

2020 Taipei Workshop on Representation Theory and Related Topics

August 31 – September 2, 2020

Institute of Mathematics, Academia Sinica, Taipei, Taiwan

	Aug.31, Monday	Sep.1, Tuesday	Sep.2, Wednesday
	09:30 – 10:00 registration		
Chair	Yung-Ning Peng	Wan-Yu Tsai	Cheng-Chiang Tsai
10:00 – 10:50	Cheng-Chiang Tsai	Chun-Ju Lai	Wei-Hsuan Yu
11:00 – 11:50	Shu-Yen Pan	Yung-Ning Peng	Ziqing Xiang
	Group Photo		
LUNCH			
Chair	Chih-Whi Chen	Wei-Hsuan Yu	
13:20 – 14:10	Wan-Yu Tsai	Chih-Whi Chen	
14:20 – 15:10	Meng-Kiat Chuah	Shun-Jen Cheng	
15:10 – 15:30	TEA		
Chair	Chun-Ju Lai	Ziqing Xiang	
15:30 – 16:20	Sheng-Fu Chiu	Ching Hung Lam	
16:30 – 17:20	You Hung Hsu	Ryo Sato	

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Tilting modules for classical Lie superalgebras

Chih-Whi Chen (NCU)

Abstract

We will introduce tilting modules and a version of Ringel duality for the parabolic versions of the category \mathcal{O} of a general classical Lie superalgebra. As an application, we study the irreducible character problem and homological properties of parabolic category \mathcal{O} for the periplectic Lie superalgebra. This talk is based on several joint works with Shun-Jen Cheng, Kevin Coulembier, Volodymyr Mazorchuk and Yung-Ning Peng.

Representation theory of a semisimple extension of the Takiff superalgebra

Shun-Jen Cheng (AS)

Abstract

We study a semisimple extension of a Takiff superalgebra which turns out to have a remarkably rich representation theory. We classify the conjugacy classes of Borel subalgebras and determine the blocks in the finite-dimensional and BGG categories. We then study the blocks in the finite-dimensional module categories in detail. This is a joint work with Kevin Coulembier.

Hamiltonian Derived Representation and Rigidity

Sheng-Fu Chiu (AS)

Abstract

The Hamiltonian diffeomorphism group of a symplectic manifold is a mysterious group exhibiting both flexibility and rigidity. On the one hand, this group satisfies fragmentibility and can be as multiply transitive as possible. On the other hand, this group possesses strictly more fixed points than a general diffeomorphism should have, and is topologically closed in the group of all diffeomorphisms. As a Lie group, it is rich enough to carry a bi-invariant metric which is a remarkable pure infinite dimensional feature. Despite its lack of usual representation, however, it admits locally a representation on the derived category of sheaves. In this talk I will discuss the usage of this derived version of representation of Hamiltonian group to study the rigidity phenomenon of the bracket of its Lie algebra.

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Diagrammatic Methods in Lie Theory

Meng-Kiat Chuah (NTHU)

Abstract

In this survey talk, I discuss how I use the Dynkin diagrams to reveal algebraic structures of complex and real semisimple Lie algebras and Lie superalgebras, including their symmetric spaces, finite order automorphisms, and outer automorphism groups.

A categorical action of the shifted $q=0$ affine algebras

You Hung Hsu (NCTS)

Abstract

Categorification is the process of finding hidden higher-level structures. In this talk, I will introduce a new class of algebra, which is called the shifted $q=0$ affine algebra. It is similar to the shifted quantum affine algebras defined by Finkelberg-Tsymbaliuk. Our motivation comes from the categorification of quantum groups and their actions on categories. Then I will explain how the shifted $q=0$ affine algebra acts on categories by using the language of Fourier-Mukai transformations. The kernels are induced by natural correspondences on the bounded derived categories of coherent sheaves on Grassmannians or partial flag varieties. Finally, I will discuss the application to Hecke algebras and possible interesting further directions.

The power of folding in representation theory

Chun-Ju Lai (AS)

Abstract

The goal of the talk is to explain recent developments in representation theory that arise from folding graphs such as quivers and Dynkin diagrams. Since introduced by Drinfeld-Jimbo, the quantum groups and their canonical bases have played a central role in Lie theory. By diagram folding the quantum groups are generalized to the quantum symmetric pairs, which also affords a theory of canonical basis due to Bao-Wang. Such a theory accounts for the 2020 Chevalley Prize as it solves the character problem for ortho-symplectic Lie superalgebras, which is parallel to that the Kazhdan-Lusztig bases are essential to the character problem for Lie algebras. In another direction, the Nakajima quiver varieties and the Springer fibers are objects of interest in geometric representation theory. A recent theory by Henderson-Licata and Li allows one to fold a quiver in order to produce a variant of the Nakajima quiver variety. By embedding Springer fibers into the Nakajima quiver varieties, we obtained an explicit description of irreducible components of Springer fibers of all classical types.

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Automorphism groups of cyclic orbifolds of lattice VOA.

Ching Hung Lam (AS)

Abstract

Let V be a VOA and $g \in \text{Aut}(V)$ a finite automorphism of V . The fixed point subset $V^{(g)} = \{x \in V | gx = x\}$ is a subVOA of V and is often called a cyclic orbifold of V . In this talk, we will study the full automorphism groups of certain cyclic orbifolds of lattice VOA. In particular, we will determine the full automorphism group of some orbifold VOA $V_{\Lambda, g}^g$ associated with some coinvariant lattices of the Leech lattice Λ . As an application, we will determine the full automorphism groups of several holomorphic VOAs of central charge 24.

On eta correspondence for finite reductive dual pairs

Shu-Yen Pan (NTHU)

Abstract

It is known that the Theta correspondence for a finite reductive dual pair is not one-to-one in general. Gurevich-Howe define a one-to-one sub-correspondence called the eta-correspondence when the dual pair is in stable range. In this talk, we want to discuss the possibility to extend the eta-correspondence to any dual pairs beyond the stable range.

Type A Finite W-(super)algebra and Yangian

Yung-Ning Peng (NCU)

Abstract

A finite W-algebra is some sort of generalization of the universal enveloping algebra. It can be defined in several different yet equivalent approaches involving different branches of mathematics. In a series of works by Brundan-Kleshchev, a realization of type A finite W-algebra in terms of Yangian is obtained in full generality, which provides a powerful algebraic tool to the study of finite W-algebra and deduces further results about its representations.

In this talk, we will go into some detail about such a realization and then mention some recent progress about a generalization of their results to type A Lie superalgebra.

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Kazama-Suzuki coset vertex superalgebras at admissible levels

Ryo Sato (AS)

Abstract

The Kazama-Suzuki coset (=commutant) construction is a powerful tool to construct representations of the $N=2$ superconformal algebra from affine Lie superalgebras. In the affine side, it has been known that highest weight representations at certain rational levels (known as Kac-Wakimoto admissible levels) have modular invariance properties.

In this talk we review the corresponding modular invariant properties in the superconformal side, based on recent developments of the "inverse" Kazama-Suzuki coset construction originally due to Feigin-Semikhatov-Tipunin in the affine $sl(2)$ case.

Cuspidality in affine Springer theory

Cheng-Chiang Tsai (Stanford/AS)

Abstract

In generalized Springer theory we study equivariant perverse sheaves on the nilpotent cone, or equivalently their Fourier transforms called character sheaves, on a reductive Lie algebra. Among them there are the cuspidal local systems whose presence gives a block decomposition for the category so that each block is given by parabolic inductions of cuspidal local systems. The functions associated to aforementioned sheaves are then building blocks for character theory of finite reductive groups. In this talk, we present an affine generalization of such cuspidal objects and explain how they are relevant to local characters of representation of p -adic reductive groups. If time permits, we wish to give some comments about their relation with character sheaves on finite reductive groups, and with endoscopy for representations of p -adic groups.

On the wavefront sets associated with certain representations of a covering group

Wan-Yu Tsai (NTHU)

Abstract

In this talk, we study a formula for the maximal elements in the wavefront set associated with an irreducible admissible representation. This formula originated from groups over an Archimedean field. Motivated from this, we aim at generalizing this formula to p -adic groups. In particular, we state a conjectural formula for the theta representation of a covering group and show that this formula agrees with the existing work in the literature for various families of groups. This is joint work with Fan Gao.

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On q -Schur algebras of classical type

Ziqing Xiang (AS)

Abstract

In this talk, I will present a coordinate algebra type construction of q -Schur algebras of classical type. These q -Schur algebras are realized as the duals of the graded components of certain graded coalgebras. Under suitable conditions, an isomorphism theorem demonstrates that the representation theory for the q -Schur algebras of type B reduces to the q -Schur algebras of type A. This enables us to address the questions of cellularity, quasi-hereditariness and representation type of the q -Schur algebras of type B. I will also discuss possible approaches to the representation theory for the q -Schur algebras of type D. This is joint work with Chun-Ju Lai and Daniel K. Nakano.

Four points semidefinite programming bounds for spherical codes

Wei-Hsuan Yu (NCU)

Abstract

Spherical codes are the classical topics in discrete geometry area. For instance, the maximum size of equiangular lines and kissing number problems are these type of questions. In this talk, I will introduce the four points semidefinite programming method and apply this method on the problems of spherical codes. Some experimental new results will be discussed.