Venue: Mathematical Institute, Endenicher Allee 60, Bonn

Timetable

50 min talk + 10 min discussion + 15 min break

	Mon	**Tue**	**Wed**	**Thu**	**Fri**
9:00	Ostrik	Snowden	Etingof	Benson	Stroppel
10:15	Witherspoon	Utiralova	Plavnik	Entova-Aizenbud	Negrón
11:30	Andruskiewitsch	Heidersdorf	Shimizu	Harman	Nikshych
12:30					
14:15	Serganova	Davydov		Pevtsova	
15:30	Stroiński	Schweigert		Gruber	
16:45	Lentner			Angiono	
17:45					

Contents

1. Victor Ostrik: Finite tensor categories from quantum groups

I will describe partly conjectural construction of finite braided tensor categories from quantum groups at roots of unity. The construction is based on the theory of tilting modules and cells in affine Weyl groups. This is based on joint work with Coulembier, Etingof, and with Utiralova.

2. Sarah Witherspoon: Support theory for tensor categories and module categories

We will discuss two types of topological spaces associated to tensor triangulated categories and their module categories, the Balmer support and the cohomological support. These spaces are tools for understanding the structure of the categories, for example their tensor ideals, in settings where connections between these support spaces are understood. We will focus specifically on categories of modules and bimodules for an algebra. This is joint work with Kent Vashaw and Oeyvind Solberg.

3. Nicolás Andruskiewitsch: Pointed Hopf algebras over finite simple groups

The question of classifying finite-dimensional Hopf algebras over finite simple groups is nearing completion, thanks to the efforts of many authors. An overview of the methods used for this problem and the results obtained so far will be presented.

4. Vera Serganova: Abelian envelope of the Deligne's category $GL(t)$

We discuss the highest weight structure on the abelian envelope $\mathcal{V}(t)$ of $GL(t)$ for integer t, which now follows from recent general results of Flake and Gruber. We classify the blocks of $\mathcal{V}(t)$, compute some Ext groups and Kazhdan-Lusztig coefficients.

5. Mateusz Stroiński: Jacobson radicals for finite tensor categories and their generalizations

A finite-dimensional algebra is semisimple if and only if its Jacobson radical vanishes. I will present a generalization of this result to the setting of algebra objects in finite tensor categories, and show how to apply it to obtain a characterization of exact module categories among more general finite abelian module categories, of finite tensor categories among more general finite abelian monoidal categories, and finally also of 2-categories of module categories among more general (but in a sense finite) 2-categories. This is based on joint (and in part ongoing) works with Kevin Coulembier, Thibault Décoppet and Tony Zorman.

6. Simon Lentner: New Nichols algebras, braided tensor categories and conformal field theory

To any object in a braided tensor category we can associate a Nichols algebra, either through braid group combinatorics or through a universal property. The main motiviation for Nichols algebras is to systematically construct the quantum group from its Cartan part, but it can be used to construct many novel braided tensor categories.

In conformal field theory, braidings appear as monodromies of certain differential equations such as the Knizhnik–Zamolochikov equation. The Kazhdan–Lusztig correspondence links the representation theory appearing in such conformal field theories to quantum groups. Using Nichols algebras and other categorical tools, we have recently proven a nonsemisimple version of this result conjectured by Feigin et al. In our most recent work, we determine the braided tensor category of modules of affine $\mathfrak{sl}_2$ at admissible level in terms of a new type of quantum group.

7. Andrew Snowden: The Drinfeld center of an oligomorphic tensor category

I will describe some results (joint with Pavel Etingof) on the Drinfeld center of a tensor category coming from an oligomorphic group. We introduce a class of objects in the center called Yetter–Drinfeld modules, and show that (under some conditions) they account for all objects in the center. This gives a complete description of the center in a number of cases, including the Delannoy category, the arboreal categories, and many interpolation categories.

8. Alexandra Utiralova: An example of a braided finite tensor category not Witt equivalent to any semisimple category

My talk will be a continuation of Victor's talk, in which I'll talk more about concrete examples of braided finite tensor categories obtained from the category of tilting modules for quantum $U(\mathfrak{g})$. In particular, I will discuss in detail an example of a non-degenerate braided tensor category, which is not Witt equivalent to any semisimple category.

9. Thorsten Heidersdorf: Tensor ideals in oligomorphic permutation categories

Tensor ideals (on morphisms or objects) are important invariants of tensor categories. While the classification and explicit construction of all such ideals is often an intractable problem in complicated representation categories, it is often easier in diagrammatic tensor categories.

For the Deligne categories $\underline{\mathrm{Rep}}(S_t)$, $\underline{\mathrm{Rep}}(GL_t)$ and $\underline{\mathrm{Rep}}(O_t)$ (where t is a complex number) this was completed a couple of years ago by Comes, Coulembier, Heidersdorf and Ostrik. In the $\underline{\mathrm{Rep}}(S_t)$ case there is a single tensor ideal $\mathcal{N}$, the negligible morphisms.

A very general construction of Harman and Snowden attaches to any oligomorphic group (G, Θ) and a measure μ a tensor category $\underline{\mathrm{Perm}}(G, \mu)$ of permutation modules, and it is natural to ask whether one can classify the tensor ideals (on morphisms or objects) in these categories.

I will show a classification theorem for any $\underline{\mathrm{Perm}}(G, \mu)$-category, but we will see that while some easy examples also have only one proper tensor ideal, the general situation is much more complicated than for $\underline{\mathrm{Rep}}(S_t)$.

This is joint work with Inna Entova-Aizenbud.

10. Alexei Davydov: Equivariant higher vector spaces

Higher categories of higher vector spaces are supposed to naturally form what is now called a categorical spectrum. Homotopy groups of this categorical spectrum are very non-trivial and interesting for applications. We examine their behaviour under the "change of base". One example of such change of base is passing from vector spaces to their equivariant versions.

11. Christoph Schweigert: Skein theory, Frobenius functors and CFT correlators

Skein theory is an efficient tool for the graphical construction of topological field theories and modular functors, based on a given input category . We show that a Frobenius monoidal functor induces a relation between the associated skein theories. We present a situation where this relation is an equivalence. This turns out to encode information about correlators of two-dimensional conformal field theories.

12. Pavel Etingof: Chevalley–Eilenberg cohomology of linearly reductive Lie algebras in the Verlinde category

Let k be an algebraically closed field of characteristic $p \geq 5$. Let Ver_p be the Verlinde fusion category over k, i.e., the semisimplification of $\mathrm{Rep}_k(\mathbb{Z}/p)$, with simple objects $L_1 = \mathbf{1}, L_2, \ldots, L_{p-1}$. Let Ver_p^+ be the even part of Ver_p, with simple objects $L_1, L_3, \ldots, L_{p-2}$. Let $\mathfrak{g}$ be a linearly reductive Lie algebra in Ver_p^+, i.e., one whose finite-dimensional representations are semisimple. For example, $\mathfrak{g}$ can be the image under semisimplification of a usual simple Lie algebra $\mathfrak{g}_k$ over k with action of $\mathbb{Z}/p$ by a principal (=regular) unipotent element when p exceeds the Coxeter number of $\mathfrak{g}_k$.

We first prove that $\mathfrak{g}$ is invariantless, i.e., the unit object of Ver_p^+ is not a summand of $\mathfrak{g}$. Next, for $3 \leq m \leq p-2$, m odd, set $\mathfrak{g}_m := \mathrm{Hom}_{\mathrm{Ver}_p^+}(L_m, \mathfrak{g})$ and define the graded vector space $E_\mathfrak{g} := \bigoplus_{\substack{3 \leq m \leq p-2 \\ m \text{ odd}}} \mathfrak{g}_m^{(1)}[m]$, where (1) denotes Frobenius twist and $[m]$ the grading; thus $E_\mathfrak{g}^* = \bigoplus_{\substack{3 \leq m \leq p-2 \\ m \text{ odd}}} \mathfrak{g}_m^{(1)*}[m]$. Our main result is that the Chevalley-Eilenberg cohomology $H^\bullet_{\mathrm{CE}}(\mathfrak{g})$ of $\mathfrak{g}$ with trivial coefficients is isomorphic to $\wedge^\bullet E_\mathfrak{g}^*$ as a graded algebra. We also show that the algebra $H^\bullet_{\mathrm{CE}}(\mathfrak{g})$ is naturally isomorphic to the de Rham cohomology $H^\bullet_{\mathrm{dR}}(G)$ of the group scheme $G := \exp(\mathfrak{g})$ and hence has a natural graded Hopf algebra structure given by multiplication in G, and prove that it corresponds to the usual graded Hopf algebra structure on $\wedge^\bullet E_\mathfrak{g}^*$.

Moreover, if V is a simple $\mathfrak{g}$-module on which $\mathfrak{g}$ acts nontrivially, then $H^\bullet_{\mathrm{CE}}(\mathfrak{g}, V) = 0$. Thus for every finite $\mathfrak{g}$-module V, $H^\bullet_{\mathrm{CE}}(\mathfrak{g}, V) \cong \wedge^\bullet E_\mathfrak{g}^* \otimes V^\mathfrak{g}$ as a $H^\bullet_{\mathrm{CE}}(\mathfrak{g}) \cong \wedge^\bullet E_\mathfrak{g}^*$-module. This implies the classical theorem of Borel and Chevalley on the cohomology of complex semisimple Lie algebras, as well as its analogue in sufficiently large positive characteristic.

The proof uses the vanishing of Exts in the category $\mathrm{Rep}(\mathfrak{g})$, which follows from its semisimplicity, together with the almost Koszul property of the object $\mathfrak{g} \in \mathrm{Ver}_p^+$.

This is joint work with Serina Hu.

13. Julia Plavnik: Exact Factorizations and Bicrossed Products of Fusion Categories

New constructions play a central role in fusion category theory, both as a source of new examples and as a way to better understand their structure. Exact factorizations provide a natural framework for building a fusion category from two fusion subcategories, extending analogous notions for finite groups and Hopf algebras.

In this talk, we will start by introducing exact factorizations of fusion categories and discussing some of their basic properties and examples. We will then define matched pairs of fusion categories and explain how they give rise to a new construction, called the bicrossed product, for which the tensor product and associativity constraints can be described explicitly. Finally, we will explore its connection with crossed extensions of fusion categories, together with some applications. This talk is based on joint work with Monique Müller and Héctor Martín Peña Pollastri.

14. Kenichi Shimizu: Galois connection between tensor subcategories and subalgebras

This talk is based on a joint work with Harshit Yadav. The Drinfeld center $\mathcal{Z}(\mathcal{C})$ of a finite tensor category $\mathcal{C}$ has a canonical Lagrangian algebra, say L. Under the assumption that $\mathcal{C}$ is semisimple (i.e., $\mathcal{C}$ is a fusion category), Davydov, Mueger, Nikshych and Ostrik proved that the lattice of subalgebras of L is anti-isomorphic to the lattice of fusion subcategories of $\mathcal{C}$. Motivated by their result, for a simple commutative algebra A in a braided finite tensor category $\mathcal{B}$, we establish a Galois connection between the lattice of subalgebras of A and the lattice of tensor full subcategories lying between the category of local A-modules in $\mathcal{B}$ and the category of all A-modules in $\mathcal{B}$. We also show that the Galois connection is in fact an anti-isomorphism if $\mathcal{B}$ is non-degenerate. This result, applied to $\mathcal{B} = \mathcal{Z}(\mathcal{C})$ and $A = L$, yields a non-semisimple generalization of the result of Davydov et al. We also remark that our result gives a bijection between the set of normal left coideal subalgebras of a Hopf algebra H in a braided finite tensor category and the set of Hopf ideals of H.

15. Dave Benson: Group schemes over symmetric tensor categories

I shall discuss the theory of affine group schemes over a symmetric tensor category. I will concentrate on the algebra of distributions, and show how to view the tangent space at the identity as a restricted Lie algebra in a suitable sense. This is joint work with Julia Pevtsova.

16. Inna Entova-Aizenbud: Odd orbits in Lie superalgebras

I will present the results of a joint project with V. Serganova. Given a supergroup G whose underlying even subgroup G_0 is reductive, we consider the G_0 orbits of odd elements in the Lie superalgebra $\mathrm{Lie}(G)$. I will describe how each odd element in the Lie superalgebra defines a "cohomological" monoidal functor on the category of representations of G and explain how the properties of the odd element relate to the properties of the monoidal functor.

17. Nate Harman: The tensor triangulated geometry of Delannoy categories.

Tensor categories associated to oligomorphic groups have proved to be a rich source of new and interesting behavior for abelian tensor categories. Passing to the bounded derived category or the stable module category, we obtain new examples of tensor triangulated categories, and it's natural to wonder if these will also exhibit interesting behavior from a tensor triangulated geometry perspective. I will discuss some initial steps in this direction, including the calculation of the Balmer spectra of tensor triangular categories associated to the circular and second Delannoy categories.

18. Julia Pevtsova: Schur algebras, symmetric groups, and tensor ideals

We study thick tensor ideals in the derived category of the Schur algebra $S(n, d)$ over a field of positive characteristic, relating our work to the recent results of Paul Balmer and Martin Gallauer on permutation modules and to (semi-)classical calculations in the category of strict polynomial functors. This is a preliminary report on a joint work with D. Benson, S. Iyengar, and H. Krause.

19. Jonathan Gruber: Monoidal highest weight envelopes via monoidal Ringel duality

Interpolation categories are a class of monoidal categories that interpolate classical families of representation categories, e.g. of the symmetric groups or general linear groups. In recent years, there has been a lot of interest in understanding the universal abelian tensor category (the so-called monoidal abelian envelope) containing a given interpolation category. In many cases, it has been observed that the monoidal abelian envelope is a highest weight category and that the interpolation category can be identified with the subcategory of tilting objects. The goal of this talk is to provide a general explanation for this phenomenon. Using a monoidal enhancement of Brundan-Stroppel's semi-infinite Ringel duality, I will explain how a large class of interpolation categories (e.g. Knop's tensor envelopes of regular categories) can be embedded as subcategories of tilting objects in highest weight tensor categories. If the interpolation category admits a monoidal abelian envelope, then the resulting highest weight category is the monoidal abelien envelope.

This talk is based on joint work with Johannes Flake.

20. Iván Angiono: Finite pointed tensor categories

We will review the state of art of the classification of finite pointed tensor categories over the complex number. In the meantime we will recall advances on the classification of finite dimensional pointed Hopf algebras and how to derive results on coquasi-Hopf algebras.

21. Catharina Stroppel: Centralisers and braidings with higher structure

22. Cris Negrón: Derived topological theories in dimension 3

I will discuss ongoing work on constructions of (Reshetikhin-Turaev style) TQFTs from derived categories of quantum group representations. Such theories can be constructed, at least in part, by "deriving" non-semisimple TQFTs from De Renzi et al. This derivation process is more or less complicated depending on whether one operates at the 1-categorical, or ∞-categorical level. I will try to focus on a view towards the future, where we might anticipate theories in both dimensions 3 and 4 for any "modular ∞-category", and an accompanying skein theory for such categories.

23. Dmitri Nikshych: Grothendieck Rings of Module Categories: Localizations, Strata, and Radicals

Let $\mathcal{B}$ be a non-degenerate braided fusion category. The relative tensor product makes the equivalence classes of indecomposable $\mathcal{B}$-module categories into a positive integral Grothendieck ring. We show that this ring carries a canonical filtration indexed by the poset of localizations, obtained from connected étale algebras in $\mathcal{B}$. The filtration arises from the description of module categories by residual Lagrangian correspondences: under composition, the residual category can only undergo further localization. Unlike ordinary fusion rings, the complexified module Grothendieck ring need not be semisimple. We develop this general framework and, for Drinfeld doubles of elementary abelian groups, identify the resulting localization geometry with finite orthogonal geometry and dual polar graphs. I will also explain how the top stratum becomes a sandwich algebra whose radical measures linear relations among Lagrangian algebra objects. This suggests a categorical analogue of the double Burnside algebra. Joint work with Riley Chinburg.