SE Lie Theory Workshop 2018: Plenary Talks

Speaker: Pramod Achar
Affiliation: Louisiana State University

Title: *Tensor ideals of tilting modules*

Abstract: The category of tilting modules for a quantum group or a reductive algebraic group is closed under tensor product. One can therefore ask for a classification of the tensor ideals in this additive category. In the quantum group case, this problem was solved more than 20 years ago by Ostrik: the answer is in terms of‘ "Kazhdan-Lusztig cells," which are in turn defined in terms of the Kazhdan-Lusztig basis (or canonical basis) for the affine Hecke algebra. Recent developments have made it possible to prove a parallel result for reductive algebraic groups in characteristic p: the answer is in terms of "p-Kazhdan-Lusztig cells," which are in turn defined in terms of the p-canonical basis of the Hecke algebra. This is joint work with W. Hardesty and S. Riche.

Speaker: Christopher Bendel
Affiliation: University of Wisconsin, Stout

Title: *Cohomology of algebraic groups, Lie algebras, and related finite groups of Lie type: I and II*

Abstract: Let G be an algebraic group (scheme) over a field of prime characteristic. One can associate to G its Lie algebra, its Frobenius kernels (which are examples of infinitesimal algebraic group schemes), and the subgroup of points over a finite field (a finite group of Lie type). The representation theories of these structures are highly interconnected. This pair of talks will specifically address the cohomology theories of these various structures and the relationships between them. Examples will be given demonstrating how cohomology computations for certain structures can be used to make computations for other structures. The talks will also aim to identify a number of open problems in the field.

Speaker: Georgia Benkart
Affiliation: University of Wisconsin, Madison

Title: *McKay Quivers and Results on Representations I*

Abstract: The McKay quiver determined by a finite group G and a finite-dimensional complex G-module V can be used to prove results about invariants and centralizer algebras and their representations. This talk will describe Schur-Weyl duality results related to McKay quivers. A featured example will be the symmetric group $\mathsf{G} = \mathsf{S}_n$, its n-dimensional permutation module V, and the centralizer algebras $\mathsf{End}_{\mathsf{S}_n}(\mathsf{V}^{\otimes k})$, which are partition algebras whenever $n \geq 2k$.

Title: *McKay Quivers and Results on Representations II*

Abstract: A finite-dimensional Hopf algebra H and a finite-dimensional H-module V over an algebraically closed field of arbitrary characteristic can be used to construct a McKay quiver. This talk will discuss results that can be derived in this more general setting. Examples of such Hopf algebras include group algebras of finite groups, restricted enveloping algebras for finite-dimensional Lie algebras of prime characteristic, and quantum groups at roots of unity. The quivers lead to Markov chains that have interesting properties and exhibit new phenomena.

Speaker: Vyjayanthi Chari
Affiliation: University of California, Riverside

Title: *Quantum affine algebras and cluster algebras*

Abstract: In 2009 Hernandez and Leclerc defined certain subcategories $\mathcal{C}_\xi$ of finite–dimensional representations of a quantum affine algebra. In the case of $\mathfrak{sl}_{n+1}$ these are indexed by a quiver Q_ξ of type A_n. In the case when the quiver is monotonic or bipartite, they showed that the Grothendieck ring of $\mathcal{C}_\xi$ is isomorphic to a cluster algebra of type A; the isomorphism maps the fundamental representations to an element of the initial seed.

In this talk, we shall begin with a gentle introduction to the connection between the two subjects. We will then show that their results hold for arbitrary quivers using very different methods . As a consequence we identify the image of an arbitrary cluster variable and give a closed formula for the cluster variable in terms of the initial seed. In the language of representation theory, this amounts to giving a closed

formula for the character of the prime representations in $\mathcal{C}_\xi$. The talk is based on joint work with Matheus Brito.

Speaker: William Graham
Affiliation: University of Georgia

Title: *Combinatorics of cominuscule points*

Abstract: It has been known for some time that equivariant cohomology and K-theory can be used to compute multiplicities and Hilbert series of Schubert varieties in cominuscule flag varieties such as Grassmannians. More recently, it was shown that equivariant methods can be applied more generally at certain points called cominuscule points of Schubert varieties in arbitrary flag varieties. This talk will focus on some combinatorial questions arising out of the notion of cominuscule points. The talk is on joint work with Victor Kreiman.

Speaker: Nicolas Guay
Affiliation: University of Alberta

Title: *Twisted Yangians for symmetric pairs of types B, C and D*

Abstract: I will introduce twisted Yangians associated to symmetric pairs of types B, C and D which are similar to those of type A introduced by G. Olshanski over twenty-five years ago and which have been quite well studied. Whereas Yangians are Hopf algebras and important examples of quantum groups, twisted Yangians are families of co-ideal subalgebras of Yangians with an interesting representation theory and applications to theoretical physics. After a discussion of some of their properties, I will present classification results for their irreducible finite dimensional modules. This is joint work with Vidas Regelskis and Curtis Wendlandt.

Speaker: George McNinch
Affiliation: Tufts University

Title: *Reductive subgroup schemes of a parahoric group scheme*

Abstract: Let K be the field of fractions of a complete discrete valuation ring A with residue field k, and let G be a connected and reductive

linear algebraic group over K. Bruhat-Tits associate to G various parahoric group schemes P. Such P are smooth and affine group schemes over A, but in general they are not reductive.

Assume that G splits over an unramified extension of K and that P is an associated parahoric group scheme. In that case, we prove that there is a reductive subgroup scheme M of P such that M_k is a Levi factor of the special fiber P_k, and such that M_K is a reductive subgroup of G containing a maximal torus. In fact, M_K is - at least geometrically - the centralizer of the image of a homomorphism μ_N for some $N > 1$.

The talk will describe the construction of M, and it will describe some application of the existence of M to the study of $G(K)$-orbits on nilpotent elements of Lie(G).

Speaker: Eric Sommers
Affiliation: University of Massachusetts, Amherst

Title: *Special pieces in the nilpotent cone*

Abstract: This talk concerns a conjecture of Lusztig about the geometry of the special pieces in the nilpotent cone. The special pieces are unions of nilpotent orbits attached to a single special nilpotent orbit and they are locally closed in the nilpotent cone. Lusztig conjectured that each special piece is a quotient of a smooth variety in the exceptional groups, something which was already known in the classical groups by work of Kraft and Procesi. In this talk we discuss a version of the conjecture for Slodowy slices and from it deduce the original conjecture in all remaining cases except possibly two. This is joint work with Fu, Juteau and Levy.