 2
- 14:40 - 15:10 Cristian Schmidt (PUC-PR)
Tilting Complexes and Strong Global Dimension in Piecewise Hereditary Algebras
- 15:10 - 15:40 CARLOS ALEXANDRE GOMES DA SILVA (UFRN)
Módulos de Gelfand-Tsetlin singulares de $gl(n)$
- 15:40 - 16:10 Keidna Cristiane Oliveira Souza (UFT)
 σ -involução no anel de matrizes \mathbb{Z}_3 -graduado
- 16:10 - 16:40 Luis Enrique Ramirez (UFABC)
Gelfand-Tsetlin $gl(n)$ -modules defined by admissible sets of relations
- 16:40 - 17:10 Coffee break
- 17:10 - 18:40 Round Table

Thursday, December 13

- 9:00 - 10:00 Plenary talk 3
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 10:30 - 11:00 Dragomir Mitkov Tsonev (UFAM)
Lie superalgebras and curvature
 11:00 - 11:30 Danilo Dias da Silva (UFS)
Feixes instanton e representações de aljavas
 11:30 - 12:00 Tanise Carnieri Pierin (UFPR)
Some sufficient conditions for an algebra to be piecewise hereditary
 12:00 - 13:30 Lunch
 13:30 - 14:30 Plenary talk 4
 14:40 - 15:10 Manuela da Silva Souza (UFBA)
Specht property for the graded Jordan algebra of upper triangular matrices of order 2
 15:10 - 15:40 Oscar Marquez (UFMS)
On Nichols Algebras arising from Radford Algebras
 15:40 - 16:10 Maria Eugenia (UFPR)
On Exceptional Jordan Superalgebras
 16:10 - 16:40 Jian Zhang (USP)
Irreducibility of tensor products of Yangian modules
 16:40 - 17:10 Coffee break
 17:10 - 17:40 Heily Wagner (UFPR)
On linearly oriented pullback of finite dimensional algebras
 17:40 - 18:10 Germán Alonso Benitez Monsalve (UFAM)
Gelfand-Tsetlin type for \mathfrak{sp}_4
 20:00 - 0:00 Social dinner

Friday, December 14

- 9:00 - 10:00 Plenary talk 5
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 10:30 - 11:00 Felipe Albino dos Santos (USP)
Superelliptic Affine Lie Algebras
 11:00 - 11:30 Wilhelm Alexander Cardoso Steinmetz (UFAM)
Subgrupos abelianos finitos constantes de grupos algébricos lineares clássicos sobre C
 12:00 - 13:30 Lunch
 13:30 - 14:30 Plenary talk 6
 16:40 - 17:10 Coffee break
 17:10 - 18:40 Assembly

Abstracts

1. *Speaker:* **ASHISH MISHRA**

Affiliation: UNIVERSIDADE FEDERAL DO PARÁ

Title: ***On representations of dual rook monoid algebra***

The semigroup algebra of dual symmetric inverse semigroup is the subalgebra, $\mathbb{C}\mathcal{I}_k$, of the partition algebra $A_k(n)$, generated by those partition diagrams whose each block is propagating. Let $\mathbb{C}\mathcal{I}_{k+\frac{1}{2}}$ be the subalgebra of $A_{k+\frac{1}{2}}(n)$ generated by those partition diagrams whose each block is propagating. In this paper, we show that the centralizer of rook monoid algebra $\mathbb{C}R_{n-1}$ inside $\text{End}_{\mathbb{C}}((\mathbb{C}^n)^{\otimes k})$ is the algebra $\mathbb{C}\mathcal{I}_{k+\frac{1}{2}}$ whenever $n \geq k$. We call $\mathbb{C}\mathcal{I}_k$ and $\mathbb{C}\mathcal{I}_{k+\frac{1}{2}}$ the dual rook monoid algebra. The irreducible representations of dual rook monoid algebra are described and it is shown that the inclusion $\mathbb{C}\mathcal{I}_k \subset \mathbb{C}\mathcal{I}_{k+\frac{1}{2}}$ has multiplicity free branching rule. Also, we determine the Jucys-Murphy elements of dual rook monoid algebra.

2. *Speaker:* **Antonio Marcos Duarte de França**

Affiliation: Universidade de Brasília

Title: ***Graded Algebras whose Neutral Component Satisfies a Polynomial Identity of Degree 2***

Let \mathfrak{A} be an associative algebra over a field \mathbb{F} graded by a group \mathbf{G} and e be the unit of \mathbf{G} . In this work, we have studied and we have answered the following questions: what can we say about a graded algebra \mathfrak{A} when \mathfrak{A}_e is: 1) a nil ring? 2) a nilpotent ring? 3) a central algebra? 4) a commutative algebra?. In this sense, we have studied the class of \mathbf{G} -graded rings whose neutral component is nil, the class of all the graded algebras whose neutral component is central and the class of all the graded algebras whose neutral component is commutative. Therefore, we have proved that, under suitable conditions, any \mathbf{G} -graded (associative) ring with nil neutral component is a nil ring. Among other results, using Nagata-Higman Theorem we obtain a important application of our results. Besides that, we have exhibited a considerable relation between graded rings and Köthe's Problem. After, we have studied the graded variety generated by \mathbf{G} -graded polynomials $[x^{(e)}, y^{(g)}]$ for all $g \in \mathbf{G}$, where \mathbf{G} is a finite abelian group and $\text{char}(\mathbb{F}) = 0$. Thus, we have proved that any \mathbf{G} -graded finite dimensional associative algebra over a field of characteristic zero with central neutral component is *GPI*-equivalent to a semiprime graded algebra, and hence, we have exhibited a complete description of algebras graded by a finite abelian group whose neutral component is central. Finally, we also have studied the graded variety \mathcal{V} of all the graded algebras whose neutral component is commutative, in particular, we have shown that all algebra of \mathcal{V} is *GPI*-equivalent, under suitable conditions, to a semiprime graded algebra.

3. *Speaker:* **Cristian Schmidt**

Affiliation: Pontificia Universidade Católica do Paraná

Title: ***Tilting Complexes and Strong Global Dimension in Piecewise Hereditary Algebras***

The main goal on this work is to find an upper bound for the strong global dimension of piecewise hereditary algebras. In order to prove that, we need to study the properties of a tilting complex T^\bullet in the derived category $\mathcal{D}^b(\mathcal{A})$ of a hereditary category with tilting object. More specifically, we will present an upper bound for the spread of T^\bullet in $\mathcal{D}^b(\mathcal{A})$, that is, we will find a pair (\mathcal{H}, ℓ) , where \mathcal{H} is a hereditary generating subcategory of $\mathcal{D}^b(\mathcal{A})$ and ℓ is an integer number, satisfying

$$T^\bullet \in \bigvee_{i=0}^{\ell} \mathcal{H}[i],$$

moreover, such ℓ is the smallest integer number satisfying this. Finally, we know from Rickard's theorem that given an piecewise hereditary algebra satisfying $\mathcal{D}^b(\text{mod } \Lambda) \simeq \mathcal{D}^b(\mathcal{H})$, there is a tilting complex $T^\bullet \in \mathcal{D}^b(\mathcal{H})$ such that $\text{End} T^{\bullet \text{op}} \simeq \Lambda$, then, we will use properties of T^\bullet to describe the strong global dimension of Λ .

Keywords: *Strong Global Dimension, Tilting Complexes, Perpendicular Categories, Exceptional Sequences*

4. *Speaker:* **CARLOS ALEXANDRE GOMES DA SILVA**

Affiliation: UFRN

Title: *Módulos de Gelfand-Tsetlin singulares de $gl(n)$*

Apresentaremos a construção, os principais resultados sobre os Módulos de Gelfand-Tsetlin culminando com um critério de irreduzibilidade de tais módulos.

5. *Speaker:* **Keidna Cristiane Oliveira Souza**

Affiliation: Universidade Federal do Tocantins

Title: *σ -involução no anel de matrizes \mathbb{Z}_3 -graduado*

O Teorema de Kaplansky caracteriza involuções em anéis primitivos com ideais unilaterais em termos de formas hermitianas e alternadas (ver [1]). Em 1997, Racine, [2], provou resultados similares para superanéis primitivos com superideais unilaterais. Entre eles, a classificação de superanéis com superinvoluções. Jaber em [3] estuda a existência de \mathbb{Z}_3 -involuções na álgebra \mathbb{Z}_3 -graduada $\mathcal{A} = M_{p+q+p}(\mathcal{D})$, onde \mathcal{D} é uma álgebra de divisão. Vamos considerar σ -involução que unifica a notação de superinvolução e \mathbb{Z}_3 -involução graduada. Apresentaremos alguns problemas e resultados relacionados com σ -involução. Em particular, a descrição de σ -involução no anel \mathbb{Z}_3 -graduado $\mathcal{R} = M_n(\mathcal{D})$ de matrizes $n \times n$ sobre um anel \mathbb{Z}_3 -graduado de divisão \mathcal{D} no caso de algumas classes de graduações elementares em \mathcal{R} .

Trabalho em conjunto com Irina Sviridova (Universidade de Brasília, Brasil).

References

- [1] Jacobson, N. *Structure of rings*, Amer. Math. Soc. Colloq. Publ., vol. 37, Amer. Math. Soc., Providence, RI, 1956.
- [2] Racine, M. L., *Primitive superalgebras with superinvolution*, J. Algebra **206**(2)(1998), 588-614.
- [3] Jaber, A. *Division \mathbb{Z}_3 -algebras*, International Electronic J. Algebra, **7**(2010), 1-11.

6. *Speaker: Luis Enrique Ramirez*

Affiliation: UFABC

Title: Gelfand-Tsetlin $gl(n)$ -modules defined by admissible sets of relations.

In this talk we describe the construction of a large family of simple $gl(n)$ -modules that have a basis consisting of Gelfand-Tsetlin tableaux, the action of the Lie algebra is given by the Gelfand-Tsetlin formulas and with all Gelfand-Tsetlin multiplicities equal 1.

7. *Speaker: Dragomir Mitkov Tsonev*

Affiliation: UFAM

Title: Lie superalgebras and curvature

In a relatively short and recent paper, David Richter elaborated on a remarkable relationship between Lie superalgebras and curvature. The humble goal of this talk is to communicate this yet another exciting link between Algebra and Geometry as well as making some speculations on probable further directions of research.

8. *Speaker: Danilo Dias da Silva*

Affiliation: Universidade Federal de Sergipe

Title: Feixes instanton e representações de aljavas

Buscamos entender o espaço de módulos de feixes instanton no espaço projetivo de dimensão 3 através da equivalência com cohomologias de mônadas lineares sob o ponto de vista de representações de aljavas. Serão apresentados resultados anteriores na literatura que tratam da equivalência entre a categoria de mônadas lineares e a categoria de representações de uma certa aljava e resultados novos que relacionam o espaço de módulos de feixes instanton de carga 1 com o espaço de módulos de representações da aljava mencionada.

9. *Speaker: Tanise Carnieri Pierin*

Affiliation: Universidade Federal do Paraná

Title: Some sufficient conditions for an algebra to be piecewise hereditary

A finite dimensional k -algebra A is said to be piecewise hereditary if its bounded derived category $\mathcal{D}^b(\text{mod } A)$ is triangle equivalent to $\mathcal{D}^b(\mathcal{H})$, where \mathcal{H} is a hereditary abelian category. According to Rickard, any piecewise hereditary algebra can be written as $(\text{End}_{\mathcal{D}^b(\mathcal{H})} T)^{op}$, where T is a tilting complex in $\bigvee_{i=1}^{\ell} \mathcal{H}[i]$, for some ℓ . Happel, Reiten and Smalø investigated those piecewise hereditary algebras such that $T \in \mathcal{H}[0]$, called quasitilted, and obtained several properties and characterisations which explain their relevance. For instance, an algebra A is quasitilted if and only if (i) $\text{gl.dim } A \leq 2$ and (ii) for each indecomposable A -module X , $\text{pd}_A X \leq 1$ or $\text{id}_A X \leq 1$. In 2010, Happel and Zacharia obtained necessary homological conditions for an algebra to be piecewise hereditary. In this work we give some sufficient conditions for an algebra with homological properties similar to (i) and (ii) to be piecewise hereditary.

10. *Speaker: Manuela da Silva Souza*

Affiliation: Universidade Federal da Bahia

Title: Specht property for the graded Jordan algebra of upper triangular matrices of order 2

Abstract

Let A be an algebra with non-trivial polynomial identity (or simply PI-algebra) and denote by $\text{Id}(A)$ the T -ideal of all its polynomial identities. In general the description of a T -ideal is a hard problem. The ideal $\text{Id}(A)$ of an algebra A satisfies the Specht property if $\text{Id}(A)$ itself and all T -ideals containing $\text{Id}(A)$ are finitely generated as T -ideals. Kemer proved that every associative algebra over a field of characteristic 0 satisfies the Specht property. For associative algebras graded by a finite group the result remains valid. Different from the associative case, for non-associative algebras there is no general result in this direction not even when the characteristic of the field is 0. In the case of graded Lie or Jordan algebras we have experimental results. In this talk we use the finite basis property for sets to show the Specht property for the graded Jordan algebra of upper triangular matrices of order 2. This is joint work with L. Centrone and F. Martino ([1]).

References

- [1] L. Centrone, F. Martino and M. da S. Souza, *Specht property for some varieties of Jordan algebras of almost polynomial growth* (submitted for publication).

11. *Speaker: Oscar Marquez*

Affiliation: UFSM

Title: On Nichols Algebras arising from Radford Algebras

In this work we present a family of Hopf algebras, called Radford algebras, defined by Radford as an example of families of Hopf algebras such that the coradical is not a subalgebra. First, we describe some representation theory related to these algebras.

After describing the simple Yetter Drinfeld modules and its projective covers; we focus on the Nichols algebras associated arising from them. Such algebras turn out interesting in order to find new examples of Hopf algebras, and so, in the classification of Hopf algebras.

12. *Speaker: Maria Eugenia Martin*

Affiliation: UFPR

Title: On exceptional Jordan Superalgebras

M. C. López-Díaz, I. P. Shestakov and S. Sverchkov posed in "On Speciality of Bernstein Jordan Algebras", the problem of determining the minimal dimension, namely d , of an exceptional Jordan superalgebra. Our strategy to provide a lower bounded for this dimension is to determine the complete list of Jordan superalgebras of small dimensions over an algebraically closed field of characteristic different of 2 and verify which ones are special or exceptional.

Until the present time we have obtained the complete classification of Jordan superalgebras up to dimension five and proved that $5 \leq d \leq 7$.

13. *Speaker: Jian Zhang*

Affiliation: IME-USP

Title: Irreducibility of tensor products of Yangian modules

We give an explicit construction of some highest weight modules for \mathfrak{gl}_n . The evaluation homomorphisms from the Yangian $Y(\mathfrak{gl}_n)$ to the universal enveloping algebra $U(\mathfrak{gl}_n)$ allow one to regard these modules as Yangian modules. We give sufficient conditions for the irreducibility of tensor products of such evaluation modules.

14. *Speaker: Heily Wagner*

Affiliation: UFPR

Title: On linearly oriented pullback of finite dimensional algebras

Given two epimorphisms of algebras $f: A \rightarrow B$ and $g: C \rightarrow B$ the pullback R is the subalgebra of $A \times C$ defined by $\{(a, c) \in A \times C \mid f(a) = g(c)\}$. For finite dimensional k -algebras (k an algebraically closed field), which can be determined by bounded quivers, the quiver ordinary of the pullback R can be determined by those of A , B and C . Here we consider a particular class, the so-called linearly oriented pullback, where the injective and projective R -modules can be determined by those ones

over A and C . For this class of pullbacks, we study the relationship between the category of modules over the involved algebras.

15. *Speaker:* **Germán Alonso Benitez Monsalve**
Affiliation: Universidade Federal do Amazonas UFAM
Title: ***Gelfand-Tsetlin type for \mathfrak{sp}_4***

S. Ovsienko proved in 2003, that the Gelfand-Tsetlin variety for \mathfrak{gl}_n is equidimensional (i.e. all its irreducible components have the same dimension) with dimension equals $\frac{n(n-1)}{2}$. This result has important consequences in Representation Theory of Algebras. In this lecture, we will present the version for Symplectic Lie algebra \mathfrak{sp}_4 .

16. *Speaker:* **Felipe Albino dos Santos**
Affiliation: USP
Title: ***Superelliptic Affine Lie Algebras***

We consider Lie algebras of the form $\mathfrak{g} \otimes R$ where \mathfrak{g} is a simple complex (finite-dimensional) Lie algebra and R is a ring of the form $\mathbb{C}[t^{\pm 1}, u]$ where $u^3 \in \mathbb{C}[t]$. We determine a basis for the kernel of the universal central extension of $\mathfrak{g} \otimes R$. In the case $R = \mathbb{C}[t^{\pm 1}, u]/\langle u^m - t^n - 1 \rangle$, we prove $\mathfrak{g} \otimes R$ is not a n -point loop algebra.

17. *Speaker:* **Wilhelm Alexander Cardoso Steinmetz**
Affiliation: UFAM
Title: ***Subgrupos abelianos finitos constantes de grupos algébricos lineares clássicos sobre C***

Existe uma maneira de estudar certas álgebras de Lie (Extended Affine Lie Algebras ou "EALA's") como torsores sobre o anel de polinômios de Laurent em n variáveis sobre C . Este torsores podem ser associados a grupos finitos abelianos constantes. Nós pretendemos mostrar alguns casos especiais desta correspondência.