Atlantic Association for Research in the Mathematical Sciences

Memorial University of Newfoundland

Atlantic Algebra Centre

CRG Groups, Rings, Lie and Hopf Algebras

International Workshop

Groups, Rings, Lie and Hopf Algebras. IV

May 30 - June 2, 2022

Memorial University of Newfoundland
St. John's, NL

Schedule and Abstracts of Talks

Organizing committee

Yuri Bahturin

Mikhail Kochetov

Yorck Sommerhäuser

St. John's, NL
2022

Monday, May 30, 2022

Room A-2065

9:00	-	9:30	**Opening/Registration** *Atlantic Algebra Centre, HH-2010*
9:30	-	10:20	**Ivan Shestakov** *Universidade de São Paulo, Brazil* Non-matrix varieties and coordinatization theorems for nonassociative algebras
10:30	-	11:00	**Coffee break**
11:00	-	11:50	**David Riley** *University of Western Ontario, Canada* Combinatorial criteria for an algebra endowed with an action to satisfy a polynomial identity
12:00	-	2:00	**Lunch Break**
2:00	-	2:50	**Eli Aljadeff** *Technion, Israel* G-graded division algebras and division algebras that are G-graded
3:00	-	3:50	**Dorette Pronk** *Dalhousie University, Canada* Colimits of double categories
4:00	-	4:30	**Coffee Break**
4:30	-	4:55	**Geoffrey Vooys** *Dalhousie University, Canada* Derived categories of equivariant sheaves
5:00	-	5:25	**Darien DeWolf** *Brandon University, Canada* Left cancellative categories and ordered groupoids
5:30	-	5:55	**Irina Sviridova** *Universidade de Brasília, Brazil* A hook theorem for identities with additional structures

Tuesday, May 31, 2022

Room A-1046

9:30	-	10:20	**Stefan Gille** *University of Alberta, Canada* The Splitting principle for cohomological invariants of reflection groups
10:30	-	11:00	**Coffee break**
11:00	-	11:50	**Kirill Zaynullin** *University of Ottawa, Canada* The correspondence product and the coproduct on oriented equivariant cohomology theories
12:00	-	2:00	**Lunch Break**
2:00	-	2:50	**Erhard Neher** *University of Ottawa, Canada* Springer's theorem on quadratic forms
3:00	-	3:50	**Ehud Meir** *University of Aberdeen, United Kingdom* Interpolations of monoidal categories by invariant theory
4:00	-	4:30	**Coffee Break**
4:30	-	4:55	**Alexandre Lourdeaux** *University of Alberta, Canada* Brauer invariants of linear algebraic groups
5:00	-	5:25	**Changlong Zhong** *SUNY Albany, USA* K-theory stable bases of Springer resolutions
5:30	-	5:55	**Cameron Ruether** *University of Ottawa, Canada* Twisting linear algebraic groups and Hopf algebras

Wednesday, June 1, 2022

Room A-2065

9:30	-	10:20	**Nicolás Andruskiewitsch** *Universidad Nacional de Córdoba, Argentina* On the double of the Jordan plane
10:30	-	11:00	**Coffee break**
11:00	-	11:50	**Gastón Andrés García** *Universidad Nacional de La Plata, Argentina* Formal multiparameter quantum groups, deformations and specializations
12:00	-	2:00	**Lunch Break**
2:00	-	2:50	**Anthony Giaquinto** *Loyola University Chicago, USA* Schur-Weyl duality for braid and twin groups
3:00	-	3:50	**Simon Lentner** *Universität Hamburg, Germany* Folded Nichols algebras and the logarithmic Kazhdan-Lusztig conjecture
4:00	-	4:30	**Coffee Break**
4:30	-	4:55	**Yevgenia Kashina** *DePaul University, USA* Semisimple Hopf algebras constructed as biproducts
5:00	-	5:25	**Henry Tucker** *UC Riverside, USA* Frobenius-Schur indicators and Drinfel'd centers for quadratic fusion categories
5:30	-	5:55	**Mitja Mastnak** *Saint Mary's University, Canada* Graded deformations of Nichols algebras
7:00	-	8:00	**AARMS Distinguished Lecture: Ivan Shestakov** *Universidade de São Paulo, Brazil* Tame and wild automorphisms of free algebras *Location: EN-2006 (Engineering Building)*
8:00	-	10:00	**Reception**

Thursday, June 2, 2022

Room A-1046

9:30	-	10:20	**Seidon Alsaody** *Uppsala Universitet, Sweden* Parametrising algebras by quotients of algebraic groups
10:30	-	11:00	**Coffee break**
11:00	-	11:50	**Cornelius Pillen** *University of South Alabama, USA* On the Humphreys-Verma conjecture, Donkin's tilting module conjecture and a question of Jantzen
12:00	-	2:00	**Lunch Break**
2:00	-	2:50	**Kent Vashaw** *Massachusetts Institute of Technology, USA* On the spectrum and support theory of a finite tensor category
3:00	-	3:50	**Nicholas Touikan** *University of New Brunswick, Canada* Panel collapse and many-ended topological groups
4:00	-	4:30	**Coffee Break**
4:30	-	4:55	**Sam Hughes** *Oxford University, United Kingdom* Hierarchical hyperbolicity versus biautomaticity
5:00	-	5:25	**Shivam Arora** *Memorial University, Canada* On compactness properties of subgroups
5:30	-	5:55	**Eduardo Martínez-Pedroza** *Memorial University, Canada* Eilenberg-Ganea phenomena and coarse geometry

Eli Aljadeff

Technion, Israel

G-graded division algebras and division algebras that are G-graded

If G is a finite group and D is a finite dimensional G-graded division algebra over k (i.e. every nonzero homogeneous element is invertible) and in particular if D is a division algebra which is G-graded, then extending scalars to $F = \bar{k}$, the algebraic closure, we obtain a finite dimensional G-graded simple algebra. In this lecture we discuss the problem in the opposite direction, namely if A is finite dimensional G-graded simple algebra over F (with $\mathrm{char}(F) = 0$), then under which conditions it admits (1) a G-graded division algebra form (2) a division algebra form which is G-graded? (forms here in the sense of descent theory).

One of the tools we use is PI theory. It allows us to construct generic objects. Joint work with Haile and Karasik.

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Seidon Alsaody

Uppsala Universitet, Sweden

Parametrising algebras by quotients of algebraic groups

Given an algebraic group G and a subgroup H, one can form the corresponding fppf-quotient G/H. This is a sheaf with respect to the fppf-topology, with a locally surjective quotient projection that makes it into an H-torsor.

After giving the definitions of the above-mentioned notions, I will show, using recent examples, how this can be used to give a geometric understanding of the structure of various classes of algebras with additional structure. These algebras have in common the fact that several (exceptional) algebraic groups arise as symmetry groups of their different structures, and the above torsors provide links between these structures. The discrepancy between local and global surjectivity of the quotient projection mentioned above, which is a key feature of descent theory, plays a key role.

Nicolás Andruskiewitsch

Universidad Nacional de Córdoba, Argentina

On the double of the Jordan plane

The Jordan plane, a well-known deformation of the polynomial ring in two variables, has a structure of braided Hopf algebra and as such, it has various associated Hopf algebras, varying with the characteristic of the base field. I will report on recent work on these Hopf algebras, jointly with Héctor Peña Pollastri and François Dumas.

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Shivam Arora

Memorial University, Canada

On compactness properties of subgroups

Results of Herbert Abels show that groups in the class of locally compact groups containing a compact open subgroup admit transitive actions on locally finite graphs with compact open vertex stabilizers. This is analogous to the case of finitely generated discrete groups via Cayley graphs. There is a current program of extending geometric techniques used in the study of discrete groups to this larger class. We will give brief overview of this approach and some of the applications that we obtained regarding compactness properties of subgroups.

Darien DeWolf

Brandon University, Canada

Left cancellative categories and ordered groupoids

One way to characterize etendues is as the categories of sheaves on a site with monic maps, or, in the language of Lawson, a left cancellative category with a Grothendieck topology.

Lawson introduces a notion of ordered groupoid and introduces functors between the category of left cancellative categories and that of ordered groupoids, but does not establish it as an equivalence of 2-categories, because it is not clear when two ordered groupoids should be equivalent.

Lawson and Steinberg introduce the notion of an Ehresmann topology on ordered groupoids and establish a correspondence between Grothendieck topologies on left cancellative categories and Ehresmann topologies on ordered groupoids, corresponding to each of their functors. They show that these correspondences give an equivalence between the induced categories of sheaves. The main result in this paper is a characterization of etendues as sheaves on an Ehresmann site. What is missing in this paper are equivalences of the 2-categories of left cancellative categories and ordered groupoids and a description of what morphisms between ordered groupoids give rise to geometric morphisms between the induced categories of sheaves on the Ehresmann sites.

By considering ordered groupoids as a special type of double categories, we characterize what a weak equivalence of ordered groupoids is, and then use this to establish an adjoint equivalence of 2-categories between the 2-category of left cancellative categories and the 2-category of ordered groupoids.

We show how this extends to an equivalence between the appropriate categories of Grothendieck sites with monic maps and Ehresmann sites and as an application, we translate the comparison lemma for sites with monic maps, given by Kock and Moerdijk, to a comparison lemma for Ehresmann sites, characterizing which functors between Ehresmann sites give rise to equivalences of etendues.

The talk is based on joint work with Dorette Pronk.

Gastón Andrés García

Universidad Nacional de La Plata, Argentina

Formal multiparameter quantum groups, deformations and specializations

This talk is based on joint work with Fabio Gavarini, where we introduce the notion of formal multiparameter quantum enveloping algebras (FoMpQUEA) as a generalization of the well-known Drinfeld's quantum group (ArXiv:2203.11023).

We show that this class of quantum groups is closed under deformations by "toral" twists and deformations by "toral" 2–cocycles: as a consequence, all "multiparameter formal QUEA's" considered so far are recovered. In particular, we prove that any FoMpQUEA is isomorphic to a suitable deformation, by twist or by 2–cocycle, of Drinfeld's standard QUEA.

Concerning the classical picture, we also introduce multiparameter Lie bialgebras (MpLbA's), and consider their deformations, by twist and by 2–cocycles. It turns out that the semiclassical limit of every FoMpQUEA is a suitable MpLbA, and conversely each MpLbA can be quantized to a suitable FoMpQUEA. We also provide several results that give structural properties and relate the classical and the quantum objects.

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Anthony Giaquinto

Loyola University Chicago, USA

Schur-Weyl duality for braid and twin groups

The symmetric group admits two natural covering groups: the braid group and the twin group. These are obtained, respectively, by removing the involution and cubic relations in the Coxeter presentation of the symmetric group. There is a natural Burau representation for each group, which for the braid group is a q-analog of the permutation representation of the symmetric group and for the twin group is a related orthogonal representation generated by complex reflections. New instances of Schur-Weyl duality are found by examining the diagonal action of these groups on tensor powers of the Burau representation. The centralizer algebra of the action of each group is described diagrammatically in terms of partial permutation and partial Brauer algebras. As a result, we obtain many representations of the braid and twin groups that can be combinatorially constructed. This is joint work with Stephen Doty.

Stefan Gille

University of Alberta, Canada

The Splitting principle for cohomological invariants of reflection groups

After recalling the definition of cohomological invariants of finite groups, I will discuss the proof of the splitting principle: The invariants of an orthogonal reflection group are determined by their restrictions to elementary 2-subgroups. Joint work with Christian Hirsch.

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Sam Hughes

Oxford University, United Kingdom

Hierarchical hyperbolicity versus biautomaticity

A hierarchically hyperbolic structure on a group G endows G with a rich geometry which can often be exploited to prove powerful theorems. Similarly, the algebraic-combinatorial-language theoretic notion of a biautomatic structure on a group G gives efficient algorithms for solving the word and conjugacy problems. In many situations the existence of a biautomatic structure is given by some geometric structure on the group (for example the Niblo–Reeves structure on CAT(0) cubical groups). In this talk we settle the question of whether every hierarchically hyperbolic group is biautomatic. Based on joint work with Motiejus Valiunas.

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Yevgenia Kashina

DePaul University, USA

Semisimple Hopf algebras constructed as biproducts

In joint work with Yorck Sommerhäuser, we constructed two families of eight-dimensional Yetter-Drinfel'd Hopf algebras over the Klein four group. Both families are cocommutative, but one is commutative, and the other is noncommutative. Each family consists of four Yetter-Drinfel'd Hopf algebras, corresponding to a fourth root of unity. Via the Radford biproduct construction, these Yetter-Drinfel'd Hopf algebras give rise to semisimple Hopf algebras of dimension 32. We will analyze the structure of these Hopf algebras and describe them from the point of view of extensions. We also discuss whether these Yetter-Drinfel'd Hopf algebras that arise from different roots of unity are isomorphic, and answer the analogous question for the Radford biproducts.

Simon Lentner

Universität Hamburg, Germany

Folded Nichols algebras and the logarithmic Kazhdan-Lusztig conjecture

Nichols algebras are Hopf algebras in a braided sense that fulfill some universal property. They are an essential part in the description and classification of Hopf algebras. For example, the Borel part of a quantum group is a Nichols algebra. In the first half of the talk, I will give an introduction to Nichols algebras and review a second class of examples, each associated to a simple Lie algebra and an outer automorphism, which I have constructed some time ago. In the second half of the talk, I will explain more recent work on how Nichols algebras determine the zeroes of certain complex-valued integrals. The philosophy behind these statements is a deep conjectural equivalence of representation categories associated to quantum groups and to certain conformal field theories. We have increasing evidence for such a correspondence in the second class of examples.

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Alexandre Lourdeaux

University of Alberta, Canada

Brauer invariants of linear algebraic groups

The notion of cohomological invariants of algebraic groups was formalized by Serre in the 90's. It allows to study the geometry of linear algebraic groups or forms of an algebraic structure (such as central simple algebras with involutions) via Galois cohomology. We intend to introduce the general ideas of the theory and to present a generalization of a result by Blinstein and Merkurjev about invariants with values in the Brauer groups of fields for smooth and connected linear algebraic groups.

Eduardo Martínez-Pedroza

Memorial University, Canada

Eilenberg-Ganea phenomena and coarse geometry

The Eilenberg-Ganea conjecture states that if a group has cohomological dimension two then it has geometric dimension two. It is known this this conjecture cannot hold simultaneously with the Whitehead asphericity conjecture by work of Bestvina and Brady. There are examples of groups that show that certain analogues of the EG-conjecture are false. The talk will introduce some of these topics and give an overview of an argument that shows that the existence of one counter-example to the EG-conjecture (resp. analogue of the EG-conjecture) implies that there are uncountably many geometrically different counter-examples to the EG-conjecture (resp. analogue of the EG-conjecture). Based on joint work with Luis Jorge Sánchez Saldaña (UNAM).

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Mitja Mastnak

Saint Mary's University, Canada

Graded deformations of Nichols algebras

Lie algebra structures on a fixed vector space V are in bijective correspondence with graded bialgebra deformations of the symmetric algebra $S(V)$. The analogue of symmetric algebras in braided categories are Nichols algebras. In earlier joint work with I. Angiono and M. Kochetov we have shown that in many situations (including diagonal braidings and symmetric braidings arising from coactions of finite dimensional cotriangular bialgebras), finite dimensional Nichols algebras are rigid. After discussing some preliminaries and the joint work mentioned above, I will also discuss some work in progress, joint with M. Kochetov, on graded braided deformations of some infinite dimensional Nichols algebras where the braiding is neither diagonal nor symmetric.

Ehud Meir

University of Aberdeen, United Kingdom

Interpolations of monoidal categories by invariant theory

In this talk I will consider algebraic structures such as Lie, Hopf, and Frobenius algebras. I will show that under certain assumptions such structures can be reconstructed from their scalar invariants. I will then show how one can interpolate the category of representations of the automorphism groups of the structures by interpolation of the invariants of the algebraic structures. In this way we recover the constructions of Deligne for categories such as $\mathrm{Rep}(S_t)$, $\mathrm{Rep}(O_t)$ and $\mathrm{Rep}(Sp_t)$, as well as some of the constructions done by Knop and by Khovanov-Ostrik-Kononov.

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Erhard Neher

University of Ottawa, Canada

Springer's theorem on quadratic forms

We give an introduction to Springer's theorem on quadratic forms: If a regular quadratic form q over a field becomes isotropic after an odd degree field extension, then already q is isotropic. We will also discuss generalizations and applications. The talk is based on joint work with Philippe Gille.

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Cornelius Pillen

University of South Alabama, USA

On the Humphreys-Verma conjecture, Donkin's tilting module conjecture and a question of Jantzen

Let G be a simple, simply connected algebraic group over an algebraically closed field of prime characteristic p. In 1973, Humphreys and Verma conjectured that the principal indecomposable modules of the associated restricted Lie algebra can be lifted to G. For large p, it was shown by Ballard and Jantzen that this conjecture is true. In 1990, Donkin made the more precise conjecture that these liftings should in fact be tilting modules for G. While also known to be true for large primes, it was fairly recently shown that this stronger conjecture fails to hold in general. Donkin's tilting module conjecture is closely linked to a second conjecture of his on the existence so-called good p-filtrations for certain modules of G. This second conjecture would give a positive answer to a question raised by Jantzen in 1980. In this talk we will discuss recent developments on these conjectures and Jantzen's question. Most of the results presented are based on joint work with Dan Nakano, Chris Bendel and Paul Sobaje.

Dorette Pronk

Dalhousie University, Canada

Colimits of double categories

When we view groups as one-object categories, this provides us, among other things, with the ability to consider generalizations of the notion of colimit of groups. The colimit of a diagram of groups as categories is not the same as the colimit in the category of groups. For instance, a coproduct of two groups becomes a category with two objects and we only obtain the coproduct of the groups by taking the free category generated by a quotient of this coproduct category. Furthermore, since the category **Cat** of categories is a 2-category, we may also consider various notions of weak colimit: pseudo, lax and oplax colimits (some of these may not even be groupoids). This has proven especially useful for groups and groupoids with additional structure, such as Lie groupoids and topological groupoids. The tom Dieck fundamental groupoid for a manifold with an action by a compact Lie groupoid is an important example of this: it can be obtained as an oplax colimit of local fundamental groupoids by a Van Kampen type of result.

Recent literature (e.g., [1]) has shown that double groupoids form a useful presentation for matched pairs of groups and have further led to the study of matched pairs of groupoids. These and other applications of double categories lead us to investigate colimits of double groupoids, or more generally, double categories. The category of double categories and double functors can be viewed as a 2-category in two distinct ways: with horizontal transformations and with vertical transformations. This has led us naturally to consider colimits in two flavours: either horizontally or vertically lax [4]. These are 2-colimits in the sense that they are indexed by a 2-category (or bicategory).

However, recent questions about actions of groups and topological complexity have led us to consider diagrams that are indexed by a double category. The first challenge is then to define what an indexing functor from a double category to the category of double categories is, because the latter is not a double category. Since the category **DblCat** of double categories has only one type of arrows (namely, double functors), both horizontal and vertical arrows in the indexing double category $\mathcal{D}$ will be mapped to double functors. However, at the level of cells we need to make a choice: $\mathcal{D}$ has only one type of 2-dimensional cells, whereas **DblCat** has two: horizontal and vertical transformations. Here we make the choice to send the cells to vertical transformations. Such an indexing functor will be called a *vertical functor* from $\mathcal{D}$ to **DblCat**. The information about which arrows in the domain are horizontal and which ones are vertical turns out to affect what transformations between such functors are (there is only one type and involves both horizontal and vertical arrows, and double cells). (Our notion of transformation is inspired by Bénabou's cylinder construction [2].) Hence, the notion of (op)lax colimit will also be lax in both directions (depending on the arrows in $\mathcal{D}$).

In this talk I plan to begin with a gentle review of double categories, double functors and horizontal and vertical transformations. I will then show how to adjust these concepts to obtain vertical indexing functors into **DblCat** and transformations between them, and finally introduce the oplax colimit in terms of a double category of elements construction. If there is time I will show how other 2-dimensional (op)lax colimits form special cases of this one.

References

[1] N. Andruskiewitsch, S. Natale, Double categories and quantum groupoids, *Publ. Mat. Urug.* 10 (2005) 11–51.

[2] J. Bénabou, Introduction to bicategories, *Reports of the Midwest Category Seminar*, Springer LNM 47 (1967) 1–77.

[3] M. Buckley, Fibred 2-categories and bicategories, *J. Pure Appl. Algebra* 218 (2014) 1034–1074.

[4] M. Grandis, R. Pare, Limits in double categories, *Cah. Topologie Géom. Différ. Catégoriques* 40 (1999) 162–220.

[5] M. E. Descotte, E. J. Dubuc, M. Szyld, Sigma limits in 2-categories and flat pseudofunctors, *Adv. Math.* 333 (2018) 266–313.

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David Riley

University of Western Ontario, Canada

Combinatorial criteria for an algebra endowed with an action to satisfy a polynomial identity

Let R be a unitary associative algebra over a field k. We say that an associative k-algebra A endowed with an R-action is a *hypomorphic R-algebra* whenever:

$$R \cdot (ab) \subseteq \operatorname{span}_k\{(R \cdot a)(R \cdot b)\} + \operatorname{span}_k\{(R \cdot b)(R \cdot a)\},$$

for all $a, b \in A$. Furthermore, we say A is *R-rewritable* if for some integer d:

$$a_1 \cdots a_d \in \sum_{1 \neq \sigma \in S_d} \operatorname{span}_k\{(R \cdot a_{\sigma(1)}) \cdots (R \cdot a_{\sigma(d)})\},$$

for all $a_1, \ldots, a_d \in A$, where S_d denotes the symmetric group of degree d. Consider now any associative hypomorphic R-algebra A with the property that the algebra of endomorphisms of A induced by the R-action is finite-dimensional. We prove that, if A is R-rewritable, then A is a PI-algebra. We also prove that an analogous result holds for Lie algebras, thereby extending a collection of known results in associative and Lie PI-theory. The talk is based on joint work with Mayecxiliana Cárdenas Montoya.

Cameron Ruether

University of Ottawa, Canada

Twisting linear algebraic groups and Hopf algebras

We begin by reviewing the well-known story that central simple algebras over a non-algebraically closed field F are twisted forms of matrix algebras. This procedure readily applies to linear algebraic groups which come from subgroups of $M_n(F)$, such as SL_n or SO_n, to produce their twisted counterparts, $SL(A)$ or $SO(A,t)$, where t is an orthogonal involution on A, and the procedure also extends to all classical linear algebraic groups. In particular we show that we can twist $Spin_n$ and $HSpin_n$ to produce $Spin(A,t)$ and $HSpin(A,t)$. In addition, as it is needed for the result about $HSpin$, we discuss how the twisting story for linear algebraic groups is mirrored in their representing Hopf algebras.

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Ivan Shestakov

Universidade de São Paulo, Brazil

Non-matrix varieties and coordinatization theorems for nonassociative algebras

The talk consists of two parts. The first part is devoted to varieties that do not contain matrix algebras. These varieties were introduced and first studied for associative algebras by V. N. Latyshev (see 'The complexity of non-matrix varieties of associative algebras. I, II', Algebra i Logika 16, 2, p. 149–183, 184–199, 1977). Various characterizations of non-matrix varieties were obtained by S. P. Mishchenko, V. M. Petrogradsky, and A. Regev (see 'Characterization of non-matrix varieties of associative algebras', Israel Journal of Mathematics, 182, p. 337–348, 2011).

We define non-matrix varieties for some classes of nonassociative algebras and obtain their characterizations, generalizing the results of the latter paper.

The second part of the talk is devoted to the coordinatization theorems for alternative and Jordan algebras, containing the matrix algebra of order 2 and the symmetric matrix algebra of order 2, correspondingly, with the same unit. Besides, we consider the coordinatization theorem for octonions in the class of right alternative algebras.

Ivan Shestakov

Universidade de São Paulo, Brazil

Public lecture:

Tame and wild automorphisms of free algebras

An automorphism φ of a free algebra $F_{\mathcal{V}}[x_1, \ldots, x_n]$ from a class $\mathcal{V}$ is called *elementary* if it is of the form

$$\varphi : (x_1, \ldots, x_i, \ldots, x_n) \to (x_1, \ldots, \lambda x_i + f, \ldots, x_n),$$

where $0 \neq \lambda \in F$ and the element f belongs to the subalgebra generated by $x_1, \ldots, x_{i-1}, x_{i+1}, \ldots, x_n$.

An automorphism is called *tame* if it can be represented as a composition of elementary automorphisms, otherwise it is called *wild*.

It is known that the automorphisms of the polynomial algebra and of the free associative algebra are tame in the case of two generators, while in the case of three generators there exist wild automorphisms. In our talk, we will discuss known results and open problems on tame and wild automorphisms in various classes of algebras.

Irina Sviridova

Universidade de Brasília, Brazil

A hook theorem for identities with additional structures

One of the key results of the classical theory of polynomial identities of algebras in the case of a field of characteristic zero is the famous Hook theorem, see e.g. [2]. This well-known result is fundamental for applications of the technique of the classic representation theory of the symmetric group to study identities. It has essential connections with many important facts of PI-theory, and implies many important consequences. In particular, it is one of the basic results for Kemer's positive solution of the Specht problem [1].

The theorem describes the form of Young diagrams associated with the multilinear part of the relatively free algebra of varieties. In some sense, the Hook theorem limits the size of Young diagrams corresponding to non-identities of a variety, and is directly connected with exponential bound of asymptotic behaviour of the multilinear part of the relatively free algebra of a variety. It is also well known that the parameters on the form of Young diagrams defined by the Hook theorem (parameters of the size of the infinite hook) are also connected with structure characteristics of carriers of varieties, and define the growth of varieties of associative PI-algebras over a field of characteristic zero.

In the last years, one of the most popular directions of the theory of polynomial identities is to consider algebras with some additional structures (such as gradings, involutions, actions by automorphisms, etc.), and to study identities of such algebras with the additional signature. It is natural to extend key results of the classical theory for these algebras, and its identities, when it is possible.

We will discuss the versions of the Hook theorem for various types of such identities with complementary structures. In particular, we will represent some version of the Hook theorem for graded identities with action of a color anti-automorphism of finite order. This result generalises the analogous results for graded identities, identities with involution, graded identities with a graded involution, and graded identities with a super-involution. We also will discuss some possible consequences and applications of this theorem.

The talk is based on joint work with Renata Alves da Silva. The authors are partially supported by CNPq and CAPES.

References

[1] A. R. Kemer, Ideals of identities of associative algebras, Amer. Math. Soc., Translations of Math. Monographs 87, Providence, R.I., 1991.

[2] A. Giambruno, M. Zaicev, Polynomial identities and asymptotic methods, Amer. Math. Soc., Math. Surveys and Monographs 122, Providence, R.I., 2005.

Nicholas Touikan

University of New Brunswick, Canada

Panel collapse and many-ended topological groups

Panel collapse is a technique used to equivariantly eliminate free faces of CAT(0) cube complexes and is a versatile tool to make groups act on trees. In this talk, I will present panel collapse and give a simple proof of a 1974 result of Abels that generalized Stallings's End Theorem, which relates decompositions of groups of graph automorphisms as amalgams over compact open subgroups and the presence of finite essential cutsets in the graph they act on.

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Henry Tucker

UC Riverside, USA

Frobenius-Schur indicators and Drinfel'd centers for quadratic fusion categories

Quadratic categories are fusion categories with a unique non-trivial orbit from the tensor product action of the group of invertible objects. Familiar examples are the near-groups (with one non-invertible object) and the Haagerup-Izumi categories (with one non-invertible object for each invertible object). Frobenius-Schur indicators are an important invariant of fusion categories generalized from the theory of finite group representations. These indicators may be computed for objects in a fusion category C using the modular data of the Drinfel'd center $Z(C)$ of the fusion category, which is itself a modular tensor category. Recently, Izumi and Grossman provided new (conjecturally infinite) families of modular data that include the modular data of Drinfel'd centers for the known quadratic fusion categories. We use this information to compute the FS indicators; moreover, we consider the relationship between the FS indicators of objects in a fusion category C and FS indicators of objects in that category's Drinfel'd center $Z(C)$.

Kent Vashaw

Massachusetts Institute of Technology, USA

On the spectrum and support theory of a finite tensor category

Determining the precise relationship between the cohomological support varieties of Quillen and Carlson on the one hand and the tensor triangular support of Balmer on the other hand is a central problem in the study of stable categories of finite tensor categories. In this talk, we will introduce a certain subalgebra of the cohomology ring of a finite tensor category, and construct a surjective continuous map from the Balmer spectrum of the associated stable category to the Proj of this ring. We prove that this map is a homeomorphism in many cases, and conjecture that this holds in general. Concrete examples arising from the representation theory of Hopf algebras will be used to illustrate the general theory. This project is joint with Daniel Nakano and Milen Yakimov.

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Geoffrey Vooys

Dalhousie University, Canada

Derived categories of equivariant sheaves

If G is a smooth algebraic group over a field K and X is a left G-variety over K, then the construction of the equivariant (bounded) derived category $D^b_G(X)$ is known to be complicated and to require equivariant descent in order to be defined. This implies the question of why it is that we need to go through these steps in order to construct $D^b_G(X)$; why not just work with the (bounded) derived category of equivariant sheaves $D^b(\mathbf{Shv}_G(X))$? In this talk we will present an example, based on a list of properties $D^b_G(X)$ satisfies, in order to show that $D^b(\mathbf{Per}_{\mathrm{SL}_2}(-)) \simeq D^b(\mathbf{Shv}_{\mathrm{SL}_2}(-))$ need not be an equivariant derived category for any field K of characteristic zero.

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Kirill Zaynullin

University of Ottawa, Canada

The correspondence product and the coproduct on oriented equivariant cohomology theories

We discuss the correspondence product on equivariant oriented cohomology theories. In particular, we study its behavior with respect to the characteristic and Borel maps. We also describe the associated coproduct structure on the (augmented and reduced) structure algebras. This is joint work in progress with Martina Lanini and Rui Xiong.

Changlong Zhong

SUNY Albany, USA

K-theory stable bases of Springer resolutions

In enumerative geometry, K-theory stable bases are defined by Maulik and Okounkov and are used to construct a quantum group action on the K-theory of quiver varieties. In this talk I will focus on such bases for Springer resolutions. I will talk about the connection between K-theory stable bases, the Hecke algebra, and the wall crossing functors.