Conference Schedule

Invited Addresses

	Saturday morning *Clark 107* (Chair: AAA)	Sunday morning *Clark 107* (Chair: BBB)
	Tsymbaliuk (8:30–9:20am)	Losev (8:30–9:20am)
	Losev (9:30–10:20am)	Halacheva (9:30–10:20am)
	Coffee break (10:30–10:50am)	Coffee break (10:30–10:50am)
	Contributed talks (10:50am–12:30pm)	Contributed talks (10:50am–11:40pm)
Friday afternoon *Ridley G004* (Chair: XXX)	Saturday afternoon *Clark 107* (Chair: YYY)	Jing (11:40-12:30pm)
Losev (2:00–2:50pm)	Lu (2:00-2:50pm)	
Coffee break (3:00-3:20pm)	Coffee break (3:00–3:20pm)	
Haines (3:20–4:10pm)	Panel Discussion (3:20–4:20pm)	
Plavnik (4:20–5:10pm)	Contributed talks (4:25–5:40pm)	

Panel Discussion *Conversations About Applying for NSF Funding*, featuring

- Matt Douglass (NSF Program Director, Algebra and Number Theory),
- Pramod Achar (Shirley Blue Barton Professor of Mathematics, Louisiana State University)
- Daniel Nakano (Distinguished Research Professor, University of Georgia)

Contributed Talks

Saturday Morning Session 1 *Clark 107* (Chair: XXX)	Saturday Morning Session 2 *Clark 108* (Chair: YYY)
Shen (10:50–11:10am)	Addabbo (10:50–11:10am)
Kalmykov (11:15–11:35am)	Ocal (11:15–11:35am)
Higgins (11:40–12:00pm)	Aldi (11:40–12:00pm)
Dahiya (12:05–12:25pm)	Dumanski (12:05–12:25pm)

Saturday Afternoon Session 1 *Clark 107* (Chair: ZZZ)	Saturday Afternoon Session 2 *Clark 108* (Chair: WWW)
Gannon (4:25–4:45pm)	Wu (4:25–4:45pm)
Larson (4:50–5:10pm)	Im (4:50–5:10pm)
Hamil (5:15–5:35pm)	Molander (5:15–5:35pm)

Sunday Morning Session 1 *Clark 107* (Chair: XXX)	Sunday Morning Session 2 *Clark 108* (Chair: XXX)
Hou (10:50–11:10am)	Dillery (10:50–11:10am)
Nourozi (11:15–11:35am)	Zhu (11:15–11:35am)

Program: Titles and Abstracts of Invited Addresses

Ivan Losev Quantum category $\mathcal{O}$

Yale University, Email: ivan.loseu@gmail.com

Abstract: The representation theory of quantum groups including at roots of unity is an important part of Lie representation theory. In this talk, we will study one of categories of representations: the quantum category $\mathcal{O}$, which is a suitable analog of the classical Bernstein-Gelfand category $\mathcal{O}$. We will relate it to a model representation category, the affine Hecke category, more precisely to the heart of the new t-structure on that category (all these terms will be defined in the lectures). The lectures are based on arXiv:2310.03153.

Thomas Haines Pavings of convolution fibers and applications

University of Maryland, Email: tjh@umd.edu

Abstract: A convolution morphism is the geometric analogue of the convolution of functions in a Hecke algebra. The properties of fibers of convolution morphisms are used in a variety of ways in the geometric Langlands program and in the study of Schubert varieties. I will explain a very general result about cellular pavings of fibers of convolution morphisms in the setting of partial affine flag varieties, as well as applications related to the very purity and parity vanishing of cohomology of Schubert varieties over finite fields, structure constants for parahoric Hecke algebras, and the (motivic) geometric Satake equivalence. The primary reference is the paper arXiv:2309.14218.

Naihuan Jing Characters of $\mathrm{GL}(n,q)$ and vertex operators

North Carolina State University, Email: jing@ncsu.edu

Abstract: Irreducible characters of the finite group $\mathrm{GL}(n,q)$ were determined by Green in a remarkable paper that has influenced representation theory greatly. In this talk, I will discuss a vertex algebraic approach to construct and compute all complex irreducible characters of $\mathrm{GL}(n,q)$. Green's theory is recovered and enhanced under the realization of the Grothendieck ring of representations $R(G) = \bigoplus_{n\geqslant 0} R(\mathrm{GL}(n,q))$ as two isomorphic Fock spaces. Under this picture, the irreducible characters are realized by the Bernstein vertex operators for Schur functions, the characteristic functions of the conjugacy classes are realized by the vertex operators for the Hall-Littlewood functions, and the character table is completely given by matrix coefficients of vertex operators of these two types. This offers a simplification to identify the Fock space $R(G)$ as the Hall algebra of symmetric functions. We will also discuss how to compute the characters in general. This is joint work with Y. Wu.

Kang Lu A Drinfeld presentation of twisted Yangians via degeneration

University of Virginia, Email: kang.lu@virginia.edu

Abstract: We formulate a new family of algebras, twisted Yangians (of split type) in current generators and relations, via degeneration of Drinfeld presentations of affine $\imath$quantum groups (associated with split Satake diagrams). These new algebras admit PBW type bases and are shown to be a deformation of twisted current algebras. For type AI, it matches with the Drinfeld presentation of twisted Yangian obtained via Gauss decomposition. We conjecture that our twisted Yangians are isomorphic to twisted Yangians constructed in RTT presentation. This is joint work with Weiqiang Wang and Weinan Zhang.

Oleksandr Tsymbaliuk Lyndon words and fused currents in shuffle algebra
Purdue University, *Email: otsymbal@purdue.edu*
Abstract: Classical q-shuffle algebras provide combinatorial models for the positive half $U_q(n)$ of a finite quantum group. We define a loop version of this construction, yielding a combinatorial model for the positive half $U_q(Ln)$of a quantum loop group. In particular, we construct a PBW basis of $U_q(Ln)$ indexed by standard Lyndon words, generalizing the work of Lalonde-Ram, Leclerc and Rosso in the $U_q(n)$ case. We also connect this to Enriquez' degeneration A of the elliptic algebras of Feigin-Odesskii, proving a conjecture that describes the image of the embedding $U_q(Ln) \to A$ in terms of pole and wheel conditions. The talk shall conclude with the shuffle interpretations of fused currents proposed by Ding-Khoroshkin. This is based on joint works with Andrei Negut.

Program: Titles and abstracts of Contributed Talks

Darlayne Addabbo Vertex Operators for Imaginary gl_2-subalgebras in the Monster Lie Algebra
University of Arizona *Email:addabbo@math.arizona.edu*
Abstract: The Monster Lie algebra m is a quotient of the physical space of the vertex algebra $V = V^{\natural} \otimes V_{1,1}$, where $V^{\natural}$ is Frenkel, Lepowsky, and Meurman's Moonshine module vertex operator algebra, and $V_{1,1}$ is the vertex algebra corresponding to the rank 2 even unimodular lattice $II_{1,1}$. I will discuss the construction of vertex algebra elements that project to bases for subalgebras of m isomorphic to gl_2 and corresponding to imaginary simple roots $(1, j)$ for $j > 0$. The action of the Monster finite simple group M on $V^{\natural}$ induces an M-action on the set of gl_2 subalgebras corresponding to a fixed imaginary simple root. I will discuss this action and related open questions. (This talk is based on joint work with Lisa Carbone, Elizabeth Jurisich, Maryam Khaqan, and Scott H. Murray).

Marco Aldi Dani-Mainkar Lie Algebras and their cohomology
Virginia Commonwealth University *Email: maldi2@vcu.edu*
Abstract: The Dani-Mainkar construction associates metabelian Lie algebras to finite simple graphs. We present some recent advances, including strong homotopy generalizations for hypergraphs and cohomology calculations. We also illustrate the connection to supersymmetric quantum mechanics and quantum computing.

Keshav Dahiya Intertwiners of representations of quantum affine algebras
Indian University Purdue University, Indianapolis *Email: kkeshav@iu.edu*
Abstract: I wish to give a talk on the explicit expressions of the R-matrices acting in tensor squares of the first fundamental representations of all types of quantum affine algebras, in terms of projectors related to decomposition of the tensor squares with respect to non-affine quantum algebras.

Peter Dillery Rigid inner forms and the Bernstein decomposition for L-parameters
University of Maryland *Email: dillery@umd.edu*
Abstract: Let H be a (potentially disconnected) reductive group over an algebraically closed field of characteristic zero. The main goal of this talk is to explain a new approach for constructing the generalized Springer correspondence for H-equivariant irreducible perverse sheaf on the nilpotent cone of H. An alternative approach to this task was first introduced by Aubert-Moussaoui-Solleveld in order to construct the Bernstein decomposition for enhanced L-parameters (in the sense of Arthur)—a first step in a general strategy to reduce local Langlands correspondences to the supercuspidal case. Our approach lets us construct and study the Bernstein decomposition for L-parameters in the context of Kaletha's refined local Langlands correspondence, which this talk will also discuss. This work is joint with David Schwein.

Ilya Dumanski Cluster categorifications and Feigin-Loktev fusion product
Massachussettes Institute of Technolology *Email: ilyadumnsk@gmail.com*
Abstract: There are two different kinds of categories with cluster structure in representation theory: modules over quantum affine group (due to Hernandez-Leclerc) and perverse coherent sheaves on the affine Grassmannian (due to Cautis-Williams). We show that they are in fact connected via the third category: modules over the current algebra with operation of the Feigin-Loktev fusion

product. This helps to prove facts about one of these categories, knowing their analogs about the other. Based on arXiv:2308.05268.

Thomas Gannon Proof of the Ginzburg-Kazhdan Conjecture
University of California, Los Angeles *Email: gannonth@math.ucla.edu*
Abstract: The main theorem of this talk will be that the affine closure of the cotangent bundle of the basic affine space (also known as the universal hyperkahler implosion) has symplectic singularities for any reductive group, where essentially all of these terms will be defined in the course of the talk. After discussing some motivation for the theory of symplectic singularities, we will survey some of the basic facts that are known about the universal hyperkahler implosion and discuss how they are used to prove the main theorem. Time permitting, we will also discuss recent joint with Harold Williams, which identifies the universal hyperkahler implosion in type A with a Coulomb branch in the sense of Braverman, Finkelberg, and Nakajima, confirming a conjectural description of Dancer, Hanany, and Kirwan.

Matthew Hamil Nilpotence via homological residue fields in stable categories of Lie superalgebra representations
University of Georgia *Email: mhh14981@uga.edu*
Abstract: Let $\mathfrak{g} = \mathfrak{g}_0 \oplus \mathfrak{g}_1$ be a Type I classical Lie superalgebra with an ample detecting subalgebra $\mathfrak{f}$. In this talk, the speaker will consider the tensor triangular geometry for the stable category of finite-dimensional Lie superalgebra representations: $\mathrm{stab}(\mathcal{F}_{(\mathfrak{g},\mathfrak{g}_0)})$. The localizing subcategories for the detecting subalgebra are classified which allows us to prove a nilpotence theorem and determine the homological spectrum for the stable module category of $\mathcal{F}_{(\mathfrak{f},\mathfrak{f}_0)}$.

These results on the detecting subalgebras are then applied with work of Balmer and key assumptions in work of Boe, Kujawa and Nakano, to provide a method to explicitly realize the Balmer spectrum of $\mathrm{stab}(\mathcal{F}_{(\mathfrak{g},\mathfrak{g}_0)})$ for Type I classical Lie superalgebras (with an ample detecting subalgebra).

Vijay Higgins Central elements in the SL(d) skein algebra
Michigan State University *Email: higgi231@msu.edu*
Abstract: The skein algebra of a surface is spanned by links in the thickened surface, subject to skein relations which diagrammatically encode the data of a quantum group. The multiplication in the algebra is induced by stacking links in the thickened surface. This product is generally noncommutative. When the quantum parameter q is generic, the center of the skein algebra is essentially trivial. However, when q is a root of unity, interesting central elements arise. When the quantum group is quantum SL(2), the work of Bonahon-Wong shows that these central elements can be obtained by a topological operation of threading Chebyshev polynomials along knots. In this talk, I will discuss joint work with F. Bonahon in which we use analogous multi-variable 'threading' polynomials to obtain central elements in higher rank SL(d) skein algebras.

Dennis Hou Quantized enveloping algebras over noncommutative rings
Rutgers University–New Brunswick *Email: dhou@rutgers.edu*
Abstract: Berenstein and Retakh have defined Lie groups and algebras over arbitrary division rings in terms of "noncommutative envelopes." Using this notion of a Lie algebra over a noncommutative

ring, we can define the analogue of its universal enveloping algebra, which has the natural structure of a (left) Hopf algebroid in the sense of Böhm and Szlachányi. This will admit a Drinfeld–Jimbo quantization, the span of whose skew-primitive elements can be considered a noncommutative version of a quantum Lie algebra.

Meeseong Im Diagrammatics of infinitesimal dilogarithms and entropy
United States Naval Academy *Email:meeseongim@gmail.com*
Abstract: A special case of certain diagrammatics, when G is the group of affine transformations of a line, can be related to the infinitesimal dilogarithm and to the Shannon entropy of finite probability distributions. I will explain the diagrammatics and their connections to infinitesimal dilogarithms and entropy.

Artem Kalmykov Yangians, mirabolic subalgebras, and Whittaker vectors
Massachussettes Institute of Technolology *Email:artkalm@mit.edu*
Abstract: In this talk, we will introduce an object (which we call the Kirillov projector) that connects the topics of title. We will also show that it provides a nonstandard solution to the quantum Yang-Baxter equation, a certain version of the Belavin's R-matrix associated with stable bundles on elliptic curves.

Scott Larson A Family of Irreducible Characteristic Cycles for U(p,q)
University of Georgia *Email:scott.larson@uga.edu*
Abstract: Fibers of resolutions of singularities have many connections to representation theory, for example, Springer's resolution and Weyl groups. In the case of real reductive groups, we have resolutions of singularities of K-orbit closures in flag varieties. It was shown by Larson–Romanov that cohomology of fibers are related to Kazhdan–Lusztig–Vogan polynomials. In joint work with Bill Graham and Minyoung Jeon, we analyze further the algebraic geometry of these resolutions. We prove that a family of small resolutions for U(p,q) have reduced scheme theoretic fibers. We furthermore prove that the corresponding Harish-Chandra modules for U(p,q) have irreducible characteristic cycles.

Melody Molander Skein Theory for Index 4 Subfactor Planar Algebras
University of California, Santa Barbara *Email:melodymolander@ucsb.edu*
Abstract: Subfactor planar algebras first were constructed by Vaughan Jones as a diagrammatic axiomatization of the standard invariant of a subfactor. These planar algebras also encode two other invariants of the subfactors: the index and the principal graph. The Kuperberg Program asks to find all diagrammatic presentations of subfactor planar algebras. This program has been completed for index less than 4. In this talk, I will introduce subfactor planar algebras and give some presentations of subfactor planar algebras of index 4 which have affine ADE Dynkin diagrams as their principal graphs.

Vahid Nourozi Linear Scaling Quantum LDPC Codes via Balanced Products
New Mexico State University *Email:nourozi.v@gmail.com*
Abstract: Quantum low-density parity-check (QLDPC) code constructions that can accomplish linear minimum distance and dimension could make error correction in quantum computing practical. However, previous constructions were limited to non-linear distance scaling. In this paper,

we describe explicit code constructions that overcome this barrier. We present families of quantum LDPC codes with parameters [[n, k, d]] where k and d both scale linearly with code length n. Taking the balanced products of expanding Cayley graph codes accomplishes this. The balanced product combines two chain complexes to preserve the desired properties. With a careful selection of Cayley graph codes, the resultant balanced product codes exhibit distance and dimension in linear form. We demonstrate efficient decoding using belief propagation and ordered statistics methods. Our constructions illustrate the existence of good QLDPC codes that attain the optimal distance-versus-length tradeoff asymptotically. This is a significant step toward the practical implementation of quantum error correction.

Pablo Sanchez Ocal Representations of algebras via universal supports
University of California, Los Angeles *Email: socal@math.ucla.edu*
Abstract: In this talk I will present progress towards understanding the representation theory of noncommutative algebras. The ideas are inspired by the Balmer spectrum of a symmetric tensor triangulated category, a topological tool analogous to the usual spectrum of a commutative ring. I will describe a universal support theory for triangulated categories, and illustrate it with the bounded derived category of path algebras of type A quivers.

Yaolong Shen Quantum supersymmetric pairs and Schur duality of type AI-II
University of Virginia, *Email: ys8pfr@virginia.edu*
Abstract: Let $\mathfrak{g}$ be a semisimple Lie algebra and θ be an involution of $\mathfrak{g}$. The quantization $(\mathbf{U}_q(\mathfrak{g}), \mathbf{U}^\imath)$ of the symmetric pair $(\mathfrak{g}, \mathfrak{g}^\theta)$ was systematically developed by Letzter where $\mathbf{U}_q(\mathfrak{g})$ is the Drinfeld-Jimbo quantum group and $\mathbf{U}^\imath$ is a coideal subalgebra of it. We usually refer $\mathbf{U}^\imath$ as the $\imath$quantum group. Over the last decade, many fundamental constructions in quantum groups have been generalized to quantum groups by Wang and his collaborators.

In this talk, we will discuss the super analogue of $\mathbf{U}^\imath$ and introduce one specific family which unites quantum groups (non-super) of type AI and AII. We will also demonstrate an Schur duality between this specific family and the q-Brauer algebra. This duality can be viewed as a quantization of the classical duality between the orthosymplectic Lie superalgebra and the Brauer algebra. This is joint work with Weiqiang Wang.

Haihan Wu Webs for the Quantum Orthogonal Group
University of California, Davis *Email: hihwu@ucdavis.edu*
Abstract: The Jones polynomial can be defined with the Temperley-Lieb category, whose Karoubian completion is equivalent to the representation category of quantum SL(2). In order to generalize the equivalence between a graphical category and the representation category of a quantum group, G. Kuperberg introduced web categories for rank 2 Lie algebras, where trivalent graphs are used in addition to planar matchings. Web categories have been widely studied since then. I will talk about how to define the web category for the quantum orthogonal group, based on joint work with E. Bodish.

Songhao Zhu Supersymmetric Shimura operators and interpolation polynomials
Rutgers University *Email: sz446@rutgers.edu*
Abstract: The Shimura operators are a certain invariant differential operators on a Hermitian

symmetric space. Answering a question of Shimura, Sahi–Zhang showed that the Harish-Chandra images of these operators are specializations of certain BC-symmetric interpolation polynomials that were defined by Okounkov. We consider the problem in the super setting for the Hermitian symmetric superpair $(\mathfrak{gl}(2p|2q), \mathfrak{gl}(p|q) \oplus \mathfrak{gl}(p|q))$, and we prove their Harish-Chandra images are specializations of certain BC-supersymmetric interpolation polynomials introduced by Sergeev and Veselov. This question is related to the quantum Capelli eigenvalue problem recently answered by Letzter, Sahi and Salmasian. This talk is based a joint work with Siddhartha Sahi.