Hopf Algebras and Actions, Part II
Seattle Workshop 2016

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Organizers of the workshop

Susan Montgomery, University of Southern California, USA
James J. Zhang, University of Washington, USA

Organizers of the Lie Theory Workshop series

This workshop is one of the Lie Theory Workshops organized by Geoff Mason (University of California, Santa Cruz), Susan Montgomery (University of Southern California) and Joseph Wolf (University of California at Berkeley).

All talks are given in Room SAV 131 and coffee break in SAV 156.

ABSTRACT

Poisson Clusters and Unique Factorization

Ken Goodearl

University of California at Santa Barbara

I will discuss cluster algebras with Poisson structures, their relationship with quantum cluster algebras, and how they can arise from unique factorization in Poisson polynomial rings. This is joint work with Milen Yakimov.

On the adjoint representation of Hopf algebras

Adam Jacoby

Temple University

The talk will recall basic properties of the adjoint representation of a group algebras and then discuss their generalizations to wider classes of Hopf algebras. In particular it will focus on the Hopf annihilator of the adjoint representation.

On classification of semisimple Hopf algebras

Yevgenia Kashina

DePaul University

In this talk we will discuss classification of semisimple Hopf algebras of dimension 2^m arising from abelian extensions. We will consider a group homomorphism from the group of equivalence classes of abelian extensions of kL by k^G, $\mathrm{H}^2\left(kL, k^G\right)$, to the Schur multiplier $M(G)$ (for a fixed action of the group L of order 2 on an arbitrary group G of order 2^{m-1}). We will show that its kernel is isomorphic to $\mathrm{H}^2\left(L, \hat{G}\right)$ and that its image lies inside certain subgroup $M(G)^-$. This implies that $\left|\mathrm{H}^2\left(kL, k^G\right)\right| \leq \left|\mathrm{H}^2\left(L, \hat{G}\right)\right| \cdot \left|M(G)^-\right|$. We will conclude that there are at most $N\left(|\mathbf{G}| \cdot |M(\mathbf{G})|/2 - 1\right)$ nonisomorphic nontrivial Hopf algebras of dimension 2^m with group of group-like elements isomorphic to an abelian group $\mathbf{G}$ of order 2^{m-1}, where N is the number of distinct conjugacy classes of elements of order 2 in $\mathrm{Aut}(\mathbf{G})$.

Auslander's Theorem: A survey

Ellen Kirkman

Wake Forest University, USA

Maurice Auslander proved that when a finite subgroup G of $\mathrm{GL}_n(\mathbb{C})$, containing no reflections, acts on $A = \mathbb{C}[x_1, \ldots, x_n]$ naturally, with fixed subring A^G, then the skew group algebra $A\#G$ is isomorphic to $\mathrm{End}_{A^G}(A)$ as algebras. I will detail some extensions of this theorem to more general settings, including some recent results by Bao, He, and Zhang.

Connected Hopf Algebras from Drinfel'd R-Matrix Quantizations: Properties and Applications

Jesse Levitt

Louisiana State University, USA

The classification problem for Hopf Algebras of finite GK-dimension has attracted a lot of interest in recent years. We recently developed a new perspective on it from deformation theory. In 1983 Drinfel'd constructed quantizations from all triangular R-matrices. Hopf algebras constructed in this way are isomorphic, as algebras, to universal enveloping algebras. This construction recovers almost all of the known connected Hopf algebras of finite GK-dimension, and leads to many new examples from the general point of view of quasi-Frobenius Lie algebras. This talk will explore several useful properties and applications of connected Hopf algebras of this type. This is a joint work with Milen Yakimov.

On the projective representation of SL(2,Z) of a modular category

Richard Ng

Louisiana State University, USA

The Yetter-Drinfeld category of any complex semisimple Hopf algebra is a modular category. Associated to each modular category is natural a projective representation of SL(2,Z), which is an invariant of the modular category. This representation is, in general, reducible. The characterization of modular categories with irreducible representations of SL(2,Z) remains open. In this talk, we discuss the some decomposition conditions for these representations and their application on modular categories of small rank.

Orbits of the Brauer-Picard group of a fusion category

Julia Plavnik

Texas A&M University

Fusion categories and their module categories can be seen as categorical analogous to rings and their modules. The Brauer-Picard group BrPic(C) of a fusion category C consists of equivalence classes of invertible C-bimodule categories. This group was introduced by Etingof, Nikshych and Ostrik and it is a fundamental tool to construct extensions of fusion categories. That is why this group has gained a lot of attention lately. In this talk, we will introduce some basic notions and properties and we will describe the orbits of the action of the Brauer-Picard group on the set of module categories. We will also present a categorification of the Rosenberg-Zelinsky sequence for fusion categories. These results are part of a joint work with C. Galindo (preprint arXiv:1407.2783).

Automorphisms of Drinfeld Doubles and Bismash Products

Joe Timmer

University of Colorado at Boulder

Recent work of Marc Keilberg and Peter Schauenburg can be used to describe the structure of the automorphism group of the Drinfeld double $\mathcal{D}(G)$ for a finite group $G = C \times H$ with C abelian and H non-abelian with no non-trivial abelian direct factor.

In this talk, we will outline the methods and reductions used to prove this result. We also present current obstacles and questions about generalizations to bismash products and in particular, Drinfeld doubles of finite groups.

Classifying fusion categories by realization as systems of endomorphisms on operator algebras

Henry Tucker

University of Southern California

Izumi and Evans-Gannon have obtained classification results for some important families of singly-generated fusion categories using techniques from the Jones theory of subfactors. Specifically, they realize these abstract fusion categories as systems of endomorphisms on Cuntz C* algebras and their non-unitary generalizations. From these realizations one may obtain classification parameters as well as the modular data for the Drinfel'd centers. We will discuss preliminary work with Izumi for completing the classification of near-group fusion categories and for understanding his classification parameters in the context of quadratic forms.

Finite dimensional Hopf actions on algebraic quantizations

Chelsea Walton

Temple University

I will discuss joint work with Pavel Etingof on (the lack of) finite dimensional Hopf actions on algebraic quantizations of commutative domains. (Here, the deformation parameter of the quantization is an element of the ground field, rather than a formal parameter.) This includes results on Hopf actions on universal enveloping algebras of finite dimensional Lie algebras, spherical symplectic reflection algebras, quantum polynomial algebras, and elliptic algebras (twisted homogeneous coordinate rings of abelian varieties and Sklyanin algebras). This is a continuation of the joint work with Juan Cuadra on finite dimensional Hopf actions on Weyl algebras (arxiv:1409.1644, arXiv:1509.01165) and the recent work on such actions on deformation quantizations (arXiv:1602.00532).

Quantum groups associated to N-Koszul Artin-Schelter regular algebras

Xingting Wang

Temple University

In the previous work, we showed that certain quantum groups that universally coact on an Artin-Schelter (AS) regular algebra of global dimension two possess the same nice homological and ring-theoretic properties as the underlining graded algebra. In this talk, we take a further step to investigate universal quantum groups associated to arbitrary N-Koszul AS regular algebras. This work leads to a rediscovery of many quantum groups defined by various authors in the literature. By a recent work of Raeschelders and van den Bergh, quantum groups associated to one single Koszul AS regular algebra have nice corepresentation theory. But in the ring-theoretic direction, it is more interesting to look at universal quantum groups that simultaneously coact on a pair of N-Koszul AS regular algebras. It turns out that these quantum groups have surprisingly nice presentations in terms of the corresponding twisted superponentials of the underlining graded algebras. Many examples of this type will be discussed including those defined by three-dimensional Sklyanin algebras. This is a joint work with Alexandru Chirvasitu and Chelsea Walton.

Primitive cohomology of Hopf algebras

Guangbin Zhuang

University of Southern California

Primitive cohomology of a Hopf algebra is defined by using a modification of the cobar construction of the underlying coalgebra. As an application, we classify all pointed Hopf algebras of rank one, generalizing results of Krop-Radford and Wang-You-Chen which classified Hopf algebras of rank one under extra hypothesis. In this talk I will also talk about some other applications of primitive cohomology.