

**International Workshop on
quantum groups,
categorification and related topics**

Conference Program Book



天元數學國際交流中心

Tianyuan Mathematics Research Center

**Tianyuan Mathematics Research
Center**

June 07-13, 2026

Conference Schedule

Lecture Location: TBA

June 07 (Sunday)			
Registration: Tianyuan Mathematics Research Center			
June 08 (Monday)			
Time	Speaker	Title	Chair
09:00-09:10	Open Ceremony		
09:10-09:55	Qiang Fu (付强)	Quantum Groups and q-Schur Algebras	Jinkui Wan
10:00-10:45	Jonathan Gruber	A refined Peter–Weyl theorem for quantum Borel subalgebras	
10:50-11:10	Tea Break		
11:10-11:55	Haixia Gu (顾海霞)	Baby Verma modules of restricted quantum queer supergroup $U_v(q_2)$	Jinkui Wan
12:00-14:00	lunch		
14:00-14:45	Yongjie Wang (汪永杰)	Center for Lie (super) algebras and (Super) Yangians	Qiang Fu
14:50-15:10	Tea Break		
15:10-15:55	Linliang Song (宋林亮)	Weakly triangular decomposition and affine Brauer categorification	Qiang Fu
16:00-16:45	Shixuan Wang (王世轩)	Bases and Symmetric Structure of Alternating Cyclotomic Hecke Algebras	
16:45-17:30	Discussion		
17:30-	Dinner		
June 09 (Tuesday)			
Time	Speaker	Title	Chair
09:00-09:45	Liam Samuel Rogel	The Zamolodchikov relation	Haixia Gu
09:50-10:35	Pengcheng Li (李鹏程)	Categorical action on finite classical groups and its applications: positive characteristic	
10:40-11:00	Tea Break		
11:00-11:45	Tao Qin (秦涛)	On the Different Approaches to the Runner-Removal Theorems	Haixia Gu
12:00-14:00	Lunch		
14:00-14:45	Mei Si (司梅)	The representations of certain quantum endomorphism algebras	Yongjie Wang
14:50-15:10	Tea Break		
15:10-17:30	Discussion		

17:30-	Dinner		
June 10 (Wednesday)			
Time	Speaker	Title	Chair
09:00-09:45	Andrew Mathas	Computing decomposition numbers of KLR algebras	Ming Fang
09:50-10:35	Yixing Lan (兰亦心)	From canonical bases to Nakajima's quiver varieties	
10:40-11:00	Tea Break		
11:00-11:45	Huansheng Li (李焕笙)	On the cyclotomic Mackey decompositions and the standard symmetrizing forms of the cyclotomic Hecke algebras	Ming Fang
12:00-14:00	Lunch		
14:00-17:00	Discussion		
17:30-	Dinner		
June 11 (Thursday)			
Time	Speaker	Title	Chair
09:00-09:45	Bin Shu (舒斌)	Zassenhaus varieties and modular representations	Jun Hu
09:50-10:35	Huang Lin (林煌)	On the number of Scopes chambers for affine type C KLR algebras	Jun Hu
10:40-11:00	Tea Break		
11:00-11:45	Xiangyu Qi (齐翔宇)	Moving vectors of blocks of Ariki-Koike algebras	Jun Hu
12:00-14:00	Lunch		
14:00-17:00	Discussion		
17:30-	Dinner		
June 12 (Friday)			
Time	Speaker	Title	Chair
09:00-09:45	Ming Fang (方明)	A mirror construction of cellular algebras	Xun Xie
09:50-10:35	Lei Shi (施磊)	Schur Elements for Cyclotomic Hecke-Clifford Superalgebras and Applications	Xun Xie
10:40-11:00	Tea Break		
11:00-11:45	Xun Xie (谢迅)	On the second lowest two-sided cell of an affine Weyl group	Bin Shu
12:00-14:00	Lunch		
14:00-	Leave		
June 13 (Saturday)			
Leave			

Quantum Groups and q -Schur Algebras

Qiang Fu (Tongji University)

Abstract: This talk provides a concise overview of quantum groups and q -Schur algebras, with a focus on their deep and consequential interrelations. As a prominent class of finite-dimensional algebras, q -Schur algebras are defined via Hecke algebras for type A, while for types B, C, D they can be defined either through Hecke algebras or through BMW algebras, leading to inequivalent constructions. These algebras play a central role in the representation theory of quantum groups. The talk also examines affine q -Schur algebras and their connection to affine quantum groups.

A refined Peter-Weyl theorem for quantum Borel subalgebras

Jonathan Gruber (University of Bonn)

Abstract: For a reductive group G over the complex numbers, the Peter–Weyl theorem gives a decomposition of the coordinate algebra of G as a direct sum of simple $G \times G$ -modules. This result has an analogue for reductive groups in positive characteristic, where the direct sum of simple $G \times G$ -modules is replaced by a filtration whose layers are induced $G \times G$ -modules. Both of these results can be obtained as a consequence of Lusztig's refined Peter–Weyl theorem, which describes the cell structure of the canonical basis of the modified quantum group. By results of van der Kallen and Brion–Polo, the coordinate algebra of a Borel subgroup B of a reductive group also admits a Peter–Weyl type filtration, where the filtration layers are so-called Schubert modules for $B \times B$. In this talk, I will explain how the filtration of van der Kallen and Brion–Polo can be obtained from a refined Peter–Weyl theorem for the canonical basis of the modified quantum Borel subalgebra. As a consequence, this filtration can be defined over the integers, and it is compatible with the Peter–Weyl filtration of the coordinate ring of the reductive group.

Baby Verma modules of restricted quantum queer supergroup $U_v(\mathfrak{q}_2)$

Haixia Gu (Huzhou Normal University)

Abstract: In this talk, we investigate a class of modular representations of the quantum queer supergroup $U_v(\mathfrak{q}_2)$, where v is an l -th primitive root of unit with $l \geq 3$ and l odd. We first introduce the definition of the restricted quantum queer supergroup $U_v(\mathfrak{q}_2)$. Motivated by studies on baby Verma modules for the queer Lie superalgebra \mathfrak{q}_2 over an algebraically closed field of characteristic p , we define, for each $\lambda \in \mathbb{Z}^2$, the baby Verma module $Z_v(\lambda)$ of $U_v(\mathfrak{q}_2)$. We further establish the irreducibility criterion for $Z_v(\lambda)$ and explore the structural properties of reducible baby Verma modules $Z_v(\lambda)$. This is joint work with Shuna Yang.

Center for Lie (super) algebras and (Super) Yangians

Yongjie Wang (Hefei University of Technology)

Abstract: In this talk, I will present the centers of classical Lie superalgebras and their quantizations (including quantum superalgebras and super-Yangians). The talk is based on joint work with Hongda Lin, Honglian Zhang.

Weakly triangular decomposition and affine Brauer categorification

Linliang Song (Tongji University)

Abstract: The affine Brauer category and its cyclotomic quotients play a role analogous to that of affine and cyclotomic Hecke algebras in types B/C/D. In this talk, we establish an analogue of Ariki's categorification theorem for cyclotomic Brauer categories and Kauffman categories. These structures arise as categorical versions of

cyclotomic Brauer algebras (introduced by Ariki-Mathas-Rui, also called cyclotomic Nazarov-Wenzl algebras) and cyclotomic BMW algebras, both of which appear naturally in Lie theory via Schur-Weyl duality. The proof relies on the notion of a weakly triangular decomposition, which provides a sufficient condition for showing that the corresponding categories are upper finite fully stratified categories in the sense of Brundan-Stroppel. Furthermore, we show that the affine Brauer categorification is equivalent to an i -Kac-Moody categorification in the quasi-split type A_{III} case (without fixed points). This talk is based on joint works with H. Rui, as well as joint works with M. Gao and H. Rui.

Bases and symmetric structure of alternating cyclotomic Hecke algebras

Shixuan Wang (Huzhou Normal University)

Abstract: Alternating cyclotomic Hecke algebras are fixed-point subalgebras of cyclotomic Hecke algebras under a generalized hash involution. They generalize alternating Hecke algebras associated with symmetric groups. In this talk, we introduce alternating cyclotomic Hecke algebras and discuss recent results on their structure. We explain the construction of seminormal and integral bases using distinguished bases and modulo reduction systems. We also discuss the symmetric algebra structure of alternating cyclotomic Hecke algebras and briefly mention related questions in graded representation theory.

The Zamolodchikov relation

Liam Rogel (TU Kaiserslautern)

Abstract: The diagrammatic Hecke category categorifies the category of Soergel bimodules. For every generating reflection of the underlying Coxeter group we have one color of strands in the diagrammatic category. They satisfy certain one-color,

two-color and three-color relations. The latter is also called Zamolodchikov relation. While in type A_3 and B_3 Elias--Williamson gave an exact description there is still a gap in type H_3 . We will explain how a solution can look like; what happens in type A_3 and B_3 for variants of the original Zamolodchikov and how far the calculation in type H_3 has come.

Categorical action on finite classical groups and its applications: positive characteristic

Pengcheng Li (The University of Hong Kong)

Abstract: Categorification has played a prominent role in the recent advances in representation theory. The pioneering work of Chuang and Rouquier introduced the notion of an \mathfrak{sl}_2 -categorification and, using this new tool, solved Broué's abelian defect group conjecture for the symmetric groups S_n and the finite general linear groups $GL_n(q)$. For the unipotent block of the finite classical groups, Dudas--Varagnolo--Vasserot similarly constructed an \mathfrak{sl}_1 -categorification and verified Broué's conjecture for these blocks at linear primes. In ongoing work, we construct a categorical double quantum Heisenberg action on the representation category of finite classical groups $O_{2n+1}(q)$, $Sp_{2n}(q)$ and $O_{2n}^\pm(q)$, and explore its applications in positive characteristic. By studying the modulo ℓ reduction of the colored weight functions $O^+(u)(\bullet)$ and $O^-(u)(\bullet)$, we complete the determination of the ℓ -block distribution for the characters of $Sp_{2n}(q)$ and $O_{2n}^\pm(q)$, and prove that Broué's abelian defect group conjecture holds for all blocks of $Sp_{2n}(q)$ and $O_{2n}^\pm(q)$ at linear primes. This is joint work with Peng Shan and Jiping Zhang.

On the Different Approaches to the Runner-Removal Theorems

Tao Qin (The University of Sydney)

Abstract: James and Mathas introduced the empty runner-removal theorems, relating the graded decomposition numbers of Iwahori-Hecke algebras and q -Schur algebras across different quantum characteristics. Later, Fayers introduced two additional variants: the full and the general runner-removal theorems. The original proofs rely on Fock space calculations and are thus restricted to characteristic zero. A second approach utilizes the equivalence between graded decomposition numbers and anti-spherical Kazhdan-Lusztig polynomials; we present a proof of the James-Mathas empty runner-removal theorem using this method. A third approach is categorical. Chuang and Miyachi extended the empty runner-removal theorem to positive characteristic via categorification and derived equivalences. Furthermore, Maksimau, Mathas, and Tubbenhauer introduced the subdivision map between cyclotomic Khovanov-Lauda-Rouquier (KLR) algebras, which generalize Iwahori-Hecke algebras. Mathas conjectured that this map categorifies the runner-removal theorems. Establishing this conjecture would provide a categorical proof, potentially extending certain runner-removal theorems to cyclotomic KLR algebras. In this paper, we partially confirm this conjecture.

The representations of certain quantum endomorphism algebras

Mei Si (Shanghai Jiaotong University)

Abstract: Lehrer and Zhang gave a presentation of the endomorphism algebra of the tensor powers of the three-dimensional irreducible module for quantum \mathfrak{sl}_2 over a function field, realizing it as a quotient of the Birman – Wenzl – Murakami algebra (also known as the Temperley – Lieb analogue of the BMW algebra) by a single

idempotent. This is analogous to the classical construction of the Temperley – Lieb algebra from the Hecke algebra in the two-dimensional case. Generalizing to the Weyl module of arbitrary dimension, Andersen, Lehrer and Zhang proved that these endomorphism algebras admit a cellular structure described in terms of Temperley – Lieb-like diagrams. In this paper, we give a necessary and sufficient condition for the semisimplicity of these endomorphism algebras over an arbitrary field. In particular, we obtain a precise characterization of the parameter for the semisimplicity of the Temperley – Lieb analogue of the BMW algebra over an arbitrary field. This is a joint work with Shaohuang Fang.

Computing decomposition numbers of KLR algebras

Andrew Mathas (The University of Sydney)

Abstract: I will describe a new algorithm for computing the decomposition matrices of the cyclotomic KLR algebras of affine types A and C. I will discuss applications to the James conjecture.

From canonical bases to Nakajima's quiver varieties

Yixing Lan (Max Planck Institute for Mathematics)

Abstract: The canonical bases of half quantum groups, irreducible representations of quantum groups and their tensor products can be realized from Lusztig's perverse sheaves on moduli space of quiver representations. On the other hand, the Borel-Moore homology groups of Nakajima quiver varieties provide another geometric model for degenerate case ($q = 1$). In this talk, I will compare these construction with the help of characteristic cycles.

On the cyclotomic Mackey decompositions and the standard symmetrizing forms of the cyclotomic Hecke algebras

Huansheng Li (Beijing Institute of Technology)

Abstract: In this talk, I will introduce some recent progress on the research of the cyclotomic Hecke algebras of type $G(l, 1, n)$. The cyclotomic Hecke algebra has the cyclotomic Mackey decomposition, and the standard symmetrizing form of the cyclotomic Hecke algebra has a recursive realization, which are similar as the Kang-Kashiwara decomposition and the recursive definition of the SVV's trace form of the cyclotomic KLR algebra. In my joint work with Jun Hu, we compute the explicit value of the standard symmetrizing form on each Murphy basis element. As an application, we obtain some equations on the coefficients which occur in the transition matrix between the Murphy basis and the seminormal basis. In a work in progress, we also obtain a recursive algorithm of these coefficients for the Iwahori-Hecke algebras of the symmetric groups.

Zassenhaus varieties and modular representations

Bin Shu (East China Normal University)

Abstract: The Zassenhaus variety for a reductive Lie algebra \mathfrak{g} in prime characteristic is a fundamental geometric object in a close connection to modular representations of \mathfrak{g} . In this talk we will introduce our recent works in the related topics, mainly including:

- (1) The Zassenhaus variety for a finite W -algebras $W(\mathfrak{g}, e)$ is a normal variety, whose smooth locus coincides with the Azumaya locus corresponding all maximal irreducible modules. Here, the finite W -algebra $W(\mathfrak{g}, e)$ associated with the nilpotent orbit $G.e$ for $\mathfrak{g} = Lie(G)$ is a quantum deformation of a good

transverse slice S to this nilpotent orbit.

- (2) The Zassenhaus variety is in a birational equivalence to the above transverse slice S . Consequently, it is a rational variety.
- (3) The Zassenhaus variety of a basic classical Lie superalgebra $\mathfrak{g} = \mathfrak{g}_0 + \mathfrak{g}_1$ in prime characteristic is birationally equivalent to the Zassenhaus variety of its purely even part (reductive Lie algebra) \mathfrak{g}_0 .

On the number of Scopes chambers for affine type C KLR algebras

Huang Lin (The University of Sydney)

Abstract: Chuang and Rouquier construct derived equivalences between the weight blocks of categorial \mathfrak{g} -action and show that they induce abelian equivalences (called "Scopes equivalences") when they are t-exact. Webster classifies these Scopes classes by chambers of a finite arrangement when \mathfrak{g} is of affine type. This is a generalization of the m-generalized Catalan arrangement. In this talk, we describe a Scopes chamber via the abacus of its distinguished representative alcove, which in turn enables us to count the number of Scopes chambers easily.

Moving vectors of blocks of Ariki–Koike algebras

Xiangyu Qi (Beijing Institute of Technology)

Abstract: Ariki–Koike algebras, also known as cyclotomic Hecke algebras of type $G(r, 1, n)$, play an important role in the modular representation theory of finite

groups of Lie type and are closely related to quantum groups, Khovanov–Lauda–Rouquier algebras, and rational Cherednik algebras. In this talk, we introduce a new invariant for blocks of Ariki–Koike algebras, called the block moving vector. This invariant records the process of moving an abacus in a given block to its core, and its components sum to the weight of the block. Using moving vectors, we present a classification of representation-finite blocks of Ariki–Koike algebras. We will also explain some applications of this classification, including examples showing that blocks with the same weight and the same multicharge need not be derived equivalent, and examples of derived equivalent blocks lying in different orbits under the adjoint action of the affine Weyl group. Finally, we discuss the corresponding representation type problem for blocks of cyclotomic q -Schur algebras.

A mirror construction of cellular algebras

Ming Fang (AMSS, CAS)

Abstract: A symmetric cellular algebra has an involution from its cellular structure and also a symmetrizing form which is not necessarily invariant under the involution, a priori. In this talk, we first show that if the field has characteristic different from 2, then such a symmetrizing form always exists. Then we apply this result to the mirror construction of cellular algebras, a procedure that allows to construct a series of cellular algebras from a given symmetric cellular algebras. This talk is based on a joint work with Hongpeng Zhang.

Schur Elements for Cyclotomic Hecke-Clifford Superalgebras and Applications

Lei Shi (Max Planck Institute for Mathematics)

Abstract: This talk is based on joint work with Shuo Li. I will discuss recent results on Schur elements for cyclotomic Hecke-Clifford superalgebras and their degenerate

analogues. After recalling the role of Schur elements in the construction of graded cellular bases for quiver Hecke algebras, following Brundan-Kleshchev, Hu-Mathas, and Evseev-Mathas, I will explain how the cyclotomic Hecke-Clifford setting is related to quiver Hecke-Clifford superalgebras via the Kang-Kashiwara-Tsuchioka isomorphism. I will then describe modified trace forms which produce symmetric or supersymmetric structures, and state explicit Schur element formulas in the split semisimple case. As applications, these formulas yield semisimplicity criteria and provide the trace-denominator control needed in the construction of generalized graded cellular bases for certain cyclotomic quiver Hecke-Clifford superalgebras. This gives a super analogue of the deformation-and-specialization strategy used in the ordinary quiver Hecke setting.

On the second lowest two-sided cell of an affine Weyl group

Xun Xie (Beijing Institute of Technology)

Abstract: Let G be a connected reductive group and e be a nilpotent element in the Lie algebra of G . Let Q_e be the maximal reductive subgroup of the centralizer of e in G . According to the structure of based rings of affine Weyl groups, the number of left cells in a two-sided cell of an affine Weyl group is equal to the number of Q_e -orbits in a certain Q_e -centrally extended set Y_e , as noted by Bezrukavnikov and Losev. Using this, we prove that the number of left cells in the second lowest two-sided cell of an affine Weyl group is equal to half the cardinality of the corresponding finite Weyl group. This confirms a conjecture posed by Jianyi Shi in 2011. This is joint work with Qianfan Zhou.