报告摘要

Deformations and Their Controlling Cohomologies of $\mathcal{O}$-operators

Chengming Bai（白承铭）
Chern Mathematical Institute

We establish a deformation theory of a kind of linear operators, namely, $\mathcal{O}$-operators in consistence with the general principles of deformation theories. On the one hand, there is a suitable differential graded Lie algebra whose Maurer-Cartan elements characterize $\mathcal{O}$-operators and their deformations. On the other hand, there is an analogue of the André-Quillen cohomology which controls the deformations of $\mathcal{O}$-operators. Infinitesimal deformations of $\mathcal{O}$-operators are studied and applications are given to deformations of skew-symmetric r-matrices for the classical Yang-Baxter equation. This is joint work with Li Guo, Yunhe Sheng and Rong Tang.

Hall Algebras and Quantum Cluster Algebras

Xueqing Chen（陈学庆）
University of Wisconsin-Whitewater

Through the Ringel-Hall algebra approach, one can construct quantum groups from some abelian categories, and construct Kac-Moody Lie algebras and some elliptic Lie algebras from the derived categories of some finite dimensional associative algebras. In this talk, the constructions of Hall algebras of some abelian categories and derived Hall algebras of some triangulated categories will be presented and the relations between them will be characterized. We will also address some connections between Hall algebras and quantum cluster algebras. As an application, we categorify an algebra homomorphsim from some subalgebra of a derived Hall algebra to the corresponding quantum cluster algebra. This talk is based on joint works with Ming Ding, Fan Xu and Haicheng Zhang.

A Realisation of the Enveloping Algebras of Queer Lie Superalgebras

Haixia Gu（顾海霞）
Huzhou University

Queer Lie superalgebras over the complex number field arise from one type of simple superalgebras. They have close relationship with queer Schur superalgebras and Hecke-Clifford algebras with quantum parameter equal to one. In this paper, we realised their enveloping algebras as the subalgebras of the direct product of queer Schur superalgebras. This is joint work with Zhenhua Li and Yanan Lin.

Algebraic Groups over a Semifield of One Element

Xuhua He（何旭华）
The Chinese University of Hong Kong

In 1994, Lusztig established the theory of total positivity. Very recently, he showed that how the total positivity of reductive groups are related to the reductive group over a semifield of one element.

Vertex Operator Algebras Generated by Ising Vectors of σ-type

Cuipo Jiang（姜翠波）
Shanghai Jiaotong University

We give a complete classification and characterization of OZ-type vertex operator algebras generated by Ising vector of σ-type. Furthermore, we prove that all these vertex operator algebras are rational, C_2-cofinite and unitary, with which we prove that the classification theorem of 3-transposition groups $G_{\frac{1}{2}',\frac{1}{2}}$ realizable by vertex operator algebras, given by Matuo, still holds without the positivity assumption. This is joint work with Ching-Hung Lam and Hiroshi Yamauchi.

Automorphic L-functions and Langlands Functoriality

Dihua Jiang（江迪华）
University of Minnesota

More than 30 years ago, Professor Cao encouraged me to study automorphic forms and the Langlands program when I was a graduate student at ECNU for my Masters degree. Since then, I have been studying and working in the Langlands program. I felt it is proper to talk about the Langlands program in memorial of Professor Cao.

Automorphic L-functions are central objects in the modern theory of automorphic forms and in the Langlands program. The poles of automorphic L-functions encode intrinsic structures of automorphic forms related to the Langlands principle of functoriality. I will recall the basics about automorphic L-functions and the Langlands functoriality, and discuss some recent progress and some prospective related to the Langlands conjectures.

From Quantum Groups to i-Quantum Groups

Li Luo（罗栗）
East China Normal University

The “ECNU group”, led by Prof. Cao Xihua, made amounts of significant work on quantum groups and Hecke algebras, such as the study of cell structure (by Shi, Xi, etc.), the study of q-Schur algebras, Schur-Weyl duality and the Beilinson-Lusztig-MacPherson realization for quantum groups (by Wang, Du, Rui, Hu, Fu, etc.). As generalizations of quantum groups, the i-quantum groups have recently drawn considerable attention. This talk will give some developments on the study of i-quantum groups, which generalize the foresaid work achieved by the “ECNU group”. Precisely, we study the q-Schur algebras and their cells for any type, establish the Schur-Weyl duality for affine type with multi-parameters, and give the BLM realization for i-quantum groups (of affine type C) and their canonical basis.

The talk is based on a series of joint work with Wang, Fan, Li, Lai, Cui and so on.

Generalized Frobenius Categories and Modified Ringel-Hall Algebras

Liangang Peng（彭联刚）
Sichuan University

我们定义广义 Frobenius 范畴，它特别地包含 Frobenius 范畴和遗传正合范畴的有界或周期的复形范畴。我们首先给出它的导出范畴的概念，然后定义相应的 modified Ringel-Hall 代数。该 modified Ringel-Hall 代数是 Bridgeland 关于投射对象的复形的 Hall 代数、Gorsky 关于 Frobenius 范畴的半导出 Hall 代数、以及我们之前关于遗传 Abel 范畴的复形范畴的 modified Ringel-Hall 代数的统一。我们的主要结果是利用广义 Frobenius 范畴的导出范畴给出了相应 modified Ringel-Hall 代数的一组基。这是与林记合作的工作。

The Lang-Trotter Conjecture and the Hardy-Littlewood Conjecture

Hourong Qin（秦厚荣）
Nanjing University

Let E be an elliptic curve over $\mathbb{Q}$. For a fixed integer r, define the prime-counting function $\pi_{E,r}(x) \coloneqq \sum_{p\le x, a_E, a_p=r} 1$. The Lang-Trotter conjecture predicts that

$$\pi_{E,r}(x) = C_{E,r} \cdot \frac{\sqrt{x}}{\log x} + o\left(\frac{\sqrt{x}}{\log x}\right)$$

as $x \longrightarrow \infty$, where $C_{E,r}$ is a specific non-negative constant.

It is open whether there exists a polynomial in one variable of degree 2 that represents infinitely many primes. For example, at present, we do not know whether the polynomial $x^2 + 1$ represents infinitely many primes. The Hardy-Littlewood conjecture gives a similar asymptotic formula as above for the number of primes of the form $ax^2 + bx + c$.

We establish a relationship between the Hardy-Littlewood conjecture for $x^2 + 1$ and the Lang-Trotter conjecture for the elliptic curve $y^2 = x^3 + Dx$.

A Miyaoka-Yau Type Inequality of Surfaces in Characteristic $p > 0$

Xiaotao Sun（孙笑涛）
Tianjin University

For minimal smooth projective surfaces S of general type, we prove $K_S^2 \leq 32\chi(\mathcal{O}_S)$ and give examples of S with $K_S^2 = 32\chi(\mathcal{O}_S)$. This proves that $\chi(\mathcal{O}_S) > 0$ holds for all smooth projective minimal surfaces S of general type, which answers completely a question of Shepherd-Barron. Our key observation is that such Miyaoka-Yau type inequality follows slope inequalities of a fiberation $f: S \to C$. However, we will give examples of $f: S \to C$ with non-smooth generic fibers of arithmetic genus $g \geq 2$ such that

$$K_{S/C}^2 < \frac{4g-4}{g} \deg f_* \omega_{S/C},$$

which are counterexamples of Xiaos slope inequality in case of a positive characteristic. This is joint work with Gu Yi and Zhou Mingshuo.

Professor Cao Xihua and His School

Lin Tan (谭琳)
West Chester University

Shared will be some Reminiscences in Professor Cao and his school in algebraic groups and related fields, from the vantage viewpoint of a student and a family member.

Trigonometric Lie algebras, Affine Lie Algebras

Shaobin Tan（谭绍滨）
Xiamen University

We present natural connections among trigonometric Lie algebras, affine Lie algebras, and vertex algebras. More specifically, we prove that restricted modules for trigonometric Lie algebras naturally correspond to equivariant quasi modules for the affine vertex algebra. Furthermore, we prove that every quasi-finite unitary highest weight irreducible module of type A trigonometric Lie algebra rises to an irreducible equivariant quasi module for the simple affine vertex algebra.

Filtered Quantization, Skew Calabi-Yau Algebras and Poisson Algebras

Quanshui Wu（吴泉水）
Fudan University

Suppose that A is a filtered algebra such that the associated graded algebra gr(A) is commutative Calabi-Yau. Then gr(A) has a canonical Poisson structure with a modular derivation and A is skew Calabi-Yau. We describe a connection between the Nakayama automorphism of A and the modular derivation of gr(A) by using homological determinants. Some applications will also be given in the talk. This talk is based on joint work with Ruipeng Zhu.

Representations of Algebraic Groups

Nanhua Xi（席南华）
Academy of Mathematics and Systems Sciences
Academy of the Chinese Academy of Sciences

I will talk about some basics and advances in representation theory of algebraic groups.

On Bases of Quantum Affine Algebras

Jie Xiao（肖杰）
Tsinghua University

Based on the work in [1] and [2], we give a reductive version of quantum affine algebras in terms of the Ringel-Hall algebras of tame hereditary algebras. This allows us to give an explicit construction of PBW bases and monomial bases. Moreover, a triangular relation between these two bases over $\mathbb{Z}[v, v^{-1}]$provides an algebraic construction of the canonical basis. This is joint work with Han Xu and Minghui Zhao.

References:

[1] B. Deng, J. Du, J. Xiao, Generic extensions and canonical bases for cyclic quivers, Canad. J. Math. 59 (2007), 1260–1283.
[2] Z. Lin, J. Xiao, G. Zhang, Representations of tame quivers and affine canonical bases, Publ. Res. Inst. Math. Sci. 47 (2011), 825–885.

Geck's Conjecture and the Generalized Gelfand-Graev Representations in Bad Characteristic

Gao Yang（杨高）
Harbin Engineering University

For a connected reductive algebraic group G defined over a finite field $\mathbb{F}_q$, Kawanaka introduced the generalized Gelfand-Graev representation (GGGR) of the finite group $G(\mathbb{F}_q)$ in the case where q is a power of a good prime for G. This representation has been widely studied and used in various contexts. Recently, Geck proposed a conjecture, characterizing Lusztig's special unipotent classes in terms of weighted Dynkin diagrams. Based on this conjecture, he gave a guideline for extending the definition of GGGRs to the case where q is a power of a bad prime for G. In this talk, I will give a basic introduction to GGGRs and its application in representation theory. Then I will explain a proof of Geck's conjecture, and some consequences. This is based on joint work with Dong Junbin, with the help of Professor Shoji. The article on arXiv, is numbered 1910.03764.

Problems and Conjectures in the Representation Theory of Finite Groups

Jiping Zhang（张继平）
Peking University

Representation theory of finite groups started and developed by Ferdinand Georg Frobenius from 1896, and contributions were also made by Dedekind, Burnside, Schur, Noether, and others. Foundations of the modular representation theory were laid out almost singlehandedly by Richard Brauer, started in 1935 and continued over the next few decades. Today the representation theory of finite groups is a thriving subject, with many fascinating and deep open problems, and some recent great successes. In 1963 Richard Brauer formulated a list of deep conjectures and problems about ordinary and modular representations of finite groups. These have led to many new concepts and methods, but basically all of his main conjectures are still unsolved to the present day. We will discuss some basic problems and current approaches and recent progress on some of these problems.