Hopf25

Book of Abstracts

Conference on Hopf algebras, quantum groups,
monoidal categories and related structures
22-26 April 2025 — ULB Brussels

Hopf25

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	Tuesday 22/4		
9h30-10h00	---		
10h00-10h30	---		
10h30-11h00	*Welcome & registration*		
11h00-11h30	*Coffee break*		
11h30-12h30	Keynote talk: Walton *Representations of braided categories*		
12h30-14h00	*Coffee break*		
	Forum E	Forum F	Forum G
14h00-14h30	Sciandra *Hopf braces and semi-abelian categories*	Misurati *Quasi-Hopf algebras of dimension 6*	Davies *Categories graded by group homomorphisms*
14h30-15h00	Byott *Hopf-Galois structures and skew braces*	Ferreira *Braid group actions on quantum invariants of free algebras*	Grosskopf *Remarks on Hopf categories*
15h00-15h30	Darlington *Hopf-Galois structures on parallel extensions*	Taipe *On algebraic quantum transformation groupoids*	Bottegoni *Heavily semiseparable functors*
15h30-16h00	*Coffee break*		
16h00-16h30	Brown *Finiteness conditions on Hopf algebras*	Maksimau *Geometric categorification of Verma modules: Grassmannian Quiver Hecke algebras*	Aziz *Generalized Yetter-Drinfeld modules, center of bi-actegories, and bi-Galois co-objects*
16h30-17h00	Lomp *Generalized Kac-Paljutkin algebras*	Manko *Two families of non-factorisable ribbon Hopf algebras and 4d topology*	Green *Tannakian reconstruction for fusion 2-categories*

	Wednessday 23/4		
9h30-10h00	Ardizzoni *On the Hopf envelope of finite-dimensional bialgebras*		
10h00-10h30	Weber *Hopf-Galois extensions in noncommutative differential geometry*		
10h30-11h00	Schauenburg *Hopf bigalois extensions from skew parings of Hopf algebroids*		
11h00-11h30	*Coffee break*		
11h30-12h30	Keynote talk: Majid *Braided Lie algebras of quantum doubles (tentative)*		
12h30-14h00	*Lunch*		
	Forum E	Forum F	Forum G
14h00-14h30	Dokuchaev *(Co)Homology of partial smash products*	Aschieri *Noncommutative Levi-Civita connections*	Ros Camacho *Detecting algebra objects from NIM-reps in pointed, near-group and quantum group-like fusion categories*
14h30-15h00	Banarjee *Comodule theories in Grothendieck categories and relative Hopf objects*	Fioresi *Differential calculus on quantum principal bundles over projective bases*	Watkins *Functors from Bicrossed Fusion Categories*
15h00-15h30	Nguyen *Homological properties of braided Hopf algebras*	Pagani *Reductions of quantum principal bundles*	Singh *Tensor Algebras in the Representation Category of Taft Algebras*

	Thursday 24/4		
9h30-10h00	Lentner *Proving the logarithmic Kazhdan-Lusztig correspondence*		
10h00-10h30	O'Buachalla *Nichols algebras versus bimodule conections*		
10h30-11h00	Halbich *A non-semisimple version of the Kitaev model*		
11h00-11h30	*Coffee break*		
11h30-12h30	Keynote talk: Miemietz *Comonoidal structures on 2-categories and tensor products of 2-representations*		
12h30-14h00	*Lunch*		
	Forum E	Forum F	Forum G
14h00-14h30	Mahaman *Rings of differential operators and Hopf algebroids*	Bazlov *Twists of reflection groups and Cherednik algebras*	Barbier *Diagram categories of Brauer type*
14h30-15h00	Kour *Measurings of Hopf algebroids and morphisms in cyclic (co)homology theories*	Heidersdorf *On highest weight structures, Koszulity, and Khovanov algebras*	Langlois-Rémillard *A category of stripped cobordisms and generalised Deligne category*
15h00-15h30	Ferri *Matched pairs and Yetter-Drinfeld braces*	Krajczok *Braided tensor product of dynamical von Neumann algebras*	Décoppet *Higher Verlinde categories: the mixed case*
15h30-16h00	*Coffee break*		
16h00-16h30	Guédénon *Fundamental theorem of (A,g,H)-comodules*	Bhattacharjee *Bimodule connection for relative Hopf module over irreducible quantum flag manifolds*	Burciu *Ito-Michler type properties for braided fusion categories*
16h30-17h00	Han *Hopf Galois extensions of Hopf algebroids*	Carotenuto *Convex orderings and quantum tangent spaces*	Pena Pollastri *Exact Factorizations of fusion categories and the bicrossed product construction*

	Friday 25/4		
9h30-10h00	Henriques *Bicommutant categories*		
10h00-10h30	Fuchs *Grothendieck-Verdier module categories and Frobenius algebras*		
10h30-11h00	Jaklitsch *Frobenius functors and pivotal comodule algebras*		
11h00-11h30	*Coffee break*		
11h30-12h30	Keynote talk: Nikshych *Tannakian radical and mantle of a braided fusion category*		
12h30-14h00	*Lunch*		
	Forum E	Forum F	Forum G
14h00-14h30	Sommerhäuser *Mapping class group representations from Hopf algebras: examples*	Rivezzi *M-adapted functors and Hopf algebras*	Shibata *Exact module categories over $\mathrm{Rep}(u_q(\mathfrak{sl}_2))$*
14h30-15h00	Kashina *Semisimple Hopf algebras constructed as biproducts and their properties*	Massar *The Poisson-Fourier transform*	Stroinski *Simple algebras and exact module categories*
15h00-15h30	Gonzales Rodrigues *Factorizations and double cross products of Hopf quasigroups*	Meereboer *Symmetries for spherical functions of type χ for quantum symmetric pairs*	Batista *Globalization and the biactegory of partial modules*
15h30-16h00	*Coffee break*		
16h00-16h30	Kesten *On extended Frobenius structures*	Vercrleyen *Anyonica and the anyonwiki*	Škoda *Bicategorical Doi-Takeuchi correspondence and locally cleft noncommutative principal bundles*
16h30-17h00	Baker *Hopf Hecke algebras*	Xu *Étale algebras in 4D Dijkgraaf-Witten models*	Zorman *Deligne reconstruction for lax module monads*

	Saturday 26/4
9h30-10h00	Snyder *Interpolation categories for conformal embeddings*
10h00-10h30	Shimizu *Simple algebras in $\mathrm{Rep}(u_q(\mathfrak{sl}_2))$*
10h30-11h00	Virelizier *Monoidal categories graded by crossed modules*
11h00-11h30	*Coffee break*
11h30-12h30	Keynote talk: Andruskiewitsch *On the finite generation of the cohomology of abelian extensions of Hopf algebras*

Hopf25

Nicolás Andruskiewitsch
Universidad Nacional de Córdoba, Argentina
Plenary talk, Forum E
Saturday, April 26, 2025
11h30-12h25

On the finite generation of the cohomology of abelian extensions of Hopf algebras

A finite-dimensional Hopf algebra is called quasi-split if it is Morita equivalent to a split abelian extension of Hopf algebras. Combining results of Schauenburg and Negron, it is shown that every quasi-split finite-dimensional Hopf algebra satisfies the finite generation cohomology conjecture of Etingof and Ostrik. This is applied to a family of pointed Hopf algebras in odd characteristic introduced by Angiono, Heckenberger and the first author, proving that they satisfy the aforementioned conjecture.

Hopf25

Alessandro Ardizzoni
University of Turin, Italy
Plenary talk, Forum E
Wednesday, April 23, 2025
9h30-9h55

On the Hopf envelope of finite-dimensional bialgebras

It is well-known that the forgetful functor from the category of Hopf algebras to the category of bialgebras has a left adjoint that assigns to each bialgebra B its Hopf envelope $\mathrm{H}(B)$ (attributed to Manin, 1988). The known construction of $\mathrm{H}(B)$ is quite technical and the unit component of the adjunction at B, that is the bialgebra map $\eta_B : B \to \mathrm{H}(B)$, is not surjective in general. The aim of this talk is to show that, when B is finite-dimensional, then $\mathrm{H}(B)$ can be realized as an appropiate quotient bialgebra of B. Our proof relies on the fact that any such a bialgebra comes out to be an example of what we will call a n-Hopf algebra.

This talk is based on a joint work with C. Menini (Univ. Ferrara) and P. Saracco (ULB).

Hopf25

Paolo Aschieri
Università del Piemonte Orientale, Italy
Parallel sessions, Forum F
Wednesday, April 23, 2025
14h-14h25

Noncommutative Levi-Civita connections

We review different approaches to Levi-Civita connections on noncommutative spaces. Considering the metric as a dynamical field, no compatibility between the metric and the noncommutative structure is a priori required. For noncommutative spaces that are triangular quantum groups or their associated quantum (homogeneous) algebras existence and uniqueness of the Levi-Civita connection for arbitrary metrics is shown. Explicit examples, in particular associated with Sweedler Hopf algebra are presented. This generalises previous results on noncommutative Riemannian geometry obtained in the more restrictive context of Drinfeld twists. A key ingredient is the Cartan calculus with noncommutative covariant derivatives (connections). This leads to the Cartan structure equations and the Bianchi identities. Vacuum Einstein equations leading to noncommutative Einstein spaces are presented.

Hopf25

Ryan Aziz
Universitas Indonesia, Indonesia
Parallel sessions, Forum G
Tuesday, April 22, 2025
16h00-16h25

Generalized Yetter-Drinfeld Modules, Center of Bi-actegories, and bi-Galois Co-objects

This is a joint work with Joost Vercruysse.

The notion of Yetter-Drinfeld modules (or YD modules) are very much well-known in the Hopf algebra community, and many generalizations of YD modules, such as anti-YD modules or YD contramodules has been studied under different motivations. An interesting fact is that many different researches show that the category of YD modules (or its variant) over Hopf algebras, is equivalent to some center of category of modules over the said Hopf algebra. In this talk, we study the (perhaps) most generalized version of YD modules studied by Caenepeel, Militaru, and Zhu in their 2002 textbook and show that it is also equivalent as a center of suitable bi-category. Moreover, we study a connection between bi-Galois co-objects and Yetter-Drinfeld modules, leading to braided structures in the category of generalized Yetter-Drinfeld modules.

Hopf25

Andrew Baker
University of Glasgow, Scotland
Parallel sessions, Forum E
Friday, April 25, 2025
16h30-16h55

Hopf Hecke algebras

Hecke algebras and various generalisations have been used in many contexts. The case of a subgroup of a finite group is amongst the simplest although perhaps not so well known. In this talk I will discuss the related case of a pair of Hopf algebras which form a Frobenius extension with various additional conditions. The theory sheds light on and generalises some of the theory known for the group case.

Hopf25

Abhishek Banerjee
Indian Institute of Science, Bangalore, India
Parallel sessions, Forum E
Wednesday, April 23, 2025
14h30-14h55

Comodule theories in Grothendieck categories and relative Hopf objects

Our objective is to study cohomology theories by means of spectral sequences for relative Hopf modules with coefficients in a Grothendieck category. We begin by developing the categorical algebra of the noncommutative base change of a comodule category by means of a Grothendieck category $\mathfrak{S}$. We describe when the resulting category of comodules is locally finitely generated, locally noetherian or may be recovered as a coreflective subcategory of the noncommutative base change of a module category. We then introduce the category ${}_A\mathfrak{S}^H$ of relative (A, H)-Hopf modules in $\mathfrak{S}$, where H is a Hopf algebra and A is a right H-comodule algebra. We study the cohomological theory in ${}_A\mathfrak{S}^H$ by means of spectral sequences. Using coinduction functors and functors of coinvariants, we study torsion theories and how they relate to injective resolutions in ${}_A\mathfrak{S}^H$. Finally, we use the theory of associated primes and support in noncommutative base change of module categories to give direct sum decompositions of minimal injective resolutions in the category ${}_A\mathfrak{S}^H$ of relative (A, H)-Hopf modules in $\mathfrak{S}$ (this is joint work with M. Balodi and S. Kour).

Hopf25

Sigiswald Barbier
Ghent University, Belgium
Parallel sessions, Forum G
Thursday, April 24, 2025
14h-14h25

Diagram categories of Brauer type

In this talk I will introduce classes of monoidal (super)categories resembling the Brauer category. These classes encompass the Brauer category and its deformations as well as the periplectic Brauer category and its deformations in one framework but also include some new exotic categories. For all categories we can construct bases of the hom-spaces using Brauer diagrams.

Hopf25

Eliezer Batista
Federal University of Santa Catarina, Brazil
Parallel sessions, Forum G
Friday, April 25, 2025
15h-15h25

Globalization and the biactegory of partial modules

Often in the mathematical literature, constructions originally designed for groups are generalized to the context of Hopf algebras. Partial actions of groups, for example, first appeared to describe a class of operator algebras which are graded by the integers as a new kind of crossed product. In fact, partial group actions became increasingly important as a way of describing symmetries that are partially defined. Promptly, the notions of partial actions and partial representations were incorporated within the context of Hopf algebras. Far from being an exotic subject, highlighting only generalization for the sake of mere generalization, partial representations of Hopf algebras opened a skylight, shedding light on the garden of representation theory and allowing us to see new and unusual paths.

The aim of this work is to explore deeper connections between the theory of partial modules of Hopf algebras and the theory of module categories of monoidal categories. In fact, the category of partial modules over a Hopf algebra H, henceforth denoted by ${}_H\mathsf{PMod}$, is a monoidal category itself and it is a module category (also called an actegory) over the monoidal category of H-modules, ${}_H\mathsf{Mod}$. Moreover, for each partial H-module M, the left and right tensor product by M define two functors from ${}_H\mathsf{Mod}$ to ${}_H\mathsf{PMod}$ which are left adjoints. We call their associated right adjoints inner homs, denoted respectively by $\{M, -\}$ and $[M, -]$.

Given a partial H-module M, we call dilation of M a global H-module N with a linear projection T in N satisfying certain special properties such that the action of H restricted to the image $T(N)$ coincides with the original partial H-module structure on M. Every partial H-module M admits a standard globalization $\overline{M}$ which is, in certain sense, its minimal dilation and this standard globalization defines a monoidal functor D between ${}_H\mathsf{PMod}$ and ${}_H\mathsf{Mod}$. We prove that there is a natural monomorphism between the standard dilation functor D and another dilation functor obtained from an inner hom $\{A_{par}, -\}$, in which A_{par} is the monoidal unit in the category ${}_H\mathsf{PMod}$. We analyse necessary and sufficient conditions for these functors to be naturally isomorphic, this is the case, for example for finite dimensonal pointed Hopf algebras.

Hopf25

Yuri Bazlov
University of Manchester, United Kingdom
Parallel sessions, Forum F
Thursday, April 24, 2025
14h-14h25

Twists of reflection groups and Cherednik algebras

Twisting group algebras of certain reflection groups G yields Hopf algebras H that admit noncommutative rational Cherednik-type algebras. For Coxeter groups of type B or D, H is the group algebra of a "mystic reflection" group, and standard Cherednik-type modules correspond to pairs of Young diagrams, with twisting flipping one diagram (`https://arxiv.org/abs/2501.06673`, with Jones-Healey). In contrast, Shephard-Todd complex reflection groups $G = G(m, p, n)$ have twists of order $m > 2$, producing novel Cherednik-type algebras over non-cocommutative H whose representations are yet to be explored. Over number fields, their finite-dimensional quotients appear to be (Galois) twisted forms of restricted Cherednik algebras for G.

Hopf25

Arnab Kumar Bhattacharjee
Charles University, Prague, Czech Republic
Parallel sessions, Forum F
Thursday, April 24, 2025
16h-16h25

Bimodule connection for relative Hopf module over irreducible quantum flag manifolds

In 2020, in the paper Holomorphic Relative Hopf Modules over Irreducible Quantum Flag Manifolds, the authors showed that there exists a left-covariant connection for relative Hopf modules over irreducible quantum flag manifolds. In this talk, we shall extend this result and show that for every relative Hopf module over irreducible quantum flag manifolds, every left-covariant connection is a bimodule connection.

Hopf25

Lucrezia Bottegoni
University of Turin, Italy
Parallel sessions, Forum G
Tuesday, April 22, 2025
15h-15h25

Heavily semiseparable functors

Motivated by an example related to the tensor algebra, a stronger notion of separable functor, called heavily separable, was introduced in [2]. Semiseparable functors have been defined in [1] as a suitable weakening of separable functors. In this talk, we present the notion of "heavily semiseparable" functor, defined as a semiseparable functor through a natural transformation which is multiplicative. Then, a functor results to be heavily separable if, and only if, it is heavily semiseparable and faithful. We investigate heavy semiseparability with respect to adjunctions and Eilenberg-Moore categories. We show how heavy semiseparability can be described for functors traditionally attached to ring morphisms, corings, bimodules and Doi-Hopf modules. We present a stronger notion of separable monad, that we call "heavily separable monad", and we characterize the heavy semiseparability of adjoint functors in terms of the heavy (co)separability of the associated (co)monad. This talk is based on a work in progress [3].

References:

[1] Ardizzoni A., Bottegoni L., "Semiseparable functors", J. Algebra 638 (2024), 862-917.
[2] Ardizzoni A., Menini C., "Heavily separable functors", J. Algebra 543 (2020), 170-197.
[3] Bottegoni L., "Heavily semiseparable functors", in preparation.

Hopf25

Nicolas Bridges
Purdue University, United States
Poster session

Involutory Hopf group-coalgebras and flat bundles over 4-manifolds

We give invariants of flat bundles over 4-manifolds generalizing a result by Chaidez, Cotler, and Cui. We utilize a structure called a Hopf G-triplet for G a group, which generalizes the notion of a Hopf triplet by Chaidez, Cotler, and Cui. In our construction, we present flat bundles over 4-manifolds using colored trisection diagrams: a direct analogue of colored Heegaard diagrams as described by Virelizier. Our main result is that involutory Hopf G-triplets of finite type yield well-defined invariants of G-colored trisection diagrams, and that if the monodromy of a flat bundle has image in G, then we obtain invariants of flat bundles. We also show that a special Hopf G-triplet yields the invariant from Hopf G-algebras described by Mochida, thus generalizing the construction.

Hopf25

Ken Brown
University of Glasgow, United Kingdom
Parallel sessions, Forum E
Tuesday, April 22, 2025
16h-16h25

Finiteness conditions on Hopf algebras

I will review recent work by myself with Bell and Stafford, and by others, on determining which Hopf algebras in certain classes satisfy various finiteness conditions, and the possible relations between these conditions.

Hopf25

Sebastian Burciu
Institute of Mathematics of Romanian Academy, Romania
Parallel sessions, Forum G
Thursday, April 24, 2025
16h-16h25

Ito-Michler type properties for braided fusion categories

The classical Ito-Michler Theorem states that the degree of every irreducible character of a finite group G is coprime to a prime p if and only if a Sylow p-subgroup of G is abelian and normal. The proof of this theorem is notably intricate, relying on the Classification of Finite Simple Groups. In this talk, we explore the analogous situation for braided fusion categories. In the modular case, we find that the Ito-Michler-type result arises naturally as a consequence of Harada's identity. Additionally, we will discuss other new implications of Harada's identity within this framework. This work is partially in collaboration with S. Palcoux.

Hopf25

Nigel Byott
University of Exeter, UK
Parallel sessions, Forum E
Tuesday, April 22, 2025
14h30-14h55

Hopf-Galois structures and skew braces

In 1987, Greither and Pareigis showed that a Galois (or just separable) extension of fields may admit multiple Hopf-Galois structures, and that these can be described in terms of group theory. Over the last decade, this area has received new impetus because of its connection with (skew) braces, which are algebraic objects related to set-theoretic solutions of the Yang-Baxter Equation. In this talk, I will outline how classification/enumeration problems for skew braces can be approached via Hopf-Galois structures, and vice versa, and discuss some related open problems.

Hopf25

Alessandro Carotenuto
Università di Parma, Italy
Parallel sessions, Forum F
Thursday, April 24, 2025
16h30-16h55

Convex orderings and quantum tangent spaces

When building up a theory of differential noncommutative geometry, one of the most delicate steps is the construction of a suitable differential calculus that describes the differential structure of a given noncommutative space. In a recent work Ó Buachalla and Somberg showed a covariant differential calculus of classical dimension for the quantum full flag manifolds of type A. They made use of the celebrated theory of Lusztig bases for the quantized enveloping algebras to build up a so-called quantum tangent space. In order to extend this result to other series, and hopefully prove the uniqueness of such differential calculi, one has to find a unifying framework to describe the coproduct of Lusztig root vectors. In this talk, I will show a way to do so in terms of convex orderings on positive roots, pointing at the combinatorial properties of a reduced decomposition of the longest element of the Weyl group that gives rise to a quantum tangent space.

Hopf25

Pierre Catoire
Université d'Artois, France
Poster session

Trends on matroid's chromatic polynomial

A matroid is a complex combinatorial object. These objects were introduced by H.Whitney in 1935 mimicking the properties of linearly independent families of a given family of vectors. It turns out that this notion appears to be useful in many different mathematical fields: graph theory, computer science, geometry and combinatorics among others.

Recently, the notion of double bialgebra has been used to give an algebraic construction of the chromatic polynomial as a particular unique object in the works of L. Foissy. Our objective will be to get a similar construction for matroids and to compare with polynomials that already exists for matroids.

In the poster, we will take time to describe the unusual and interesting combinatorics of matroids. Then, we give some clues about what should be a double bialgebra structure for matroids and what chromatic polynomial we should get.

Hopf25

Sophie Chemla
Sorbonne Université, Paris, France
Poster session

Left Hopf bialgebroids, Frobenius and quasi-Frobenius extensions

Hopf algebroids generalize Hopf algebras in the case where the basis is not commutative. But, their definition is very restrictive. G. Böhm developed an integral theory for Hopf algebroids. She also characterized those which are Frobenius or quasi-Frobenius extensions of their basis by means of their integrals. P. Schauenburg proposed a weaker generalization of Hopf algebras to the case where the basis is not commutative: Left Hopf bialgebroids. For a left Hopf bialgebroid H, the antipode does not need to exist. Nevertheless, for any element $h \in H$, there exists an element $h_+ \otimes h_-$ that corresponds to $h_{(1)} \otimes S(h_{(2)})$. Enveloping algebras of Lie algebroids (and in particular algebra of differential operators) are left Hopf biagebroids but are not Hopf algebroids in general. Thanks to recent articles of P. Schauenburg and also N. Kowalzig, one knows that duals of a left Hopf bialgebroid are right Hopf bialgebroids. We will develop an integral theory for left Hopf bialgebroids and we will characterize those that are Frobenius or quasi-Frobenius extension of their basis. We will apply our result to the restricted enveloping algebra of a restricted Lie Rinehart algebra.

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Andrew Darlington
Vrije Universiteit Brussel, Belgium
Parallel sessions, Forum E
Tuesday, April 22, 2025
15h-15h25

Hopf-Galois structures on parallel extensions

Hopf-Galois theory allows for a Galois-theoretic approach to studying potentially non-Galois field extensions L/K by studying situations in which Hopf algebras act on L/K in some natural way. Given a separable but non-normal field extension L/K of degree n with normal closure E, there may be other degree n sub-extensions L'/K of L/K (we say that L'/K is parallel to L/K) which can be related to L/K in many different ways. It is then an interesting question to ask whether, given an extension L/K admitting a Hopf-Galois structure, can we say anything about the Hopf-Galois structures on all of the extensions L'/K parallel to L/K? This talk will take a first look at answering this question, approaching the problem from a group-theoretical perspective, outlining some interesting results along the way.

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Jonathan E. Davies
University of Nottingham, United Kingdom
Parallel sessions, Forum G
Tuesday, April 22, 2025
14h-14h25

Categories graded by group homomorphisms

Given a crossed module χ, Sözer and Virelizier (2023) introduced χ-graded fusion categories for constructing homotopy quantum field theories. However, the full crossed module data are only necessary for the monoidal structure, and it is possible to define categories graded by a group homomorphism τ.

We show that such τ-graded categories form a 2-category 2-equivalent to that of certain 'τ-module' categories. This informs a classification of semisimple τ-graded categories. If time permits, we will also discuss the monoidal structures for these 2-categories.

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Antonio Del Donno
Charles University of Prague, Czech Republic
Poster session

On the Đurđevič approach to quantum principal bundles

We revisit and extend the Đurđevič theory of complete calculi on quantum principal bundles. In this setting one naturally obtains a graded Hopf–Galois extension of the higher order calculus and an intrinsic decomposition of degree 1-forms into horizontal and vertical forms. This proposal is appealing, since it is consistently equipped with a canonical braiding and exactness of the Atiyah sequence is guaranteed. Moreover, we provide examples of complete calculi, including the noncommutative 2-torus, the quantum Hopf fibration and differential calculi on crossed product algebras.

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Mikhailo Dokuchaev
University of São Paulo, Brazil
Parallel sessions, Forum E
Wednesday, April 23, 2025
14h-14h25

(Co)Homology of Partial Smash Products

Given a co-commutative Hopf algebra H over a commutative ring K and a symmetric partial action of H on a K-algebra A, we obtain a first quadrant Grothendieck spectral sequence converging to the Hochschild homology of the smash product of $A\#H$ involving the Hochschild homology of A and the partial homology of H. An analogous third quadrant cohomological spectral sequence is also obtained. The definition of the partial (co)homology of H under consideration is based on the category of the partial representations of H.

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Thibault Décoppet
Harvard University, USA
Parallel sessions, Forum G
Thursday, April 24, 2025
15h-15h25

Higher Verlinde Categories: The Mixed Case

Over a field of characteristic $p > 0$, the symmetric higher Verlinde categories are obtained by taking the abelian envelope of quotients of the category of tilting modules for the algebraic group SL_2. This construction for SL_2 can be generalized to Lusztig's quantum group for $\mathfrak{sl}_2$ and root of unity, which produces the mixed higher Verlinde categories. I will discuss the properties of these finite ribbon tensor categories. For instance, there is a functor analogue of the Frobenius-Lusztig twist, which can be used to establish a Steinberg tensor product formula for the simple objects. Further, it can be used to identify the symmetric center of the mixed higher Verlinde categories with (subcategories of) the symmetric higher Verlinde categories.

Hopf25

Vitor Ferreira
University of São Paulo, Brazil
Parallel sessions, Forum F
Tuesday, April 22, 2025
14h30-14h55

Braid group actions on quantum invariants of free algebras

Given a finite-dimensional module V over a finite-dimensional Hopf algebra H, the tensor algebra $T(V)$ becomes a module algebra with a linear action by H. It is known that the algebra of invariants $T(V)^H$ of the action of H on $T(V)$ is always free, but very rarely finitely generated. However, taking into account the action of the symmetric groups by place permutations on its homogeneous components, it can be finitely described, when H is cocommutative and semisimple, as shown by Koryukin in 1994. In the present work, we present evidence to support that the same happens if H is taken to be quasi-triangular and the symmetric groups are replaced by the braid groups. This work is the result of a collaboration with Lucia Murakami and Lucas Ogawa and was partially funded by FAPESP (Projeto Tematico 2020/16594-0).

Hopf25

Davide Ferri
Università di Torino, Italy and Vrije Universiteit Brussel, Belgium
Parallel sessions, Forum E
Thursday, April 24, 2025
15h-15h25

Matched pairs and Yetter-Drinfeld braces

We introduce Yetter-Drinfeld braces as a generalization of cocommutative Hopf braces, and we prove that they are equivalent to braiding operations and to matched pairs of actions on a Hopf algebra.

Coquasitriangular Hopf algebras will be seen to provide examples of Yetter-Drinfeld braces, with the additional structure given by Majid's transmutation.

Hopf25

Rita Fioresi
University of Bologna, Italy
Parallel sessions, Forum F
Wednesday, April 23, 2025
14h30-14h55

Differential Calculus on Quantum Principal Bundles over Projective bases

We tackle the theory of reductions of quantum principal bundles over projective bases. We show how the sheaf-theoretic approach can be effectively applied to certain relevant examples such as the Klein model for the projective spaces. In particular, we study a quantum principal bundle corresponding classically to the projection of an algebraic group onto its quotient by the maximal parabolic subgroup.

Hopf25

Jürgen Fuchs
Karlstads Universitet, Sweden
Plenary talk, Forum E
Friday, April 25, 2025
10h-10h25

Grothendieck-Verdier module categories and Frobenius algebras

A Grothendieck-Verdier category is a monoidal category having a duality structure more general than rigidity. It comes with two monoidal structures, one right exact and one left exact. The mixed associators for these are generically non-invertible. I will describe aspects of a natural class of module categories over Grothendieck-Verdier categories, such as two distinguished subcategories on which certain lax or oplax module functors are strong. The module category can be realized as the category of modules over the internal Hom of suitable objects in those subcategories. Moreover, it admits a partial relative Serre functor, which furnishes an equivalence between the two subcategories. The internal Hom of a fixed point of the relative Serre functor carries a natural structure of a Grothendieck-Verdier Frobenius algebra.

Hopf25

Ramón González Rodríguez
CITMAga and Universidade de Vigo, Spain
Parallel sessions, Forum E
Friday, April 25, 2025
15h-15h25

Factorizations and double cross products of Hopf quasigroups

In this talk we introduce the notion of factorization for Hopf quasigroups in a symmetric monoidal setting and we prove that, if A and H are Hopf quasigroups such that their antipodes are isomorphisms, then a Hopf quasigroup X admits a factorization as $X = AH$ if, and only if, X is isomorphic to a double cross product of A and H as Hopf quasigroups. Also, we prove that this kind of double cross products are examples of wreath products induced by an a-monoidal distributive law between A and H. Moreover, we show that cross products of Hopf quasigroups with a skew pairing between them, Hopf quasigroups defined by the twisted double method, smash products of Hopf quasigroups and twisted smash products of Hopf quasigroups are examples of wreath products associated to a-monoidal distributive laws.

References:

[1] González Rodríguez, R.: Factorizations of Hopf quasigroups, Publicationes Mathematicae Debrecen 104, No 1-2, 195-219 (2024).
[2] González Rodríguez, R.: Distributive laws and Hopf quasigroups, `https://arxiv.org/abs/2402.02965` (2024).
[3] González Rodríguez, R.: Distributive laws in a non associative setting (preprint) (2024).

Hopf25

David Green
The Ohio State University, United States of America
Parallel sessions, Forum G
Tuesday, April 22, 2025
16h30-16h55

Tannakian Reconstruction for fusion 2-categories

We will examine the Tannakian formalism for fiber functors landing in an arbitrary fusion 2-category. In particular, we will show the necessary and sufficient criteria for such a category to be reconstructible as a category of modules for a (Hopf) algebra object, and related results. In particular, we will realize every fusion 2-category as representations of a weak Hopf algebra object and show that all Hopf monoidal categories are group theoretical.

Hopf25

Paul Großkopf
University of Oxford, United Kingdom
Parallel sessions, Forum G
Tuesday, April 22, 2025
14h30-14h55

Remarks on Hopf categories

The Hopf V-categories are multi-object generalizations of Hopf monoids in some symmetric monoidal category V. It consist of a family of comonoid in V double indexed by some set X together with a global multiplication and units, satisfying associativity and unitality conditions as well as an antipode. One can similarly define Hopf (G, V)-categories by indexing over any groupoid G. In this talk we will discuss generalities about Hopf V- and (G, V)-categories and give an outlook on upcoming work on their representation theory.

Hopf25

Thomas Guédénon
Département de Mathématiques, Université de Ziguinchor, Sénégal
Parallel sessions, Forum E
Thursday, April 24, 2025
16h-16h25

Fundamental Theorem of (A, g, H)-comodules

Let k be a field, H a Hopf algebra with a bijective antipode, $\mathcal{G}$ an H-comodule Lie algebra and A a commutative $(\mathcal{G}, H)$-comodule algebra. We assume that there is an H-colinear algebra map from H to $A^{\mathcal{G}}$. We generalize the Fundamental Theorem of (A, H)-Hopf modules to $(A, \mathcal{G}, H)$-comodules, and we deduce relative projectivity in the category of $(A, \mathcal{G}, H)$-comodules. In many applications, A could be a commutative G-graded $\mathcal{G}$-module algebra, where G is an abelian group and $\mathcal{G}$ is a G-graded Lie algebra; or a rational $(\mathcal{G}, G)$-module algebra, where G is an affine algebraic group and $\mathcal{G}$ is a rational G-module Lie algebra.

Hopf25

Sebastian Halbig
University of Marburg, Germany
Plenary talk, Forum E
Thursday, April 24, 2025
10h30-10h55

A non-semisimple version of the Kitaev model

In 1997, Alexei Kitaev proposed a foundational model for fault-tolerant quantum computation based on complex semisimple Hopf algebras. Its key feature is a topologically invariant code space. It is constructed using combinatorial data encoded by a graph embedded into a closed oriented surface, ensuring robustness against a wide range of errors. Beyond applications in quantum computing, the model has remarkable connections with combinatorics, the study of mapping class groups, Hopf algebra representation theory, and topological quantum field theories.

In this talk, based on joint work with A. Hirmer, U. Krähmer, C. Meuburger, and T. Voss, we present a generalisation of the Kitaev model to arbitrary finite-dimensional Hopf algebras. Two challenges prevent a straightforward approach. First, the extended Hilbert space, a Yetter–Drinfeld module whose maximal trivial submodule is the code space, relies on an involutive antipode — a condition equivalent to the underlying Hopf algebra being semisimple. Second, topological invariance is proven using projectors assembled from (co)integrals. Since we do not have these tools at our disposal, we follow a new approach, inspired by homological considerations. We introduce involutive anti-Hopf bimodules, which are related to coefficients of Hopf cyclic cohomology and allow us to form appropriate, Yetter–Drinfeld valued, variants of extend Hilbert spaces. Instead of considering trivial submodules, the analoga of the code spaces arise as bitensor products — a combination of cotensor and tensor products. Our proof of their topological invariance relies on a notion of excision and uses actions of a group related to mapping class groups. Towards computing bitensor products, we discuss induction-restriction type identities, which are particularly useful for small quantum groups. Several intriguing open questions arising from our approach will be emphasised.

Hopf25

Xiao Han
Queen Mary University of London, UK
Parallel sessions, Forum E
Thursday, April 24, 2025
16h30-16h55

Hopf Galois extensions of Hopf algebroids

We study Hopf Galois extensions of Hopf algebroids as a generalization of the theory for Hopf algebras. More precisely, we introduce (skew-)regular comodules and generalize the structure theorem for relative Hopf modules. Also, we show that if $N \subseteq P$ is a left $\mathcal{L}$-Galois extension and Γ is a 2-cocycle of $\mathcal{L}$, then for the twisted comodule algebra ${}_{\Gamma}P$, $N \subseteq {}_{\Gamma}P$ is a left Hopf Galois extension of the twisted Hopf algebroid $\mathcal{L}^{\Gamma}$. We study twisted Drinfeld doubles of Hopf algebroids as examples for the Drinfeld twist theory. Finally, we introduce cleft extension and σ-twisted crossed products of Hopf algebroids. Moreover, we show the equivalence of cleft extensions, σ-twisted crossed products, and Hopf Galois extensions with normal basis properties, which generalize the theory of cleft extensions of Hopf algebras.

Hopf25

Thorsten Heidersdorf
Newcastle University, UK
Parallel sessions, Forum F
Thursday, April 24, 2025
14h30-14h55

On highest weight structures, Koszulity, and Khovanov algebras

I will report on recent work with Nehme and Stroppel on the interplay between highest weight structures and Koszulity, and the application to Khovanov algebras, Deligne categories and representations of the orthosymplectic supergroup $\mathsf{OSp}(m|2n)$.

Hopf25

André Henriques
Oxford, UK
Plenary talk, Forum E
Friday, April 25, 2025
9h30-9h55

Bicommutant categories

Bicommutant categories, initially invented for the purposes of 3d TQFT and 2d CFT, seem to also appear in other domains of math with examples related to group theory, and dynamical systems. In this talk, I will explain why the category Rep(G) of unitary representations of a discrete infinite group G is a bicommutant category, and what this teaches us about Rep(G). I conjecture that the category of representations of a locally compact quantum group is also a bicommutant category.

Hopf25

David Jaklitsch
University of Oslo, Norway
Plenary talk, Forum E
Friday, April 25, 2025
10h30-10h55

Frobenius functors and pivotal comodule algebras

A tensor functor between tensor categories can have isomorphic adjoint functors. We define a notion of Frobenius functors that accounts for the extra structure of bimodule categories. This condition will allow for the transport of unimodular and pivotal structures of module categories, thereby producing examples of Frobenius algebras. The purpose of the talk is to present this procedure in the context of Hopf algebras and pivotal comodule algebras.

Hopf25

Yevgenia Kashina
DePaul University, USA
Parallel sessions, Forum E
Friday, April 25, 2025
14h30-14h55

Semisimple Hopf algebras constructed as biproducts and their properties

In joint work with Yorck Sommerhäuser, we constructed two families of eight-dimensional semisimple Yetter-Drinfeld 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-Drinfeld Hopf algebras, corresponding to a fourth root of unity. Via the Radford biproduct construction, these Yetter-Drinfeld Hopf algebras give rise to semisimple Hopf algebras of dimension 32 which can alternatively be constructed as Hopf algebra extensions. We determine all possible ways in which this can be done. In particular, we show that these Hopf algebras cannot be constructed as cocentral abelian extensions. We will also discuss the self-duality of these Hopf algebras and describe their representations.

Hopf25

Jacob Kesten
Rice University, Houston, USA
Parallel sessions, Forum E
Friday, April 25, 2025
16h-16h25

On Extended Frobenius Structures

A classical result in quantum topology is that oriented 2-dimensional topological quantum field theories (2-TQFTs) are fully classified by commutative Frobenius algebras. In 2006, Turaev and Turner introduced additional structure on Frobenius algebras, forming what are called extended Frobenius algebras, to classify 2-TQFTs in the unoriented case. This work provides a systematic study of extended Frobenius algebras in various settings: over a field, in a monoidal category, and in the framework of monoidal functors. Numerous examples, classification results, and general constructions of extended Frobenius algebras are established.

Hopf25

Surjeet Kour
IIT Delhi, India
Parallel sessions, Forum E
Thursday, April 24, 2025
14h30-14h55

Measurings of Hopf algebroids and morphisms in cyclic (co)homology theories

Coalgebra measurings, introduced by Sweedler, provide generalized maps between rings. Coalgebra measurings enlarge and linearize the category of algebras similar to how correspondences enlarge the category of algebraic varieties. We study how coalgebra measurings induce maps between cohomology theories. More specifically, we define coalgebra measurings between Hopf algebroids and show that they induce morphisms on cyclic homology and cyclic cohomology. We also consider comodule measurings between stable anti-Yetter Drinfeld (SAYD) modules over Hopf algebroids. These give an enrichment of the global category of SAYD modules over comodules. These measurings also induce morphisms on cyclic (co)homology of Hopf algebroids with SAYD coefficients, which are compatible with Hopf-Galois maps. Finally, we consider non-symmetric operads with multiplication and modules over them which have both cyclic and Gerstenhaber type structures, known as cyclic unital comp modules. We obtain an enrichment of cyclic unital comp modules over comodules, as well as morphisms on cyclic homology induced by comodule measurings of comp modules over operads with multiplication. This is joint work with A. Banerjee.

Hopf25

Jacek Krajczok
Vrije Universiteit Brussel, Belgium
Parallel sessions, Forum F
Thursday, April 24, 2025
15h-15h25

Braided tensor product of dynamical von Neumann algebras

Whenever locally compact group acts on von Neumann algebras M, N, it gives rise to a canonical "diagonal" action on their tensor product $M\overline{\otimes}N$. This is no longer true, if we consider actions of locally compact quantum groups (which include "coactions" of discrete groups). Nonetheless, not all is lost. If the quantum group acting on von Neumann algebras M, N is quasi-triangular (i.e. it is equipped with an R-matrix), then one can form a twisted version of tensor product, called the braided tensor product $M\overline{\boxtimes}N$. This is a new von Neumann algebra which contains M, N as subalgebras and which carries a canonical action of G. As a special case, G can be taken to be the Drinfeld double of some (quantum) group H, then action of $G = D(H)$ on M, N amounts to compatible actions of H and its dual quantum group. I will discuss construction of $M\overline{\boxtimes}N$, its extension to the case of a bicharacter, some examples and properties. This is a joint work with Kenny De Commer.

Hopf25

Manujith K Michel
Indian Institute of Science Education and Research Mohali, India
Poster session

Colinear derivations on Hopf-Galois extensions and derivations on forms of algebras

The problem of extending a given derivation on a field to an algebra has been studied in different contexts in commutative algebra and noncommutative ring theory. For example, we have that any derivation on a field F extends to a separable field extension or a central simple algebra over F. We generalise these results by showing that a derivation on F extends to an F-algebra A if A is a form of some finite dimensional algebra C over the constants K of F such that the affine algebraic K-group $G := Aut(C)$ is smooth. This is done by first showing that the form A can be written as the cotensor product of a $K[G]$-Hopf Galois extension B/F and the $K[G]$-comodule C where $K[G]$ is the Hopf algebra corresponding to G. Then we show that that it is enough to extend the derivation on F $K[G]$-colinearly to the $K[G]$-Hopf Galois extension B. Finally, we show the existence of such a derivation on B, thereby completing the proof. If time permits, we will also see how to obtain a $K[G]$-colinear derivation on B from a derivation on A and show that the collection of $K[G]$-colinear derivations on B is in a bijective correspondence with the collection of derivations on A.

Hopf25

Alexis Langlois-Rémillard
University of Bonn, Germany
Parallel sessions, Forum G
Thursday, April 24, 2025
14h30-14h55

A category of stripped cobordisms and generalised Deligne category

The Deligne interpolation categories are symmetric tensor categories interpolating the categories of representation of the symmetric groups and other series of group. The construction of the Deligne categories can be made combinatorial via a diagrammatic construction using partition diagram, or equivalently 2-cobordisms with certain rules preventing higher genus surfaces to appear. Khovanov and Sazdanović offered the definition of the generalised Deligne category by considering the construction via 2-cobordisms while allowing higher genera to appear. The goal of this talk is to present a categorical construction that assign a category of stripped cobordisms to any category extending the generalised Deligne category. The construction is similar to the affinization process introduced by Mousaaid and Savage. We will focus on one example related to recent work by Calle–Hoekzema–Murray–Pacheco-Tallaj–Rovi–Sridhar-Shapiro on nested cobordisms.

Hopf25

Simon Lentner
University of Hamburg, Germany
Plenary talk, Forum E
Thursday, April 24, 2025
9h30-9h55

Proving the Logarithmic Kazhdan-Lusztig Correspondence

The logarithmic Kazhdan-Lusztig correspondence by B. Feigin and others is a conjectural equivalence between braided tensor categories of representations of quantum groups and of certain vertex algebras, which are algebras with an analytic flavour that appear in quantum field theory. I have previously reported on a proof that certain screening operators fulfill the relations of an associated Nichols algebra, and with T. Creuztig and M. Rupert we have proven the conjecture in small cases. In arXiv:2501.10735 I recently gave a proof in quite general situations, also including Nichols algebras beyond quantum groups, under the assumption that the vertex algebra side is analytically nice enough. The proof is almost completely algebraic, essentially it says: Every braided tensor category together with a big commutative algebra A, such that the category of local A-modules is semisimple and the category of A-modules contains no additional simple modules, is equivalent to representations of a quantum group associated to a Nichols algebra, which is determined by certain Ext^1-groups. In a certain sense, this is a categorical and braided version of the Andruskiewitsch-Schneider program, and prominently uses important results in this area by I. Angiono and others.

Hopf25

Jonathan Lindell
Uppsala University, Sweden
Poster session

Right algebras of corings and (co)Hochschild cohomology

Corings were first defined by Sweedler and simultaneously by Roiter under name of bocs, generalising coalgebras to when we have a non-commutative ground rings. They appear naturally in the context of non-commutative descent theory, entwining structures and in the theory of quasi-hereditary algebras. Associated to any coring, there is the right algebra, also called the opposite of the left dual algebra. We show that there is a map from the coHochschild cohomology of the coring to the relative Hochschild cohomology of the right algebra, which moreover is an isomorphism if the coring is finitely generated projective as a left module over the ground ring. Further, we show that this morphism lifts to the B-infinity level, thus inducing a map of Gerstenhaber algebras on the level of cohomology.

Hopf25

Christian Lomp
University of Porto, Portugal
Parallel sessions, Forum E
Tuesday, April 22, 2025
16h30-16h55

Generalized Kac-Paljutkin algebras

The aim of this talk is to show how to construct a family of non-trivial semisimple Hopf algebras $H_{n,m}$ of dimension $n^m m!$ over a field $\mathbb{K}$ containing a primitive nth root of unity, for integers $n, m \geq 2$. The well-known eight-dimensional Kac-Paljutkin algebra arises as $H_{2,2}$, while the Hopf algebras constructed by Pansera correspond to the cases $H_{n,2}$. Each algebra $H_{n,m}$ is an extension of the symmetric group algebra $\mathbb{K}S_m$ by the m-fold tensor product $\mathbb{K}\mathbb{Z}_n^{\otimes m}$ of the group algebra of the cyclic group of order n, and can be realized as a crossed product $H_{n,m} = \mathbb{K}\mathbb{Z}_n^{\otimes m}\#_\gamma S_m$. More generally, considering the set of transpositions $s_i = (i, i+1) \in S_m$, we provide sufficient conditions on a twist J for a bialgebra B to construct a family of twists $J_{s_1}, \ldots, J_{s_{m-1}}$ for the bialgebra $R = B^{\otimes m}$. We show that the skew monoid algebra $R\#M$, where M is the free monoid on the generators $\{\overline{s}_1, \ldots, \overline{s}_{m-1}\}$, admits a bialgebra structure with comultiplication given by $\Delta(\overline{s}_i) = J_{s_i}(\overline{s}_i \otimes \overline{s}_i)$. Additional conditions on J ensure the existence of a Hopf algebra quotient $H = (R\#M)/I$, which is isomorphic to a crossed product $R\#_\gamma S_m$, and is semisimple whenever R is. We also present a family of irreducible m-dimensional representations of $\mathbb{K}\mathbb{Z}_n^{\otimes m}\#_\gamma S_m$ that are inner faithful as R-modules and exhibit a nontrivial action on a quantum polynomial algebra.

Hopf25

Tim Lüders
University of Vienna, Austria
Poster session

Higher dagger structures, symmetric monoidal categories and TQFTs

Dagger structures are used in quantum mechanics to encode unitarity; their higher-categorical analogues are meant to encode unitarity (or reflection positivity) of quantum field theories. Moreover, they naturally appear in the context of topological quantum field theories with defects. After a short review of these ideas, we will establish a connection between (orbifolds of defect) TQFTs, symmetric monoidal (2-)categories, and higher dagger structures.

Hopf25

Myriam Mahaman
Charles University, Prague, Czech Republic
Parallel sessions, Forum E
Thursday, April 24, 2025
14h-14h25

Rings of differential operators and Hopf algebroids

The ring of differential operators over a smooth algebra A has a canonical Hopf algebroid structure. In this talk, we will introduce some descent techniques for coalgebras which we will then use to determine a class of algebras which are not smooth yet whose rings of differential operators still carry a canonical Hopf algebroid structure. This is joint work with Ulrich Krähmer (arXiv:2405.08490).

Hopf25

Shahn Majid
Queen Mary University, London, UK
Plenary talk, Forum E
Wednessday, April 23, 2025
11h30-12h25

Braided Lie algebras of quantum doubles

The talk will be based on joint work with L. McCormack. We revisit the notion of braided Lie algebras introduced 30 years ago as an abstract Lie object generating quantum groups such as $U_q(\mathfrak{g})$. The notion makes sense in any braided category and consists of a coalgebra L in the category and a Lie bracket $[-,-]$ from the tensor square of L to L obeying certain axioms such as a pentagonal Jacobi identity. Every braided Lie algebra gives rise to a solution of the braided relations on L called its fundamental braiding. In the category of sets with trivial braiding, a braided Lie algebra reduces to a rack and the fundamental braiding is the rack braiding, but the concept is much more general. Among the new results, we address a long-standing issue that the braided bialgebra $U(L)$ is never a braided Hopf algebra by means of two braided Hopf algebras $U^S(L)$ and $H(L)$ related to it. We show that for the q-$\mathfrak{sl}_n$ braided Lie algebras, these land on the transmutations of $\mathbf{C}_q[\mathrm{GL}_n]$ and $\mathbf{C}_q[\mathrm{SL}_n]$ respectively. We also introduce a new construction for a class of braided Lie algebras that go significantly beyond previous ones obtained by transmutation, and use this to a describe new and simpler braided Lie algebra for $U_q(\mathfrak{sl}_n)$. Braided Lie algebras are also known to arise as the duals of the invariant 1-forms for a bicovariant calculus on a coquasitriangular Hopf algebra and we describe some examples from the Drinfeld codouble of a finite group. Finally, we introduce a natural generalisation of a braided Lie algebra and show an example where one of these arises from a differential calculus that is left-covariant but not bicovariant.

Hopf25

Ruslan Maksimau
CY Cergy Paris University, France
Parallel sessions, Forum F
Tuesday, April 22, 2025
16h-16h25

Geometric categorification of Verma modules: Grassmannian Quiver Hecke algebras

The talk is based on arXiv:2405.20262.

Classical KLR (quiver-Hecke) algebras categorify $U_q^-(\mathfrak{g})$, and their cyclotomic quotients categorify the simple modules over $U_q(\mathfrak{g})$. Naise and Vaz introduced an extension of KLR algebras that categorifies Verma modules. The goal of this work is to propose a geometric construction of these extensions, inspired by the geometric constructions of classical KLR algebras developed by Varagnolo-Vasserot and Rouquier.

To illustrate our approach, we start with the nil-Hecke algebra, which corresponds to the version $\mathfrak{sl}_2$ of KLR algebras. Its geometric construction relies on the variety of pairs of flags. We extend this construction by adding two Grassmannians, yielding a larger algebra than required. However, one can consider a smaller variety (with a single Grassmannian instead of two), whose homology matches the desired algebra. This smaller variety, however, lacks an evident geometric product, necessitating an intermediate construction involving two Grassmannians.

In the general case of KLR algebras, the situation is even more intricate. The final variety is constructed through multiple steps, and its definition may seem relatively complex. The method of diagrammatic varieties plays a central role in this construction. The main idea of "diagrammatic varieties" is to draw a diagram, assign vector spaces to the regions of the diagram, and define a variety based on algebraic conditions derived from the diagram. This technique provides a powerful tool for identifying the geometric conditions needed to construct the required varieties. More generally, this approach serves as a valuable framework in other contexts of geometric representation theory.

Hopf25

Maksymilian Manko
University of Zurich, Switzerland
Parallel sessions, Forum F
Tuesday, April 22, 2025
16h30-16h55

Two families of non-factorisable ribbon Hopf algebras and 4d topology

Factorizable ribbon Hopf algebras and their representation categories are essential ingredients in many constructions of invariants of 3-manifolds. More recently, there have been considerable interest in the non-factorizable counterparts, due to their analogous role in constructing 4-manifold invariants, in particular the Hennings-type invariants of 2-handlebodies, due to Beliakova and De Renzi, based on the work of Bobtcheva and Piergallini. In this talk I will present two families of such non-factorizable ribbon Hopf algebras, one based on the work of Nenciu, the other extending her ideas to particular smash products involving the small quantum $\mathfrak{sl}_2$. I will explain how the non-factorizability can be ensured, and hint at what the resulting invariants of manifolds are. Joint work with Q. Faes.

Hopf25

Arthur Massar
UCLouvain, Belgium
Parallel sessions, Forum F
Friday, April 25, 2025
14h30-14h55

The Poisson-Fourier transform

While the quantization of Lie bialgebras is well understood, the problem of quantizing a given Poisson–Lie group into a locally compact quantum group remains very difficult. An interesting contrast emerges in the duality theories associated with these objects: Lie bialgebras admit a well-behaved duality that persists after quantization, whereas the Poisson-dual of a Poisson–Lie group is only characterized by its Lie algebra and is thus not unique. This raises the question of how Poisson-duality interacts with quantization.

In several examples, we identified a Fourier transform between dual Poisson–Lie groups which implements this duality after quantization. We call it the Poisson–Fourier transform. It provides a more robust interpretation of Poisson-duality and demonstrates that the connected and simply connected dual is not always the most natural choice. Remarkably it also allows us to explicitly reconstruct all the operators related to the quantum groups, including the Haar weights. This suggests we could use use these ideas in future works to construct new locally compact quantum groups.

In this talk we will look at some examples of this phenomenon and outline a potential framework for formalizing the Poisson–Fourier transform. Joint work with P. Bieliavsky.

Hopf25

Daniel Matei
Institute of Mathematics of the Romanian Academy, Bucarest, Romania
Poster session

Quandle Invariants of Conjugation Groups

A conjugation group, in short a C-group, is a group that admits a presentation with only conjugation relations. This is a large class of groups, including free, free abelian, or more generally Artin groups, as well as knot and link groups. In this poster, we will consider quandle coloring invariants of C-groups in relation with their Alexander type invariants. We will pay particular attention to an important geometric class of C-groups, the fundamental groups of complements to affine complex algebraic hypersurfaces.

Hopf25

Stein Meereboer
Radboud, Netherlands
Parallel sessions, Forum F
Friday, April 25, 2025
15h-15h25

Symmetries for spherical functions of type χ for quantum symmetric pairs

Let $\mathfrak{g}$ be a complex semisimple Lie algebra and let $U_q(\mathfrak{g})$ denote the associated Drinfel'd Jimbo quantized enveloping algebra. We are interested in spherical functions related to quantum symmetric pairs. Gail Letzter provides quantum group analogs of quantum symmetric pairs in terms of a one-sided coideal subalgebras. The spherical functions related to to characters turn out be be invariant under an action of the relative braid group, which extends Letzters result for the trivial character. We show this invariance using the Wang-Zhang braid group operators and an explicit realization of the spherical functions.

Hopf25

Vanessa Miemietz
University of East Anglia, Norwich, UK
Plenary talk, Forum E
Thursday, April 24, 2025
11h30-12h25

Comonoidal structures on 2-categories and tensor products of 2-representations

I will explain an attempt to categorify the monoidal structure on the category of modules over a bialgebra to the world of k-linear additive 2-categories. This is joint work in progress with Fiona Torzewska.

Hopf25

Thi Hoa Emilie Nguyen
University of Clermont Auvergne, LMBP, France
Parallel sessions, Forum E
Wednesday, April 23, 2025
15h-15h25

Homological properties of braided Hopf algebras

A twisted Calabi-Yau algebra is an algebra having a certain duality between its Hochschild homologies and cohomologies. In this talk I will present a convenient criterion that ensures that a braided Hopf algebra in a comodule category is twisted Calabi-Yau. The example of the two-parameter braided quantum SL_2 will be presented in detail.

The presentation will cover results from a recent paper with my supervisor Julien Bichon.

Hopf25

Dmitri Nikshych
University of New Hampshire, Durham, USA
Plenary talk, Forum E
Friday, April 25, 2025
11h30-12h25

Tannakian radical and mantle of a braided fusion category

This is a report on a joint work with Jason Green. It is known that the presence of a Tannakian subcategory in a braided fusion category B allows one to reconstruct the latter as a certain group-theoretical extension ("gauging") of a smaller category, called the localization of B. For example, twisted Drinfeld doubles are precisely gaugings of the category of vector spaces. A notable drawback of this construction is that the gauging group is not defined canonically, for instance, Drinfeld doubles of non-isomorphic groups can be equivalent as braided fusion categories. To address this issue, we define a Tannakian radical of B as the intersection of its maximal Tannakian subcategories. By Deligne's theorem, this yields a canonical group $G(B)$ associated to B. The corresponding localization of B, termed the mantle, admits a central $G(B)$-graded extension which is a complete invariant of B.

We investigate the properties of this invariant and discuss its applications in the classification of fusion categories. An intriguing aspect of our analysis is that studying braided fusion categories over the complex numbers naturally leads us to explore orthogonal representations of finite groups on quadratic vector spaces over finite fields.

Hopf25

Chiara Pagani
Università degli Studi di Napoli Federico II, Naples, Italy
Parallel sessions, Forum F
Wednesday, April 23, 2025
15h00-15h25

Reductions of Quantum Principal Bundles

From a geometric point of view, H-Galois algebra extensions correspond to quantum principal bundles, with the Hopf algebra H representing the structure group of the bundle.

We recall how the theory of reduction and prolongation of the structure group for principal bundles dualises to the algebraic setting of H-Galois extensions. We develop the theory of reduction of quantum principal bundles over projective bases by a sheaf theoretic approach.

Seminar based on a joint work with Rita Fioresi (Bologna) and Emanuele Latini (Bologna), `https://arxiv.org/abs/2403.06830`.

Hopf25

Héctor Martín Peña Pollastri
Indiana University, United States
Parallel session, Forum G
Thursday, April 24, 2025
16h30-16h55

Exact Factorizations of fusion categories and the bicrossed product construction

In 2017, Gelaki introduced the notion of exact factorization of fusion categories, generalizing the notion of exact factorization of groups. We show some general results about the structure of such factorizations, their fusion rules and universal grading groups. Also we introduce a new construction, the bicrossed product, to produce new examples, including some exact factorizations involving Tambara-Yamagami categories and pointed categories.

The talk will be based in the preprint: `https://arxiv.org/abs/2405.10207`

Hopf25

Tuan Pham
University of Edinburgh, United Kingdom
Parallel sessions, Forum F
Tuesday, April 22, 2025
14h-14h25

The orbit method for the Virasoro algebra

Let $W = \mathbb{C}[t, t^{-1}]\partial_t$ be the Witt algebra of algebraic vector fields on $\mathbb{C}^*$ and let Vir be the Virasoro algebra, the unique nontrivial central extension of W. Sierra showed that Poisson primitive ideals of $S(W)$ and $S(\mathrm{Vir})$ can be constructed by elements of W^* and Vir^* of a particular form, called local functions. In this paper, we show how to use a local function on W or Vir to construct a representation of W or Vir. We further show that the annihilators of these representations are new completely prime primitive ideals of $U(W)$ and $U(\mathrm{Vir})$. We define a version of the Dixmier map from the Poisson primitive spectrum of $S(\mathrm{Vir})$ and $S(W)$ to the primitive spectrum of the $U(\mathrm{Vir})$ and $U(W)$, respectively, successfully extending the orbit method from finite-dimensional solvable Lie algebras to the countable-dimensional setting. We construct various ring homomorphisms from $U(W)$ to the tensor product of a localized Weyl algebra and the enveloping algebra of a finite-dimensional solvable subquotient of W. We further show that the kernels of these maps are intersections of the primitive ideals constructed from natural subsets of W^*. As a corollary, we disprove the conjecture that any primitive ideal of $U(W)$ is the kernel of some map from $U(W)$ to the first Weyl algebra.

Hopf25

Brais Ramos Pérez
University of Santiago de Compostela, Spain
Poster session

Twisted relative Rota-Baxter operators and Hopf trusses

Taking into account the existence of a functorial correspondence between the category of Hopf braces and the category of relative Rota-Baxter operators that induces an adjunction between the functors involved, it results interesting to study whether there exists a relation like this for Hopf trusses. Therefore, we introduce the category of "twisted relative Rota-Baxter operators" in a braided monoidal setting together with a procedure for constructing examples of such structures based on idempotent Hopf algebra morphisms. We prove furthermore that, under certain conditions, the following results hold:

(1) There exists an adjoint pair of functors between the category of Hopf trusses and the category of twisted relative Rota-Baxter operators.
(2) The previous adjunction induces a categorical equivalence between the category of Hopf trusses and the subcategory of invertible twisted relative Rota-Baxter operators.

All the details can be consulted in `https://arxiv.org/abs/2402.16704`.

Hopf25

Andrea Rivezzi
Charles University in Prague, Czech Republic
Parallel sessions, Forum F
Friday, April 25, 2025
14h-14h25

M-adapted functors and Hopf algebras

The aim of this talk is to present the notion of M-adapted functor due to P. Ševera and how to use it in order to build Hopf monoids. If there is enough time, I will present a recent generalization of the P. Ševera's quantization functor of Lie bialgebras.

Hopf25

Charlotte Roelants
Vrije Universiteit Brussel, Belgium
Poster session

Irreducibility and non-degeneracy of Killing forms on finite groups

Killing forms are bilinear forms most well-known in the context of Lie algebras. Applying them to certain Lie algebras based on finite groups yields an expression in terms of centralizers in the group. Based on a collaboration with Kevin Piterman, we discuss some problems concerning the non-degeneracy and irreducibility of these forms. We study the case of the finite simple groups $\mathrm{PSL}(2, q)$ and cover some recent results on involutions in simple groups of Lie type and Lie rank 1.

Hopf25

Ana Ros Camacho
Cardiff University, Cymru (Wales)
Parallel sessions, Forum G
Wednesday, April 23, 2025
14h-14h25

Detecting algebra objects from NIM-reps in pointed, near-group and quantum group-like fusion categories

Algebras in tensor categories are interesting mathematical objects, related to conformal and topological field theory, which are slightly difficult to find and classify. In this work, we study the possible Morita equivalence classes of algebras coming from the Non-negative Integer Matrix representations (or simply NIM-reps) of the fusion rings of pointed, near-group and $A(1,k)_{1/2}$ fusion categories, and compare these results with some existing ones.

Joint work with Sam Hannah.

Hopf25

Samson Saneblidze
A. Razmadze Mathematical Institute of Tbilisi State University, Georgia
Poster session

Secondary cohomology operations and applications

Let H be the cohomology of a homotopy commutative differential graded algebra C over $\mathbb{Z}_p = \mathbb{Z}/p\mathbb{Z}$ with p prime. When H is a Hopf algebra, we construct the secondary cohomology operations on H and calculate the Hopf algebra structure of the cohomology of the bar-construction BC in terms of generators and relations. This in particular answers to A. Borel's decomposition of a Hopf algebra into a tensor product of the monogenic ones in which the heights of generators are determined by means of the action of the primary and secondary cohomology operations on H. An application for calculating of the loop space Hopf algebra of some spaces including the exceptional Lie group F_4 is given.

Hopf25

Peter Schauenburg
IMB, UMR 5584 CNRS, Université Bourgogne Europe, France
Plenary talk, Forum E
Wednesday, April 23, 2025
10h30-10h55

Hopf Bigalois Extensions from Skew Parings of Hopf Algebroids

In a joint project with Xiao Han we are currently trying to develop the theory of Galois and bi-Galois extensions over Hopf algebroids. This seems initially hopeless because for a general Hopf algebroid H, not even H itself is bi-Galois in the most naive sense. In this talk we will report on how skew pairings of Hopf algebroids lead to a class of candidates that ought to be bi-Galois, and how we propose to set up the general theory to encompass these examples, at least when H (while not having an antipode) fulfills the analogous condition to having bijective antipode.

Hopf25

Andrea Sciandra
University of Turin, Italy
Parallel sessions, Forum E
Tuesday, April 22, 2025
14h00-14h25

Hopf braces and semi-abelian categories

The notion of semi-abelian category was introduced in [5] in order to give a categorical "generalization" for categories like groups and Lie algebras. Semi-abelian categories provide a good categorical framework to study (co)homology of non-abelian structures and develop an approach to commutator and radical theories. Moreover, in a semi-abelian category, there are natural notions of semi-direct product, internal action and crossed module.

Hopf braces were introduced in [1] as a Hopf-theoretic generalization of skew braces [4]. Under the assumption of cocommutativity, Hopf braces are equivalent to matched pairs of actions on Hopf algebras, that can be used to produce solutions of the quantum Yang–Baxter equation.

The talk is based on a recent joint work with Marino Gran [2]. First we prove that the category of cocommutative Hopf braces is semi-abelian and strongly protomodular. Moreover, under the assumption that the base field is algebraically closed and has zero characteristic, we show that the full subcategories of "primitive Hopf braces" and of "skew braces" form an hereditary torsion theory in the category of cocommutative Hopf braces, and that "skew braces" are also a Birkhoff subcategory and a localization of the latter category. Finally, we describe commutators and central extensions for cocommutative Hopf braces. The semi-abelianness of the category of cocommutative Hopf algebras achieved in [3] is recovered by considering the Birkhoff subcategory of trivial cocommutative Hopf braces.

References

[1] I. Angiono, C. Galindo, L. Vendramin, Hopf braces and Yang-Baxter operators, Proc. Amer. Math. Soc. 145 (2017), no. 5, 1981–1995.
[2] M. Gran, A. Sciandra, Hopf braces and semi-abelian categories, preprint arXiv:2411.19238.
[3] M. Gran, F. Sterck, J. Vercruysse, A semi-abelian extension of a theorem by Takeuchi, J. Pure Appl. Algebra 223 (2019), no. 10, 4171–4190.
[4] L. Guarnieri, L. Vendramin, Skew braces and the Yang–Baxter equation, Math. Comp. 86 (2017), no. 307, 2519–2534.
[5] G. Janelidze, L. Márki, W. Tholen, Semi-abelian categories, J. Pure Appl. Algebra 168 (2002), no. 2-3, 367–386.

Hopf25

Taiki Shibata
Okayama University of Science, Japan
Parallel sessions, Forum G
Friday, April 25, 2025
14h00-14h25

Exact module categories over $\mathrm{Rep}(u_q(\mathfrak{sl}_2))$

Andruskiewitsch and Mombelli (2007) have established a general theory of module categories over the representation category $\mathrm{Rep}(H)$ of a finite-dimensional Hopf algebra H: For an indecomposable exact module category $\mathcal{M}$ over $\mathrm{Rep}(H)$, there exists a right H-simple H-comodule algebra A with trivial coinvariants such that $\mathcal{M}$ is equivalent to $\mathrm{Rep}(A)$. The Taft algebra T_q at a root of unity q is one of the simplest examples of pointed Hopf algebras. Indecomposable exact module categories over $\mathrm{Rep}(T_q)$ have been classified by Etingof and Ostrik (2004). The small quantum group $H = u_q(\mathfrak{sl}_2)$ at a root of unity q of odd order would be the next simplest example of pointed Hopf algebras (after the Taft algebra) and has applications in various areas. For the coradically graded Hopf algebra U of H, Mombelli (2010) has already classified right U-simple U-comodule algebras with trivial coinvariants, and consequently classified exact module categories over $\mathrm{Rep}(U)$. Since $\mathrm{Rep}(U)$ and $\mathrm{Rep}(H)$ are categorically Morita equivalent, one can (in principle) obtain a list of indecomposable exact module categories over $\mathrm{Rep}(H)$ from Mombelli's list.

In this talk, we will give an explicit list of right H-simple H-comodule algebras with trivial coinvariants. The strategy is as follows. First, we note that H is a 2-cocycle deformation of U and we can explicitly write down such a 2-cocycle σ. For a (right U-simple) U-comodule algebra A, we can deform the algebra structure of A by using σ, which we denote by ${}_\sigma A$. Then one sees that the resulting algebra ${}_\sigma A$ is a (right H-simple) H-comodule algebra. Moreover, $\mathrm{Rep}({}_\sigma A)$ is the indecomposable exact module category over $\mathrm{Rep}(H)$ corresponding to the indecomposable exact module category $\mathrm{Rep}(A)$ over $\mathrm{Rep}(U)$ under the categorical Morita equivalence between $\mathrm{Rep}(H)$ and $\mathrm{Rep}(U)$. Therefore, for each A in Mombelli's list, we will give an explicit description of ${}_\sigma A$. We note that the determination of the σ-cocycle deformation ${}_\sigma A$ of A is not a trivial problem. For example, there is a 3-parameter family $A(\alpha, \beta, \lambda)$ $(\alpha, \beta, \lambda \in \mathbb{C})$ of U-comodule algebras generated by a single element w subject to $w^N = \lambda$ and such that the U-coaction is given as $w \mapsto (\alpha x + \beta y) \otimes 1 + g^{-1} \otimes w$, where N is the order of q and $U = \langle x, y, g^{\pm 1} \rangle$. After the 2-cocycle deformation, the algebra ${}_\sigma A(\alpha, \beta, \lambda)$ is still generated by a single element w and a similar H-coaction. However, the minimal polynomial of w becomes more complicated:

$$\prod_{i=0}^{N-1} w - (\xi_+ q^{2i} + \xi_- q^{-2i}),$$

where $\xi_\pm \in \mathbb{C}$ are chosen so that they satisfy $\xi_+^N + \xi_-^N = \lambda$ and $\xi_+ \xi_- (1 - q^2) = \alpha\beta$.

This talk is based on ongoing joint work with Kenichi Shimizu (Shibaura Institute of Technology) and Daisuke Nakamura (Okayama University of Science).

Hopf25

Kenichi Shimizu
Shibaura Institute of Technology, Japan
Plenary talk, Forum E
Saturday, April 26, 2025
10h00-10h25

Simple algebras in $\mathrm{Rep}(u_q(\mathfrak{sl}_2))$

This talk is based on our joint work with Daisuke Nakamura, Hin Wang Ng and Taiki Shibata. In the theory of finite tensor categories and their applications, the notion of an algebra in a finite tensor category often plays an important role. As in the ordinary ring theory, simple algebras are one of the most fundamental classes of algebras. Coulembier, Stroiński, and Zorman recently showed that the category $\mathcal{C}_A$ of right modules over a simple algebra A in a finite tensor category $\mathcal{C}$ is an indecomposable exact module category over $\mathcal{C}$, as conjectured by Etingof and Ostrik. Given this result and others on finite tensor categories and their modules, we are interested in studying and classifying simple algebras with some properties or structures.

A typical example of a finite tensor category is the category $\mathrm{Rep}(H)$ of representations of a finite-dimensional Hopf algebra H. In this talk, after reviewing basic results on simple algebras in finite tensor categories, I will present the progress of our project to classify simple algebras in $\mathrm{Rep}(u_q(\mathfrak{sl}_2))$ with some properties or structures, where $u_q(\mathfrak{sl}_2)$ is the small quantum group associated with $\mathfrak{sl}_2$ at a root of unity q of odd order. Let, in general, $\mathcal{C}$ be a finite tensor category. It is known that every simple algebra in $\mathcal{C}$ is of the form $\underline{\mathrm{End}}_{\mathcal{M}}(X)$, where X is a non-zero object of an indecomposable exact module category $\mathcal{M}$ over $\mathcal{C}$ and $\underline{\mathrm{End}}_{\mathcal{M}}$ means the internal endomorphism algebra in $\mathcal{C}$. A Morita theoretic argument shows that $A := \underline{\mathrm{End}}_{\mathcal{M}}(X)$ is simple in $\mathcal{C}_A$ if and only if X is simple. Using the relative Serre functor of $\mathcal{M}$, one can also characterize when A is (symmetric) Frobenius. Given an object Y of another indecomposable exact module category $\mathcal{N}$ over $\mathcal{C}$, the algebras $\underline{\mathrm{End}}_{\mathcal{N}}(Y)$ and $\underline{\mathrm{End}}_{\mathcal{M}}(X)$ are isomorphic if and only if there is an equivalence $\mathcal{M} \to \mathcal{N}$ of module categories sending X to Y.

By applying the above abstract results for $\mathcal{C} = \mathrm{Rep}(u_q(\mathfrak{sl}_2))$, we obtain a list of simple algebras in $\mathrm{Rep}(u_q(\mathfrak{sl}_2))$ that is simple as a right module, in the form of an internal endomorphism algebra, and determine whether it is (symmetric) Frobenius.

Since the computation of the internal endomorphism algebra is not an easy problem in general, our list of simple algebras is still somewhat implicit. I will introduce some techniques or attempts to find generators and relations of the internal endomorphism algebra. I will also discuss the braided commutativity of simple algebras in $\mathrm{Rep}(u_q(\mathfrak{sl}_2))$.

Hopf25

Shashank Singh
The University of Iowa, United States
Parallel session, Forum G
Wednesday, April 23, 2025
15h-15h25

Tensor Algebras in the Representation Category of Taft Algebras

Starting with a bimodule M over an algebra A, one can form the tensor algebra $T_A(M)$ consisting of all finite tensors of elements from M with multiplication given by the tensor product over A. Following the work of Etingof-Kinser-Walton, we will take a closer look at how the construction of tensor algebras can be generalized to the abstract setting of (finite) tensor categories. I will conclude with discussing my current research on bimodules over algebras in the tensor category of finite dimensional representations of Taft algebras.

Hopf25

Noah Snyder
Indiana University, Bloomington, United States
Plenary talk, Forum E
Saturday, April 26, 2025
9h30-9h55

Interpolation categories for Conformal Embeddings

We give a diagrammatic description of the categories of modules coming from the conformal inclusions $\mathcal{V}(\mathfrak{sl}_N, N) \subset \mathcal{V}(\mathfrak{so}_{N^2-1}, 1)$. A small variant on this construction has uniform generators and relations which are rational functions in $q = e^{2\pi i/4N}$, which allows us to construct a new continuous family of tensor categories at non-integer level which interpolate between these categories. This is the second example of such an interpolation category for families of conformal inclusions after Zhengwei Liu's interpolation categories $\mathcal{V}(\mathfrak{sl}_N, N+2) \subset \mathcal{V}(\mathfrak{sl}_{N(N+1)/2}, 1)$ which he constructed using his classification Yang-Baxter planar algebras. Our approach is different from Liu's, we build a two-color skein theory, with one strand coming from X the image of defining representation of $\mathfrak{sl}_N$ and the other strand coming from an invertible object g in the category of local modules, and trivalent vertex coming from a map $X \otimes X^* \longrightarrow g$.

This is joint work with Cain Edie-Michell and Hans Wenzl.

Hopf25

Yorck Sommerhäuser
Memorial University of Newfoundland, Canada
Parallel sessions, Forum E
Friday, April 25, 2025
14h-14h25

Mapping Class Group Representations from Hopf Algebras: Examples

In a relatively recent volume of the "SpringerBriefs in Mathematical Physics" series, S. Lentner, S. N. Mierach, C. Schweigert, and the presenter have described how the so-called spaces of conformal blocks can be generalized to the so-called derived block spaces. In the present talk, we compute these block spaces in an explicit example, namely in the case of the Drinfeld double of the smallest nonabelian group, the symmetric group on three letters. The talk is based on joint work with the same authors.

Hopf25

Mateusz Stroiński
Uppsala universitet, Sweden
Parallel sessions, Forum G
Friday, April 25, 2025
14h30-14h55

Simple algebras and exact module categories

Exactness is an important property of module categories over tensor categories, and module categories are often understood via categories of modules for an algebra object. Thus, it is natural to ask when a category of modules is an exact module category. Etingof and Ostrik conjectured that, in the indecomposable case, exactness of the category of modules is equivalent to the absence of ideal objects in the algebra object.

Indeed, exactness of the internal Hom renders every module "internally projective-injective", so the algebra should be "internally semisimple", and indecomposability implies that it must be simple. In this talk, I will give a proof of the conjecture, based on an analogue of the Jacobson radical inside an algebra object.

I will explain how this result generalizes the results of Skryabin on projectivity of Hopf modules for simple comodule algebras over a finite-dimensional Hopf algebra, and show some applications to tensor categories in positive characteristic, and to vertex operator algebras.

Time allowing, I will discuss the notions of "internally semisimple" algebras and modules which emerge from the proof, and a characterization of modules over the maximal semisimple quotient of an algebra.

Hopf25

Frank Taipe
Instituto de Matemática y Ciencias Afines, Peru
Parallel sessions, Forum F
Tuesday, April 22, 2025
15h-15h25

On Algebraic Quantum Transformation Groupoids

Algebraic quantum transformation groupoids are a class of measured multiplier Hopf $*$-algebroids, in the sense of T. Timmermann, that contain as particular case transformation groupoids and algebraic quantum groups in the sense of A. Van Daele. The main ingredient of our algebraic construction is that of a braided commutative measured Yetter-Drinfeld $*$-algebra over an algebraic quantum group, and one of the interesting features of those quantum objects is that they are closed by a Pontryagin-like duality. This talk is based on the work `https://arxiv.org/abs/2306.17753`.

Hopf25

James Timmins
University of Edinburgh, United Kingdom
Poster session

Iwasawa algebras and dimensions

An Iwasawa algebra is a ring built from some of the simplest examples of Hopf algebras: group algebras of finite groups. I'll explain how this allows the Iwasawa algebra to control the representation theory of p-adic Lie groups. We'll also discuss dimension-theoretic invariants for these Noetherian rings.

Hopf25

Arne Van Antwerpen
Universteit Gent, Belgium
Poster session

Central Nilpotency in Skew Braces: an overview

Central nilpotency of skew braces was introduced by Bonatto and Jedlička. We will discuss their work and the results of work with E. Jespers and L. Vendramin. Central nilpotent skew braces coincide with the class of skew braces that are 'as nilpotent as possible', i.e. left and right nilpotent of nilpotent type. An attractive property of central nilpotency is that it is governed by a commutator, stemming from work of Bourn, Facchini and Pompili, in contrast to the known notions of left and right nilpotency. We will show that centrally nilpotent skew braces are reminiscent of nilpotent groups, e.g. torsion elements form an ideal of the skew brace and finitely generated centrally nilpotent skew braces are residually finite. We discuss some recent results on finite centrally nilpotent skew braces of prime power order and their relevance to studying multipermutation solutions of the Yang-Baxter equation, through the use of the cabling method, as proposed by Lebed, Ramírez and Vendramin and implicitly present in work of Feingesicht.

Hopf25

Gert Vercleyen
Purdue University, USA
Parallel sessions, Forum F
Friday, April 25, 2025
16h-16h25

Anyonica and the anyonwiki

In this talk I will present two tools we have developed to work with fusion categories on a computer. On the one hand there is a software package, Anyonica, that contains various datasets on fusion rings and categories, including all data on multiplicity-free fusion categories up to rank 7. On the other hand there is a website, the anyonwiki, where one can obtain data and find general properties of fusion rings and categories. Several of our future plans to expand these tools will also be discussed.

Hopf25

Alexis Virelizier
Université de Lille, France
Plenary talk, Forum E
Saturday, April 26, 2025
10h30-10h55

Monoidal categories graded by crossed modules

I will introduce the notion of a monoidal category graded by a crossed module $\chi : E \to H$. In such a category, the objects have a degree in H and the morphisms have a degree in E (which are related via χ). The motivation for the introduction of χ-graded monoidal categories is that they are useful to construct 3-dimensional homotopy field theories with target the classifying space of the crossed module χ (which is a homotopy 2-type). I will also introduce Hopf χ-(co)algebras, which generalize Hopf algebras and Hopf group-(co)algebras and whose categories of representations are χ-graded monoidal.

Hopf25

Chelsea Walton
Rice University, Houston, USA
Plenary talk, Forum E
Tuesday, April 22, 2025
11h30-12h25

Representations of braided categories

In the talk, I'll discuss recent work with Robert Laugwitz and Milen Yakimov, and with Harshit Yadav, on module categories over braided finite tensor categories. This will be based on the articles `ArXiv/2307.14764` and `ArXiv/2411.18453`, and I'll aim to keep this down-to-earth.

Hopf25

Abigail Watkins
Indiana University, United States
Parallel sessions, Forum G
Wednesday, April 23, 2025
14h30-14h55

Functors from Bicrossed Fusion Categories

The study of fusion categories is young and a problem at the forefront of the field is to develop a robust catalog of examples on which to test our intuition. Last year, M. Muller, J. Plavnik, and H. Peña Polastri introduced a new construction of fusion categories called the bicrossed product. This work has allowed for the definition of a class of fusion categories which we wish to better understand. As Yoneda introduced into category-theoretic folklore, to understand one mathematical object is equivalent to understanding its relation to others. So, in this talk, we will aim to learn more about these categories by giving a classification of functors out of bicrossed fusion categories. Further, this classification allows us to describe fiber functors and module categories over bicrossed products of fusion categories. The content of this talk is based on joint work with Monique Müller, Héctor Peña Pollastri, and Julia Plavnik.

Hopf25

Thomas Weber
Charles University in Prague, Czech Republic
Plenary talk, Forum E
Wednesday, April 23, 2025
10h-10h25

Hopf-Galois extensions in noncommutative differential geometry

The aim of noncommutative differential geometry is to extend differential geometry from commutative algebras to possibly noncommutative ones. In this framework, Hopf-Galois extensions play the role of principal bundles, where the Hopf algebra replaces the structure group and the subalgebra of coinvariants encodes the base algebra. The total space algebra turns out to be braided-commutative via the Đurđević braiding. We recall this construction of quantum principal bundle and outline how to endow the latter with differential structures in a compatible way. As a consequence, the noncommutative Atiyah sequence is exact and the total space differential calculus becomes a graded Hopf-Galois extension. We further provide examples on the quantum Hopf fibration and crossed product algebras. This talk is based on a collaboration with Del Donno, Latini and Sciandra, building on previous work of Đurđević, Brzeziński and Majid.

Hopf25

Hao Xu
University of Göttingen, Germany
Parallel sessions, Forum F
Friday, April 25, 2025
16h30-16h55

Étale algebras in 4D Dijkgraaf-Witten models

4D Dijkgraaf-Witten models are gauge theories for finite symmetry group G with anomaly given by a bosonic or fermionic 4-cocycle. Topological defects in a 4D Dijkgraaf-Witten model form a braided fusion 2-category, mathematically described by the Drinfeld center of a strongly fusion 2-category. In my talk, I will present recent progress in the classification of connected and Lagrangian étale algebras in 4D Dijkgraaf-Witten models. I will also comment on their relations with anyon condensations in 4D and application to the classification of fusion 2-categories. Based on the arXiv preprint `https://arxiv.org/abs/2411.13367`, this work offers new insights into the interplay between group cohomology, étale algebras, and higher-categorical structures, with implications for topological quantum field theory and quantum symmetry.

Hopf25

Tony Zorman
TU Dresden , Germany
Parallel sessions, Forum G
Friday, April 25, 2025
16h30-16h55

Exact module categories over $\mathrm{Rep}(u_q(\mathfrak{sl}_2))$

A classical result by Moerdijk and McCrudden is that Tannaka reconstruction for bialgebras may be lifted to bimonads: there is a bijection between monoidal structures on the Eilenberg–Moore category of a monad T that are compatible with the forgetful functor, and bimonad structures on T. This theorem may even be generalised to comodules over a bimonad.

In contrast to these kinds of reconstruction results is Deligne reconstruction, where one does not require a forgetful functor. This comes at the cost of not recovering the algebraic object of interest on-the-nose, but only up to Morita equivalence. This talk generalises a Deligne reconstruction result of Ostrik about Hopf algebras on a finite tensor categories to the general case of characterising lax module monads on a nice module category over a general abelian monoidal category with enough projectives. Crucially, the proof does not need any rigidity assumptions on the underlying category.

As an application, we give conceptual proofs of the fundamental theorem of Hopf modules, and the fact that a bimonad is Hopf if and only if it is strong as a module monad over its base category.

The talk is based on joint work with Matti Stroiński (`https://arxiv.org/abs/2409.00793`).

Hopf25

Réamonn Ó Buachalla
Charles University, Czech Republic
Plenary talk, Forum E
Thursday, April 24, 2025
10h-10h25

Nichols Algebras versus Bimodule Connections

One of the well-known motivations for Nichols algebras comes from the noncommutative geometry of quantum groups, and in particular the Woronowicz construction of Nichols algebras from bicovariant differential calculi. In recent years, a quantum principal bundle variation on the Woronowicz construction was discovered, and applied to the quantum Grassmannians' Heckenberger-Kolb calculi. Moreover, it was also conjectured that this construction extends to the B,C, and D series irreducible quantum flag manifolds. In this talk we show that this conjecture is false, explaining why, for the B2 and C3 cases, no equivariant Nichols algebra description exists. However, we produce an alternative description of these quantum exterior algebras in terms of the bimodule map of Levi-Civita connections of the Heckenberger-Kolb calculi. Time permitting, possible extensions of this work to the Lusztig calculi of the full quantum flag manifolds will be discussed.

Hopf25

Zoran Škoda
University of Zadar, Croatia
Parallel sessions, Forum G
Friday, April 25, 2025
16h-16h25

Bicategorical Doi-Takeuchi correspondence and locally cleft noncommutative principal bundles

In 1980s Doi and Takeuchi exhibited a correspondence between cocycled crossed products and cleft extensions. I show how this correspondence extends to a bicategorical equivalence, which as a particular case specializes to a presentation of locally cleft Hopf algebraic extensions of corings with a grouplike element by explicit cocycle data. In particular, the earlier examples by the speaker and others of locally cleft noncommutative principal bundles are special cases of the latter. This includes both the localities in the sense of noncommutative open covers described by flat localizations as well as those in the sense of closed covers described by ideals.