

Geometric Representation Theory and Beyond
September 26 – 30, 2016

Abstracts of Talks

Konstantin Ardakov (University of Oxford)

Title: The p-adic local Langlands program and D-modules

Abstract: The theory of admissible p-adic representations of p-adic Lie groups appears in several places in algebraic number theory, including non-commutative Iwasawa theory and the p-adic local Langlands program. I will describe a geometric approach towards understanding these representations using equivariant D-modules on rigid analytic flag varieties.

David Ben-Zvi (University of Texas, Austin)

Title: Central symmetries in categorical representation theory

Abstract: I will discuss work in progress with Sam Gunningham and David Nadler categorifying the Kostant construction of centers of enveloping algebras, quantizing the Ngô integration of classical Hamiltonian systems, and identifying new homological symmetries of character varieties.

Alexander Braverman (University of Toronto and Perimeter Institute for Theoretical Physics)

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

Abstract: In the first half of the talk I shall speak about a possible definition of Coulomb branches of 4-dimensional gauge theories (which is a variation of the definition of Coulomb branches for 3-dimensional gauge theories proposed recently by Finkelberg, Nakajima and myself) and of their quantizations, and explain some conjectures about those. As a particular special case we get some new interesting algebras, which we call cyclotomic double affine Hecke algebras (these are q-deformations of the so called cyclotomic Cherednik algebras). These algebras can be used in order to prove a conjecture of Etingof and Rains which describes various properties of the so called ring of q-quasi-invariants. This is a joint work with P. Etingof and M. Finkelberg.

Laurent Fargues (Jussieu)

Title: Geometrization of the local Langlands correspondence

Abstract: I will speak about a conjecture that is at the interface between p-adic Hodge theory, the geometric Langlands program and the classical Langlands program (over a number field of a function field). It says that given a discrete local Langlands parameter over a local field (of equal or unequal characteristic) one should be able to construct a particular perverse sheaf on the stack of G-bundles on the curve I defined and studied in my joint work with J.-M. Fontaine. This stack is a perfectoid stack in characteristic p and is a geometrization of Kottwitz set $B(G)$ of G-isocrystals. Taking the fiber at semistable points this should give a local Langlands correspondence for all extended pure inner forms of G, togetherwith the internal structure of the L-packets. The Hecke eigensheaf property implies that this local Langlands correspondence is realized in the cohomology of Rapoport-Zink spaces (Kottwitz conjecture). The trace of Frobenius function should geometrize the stable character associated to the parameter. Moreover there should be a local / global

compatibility with Caraiani-Scholze sheaf associated to a Shimura variety.

Victor Ginzburg (University of Chicago)

Title: Moduli spaces, indecomposable objects and potentials over a finite field

Abstract: Given a linear category over a finite field such that the moduli space of its objects is a smooth Artin stack (and some additional conditions) we give formulas for an exponential sum over the set of absolutely indecomposable objects and a stacky sum over the set of all objects of the category, respectively, in terms of the geometry of the cotangent bundle on the moduli stack. The first formula was inspired by the work of Hausel, Letellier, and Rodriguez-Villegas. It provides, in particular, a new approach for counting absolutely indecomposable quiver representations, vector bundles with parabolic structure on a projective curve, and irreducible etale local systems (via a result of Deligne).

Michael Harris (Columbia University)

Title: Report on the mod p local Langlands correspondence

Abstract: Let F be a p -adic field and G a connected reductive algebraic group; let k be an algebraically closed field of characteristic p . The mod p local Langlands correspondence is a hypothetical relation between Langlands parameters for the absolute Galois group of F with values in the L -group of G over k and admissible representations of the group $G(F)$ with coefficients in k . When $F = \mathbb{Q}_p$ and $G = GL(2)$, there is a complete correspondence due to Breuil, which has been extended to $SL(2)$ by Abdellatif and others. For all other groups there are many results but it is far from clear how to classify the supercuspidal representations, which are the atomic objects of the theory. The talk will describe some of what is known about structures on both sides of the hypothetical correspondence, with a view to convincing specialists in categorical representation theory to take a closer look at the problem.

Tamas Hausel (IST Austria)

Title: Refined geometric invariants and representation theory

Abstract: I will discuss two situations where refined geometric invariants of Higgs moduli spaces indicate the possibility of a refinement of the representation theory of finite groups and algebras of Lie type and affine Kac-Moody algebras respectively.

David Nadler (University of California, Berkeley)

Title: Lagrangian skeleta

Abstract: Lagrangian skeleta in symplectic manifolds (such as cotangent bundles and symplectic resolutions) arise as the classical support of quantum modules. We will discuss methods to capture their geometry in simple combinatorial terms. An overarching goal is to reconstruct as much of the symplectic geometry as possible from elementary ingredients.

Andrei Okounkov (Columbia University)

Title: q -deformed conformal blocks: difference equations and integral formulas

Abstract: This is a report on a joint work with Mina Aganagic and Edward Frenkel, in which we

link conformal blocks for quantum affine Lie algebras with the conformal blocks of deformed W-algebras of Frenkel and Reshetikhin (this extends and proves several connections made or anticipated in the context of the geometric Langlands correspondence). The construction is geometric and goes through various ingredients of use and importance in enumerative K-theory of curves in Nakajima varieties.

Vera Serganova (University of California, Berkeley)

Title: Lie superalgebra $P(n)$ and Temperley–Lieb algebra at 0.

Abstract: The Lie superalgebra $P(n)$ is one of the classical Lie superalgebras introduced by Kac in 1977. It is an analogue of both orthogonal and symplectic Lie algebra and consists of matrices preserving a non-degenerate even symmetric form on a super vector space. For a long time the problem of finding irreducible characters of $P(n)$ remained open while the similar problems had been solved for all other basic Lie superalgebras. We define translation functors on the category of finite-dimensional representation of $P(n)$ and show that they categorify the Temperley–Lieb algebra at 0. Using this action and combinatorics of certain two-colored diagrams we calculate the Kazhdan–Lusztig multiplicities and classify the blocks of this category. This is a joint work with Inna Entova-Aizenbud.

Wolfgang Soergel (Universität Freiburg)

Title: Motivic methods in representation theory

Abstract: Motivic methods allow the construction of a six-functor context, for which the category of mixed Tate objects over a point is semisimple. This in turn helps to a streamlined treatment of "graded versions" of categories of representations.

Catharina Stroppel (Universität Bonn)

Title: Super representation theory via geometry, invariant theory and categorification

Abstract: In the classical representation theory of complex semisimple Lie algebras the localisation theorem is a very important and useful tool to pass between algebraic and geometric descriptions of categories of representations. It allows to use geometric tools like gradings and parity vanishing on the algebraic side. For Lie superalgebras an analogous theorem is missing. Moreover, the category of finite dimensional representations is much harder to understand, but also an interesting category. I will explain a possible replacement for the missing theorem, outline recent developments and indicate connections of super representation theory with invariant theory and categorification.

Geordie Williamson (Universität Bonn)

Title: An example of higher representation theory

Abstract: I will describe some conjectures with Simon Riche that attempt to understand representations of algebraic groups in positive characteristic via higher representation theory. Roughly speaking, the principal block is a cyclic module over the Hecke category, and everything should be deducible from this action. I will connect this conjecture with recent results of Achar–Riche on the Finkelberg–Mirkovic conjecture. If time permits I will outline work in progress with Achar, Makisumi and Riche which establishes Koszul duality for the Hecke category. Amongst other things, this should lead to a proof of our conjecture.

