Quantum Groups and Cluster Algebras Summer 2026
ABSTRACTS

August 6, 2026

1. **Vyjayanthi Chari** (University of California, Riverside)

   Monoidal Categorification from alternating snake modules, q–characters and determinantal formulae

   We discuss a family of modules for quantum affine $\mathfrak{sl}_N$ which generalize the snake (or ladder) modules introduced by Mukhin–Young. We shall see that these modules live in a monoidal tensor category generalizing a category introduced by Hernandez–Leclerc. We give a closed form for their q-characters and identify the dominant monomials in these modules. Finally, we also give an explicit expression of their character as an alternating sum of Weyl (standard) modules. The talk is based on joint work with Matheus Brito.

2. **Ivan Dimitrov** (Queen's University)

   Quotient root systems and applications to GIT

   In the first part of the talk I will describe how inversion sets of roots can be studied recursively by expanding the set-up from root systems to quotient root systems. Then I will compare two properties of inversion sets: irreducibility and primitivity. The main result is that an inversion set Φ is primitive if and only if both Φ and its complement are irreducible. In the second part of the talk I will show how these results apply to three problems arising from GIT.

3. **Vesselin Drensky** (Institute of Mathematics and Informatics, BAS)

   From commutative to noncommutative invariant theory

   The purpose of the talk is to show how classical results in invariant theory can be transferred to the invariant theory of linear groups acting on free algebras of varieties of algebras over a field of characteristic 0. We shall consider the cases of varieties of associative, Lie, Jordan, right-symmetric, Novikov and bicommutative algebras and the acting groups are either arbitrary or important finite and classical groups.

4. **Anna Felikson** (Durham University)

   Polytopal realizations of non-crystallographic associahedra

   We use the folding technique to construct polytopal realisations of generalized associahedra for all non-simply-laced root systems, including non-crystallographic ones. We also extend the technique to the case of associahedra from non-orientable surfaces. The talk is based on the joint works (partially in progress) with Salvatore Stella, Pavel Tumarkin and Emine Yildirim.

5. **Hongdi Huang** (Shanghai University)

   Automorphism groups of some Poisson algebras

   In this talk, we will discuss how to use the Poisson valuation method to characterize the automorphism groups of some types of Poisson algebras. Their Poisson brackets are determined by weighted irreducible homogeneous polynomials.

6. **Wonwoo Kang** (ICMS - Sofia)

   Skein relations on quantum cluster algebras from surfaces

   Min Huang constructed a combinatorial expansion formula for cluster variables in quantum cluster algebras from unpunctured surfaces. In this paper, we establish quantum skein relations

within these quantum cluster algebras by extending the combinatorial framework developed by Banaian, Kang, and Kelley. By tracking arc resolutions and local crossing interactions through Huang's combinatorial model, we provide an intrinsic proof that classical surface skein relations extend naturally to the non-commutative q-deformed setting.

7. **Rinat Kedem** (University of Illinois Urbana-Champaign)

   q-Whittaker functions and their generalizations from two different cluster algebras

   The q-difference open Toda Hamiltonian is associated with the Q-system quiver, also known as the Coulomb branch. Its eigenfunctions are the q-Whittaker functions and can be obtained as special cases of matrix elements of monomials in the A-variables of this cluster algebras. We will explain the construction of such eigenfunctions using instead the application of Nakajima's q,t-characters, which are cluster A-variables in the Hernandez-Leclerc quiver. We will discuss some known and some conjectured generalizations of these statements.

8. **Bernhard Keller** (Université Paris Cité)

   On cluster categorical braid subgroup actions

   We will present an approach to the construction of actions of braid subgroups on triangulated categories arising in the (additive) categorification of cluster algebras and varieties. The examples will be inspired by combinatorial braid group actions constructed by Fraser, Fock-Goncharov, Goncharov-Shen and others. The results we will present were obtained in several joint projects notably involving, in chronological order, Chris Fraser, Yilin Wu, Alessandro Contu, Miantao Liu, Haoyu Wang and Xiaofa Chen.

9. **Alastair King** (University of Bath)

   The Grassmannian in degree 2: necklaces and matchings

   After recalling the combinatorics of Lam's description of the (dual) canonical basis of degree 2 functions on the Grassmannian, I will explain how certain aspects are categorified and speculate about other aspects. This is joint work with E. Caird.

10. **Stefan Kolb** (Newcastle University)

    Integrability and Kostant's branching law for quantum symmetric pairs

    The theory of quantum symmetric pairs provides coideal subalgebras of quantized enveloping algebras which are quantum group analogues of Lie subalgebras fixed under an involution. In 2002 Kostant formulated a branching law for symmetric pairs. In this talk, I will establish a quantum group analogue of Kostant's branching law. A main ingredient is Watanabe's notion of integrability for modules over quantum symmetric pair coideal subalgebras. The talk is based on joint work in progress with Stein Meereboer.

11. **Shrawan Kumar** (University of North Carolina at Chapel Hill)

    Counter example to a Strong Matroid Minor Conjecture

    The main result of the proposed talk asserts that a strong form of the Matroid Minor Conjecture due to J. Draisma is not true, i.e., there exist properly ascending chains of S_∞-stable ideals in the affine coordinate ring of the *affine infinite Grassmannian*, where S_∞ is the infinite symmetric group. In fact, we explicitly construct such an ascending chain. His conjecture on topological noetherian property for the affine infinite Grassmannian remain open though. This noetherian conjecture is motivated by the Matroid WQO Theorem which asserts that for each finite field k and each minor-closed class of k-representable matroids, there are only finitely many k-representable excluded minors

12. **Ivan Losev** (Yale University)

    On category O and Harish-Chandra bimodules over quantum groups at roots of 1

    The BGG category O and the category of Harish-Chandra bimodules are two closely related categories of representations of semisimple Lie algebras that have been extensively studied for more than 50 years. One can make sense of both categories over quantum groups. In my talk I will explain what is known about these categories in the most interesting case where the parameter is a root of 1. The talk is based on my preprint 2310.03153 and Trung Vu's preprint 2606.26331.

13. **Alexandre Minets** (University of Bonn)

    Schur-Weyl duality for quantum wreath product algebras

    Quantum wreath product algebras are generalizations of Hecke algebras of type A, which depend on a choice of an associative algebra. They naturally appear in the study of Lie superalgebras, categorifications of quantum groups, representations of p-adic groups, and more. I will explain how to construct their Schur versions, and how the latter give rise to new quantum group-like algebras.

14. **Daniel Nakano** (University of Georgia)

    Realizing quasi-hereditary one-covers for Hecke algebras

    Hecke algebras play a central role in representation theory, linking geometric invariants, Lie-theoretic structures, and quantum groups. A powerful framework for understanding their module categories involves constructing quasi-hereditary covers (or highest-weight categories in the sense of Cline, Parshall, and Scott) that preserve crucial homological information.

    In this talk, we will review the history of 1-covers, beginning with the work of Hemmer–Nakano which led to the general framework developed by Rouquier. Following this recollection, we will introduce the GGOR Problem, which asks how to concretely realize Category O for rational Cherednik algebras via a finite-dimensional "q-Schur algebra".

    While the GGOR Problem has a well-known solution in Type A, its resolution in other types has remained open. I will discuss our joint work with Chun-Ju Lai and Ziqing Xiang, which completes the GGOR Problem for Types B/C and Type D.

15. **Hironori Oya** (Institute of Science Tokyo)

    Algebraic study of quantum configuration spaces of decorated flags

    In this talk, we introduce a quantum analogue of the ring of regular functions on the configuration space of k decorated flags (=elements of the base affine space) of a simply-connected simple algebraic group G. We show its relationship with the quantized coordinate ring of G and study its quantum cluster algebra structures. In particular, we construct a quantum analogue of Wilson lines on the moduli space of decorated twisted G-local systems on polygons.

    This talk is based on joint work with Tsukasa Ishibashi.

16. **Greta Panova** (University of Southern California)

    Computational complexity of representation theoretic multiplicities

    Major open problems at the intersection of combinatorics and representation theory concern the computation and positive combinatorial formulas of multiplicities guiding the decomposition of tensor products of irreducible modules. In this talk we will describe some of the outstanding open problems like Kronecker and plethysm coefficients, and show recent progress on these questions. To formalize the concept of "positive combinatorial formula" we will resort to computational complexity theory and discuss the relation to classical and quantum counting complexity classes.

17. **Fan Qin** (Beijing Normal University)

    Band bases of skein algebras from unpunctured surfaces

    In this talk, we first review the band bases of skein algebras, equivalently quantum cluster algebras, associated with unpunctured surfaces. We then show that these bases coincide with the common triangular bases, that is, the Kazhdan–Lusztig–type bases of these quantum cluster algebras. In our approach to this result, we discover a phenomenon in which the unknots involved are arranged in configurations resembling beads on a necklace. Moreover, we verify a conjecture of Thurston for these bases.

18. **Job Daisie Rock** (KU Leuven)

    Cluster categories from generalized thread quivers

    Berg and van Roosmalen introduced thread quivers and their representations, the study of which was generalized in the first part of this work. In this talk we will recall generalized thread quivers

and define the discretization of a thread quiver. Then, with a mild restriction, we will discuss how to construct a cluster category from representations of a generalized thread quiver by passing through the discretization. We will conclude with remarks about cluster tilting subcategories and the mild restriction. This is joint work in progress with Charles Paquette and Emine Yıldırım. The first part can be found at arXiv:2410.14656.

19. **Siddartha Sahi** (Rutgers University)

    The Opdam–Cherednik kernel is the Laplace transform of a positive measure

    We prove that the Opdam–Cherednik kernel, also known as the nonsymmetric Opdam hypergeometric function, can be written as the Laplace transform of a positive measure supported on the convex hull of the Weyl group orbit of its argument. As a consequence, the trigonometric Dunkl intertwining operator is positivity preserving. The main ingredient in the proof is a new formula for the Opdam–Cherednik kernel as a degeneration of nonsymmetric Macdonald polynomials. As a further application, we prove majorization inequalities for Macdonald polynomials and Heckman–Opdam hypergeometric functions associated with arbitrary root systems.

    This is joint work with Colin McSwiggen (Academia Sinica), arXiv:2606.15185.

20. **Hadi Salmasian** (University of Ottawa)

    Module categories associated to quantum symmetric pairs

    It is by now well-established that diagrammatic category theory provides a graphical framework suitable for studying many categories of representations. For instance, the framed HOMFLYPT skein category $\mathrm{OS}(q,t)$ has full functors into categories of tensor modules of the quantized enveloping algebra $U_q(\mathfrak{gl}_n)$ for all n. In this talk, I explain how one can construct such diagrammatic categories for quantum symmetric pairs. Our primary example will be the disoriented skein category $\mathrm{DS}(q,t)$, which is a module category over $\mathrm{OS}(q,t)$ that is equivalent to the q-Brauer category of Sartori-Tubbenhauer, and has incarnation functors into categories of tensor modules for the iquantum supergroups of type AI. Using a general framework for classifying submodules of module categories equipped with a cylinder twist, we characterize submodules of the Karoubi envelope of $\mathrm{DS}(q,t)$ as kernels of the aforementioned incarnation functors. Time permitting, I explain ongoing work on symmetric pairs of type AIII and beyond. This talk is based on joint work with Alistair Savage and Yaolong Shen.

21. **Hugh Thomas** (Universitè du Quèbec à Montréal)

    An introduction to u-equations

    The u-equations were written down by physicists Koba and Nielsen in 1969. Their non-negative solutions play a key role in defining the tree string amplitude, an important step in the development of string theory. I will explain how the u-equations can be related to a cluster algebra of type A. I will then explain how the u-equations can be generalized to other cluster types (in work of Arkani-Hamed, He, and Lam); and how they can generalized further using representation theory of algebras (following in particular a recent preprint with Arkani-Hamed, Frost, Plamondon, and Salvatori, arXiv:2512.24870).

22. **Pavel Tumarkin** (Durham University)

    Cluster algebras, marked surfaces, and extended affine Weyl groups

    With (almost) every finite mutation class of quivers we associate two groups: an extended affine Weyl group of type A or D, and a certain quotient of a Coxeter group which behaves nicely with respect to mutations (in most cases, the latter can also be obtained as a quotient of certain surface braid group). I will discuss a connection between these groups involving spin structures on the corresponding marked surface, and a (still conjectural) characterization of mutation-finite quivers in terms of positive semidefinite symmetric matrices. The talk is based on joint works (some still in progress) with Anna Felikson, John Lawson and Michael Shapiro.

23. **Monica Vazirani** (University of California, Davis)

    Skeins on mapping tori

The G-skein module for a closed oriented 3-manifold M is finite dimensional by a result of Gunningham-Jordan-Safronov. In particular when M is the 3-torus and $G = \mathrm{GL}_N$, its skein module has dimension equal to the number of partitions of N. We computed this with Gunningham-Jordan via computing the Hochschild homology of a quantum torus, which we related to skein theory of the torus using the representation theory of the double affine Hecke algebra (DAHA). With Bierent-Jordan-Vancraeynest, we extend these results to when M is a mapping torus by computing a twisted Hochschild homology. Just as the partitions of N admits a generating function with a nice product expansion, so does the generating function of the dimensions of the GL_N-skein module of M.

24. **Chelsea Walton** (Rice University)

    Venturing to the Boundary with Braided Module Categories

    While the relationship between braided monoidal categories and quantum groups has successfully unlocked deep connections in knot theory and the Yang-Baxter equation, extending this framework to boundary phenomena requires shifting our focus to braided module categories. This talk explores this boundary setting first by introducing the "reflective center" of a module category, showing how it naturally produces solutions to the boundary Yang-Baxter equation (also known as the quantum reflection equation). We will then examine when braided module categories are "nondegenerate," which is analogous to the notion for braided finite tensor categories used to construct 3d-TQFTs. Finally, we will present concrete connections to braid groups of type BC, mirroring the classic connections to braid groups of type A. This is based on recent work with Monique Müller, Robert Laugwitz, Harshit Yadav, and Milen Yakimov.

25. **Quanshui Wu** (Fudan University)

    Chevalley Property and determinant ideals of Hopf algebras with large centers

    Any affine Cayley-Hamilton Hopf algebra, in the sense of De Concini-Procesi-Reshetikhin-Rosso, is finitely generated as a module over its center. We prove that any affine Hopf algebra admitting a large central Hopf subalgebra can be endowed, via the Hattori-Stalling trace map, with the structure of a Cayley-Hamilton Hopf algebra. Cayley-Hamilton Hopf algebras serve as a general framework for the study of the irreducible representations of certain quantum groups at roots of unity. For any affine Cayley-Hamilton Hopf algebra, the identity fiber algebra naturally admits a Hopf algebra structure. The category of finite-dimensional modules over any fiber algebra of H forms an indecomposable exact module category over the tensor category of finite-dimensional modules over the identity fiber algebra. The irreducible representations and, for instance, the Chevalley property, of H are closely related to the discriminant ideals of H. In fact, we prove that H has the Chevalley property if and only if its identity fiber algebra has the Chevalley property and all discriminant ideals are trivial. The level of the lowest discriminant ideal of H is equal to the Frobenius-Perron dimension of the identity fiber algebra plus one. This talk is based on recent work with Huang, Mi, Qi, and Zhu, following an earlier work with Mi and Yakimov.

26. **James Zhang** (University of Washington)

    Classification of simple simplicial algebras

    Let O be a connected operad over a base field. We classify simple simplicial O-algebras in terms of simple (ordinary) O-algebras.