Generalized Imaginary Verma modules

Iryna Kashuba

(IME USP)

We develop a general technique of constructing new irreducible weight modules for any affine Kac-Moody algebra using the parabolic induction, in the case when the Levi factor of a parabolic subalgebra is infinite-dimensional and the central charge is nonzero. Our approach uniforms and generalizes all previously known results with imposed restrictions on inducing modules.

Categorification of some integer sequences and Brauer configuration algebras

Pedro Fernando Fernández Espinosa

(Universidad Piloto de Colombia)

Brauer configuration algebras were introduced by Green and Schroll in [4] asa generalization of Brauer graph algebras, which are biserial algebras of tame representation type and whose representation theory is encoded by some combinatorial data based on graphs. In particular, we introduce the notions of the message of a Brauer configuration and labeled Brauer configurations.These concepts allow us to establish unexpected connections between different fields of mathematics and categorify some integer sequences [1]. In this talk, homological ideals associated to some Nakayama algebras are characterized and enumerated via integer specializations of some suitable Brauer configuration algebras. Besides, it is shown how the number of such homological ideals can be connected with the categorification process of Fibonacci numbers defined by Ringel and Fahr [2, 3].

References

[1] P.F.F. Espinosa and A.M. Cañadas, Homological Ideals as Integer Specializations of Some Brauer Configuration Algebras, arXiv 2104.00050 (2021), 1-16.

[2] P. Fahr and C. M. Ringel, A partition formula for Fibonacci numbers, J. Integer Seq.

11 (2008), no. 08.14, 1-9.

[3] , Categorification of the Fibonacci numbers using representations of quivers, J.

Integer Seq. 15 (2012), no. 12.2.1, 1-12.

[4] E.L. Green and S. Schroll, Brauer configuration algebras: A generalization of Brauer

graph algebras, Bull. Sci. Math. 141 (2017), 539-572.

Representations of Map Superalgebras

Henrique de Oliveira Rocha

(University of São Paulo)

We give a classification of simple modules with finite weight multiplicities over basic classical map superalgebras. We use this result to obtain a classification of all simple Harish-Chandra modules for basic classical loop superalgebras and extends these results to affine Kac-Moody Lie superalgebras. Finally, we show the Kac induction functor gives a bijection between simple bounded Harish-modules over affine Kac-Moody Lie superalgebras of type I and the same class of modules over the even part.

Representations of the Cartan type Lie superalgebra W(∞)

Lucas Calixto

(Federal University of Minas Gerais)

The Lie superalgebra W(∞) is the direct limit of the finite-dimensional Cartan type Lie superalgebras W(n) as n goes to infinity. This talk is concerned with Z-graded modules over W(∞). I will introduce a category T_W of W(∞)-modules which is closely related to the category of tensor sl(∞)-modules introduced and studied by Dan-Cohen, Serganova and Penkov. I will prove that each simple module in T_W is isomorphic to the unique simple quotient of a module induced from a simple tensor module over gl(∞), and vice versa, thus yielding a bijection between the simple objects of T_W and T_gl. This is completely analogous to the situation for Z-graded W(n)-module studied by Serganova. As a corollary, we find that all simple modules in T_W are highest weight modules with respect to an appropriate choice of Borel subalgebra of W(∞).

Finally, I will give a realization of each simple module from T_W as a module of tensor fields, generalizing the work of Bernstein and Leites for W(n).

On quasi Steinberg characters of complex reflection groups

Ashish Mishra

(UFPA, Belém, Brazil)

For a prime p, the quasi p-Steinberg characters of a finite group G are those irreducible characters of G which take nonzero value on every p-regular element of G. In this talk, we study and classify nonlinear quasi p-Steinberg characters of complex reflection groups. This is joint work with Digjoy Paul and Pooja Singla.

Wargaming with Quadratic Forms and Brauer Configuration Algebras

Agustín Moreno Cañadas

(Universidad Nacional de Colombia)

Recently, Postnikov introduced Bert Kostant's game to build the maximal positive root associated with the quadratic form of a simple graph. This result and some other games based on Cartan matrices give a new version of Gabriel's theorem regarding algebras classification.

In this talk, we will describe a novel wargame based on Bert Kostant's game, and a missile defense system (MDS). In this case, missile trajectories are interpreted as suitable paths of a quiver (directed graph). The MDS protects a region of the Euclidean plane by firing missiles from a ground-based interceptor (GBI) located at the point (0,0). In this case, a missile success interception occurs if a suitable positive number associated with the launches of the enemy army can be written as a mixed sum of triangular and square numbers.

On the double of the Jordan plane

Nicolas ANDRUSKIEWITSCH

(FaMAF, Universidad Nacional de Córdoba. CIEM-CONICET)

I will report on the construction, properties and representation theory of the double of the Jordan plane and their restricted versions.

Chiral homology, Hodge theory and Poisson homology

Jethro van Ekeren

(Universidade Federal Fluminense)

I will describe some recent work relating the chiral homology of a vertex algebra V (more precisely, associated chiral algebra over the torus), Hodge filtrations on configuration spaces, and the Poisson homology of the associated scheme of V. (Joint work with R. Heluani)

Admissible representations of simple affine vertex algebras

Libor Krizka

(Charles University)

We provide an explicit combinatorial description of highest weights of simple highest weight modules over the simple affine vertex algebra $V_k(\mathfrak{sl}_n)$ of admissible level k.

Faces of polyhedra associated with Relation modules

Germán Alonso Benitez Monsalve

(Universidade Federal do Amazonas)

Relation Gelfand-Tsetlin gl(n)-modules were introduced in 2019 by V. Futorny, L. E. Ramirez and J. Zhang, and are determined by some special directed graphs and Gelfand-Tsetlin characters. In this talk we will construct polyhedra associated with the class of relation modules, which includes as a particular case, any classical Gelfand-Tsetlin polytope. Following the ideas presented by J. A. De Loera and T. B. McAllister we give a characterization of d-faces of the associated polyhedra in terms of a matrix related to the corresponding graph.

Joint work with L. E. Ramirez (UFABC)

Trees Are Real And Totally Ordered Graphs Are Prime

Adriano Adrega de Moura

(Unicamp)

Although the finite-dimensional representation theory of quantum affine algebras has been intensively studied since the early 1990's, several basic questions about the underlying abelian tensor categories remain unanswered. One example is the question about reducibility of tensor products of simple objects. In the classical context, the answer is very easily described: every simple simple object is isomorphic to a tensor product of a unique (up to ordering) collection of evaluation modules and the tensor product of two simple objects is simple if and only if they do not have evaluation factors associated to the same evaluation parameter. In the quantum context the story is very different, beginning with the fact that evaluation modules exist only if the underlying finite-dimensional simple Lie algebra is of type A. Except of type A_1, a complete answer is not known.

In this talk, based on an ongoing joint work with Clayton Silva, we discuss an approach for studying results towards the classification of the simple prime modules, i.e., those which cannot be expressed as a non-trivial tensor product of other simple modules. The approach is based on the concept of the q-factorization graph of a simple module. We propose this concept as a natural language for describing the Drinfeld polynomials of the simple prime modules. Two of our main results so far are stated in the title of the talk.

Coset constructions of W-superalgebras of type B

Naoki Genra

(Kavli IPMU)

We talk about coset constructions of principal W-superalgebras of osp(1|2n), which are analogs of coset constructions of principal W-algebras of type ADE by Arakawa-Creutzig-Linshaw. The cosets are useful not only to study the category of modules at non-degenerate admissible levels, but also to prove the existence of embeddings of the affine vertex superalgebras of osp(1|2n) into the equivariant W-algebras of sp(2n) times 2n+1 free fermions. This leads to the rigidity of the category O of affine sp(2n) at admissible levels as a corollary. This is joint work with Thomas Creutzig and Andrew Linshaw.

An Algorithm to Build the Auslander-Reiten Quiver of Some Equipped Posets

Isaias David Marin Gaviria

(Universidad Nacional de Colombia)

The representation theory of equipped posets is a generalization of the theory of representation of ordinary posets developed by Nazarova, Roiter and their students in the 1970s [1]. This kind of posets was introduced by Zabarilo and Zavadskij in [2] and was classified in [3,4]. The main goal of such theories is to give a complete description of the indecomposable objects and irreducible morphisms of a category of representations rep P of a given poset P. Since the Auslander-Reiten quiver contains all this information, then one aim in this theory is to build the Auslander-Reiten quiver of rep P.

In this talk, we present a combinatoric algorithm to built the Auslander-Reiten quiver of some equipped posets based on the Auslander-Reiten quiver of some suitable ordinary posets.

Classical, Quantum and Categorical

Juan Camilo Arias

(Institute of mathematics and statistics. University of São Paulo)

In this talk we show several construction in representation theory in the three flavors of classical objects, quantum objects and its categorifications. We will use the symmetric group and the special linear group as main examples.

Relation modules and its subquotients

Luis Enrique

(Universidade Federal do ABC)

In this talk we recall the construction of relation Gelfand-Tsetlin modules and describe all its simple subquotients.

Superconformal Vertex Algebras from Killing Spinors

Andoni A. de La Hera

(ICMAT)

The aim of the talk is to present a new method to construct embeddings of the N=2 superconformal vertex algebra, responsible for mirror symmetry, into the affinization of a quadratic Lie algebra. The new input for the construction is a solution of the "Killing spinor equations on the quadratic Lie algebra. These equations can be regarded as purely algebraic conditions on the quadratic Lie algebra but in fact come from geometry and physics specifically from the approach to special holonomy based on generalized geometry on Courant algebroids. This embedding will be illustrated with an example related to homogeneous Hopf surfaces. As an application I will construct (0 2) mirror pairs given by homogeneous Hopf surfaces endowed with a Bismut-flat pluriclosed metric. This talk is based on joint work with Luis Álvarez-Cónsul and Mario Garcia-Fernandez in arxiv:2012.01851."

Ergodicity of infinite particle systems and applications

Misha Neklyudov

(UFAM)

I am going to discuss algebraic structure which naturally appears in the study of ergodicity of certain degenerate infinite dimensional sub-elliptic generators. I will showdifferent applications of the structure (which is extension of Jordan-Schwinger map) toalgebra (i.e. construction of explicit representations of finite and infinite dimensional algebras) and analysis (i.e. construction of new quantisation) and present some open problems and open directions of research. (based on joint works with B. Zegarlinski, J. Inglis, W. Bock, V. Futorny).

On the representation theory of affine vertex algebras on conformal and collapsing levels

Drazhen Adamovich

(U.Zagreb)

In this talk we discuss some applications of the theory of conformal embeddings and collapsing levels for affine vertex algebras developed in joint papers with Kac, Moseneder, Papi and Perse.

We present a proof of the semi-simplicity of the Kazhdan-Lusztig category KL of affine vertex superalgebras at collapsing and some other levels. The proof uses the representation theory of affine vertex algebras and concepts from the theory of conformal embeddings. In the Lie superalgebra case, we discuss some examples when KL_k has indecomposable highest weight modules and explain what is a possible implication of this in the representation theory of vertex algebras. We will also discuss the category of relaxed and logarithmic modules at certain collapsing levels.

Partitions with parity and representations of quantum toroidal superalgebras

Luan Bezerra

(IME-USP)

The representation theory of quantum toroidal (super)algebras is a very technical and difficult subject. On the other hand, a large class of modules where the central element C acts by 1 have an easy description through the combinatorial framework of partitions with parity. This combinatorics is not only interesting in its own right, but it is expected to be related to other concepts such as crystal bases, fixed points of the moduli spaces of BPS states, and equivariant K-theory of moduli spaces of maps.

Double Poisson Vertex Algebras - and Courant-Dorfman Algebras

Reimundo Heluani

(IMPA)

Holomorphic integer graded vertex superalgebras

Bely Rodriguez Morales

(Universidade de Sao Paulo)

We study holomorphic Z-graded vertex superalgebras. We prove that all such vertex superalgebras of central charge 8 and 16 are purely even. For the case of central charge 24 we prove that the weight-one Lie superalgebra is either zero, of superdimension 24, or else is one of an explicit list of 1332 semisimple Lie superalgebras.

Beyond the 10-fold way: 13 associative Z2xZ2-graded superdivision algebras

Zhanna Kuneztsova

(Federal University of ABC (UFABC))

The "10-fold way" refers to the combined classification of the 3 associative division algebras (of real, complex and quaternionic numbers) and of the 7, Z2-graded, superdivision algebras. The connection of the 10-fold way with the periodic table of topological insulators and superconductors is well known. Motivated by the recent interest in Z2×Z2-graded physics (classical and quantum invariant models, parastatistics) we classify the associative Z2×Z2-graded superdivision algebras and show that 13 inequivalent cases have to be added to the 10-fold way. Our scheme is based on the "alphabetic presentation of Clifford algebras", here extended to graded superdivision algebras. The generators are expressed as equal-length words in a 4-letter alphabet (the letters encode a basis of invertible 2×2 real matrices and in each word the symbol of tensor product is skipped). The connection of the classification with the Periodic Table of condensed matter will be also addressed in the talk.

Z2xZ2-graded Lie (super)algebras and detectable parastatistics

Francesco Toppan

(CBPF)

In 1978 Rittenberg-Wyler (see also Scheunert 1979) introduced the Z_2^n-graded "color" Lie (super)algebras as generalizations of the ordinary Z_2-graded Lie superalgebras. It was recently shown that color Lie superalgebras appear as dynamical symmetries of Partial Differential Equations and as symmetries of both classical sigma-models and quantum Hamiltonians. In this talk I discuss the results of two 2021 papers in J. Phys. A. It is there proved that color Lie algebras and superalgebras imply parastatistics with observable physical consequences. In a multiparticle quantum mechanics, observables can detect whether a composite system is made by Z_2^2-graded paraparticles or by ordinary particles.

The proof uses the 1995 Majid's graded-Hopf algebra framework endowed with a braided tensor product.

Weight representations of affine Kac-Moody algebras and small quantum groups

Tomoyuki Arakawa

(RIMS)

I will talk about a rather surprising connection between category of weight representations of affine Kac-Moody algebras (that does not necessarily belong to the category O) and that of the representations of the small quantum groups.

This is a joint work with Kazuya Kawasetsu and Thomas Creutzig.

Admissible tame representations of vertex algebras

Oscar Armando Hernandez Morales

(USP)

Relaxed highest weight modules over affine vertex algebras associated to higher rank Lie algebras and arbitrary non-critical levels, with finite-dimensional weight spaces, are classified in [KR19]. However, explicit construction of these representations beyond their classification is rather difficult. In this presentation, we will discuss combinatorial methods which allow constructing enumerable bases for modules of type A called strongly tame Gelfand–Tsetlin modules.

Non-injective homomorphisms between certain Verma modules

Gordan Radobolja

(U.Zagreb)

We introduce the $N=1$ super Heisenberg--Virasoro algebra at level zero and present its representations. By studying Fock spaces we calculate characters of all irreducible highest weight modules. As a notable dif{}ference from classical (non-super) case, the maximal submodules in some highest weight modules are generated by a subsingular vector. In these cases there exist non-injective homomorphisms between the Verma modules. We use screening operators which appear in study of certain logarithmic vertex operator algebras and obtain explicit formulas for singular and subsingular vectors.\\

This is a joint work with D.\ Adamovi\'c and B.\ Jandri\’c.