Abstract

G.Williamson

Title : Representations of algebraic groups and Koszul duality

Abstract : My talk will be about representations of algebraic groups and the Hecke category. I will describe a conjectural character formulas for tilting modules (joint work with Simon Riche). It is a theorem for GL_n. I will also discuss the Finkelberg-Mirkovic conjecture, upon which significant progress has recently been made by Achar-Riche. I will try to outline work in progress with Achar, Makisumi and Riche which should lead to a proof of our conjecture. Ideas of Bezrukavnikov-Yun (Koszul duality for Kac-Moody groups) play a key role.

M.Watanabe

Title : Schubert polynomials and Kraskiewicz-Pragacz modules

Abstract : Schubert polynomials, which arose from Schubert calculus on the flag varieties, are an important subject in algebraic combinatorics. In the study of Schubert polynomials, Kraskiewicz and Pragacz introduced certain modules over the upper triangular matrix group whose characters are equal to Schubert polynomials (generalizing the situation that Schur functions appear as the irreducible characters of general linear group). I will talk on how some positivity properties of Schubert polynomials can be investigated through Kraskiewicz-Pragacz modules, using the theory of highest weight categories.

I.Losev

Title : Hecke algebras for complex reflection groups

Abstract : Iwahori-Hecke algebras are classical objects in Representation theory. An important basic property is that these algebras are flat deformations of the group algebra of the corresponding real reflection group. In 1998 Broue, Malle and Rouquier have extended the definition of a Hecke algebra to the case of complex reflection groups. They conjectured that the Hecke algebras are still flat deformations of the group algebras. Recently, the proof of this conjecture was completed by myself and Marin-Pfeiffer in the case when the base field has characteristic 0. In my talk I will introduce Hecke algebras for complex reflection groups and explain some ideas of the proof of the BMR conjecture.

A.Negut

Title : From Khovanov homology to Hilbert schemes of points

Abstract : In this talk, we will present a framework that takes in a monoidal category C with some extra data, and outputs a pair of adjoint functors from C to the derived category of a certain algebraic space. Our main application is when C is the category of type A Soergel bimodules, in which case we conjecture that the resulting algebraic space is the flag Hilbert scheme of points on the plane. This would allow us to associate to any braid a sheaf on the flag Hilbert scheme, whose equivariant Euler characteristic (conjecturally) matches the triply graded Khovanov homology of the closure of the braid. We show how this leads to a geometrization of the Jones-Ocneanu trace using Hilbert schemes. Joint work with Eugene Gorsky and Jacob Rasmussen.

X.Zhu

Title : Kloosterman D-modules and Hitchin system with ramification

Abstract : I will first recall the remarkable Kloosterman D-modules constructed by Frenkel-Gross (via Galois side) and Heinloth-Ngo-Yun (via automorphic side). Then I will explain how to relate these two constructions via the Langlands correspondence. A key ingredient is to study certain Hitchin systems with ramification by the invariant theory of Vinberg's theta-groups.

T.Kuwabara

Title : Vertex algebras associated with the Hamiltonian reduction for hypertoric varieties

Abstract : We discuss vertex algebras which we obtain as the vertex algebras of global sections of sheaves of (h-adic) vertex algebras on certain symplectic manifolds. These vertex algebras are obtained by certain semi-infinite reduction, analogously to quantum Drinfeld-Sokolov reduction, corresponding to the Hamiltonian reduction for hypertoric varieties. This method gives a new construction of the affine W-algebra of subregular type A.

A.Smirnov

Title : Rationality of descendants in quantum K-theory

Abstract : We will discuss the descendant functions in quantum K-theory of Nakajima varieties. We will prove rationality conjecture, and provide explicitly rational formula for

descendant invariants. We also describe the the operators of quantum multiplication by descendants and give a proof of Nekrasov-Shatashvili conjecture on quantum multiplication by characteristic classes.

S.Naito

Title : Standard monomial theory for semi-infinite LS paths with geometric application
Abstract : As Lakshmibai-Littelmann pointed out, SMT (standard monomial theory) character formula for LS paths implies a Pieri-Chevalley formula, which is due to Pittie-Ram, for the torus equivariant K-theory $K_H(G/B)$ of the finite-dimensional flag variety G/B; this formula describes the product of a line bundle with the structure sheaf of a Schubert variety in $K_H(G/B)$ in terms of LS paths.

In this talk, we would like to explain that SMT holds also for semi-infinite LS paths, and then give its application to a variant of the equivariant K-theory (with respect to the Iwahori subgroup) of the formal model of semi-infinite flag manifold.

This talk is based on a joint work with S. Kato and D. Sagaki.

H.Williams

Title : Cluster Theory of the Coherent Satake Category
Abstract : We discuss recent work showing that the category of equivariant perverse coherent sheaves on the affine Grassmannian of GL_n is a monoidal cluster categorification in the sense of Hernandez-Leclerc. The induced cluster structure on K-theory was discovered by Finkelberg-Kuznetsov-Rybnikov, and we describe expected extensions to other types. The proofs rely on techniques developed by Kang-Kashiwara-Kim-Oh in their work on KLR algebras. We discuss a general setting of chiral tensor categories where many of the same ideas can be applied, and which abstracts formal features of irreducible line operators in 4d holomorphic-topological field theories. In particular, the field theoretic perspective provides a useful organizing framework for the implied relationship between the affine Grassmannian and invariants of certain 3-Calabi-Yau categories. This is joint work with Sabin Cautis.

T.Ikeda

Title : Quantum K-theory of flag variety and K-homology of affine Grassmannian

Abstract : Let G be a simple and simply-connected complex algebraic group. The quantum cohomology of the flag variety of G is, up to localization, isomorphic to the homology of the affine Grassmannian of G. This result of D. Peterson stated in his lectures at MIT in 1997 was proved by Lam and Shimozono in the torus-equivariant setting. We give a K-theory version of Peterson's isomorphism for $G = SL(n)$. Our approach to construct such isomorphism relies on integrable systems. In fact, Givental and Lee showed that the K-theoretic J-function is an eigenfunction of the q-difference Toda operator by Etingof. Based on this fact, a presentation of the quantum K-ring of the flag variety was conjectured by Kirillov and Maeno. By solving the relativistic Toda lattice by Ruijsenaars, we show that the quantum K-ring of the flag variety $SL(n)/B$ is, up to localization, isomorphic to the K-homology ring of the affine Grassmannian. It is worthwhile to note that the Lax matrix of the solution we used is unipotent, while in (co)homology case nilpotent solutions of Toda lattice play an essential role. We also conjecture that a quantum Grothendieck polynomial of Lenart and Maeno is sent to a simple ratio of K-theoretic k-Schur functions defined by Lam, Shimozono, and Schiling. This is a joint work with S. Iwao and T. Maeno.

A.Weekes

Title : Cohomology rings of quiver varieties, and a conjecture of Hikita

Abstract : We describe a conjectural presentation of the (equivariant) cohomology rings of quiver varieties. This presentation is based on a conjecture of Hikita which, for a symplectic dual pair $X, X^!$ of varieties, proposes an isomorphism between the coordinate ring of a fixed point subscheme $\mathbb{C}[X^{\mathbb{C}^\times}]$ on the one hand, and the cohomology ring of a resolution $Y^! \to X^!$ on the other. The relevant pair for us is a (generalized) slice in an affine Grassmannian, and a corresponding framed quiver variety. We discuss connections between our presentation and that given by Brundan-Ostrik for the cohomology of Spaltenstein varieties.

S.Yanagida

Title : Factorization space and deformation of Liouville CFT

Abstract : Factorization space introduced by Beilinson and Drinfeld along their theory of chiral algebra is a non-linear version of vertex algebra. We introduce a difference version of the factorization space arising from algebraic curves with marked points, and show that a linearization procedure of this system yields a deformation of Liouville conformal field theory. This deformed theory has three-point correlation functions encoded by the quantum toroidal algebra, and the related W algebra is the so-called deformed Virasoro algebra.

M.Kashiwara

Title : Monoidal categorification of cluster algebras by quiver Hecke algebras

Abstract : It is known that the quantum coordinate ring has a cluster algebra structure. On the other hand, the quiver Hecke algebras (QHA) categorify the quantum coordinate ring. We prove that any cluster monomials correspond to simple modules over QHA in the symmetric Cartan matrix case. It is a joint work with S.-J.Kang, M.Kim, S.-J. Oh.

V.Ostrik

Title : A sign in the associativity constraint

Abstract : This talk is based on joint work with R.Bezrukavnikov, M.Finkelberg, and I.Losev. I will discuss some tensor categories arising from tensoring of Harish-Chandra bimodules. We review what is known about these categories and emphasize a particularly subtle special case corresponding to exceptional Kazhdan-Lusztig cells in Weyl groups.

R.Kodera

Title : Quantized Coulomb branches of Jordan quiver gauge theories and cyclotomic rational Cherednik algebras

Abstract : Recently Braverman-Finkelberg-Nakajima gave a mathematical definition of the Coulomb branches of $3d$ $N = 4$ supersymmetric gauge theories. They are constructed as affine algebraic varieties, together with their quantizations. In this talk we consider the quantized Coulomb branches associated with quiver gauge theories of Jordan type. We prove that they are isomorphic to the spherical parts of (trigonometric and cyclotomic rational) Cherednik algebras. This is a joint work with Hiraku Nakajima.

T.Hikita

Title : Remarks on canonical bases in equivariant K-theory

Abstract : Lusztig defined certain involutions on equivariant K-theory of Slodowy varieties and gave a characterization of certain bases using them. In this talk, I will reformulate the definition of these involutions so that it makes sense for more general conical symplectic resolutions. Then I will discuss the case of hypertoric varieties in some detail.

K.Iwaki

Title : Resurgence, exact WKB and wall-crossing

Abstract : Ecalle's resurgent analysis enables us to describe the Stokes phenomenon for divergent series in terms of the singularity structure of the Borel transform of divergent series. I'll discuss a relation between the Stokes phenomenon in exact WKB analysis and wall-crossing formula from the view point of resurgent analysis.

P.McNamara

Title : Geometric Extension Algebras

Abstract : Geometric extension algebras are convolution algebras in Borel-Moore homology, or equivalently sheaf-theoretic Ext algebras. Interesting examples include KLR algebras, algebras related to Schur algebras, category $\mathcal{O}$ and Webster algebras. We discuss how geometric parity vanishing properties are equivalent to representation-theoretic properties of these algebras. Some applications to the theory of KLR algebras will be discussed if time permits.

A.Braverman

Title : Coulomb branches of 4-dimensional gauge theories, double affine Hecke algebras and q-quasi-invariants

Abstract : In the first part of the talk I will explain some general expectations about the (mathematical version of the) Coulomb branches of 4-dimensional gauge theories and their quantizations (defined as K-homology of certain stacks closely related to the affine Grassmannian of a reductive group G). In the 2nd part I will concentrate on a particular example in which the resulting algebras give rise to a q-deformation of trigonometric cyclotomic Cherednik algebras (this is a q-version of a result of Kodera and Nakajima). If time permits I shall also explain how these algebras can be applied in order to prove a conjecture of Etingof and Rains about the so called algebra of q-quasi-invariants. This is a joint work with Etingof and Finkelberg.

Y.Saito

Title : On quantum elliptic algebras

Abstract : Let $\mathfrak{g}$ be a semisimple Lie algebra, and $\mathfrak{g}_{tor}$ the corresponding toridal Lie

algebra. Namely, $\mathfrak{g}_{tor}$ is the universal central extension of double loop Lie algebra $\mathfrak{g} \otimes \mathbb{C}[s^{\pm}, t^{\pm}]$.

Around 2000, Kyoji Saito and Yoshii gave a new presentation of $\mathfrak{g}_{tor}$ by finitely many generators and relations, attached with elliptic Dynkin diagrams.

In this talk, we introduce a q-analogue of K. Saito and Yoshii's presentation, so-called "quantum elliptic algebras". In addition, we show that these algebras are isomorphic to quantum toroidal algebras for several types. In other words, we give a presentation of quantum toroidal algebras by finitely many generators and relations.

M.Finkelberg

Title : Comultiplication in the open Toda lattice and shifted yangians

Abstract : For a reductive group G, Kazhdan and Kostant defined the open quantum Toda lattice integrable system $\mathbb{C}[\mathfrak{h}/W] \to Toda(G)$ by a quantum hamiltonian reduction. From their definition we get a homomorphism $Toda(G) \to Toda(L)$ for any Levi subgroup. In particular, for $G = GL(n)$, $L = GL(k) \times GL(l)$, we get a comultiplication in type A Toda lattice. At the classical level we get a multiplication of universal centralizers, alias $SL(2)$ open zastava $Z^k \times Z^l \to Z^n$, alias $SU(2)$ euclidean monopoles. This multiplication corresponds to the product of scattering matrices (from the monopoles point of view) or complete monodromy matrices (from the point of view of Lax realization of the open Toda lattice). It turns out that the multiplication makes sense for monopoles (zastava) of arbitrary G, and it can be quantized by the coproduct in the corresponding shifted yangians. This is a joint work with J.Kamnitzer, L.Rybnikov, K.Pham, and A.Weekes.

S.Ariki

Title : Representation type for block algebras of Hecke algebras

Abstract : Representation type is one of the basic properties of an algebra. After explaining basic techniques to determine representation type, I briefly recall how we settled Uno's conjecture, which asserts that the Poincare polynomial of the Weyl group controls the representation type of the corresponding Hecke algebra. As an algebra is a direct sum of its block algebras, it is natural to ask the representation type for each block algebra of Hecke algebras. Our main result in this talk answers this question for Hecke algebras of classical type (except for type D in characteristic 2).

T.Licata

Title : The elliptic Hall algebra and the q-deformed Heisenberg category

Abstract : To any finite-dimensional Frobenius algebra B, there is an associated a pivotal monoidal Heisenberg category H_B, defined using a graphical calculus of planar diagrams and relations. One expects that various algebras obtained from morphism spaces in H_B can be understood in terms of the vertex algebra associated to the lattice $K_0(B - mod)$, but at present not much is known for general Frobenius algebras B. In the basic case $B = \mathbb{C}$, the associated Heisenberg category was defined by Khovanov, and it turns out that the morphism spaces in his category admit a 1-parameter deformation compatible with the deformation of the group algebra of S_n to the Hecke algebra. The main goal of this talk will explain the relationship both between Khovanov's Heisenberg category and the W-algebra $W_{1+\infty}$, and between the q-deformed Heisenberg category and the elliptic Hall algebra of Burban-Schiffmann.