**BRUCE ALLISON**
**University of Alberta**

*Realization of Lie tori*

Centreless Lie tori play a fundamental role in the construction of extended affine Lie algebras. In this talk, I will describe a construction of centreless Lie tori, called multiloop Lie tori, as multiloop algebras based on finite dimensional Lie algebras. This construction generalizes the classical realization of affine Kac-Moody Lie algebras as (twisted) loop algebras. I will discuss the extent to which multiloop Lie tori account for all centreless Lie tori, and I will describe necessary and sufficient conditions for the equivalence of two multiloop Lie tori. The talk will be based on joint work with Stephen Berman, John Faulkner and Arturo Pianzola.

**SERGEY ARKHIPOV**
**University of Toronto**

*On an exotic bialgebra structure on the Semi-regular module*

Let G be an algebraic group with a subgroup B such that the corresponding Lie algebra g=Lie(G) is a direct sum of b=Lie(B) and another Lie subalgebra n (the case of triangular decomposition). We introduce two monoidal structures on the category of BxB-integrable g-bimodules and show that they are compatible in a certain sense. We consider the g-bimodule S of algebraic distributions on G with support on B (called the semi-regular g-bimodule). We show that S is an associative algebra in the first monoidal structure on the category of BxB-integrable g+g-modules as well as an associative coalgebra in the second one. We investigate the relation between these operations. We compare the defined structure on S to the notion of entwining structure. We argue that S with the above structures should be considered as the universal envelope of the normal bundle to B in G. Finally we discuss the possible generalization of the above construction to algebraic groupoids.

**YULY BILLIG**
**Carleton University**

*Cohomology of the Lie algebra of vector fields on a parallelizable manifold*

In this talk I will review the results of Gelfand-Fuks, Haefliger and Tsujishita on the cohomology of the Lie algebra of vector fields with values in the trivial module, as well as the module of differential forms. I will also show how to calculate the second cohomology of vector fields in the quotient module of 1-forms modulo differentials of functions. This result is relevant for the theory of extended affine Lie algebras. This talk is based on the joint work with Karl-Hermann Neeb.

**DAVID BROOKE**
**University of Toronto**

*On decomposing repeated representations in a tensor product*

When multiplicites arise in the direct sum decomposition of a tensor product of irreducible representations of semisimple Lie algebras, we may choose the copies of the direct summand arbitrarily. In other words, the highest weight space is multi-dimensional and we may choose copies of the repeated representation by choosing any set of highest weight vectors that span the highest weight space. In the case of SU(3) I have developed a method that 'intrinsically' determines specific highest weight vectors and hence specific copies of the repeated representation. The method should generalise easily to other semisimple Lie algebras. In particular, adopting this 'intrinsic' choice would mean the Clebsch-Gordan coefficients of the decomposition are determined.

**VYJAYANTHI CHARI**
**University of California, Riverside**

*Weyl modules for the loop algebra of an affine Kac-Moody algebra*

Weyl modules are a certain universal family of indecomposable representations associated loop algebra of a Kac–Moody algebra. When the Kac–Moody algebra is finite dimensional, these modules are connected with Demazure modules in positive level representations of the affine Lie algebra. Moreover, the positive level representations can be realized as a limit of the Weyl modules. In this talk, we describe the structure of the Weyl module when the Kac– Moody algebra is affine and discuss possible connections with the representation theory of the toroidal generalizations of the affine Lie algebra.

**CHARLES S. HAGUE**
**University of North Carolina, Chapel Hill**

*Cohomology of Cotangent Bundles of Flag Varieties and the BK-Filtration.*

Let G be a complex algebraic group and let P be a parabolic subgroup of G. Let $T^*(G/P)$ denote the cotangent bundle of the flag variety $G/P$. In this talk I will describe results connecting cohomology of bundles on $T^*(G/P)$ to purely combinatorial objects such as filtrations on irreducible $G$-modules and Lusztig's $q$-analog of weight multiplicity. Joint with Shrawan Kumar

**GEORG HOFMANN**
**Dalhousie University**

*Weyl Groups with Presentation by Conjugation*

The Weyl group of many Lie algebras is a Coxeter group, i.e. has a certain presentation by generators and relations. The class of extended affine Lie algebras (EALAs) with their extended affine root systems (EARs) and extended affine Weyl groups (EAWeGs) are an exception.

In this talk I will focus on the class of EARS that give rise to an EAWeG with a Coxeter presentation and the larger class of EARS that lead to a presentation by conjugation. I will provide necessary and sufficient conditions for both classes. These results entail that every EAWeG has the presentation by conjugation with respect to a suitable EARS.

**JOEL KAMNITZER**
**Unversity of California, Berkeley**

*Categorification of Reshtikhin-Turaev invariants via the loop Grassmannian*

I will explain a method, joint with Sabin Cautis, for categorifying Reshtikhin-Turaev tangle invariants using derived categories of coherent sheaves on certain varieties arising in the geometric Satake correspondence. The resulting knot homology theory agrees with Khovanov homology.

**ALEXANDER KIRILLOV**
**SUNY Stony Brook**

*Affine root systems and equivariant sheaves on $P^1$*

According to McKay correspondence, to every simply-laced affine Dynkin diagram there corresponds a finite subgroup $G$ in $SU(2)$. Using this, we present an explicit construction of affine root systems in terms of the category of $G$-equivariant sheaves on $P^1$. We also discuss an analog of this construction for finite Dynkin diagrams.

**SHRAWAN KUMAR**
**University of North Carolina**

*Eigenvalue problem and a new product in cohomology of flag varieties*
*(CRM-University of Ottawa Distinguished Lecture)*

This is a report on my joint work with P. Belkale. We define a new commutative and associative product in the cohomology of any flag variety G/P (which still satisfies the Poincaré duality) and use this product to generate certain inequalities which solves the analog of the classical Hermitian eigenvalue problem for any complex semisimple group G. Our recipe provides considerable improvement, in general, over the set of inequalities defined by Berenstein-Sjamaar.

**SHRAWAN KUMAR**
**University of North Carolina**

*Equivariant K-theory of flag varieties*

This is a report on my joint work with W. Graham. We prove some general results on the T-equivariant K-theory of flag varieties G/B, where G is a semisimple complex algebraic group and B is a Borel subgroup. We also make a conjecture on some positivity phenomenon in the T-equivariant K-theory of G/B for the product of two basis elements written in terms of the basis of the T-equivariant K-theory of G/B introduced by Kostant-Kumar. This conjecture is parallel (but different) from the conjecture of Griffeth-Ram for the product of structure sheaf of schubert varieties. We give an explicit expression for the product in the T-equivariant K-theory of projectice spaces. In particular, we establish our conjecture in this case.

**ANTHONY LICATA**
**Yale University**

*Quiver varieties and level-rank duality*

We discuss level-rank duality in the representation theory of affine Lie algebras of type $\widehat{A}$, and its relation to the geometry of Nakajima quiver varieties of type $\widehat{A}$.

**MARYNA NESTERENKO**
**University of Montreal**

*Contractions of low-dimensional Lie algebras*

An algorithm based on necessary criteria of contractions is presented and applied to low-dimensional Lie algebras. As a result, all one-parametric continuous contractions for the both complex and real Lie algebras of dimensions not greater than four are constructed.

Levels and co-levels of low-dimensional Lie algebras are discussed in detail. Properties of multi-parametric and repeated contractions are also investigated.

**PRASAD SENESI**
**University of California, Riverside**

*Weyl Modules of Twisted Loop Algebras*

Weyl modules for the loop algebras $\mathfrak{g} \otimes \mathbb{C}[t^{\pm 1}]$, $\mathfrak{g}$ a complex simple Lie algebra, were described and classified by V. Chari and A. Pressley. In talk we will discuss the recent joint work between V. Chari, P. G. Fourier and P. Senesi in which the notion of a Weyl module is extended to representations of the twisted loop algebras. We will describe the classification of these representations and their universal properties, as well as some recent results concerning their dimensions.

**PAVEL WINTERNITZ**
**Centre de recherches mathematiques and Universite de Montreal**

*Applications of Lie theory to the numerical solution of differential equations*

We will show how to discretize an ordinary differential equation and obtain difference schemes invariant under the same Lie point symmetry group as the original differential equation. As examples we will consider several second and third order nonlinear differential equations and show that the invariant schemes provide a much higher precision than standard schemes, without significantly increasing the complexity of the computations. Moreover, we will show on an example how invariant schemes can provide solutions in the neighbourhood of singularities and beyond singularities, where standard numerical methods fail.

**SEBASTIAN ZWICKNAGL**
**University of California, Riverside**

*Quantum Symmetric Algebras and their Applications*

I will first introduce the concept of quantum symmetric algebras as introduced by Arkady Berenstein and myself: Let $g$ be a complex reductive Lie algebra and let $V$ be a finite-dimensional $g$-module $V$. We deform the symmetric $U(g)$-module algebra $S(V)$ to obtain the quantum (or braided) symmetric algebra $S_q(V)$, a module algebra over the quantized enveloping algebra $U_q(g)$.

I will briefly classify the modules for which this deformation is flat and then explain how quantum symmetric algebras provide a unifying construction for many known quantum algebras such as quantum matrices, quantum antisymmetric matrices or quantum Euclidean space.

Finally, I would like to address the corresponding geometric picture of equivariant Poisson structures and their quantizations. This will provide an outlook to future directions and potential applications.