hausdorff CENTER FOR MATHEMATICS

UNIVERSITÄT BONN

QTMART

"Queer and Trans Mathematicians in Algebra and Representation Theory"

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organized by

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Abstracts

Ramla Abdellatif (Université de Picardie Jules Verne)

Welcome to the p-modular world

Abstract: Given a prime integer p, the goal of this talk is to explain how the p-modular representation theory of p-adic groups strongly differs from the classical representation theory of p-adic groups (i.e. over complex vector spaces) and from the ℓ-modular representation theory when ℓ is a prime integer other than p. We will use the basic examples of $\mathrm{GL}_2(F)$ and $\mathrm{SL}_2(F)$, with F being a finite extension of the field of p-adic numbers, as guidelines, so that no specific background beyond classical representation-theoretic definitions is required.

Chris Bowman (University of York)

Diagrammatic algebra and modular representation theory

Abstract: We introduce the idea of a "modular representation" of a group and discuss how the structure of these modular representations can be encapsulated within a remarkable family of polynomials, defined by Kazhdan and Lusztig in the 1980s. Many properties of these polynomials have remained mysterious for over forty years . . . we will spill the tea on how Elias–Williamson's diagrammatic algebras can be used to enrich our understanding of these polynomials. Time allowing, we might discuss the applications in knot theory, statistical mechanics and elsewhere.

Aram Dermenjian (Universidad de Sevilla)

The strong exchange property of Coxeter Matroids

Abstract: This talk assumes no prior knowledge for any of the terms mentioned in this abstract. Coxeter matroids are an interesting generalization of matroids through the use of root systems. Borovik, Gelfand and White give a description of a strong exchange property for Coxeter matroids and give an example of a Coxeter matroid which does not satisfy the strong exchange property. In this talk we describe precisely when Coxeter matroids satisfy the strong exchange property using representation theory, tropical geometry and polytope theory.

Darius Dramburg (Uppsala University)

Skew-group algebras in higher Auslander-Reiten theory

Abstract: Starting from the classical McKay correspondence, I want to present some interesting interactions between higher Auslander-Reiten theory and the geometry of quotient singularities. I will recall the notions of (higher) representation-infinite algebras and (higher) preprojective algebras, and we will see many examples coming from skew-group algebras. In some special cases, we will answer the question when a skew-group algebra is higher preprojective. Answering this question in so-called "higher type " gives a correspondence between higher type algebras and crepant divisors, and I want to finish by explaining some open questions. This is based on joint work with Oleksandra Gasanova.

Matthias Fresacher (Western Sydney University)

Congruence Lattices of Finite Twisted Brauer and Temperley-Lieb Monoids

Abstract: In 2022, East and Ruškuc published the congruence lattice of the infinite twisted partition monoid. As a by product, they established the congruence lattices of the finite d-twisted partition monoids. This talk is a first step in adapting the work of East and Ruškuc to the setting of the Brauer and Temperley-Lieb monoid. Specifically, it presents the newly established congruence lattice of the 0-twisted Brauer and Temperley-Lieb monoids. With simple to grasp visual multiplication and applications in theoretical physics and representation theory, the family of diagram monoids are of particular interest to a number of fields as well are of stand alone interest.

Chris Grossack (UC Riverside)

How to Compute with (Locally) Gentle Algebras by Doodling

Abstract: (Locally) gentle algebras are a broad family of algebras whose representation theory is well understood (and computationally effective!), which makes them an excellent testing ground for new conjectures. In this expository talk we'll discuss the "geometric model" for (locally) gentle algebras, due to Haiden–Katzarkov–Kontsevich, Opper–Plamondon–Schroll, and Lekili–Polishchuk, and show how you can compute everything about the derived category by drawing curves on surfaces and counting intersection points. Given time, we'll discuss applications of this machinery to the speaker's thesis work, relating the HOMFLY skein relation in a surface to the Hall algebra of that surface's Fukaya category.

Daan Janssen (University of York)

Quantum fields, local algebras and their representations

Abstract: I give a brief introduction into the algebraic approach to quantum field theory (AQFT), discussing the notion of local algebras of observables and their representations. As an application, I comment on recent developments towards an algebraic description of quantum gravity, combining ideas from the theory of von Neumann algebras, Tomita-Takesaki modular theory and Mackey's imprimitivity theorem.

Thibault Juillard (Université Paris Saclay / Polytechnique)

Reduction by stages for affine W-algebras

Abstract: Affine W-algebras form a family of vertex algebras generalising affine and Virasoro Lie algebras. They are in 1-to-1 correspondence with some affine Poisson varieties, the Slodowy slices. In this talk, I will present how one can use Poisson geometry to prove reduction by stages for affine W-algebras. By definition, we say that reduction by stages holds whenever some W-algebra can be obtained as the noncommutative Hamiltonian reduction of another W-algebra. This work is joint with Naoki Genra.

Maximilian Kaipel (Universität zu Köln)

τ-tilting finiteness under base field extension

Abstract: In rare cases, a finite-dimensional associative algebra admits only finitely many indecomposable modules up to isomorphism. In this case, the algebra is usually easy to understand and we call it representation finite. On the other hand, for representation infinite algebras, a general understanding of all modules is beyond hope. Thus, it makes sense to restrict our attention to particular families of modules. In this talk, we focus on τ-tilting modules, which are closely related to the theory of cluster algebras. As it turns out, many representation infinite algebras have only finitely many basic τ-tilting modules up to isomorphism, in which case we call them τ-tilting finite.
Let $L : K$ be a field extension. A theorem of Jensen-Lenzing from 1982 states that if a K-algebra A is representation finite, then the L-algebra $A \otimes_K L$ is also representation finite, provided that $L : K$ is "nice enough". In my talk I will discuss the question of whether τ-tilting finite algebras are similarly preserved under base field extension, illustrating the theory on many examples. This is based on joint work with Erlend D. Børve.

Tessa Kammermeier (University of Hamburg)

Cauchy Completion of Categories

Abstract: Cauchy completing a category is the construction of adding all absolute colimits to a given category, where absolute colimits are those colimits which are preserved by any and all functors. This being a very restrictive definition, absolute colimits form a comparatively small class of colimits which are realised by quite canonical and natural constructions. Which constructions correspond to absolute colimits varies by what extra structures a category has, namely its enrichment. In this talk, I will briefly go over the definition absolute colimits and give interesting examples of absolute colimits in different settings, including in the setting of 2-categories.

Justina Lückehe (Universität der Bundeswehr München)

Fitting invariants of some modules in non-commutative Iwasawa theory

Abstract: The (zeroth) Fitting ideal of a finitely presented torsion module over a commutative ring is contained in the annihilator of the module, but is generally easier to calculate than the latter. Nickel, Johnston and Kataoka generalised the concept of Fitting invariants to certain non-commutative rings. Kataoka's theory of shifts of Fitting invariants gives rise to a generalisation of the MacRae invariant which is compatible with the relative K-theory of the algebra. We consider Iwasawa algebras of one-dimensional admissible p-adic Lie extensions of number fields and prove localisation formulas for the

two invariants mentioned above. Finally, we use this theory to calculate the Fitting invariants of certain Iwasawa modules, locally in a large number of cases and globally for special ones. This is work in progress.

Ben Mills (University of York)

A combinatorial presentation for the Hecke category

Abstract: Ever since being defined in the 1970s, the Kazhdan–Lusztig polynomials have been a source of research problems for representation theorists. Recently, interpreting these polynomials as composition factors of modules in the Hecke category has resulted in proof of the famous Kazhdan–Lusztig positivity conjecture and helped produce a counter-example to Lusztig's equally famous conjecture. In this talk, we'll present a 'nice' combinatorial way to describe the algebraic structure of the Hecke category using (the top half of) oriented Temperley-Lieb diagrams. This will allow us to create an isomorphism between the Hecke category and Khovanov arc algebra (of knot theory fame) in type D, which this talk will focus on, although similar results for types A and B exist.

Sven Möller (Universität Hamburg)

Vertex Algebras for Quiver Varieties

Abstract: Vertex algebras describe two-dimensional conformal field theories in physics. They can be viewed as "chiral quantisations" of symplectic varieties. In this talk, I will explain how to construct vertex algebras over Nakajima quiver varieties by quantum Hamiltonian reduction. As an application, we construct vertex algebras that appear in the context of three- and four-dimensional superconformal field theories. I will also discuss the relation to 3d mirror symmetry and symplectic duality.

Ian Musson (University of Wisconsin-Milwaukee)

Weyl groupoids, Young diagrams and Borel subalgebras

Abstract: Let $\mathtt{k}$ be an algebraically closed field of characteristic zero. Let $\overset{\circ}{\mathfrak{g}}$ be the Lie superalgebra $\mathfrak{sl}(n|m)$ and let $\mathfrak{T}_{iso}$ be the groupoid introduced by Sergeev and Veselov with base the set of odd roots of $\overset{\circ}{\mathfrak{g}}$. We show the Cayley graphs for three actions of $\mathfrak{T}_{iso}$ are isomorphic. These actions originate in quite different ways. The first arises from Young diagrams contained in a rectangle with n rows and m columns, the second from Borel subalgebras of the affinization $\widehat{L}(\overset{\circ}{\mathfrak{g}})$ of $\overset{\circ}{\mathfrak{g}}$ which are related by odd reflections. The third action comes from an action of $\mathfrak{T}_{iso}$ on $\mathtt{k}^{n|m}$ defined by Sergeev and Veselov motivated by deformed quantum Calogero-Moser problems.

David Nkansah (Aarhus University)

Homological Algebra Without Grading

Abstract: Complexes are a fundamental object in homological algebra, and as such, grading is deeply ingrained in the subject. But what happens if we remove the grading from a complex? This leads us to the notion of a differential module. In this talk, we will explore how the finiteness of the injective dimension of a finitely generated module over a local commutative noetherian ring can be detected using this ungraded framework. As an immediate application, we will see that this perspective also

detects when such a ring is Cohen–Macaulay. This approach offers a new perspective on a classical question posed by H. Bass.

J. Daisie Rock (FWO, KU Leuven, UGent)

On finite-ness, discrete-ness, and when to let them go

Abstract: I will start with quivers and their representaions, including an overview on some applications. From here we will start peeling away finite-ness and discrete-ness assumptions. We will discuss different types of quivers and their representations (infinite, thread, continuous, generalized thread); cluster categories and related structures (infinite, continuous, semi-discrete), and a continuous-dimensional associahedron. Technical expertise is not required! We will focus on intuitive descriptions and pictures. Instead of one biographical section, throughout the talk I will point at my life as it relates to mathematics and the point of this conference. There is a lot of joint work mentioned in this talk, all of which is noted in the slides.

Beth Romano (King's College London)

Slodowy slices in graded Lie algebras

Abstract: Vinberg theory of graded Lie algebras is a beautiful part of algebra that has applications to a wide range of mathematics, including the representation theory of p-adic groups and arithmetic statistics. In this talk, I'll give an introduction to this area via examples. Time permitting, I'll show how to adapt a construction of Slodowy to the setting of graded Lie algebras to produce families of algebraic curves. This is based on joint work with Jef Laga, and generalizes work of Jack Thorne.

Dani Tubbenhauer (University of Sydney)

Picture recognition and quantum algebra

Abstract: Mathematical knots, appearing everywhere from category theory to DNA, are visual objects, yet recognizing them from images remains a challenge. This friendly introduction outlines a project aimed at automated knot recognition from everyday pictures (e.g., taken with your phone), using tools from quantum algebra (think: Jones polynomial), though we are still far from that goal.

Marco Vergani (University of Florence)

Alternating groups and 69: when uniformity meets rational partitions

Abstract: This seminar explores the uniformly semi-rationality property of alternating groups. These groups are of particular interest as they constitute a generalization of the well-studied CUT groups. The study of simple groups with this property ultimately reduces to examining alternating groups. Using combinatorial arguments and a seemingly unrelated numerical result, that all natural numbers greater than 69 possess a rational partition, we proved that there are only a finite number of alternating group that have this uniformity condition.

Jay Wang (City St George's, University of London)

On the solvability of the Lie algebra $\mathrm{HH}^1(B)$ for blocks of finite groups

Abstract: We give some criteria for the Lie algebra of first degree Hochschild cohomology of the twisted group algebra, i.e. $\mathrm{HH}^1(k_\alpha(P \rtimes E))$, to be solvable, where P is a finite abelian p-group, E is an abelian p'-subgroup of $\mathrm{Aut}(P)$ and $\alpha \in Z^2(E; k^\times)$ inflated to $P \rtimes E$ via the canonical surjection $P \rtimes E \to E$. As a special case, this gives the criterion to the solvability of the Lie algebra $\mathrm{HH}^1(B)$ where B is a p-block of a finite group algebra with abelian defect P and inertial quotient E.