INdAM Intensive research period

Perspectives in Lie Theory

Session 1: Vertex algebras, W-algebras, and applications

Mini-courses

Tomoyuki Arakawa *Introduction to W-algebras and their representation theory*

Abstract: Preliminary Course Outline:

(1) Elementary introduction to arc spaces and their relations with vertex algebras

(2) Associated varieties of vertex algebras and representation theory of affine vertex algebras

(3) Introduction to BRST reduction and W-algebras

(4) Representation theory of W-algebras and (Frenkel)-Kac-Wakimoto conjecture

Victor Kac: *Introduction to vertex algebras, Poisson vertex algebras, and integrable Hamiltonian PDE*

Abstract: Preliminary Course Outline:

(1) Introduction to vertex algebras, the extension theorem

(2) Introduction to Poisson vertex algebras and Lenard-Magri scheme of integrability of Hamiltonian equations

(3) Variational de Rham complex

(4) Classical Hamiltonian reduction and classical W-algebras

(5) Non-local Poisson vertex algebras and Dirac reduction

(6) Double Poisson (vertex) algebras and non-commutative Hamiltonian equations.

Fyodor Malikov: *Introduction to algebras of chiral differential operators*

Abstract:

(1) Elementary introduction to usual algebras of differential operators. We shall focus on the example of the projective line and see how this theory relates to the representation theory of sl(2).

(2) Algebras of chiral differential operators on the projective line and their relations to the affine sl(2).

(3) Higher dimensional generalization: characteristic classes, flag manifolds, and affine Kac-Moody algebras.

Every effort will be made to make this course accessible and self-contained.

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Seminar

Drazen, Adamovic *C_2 cofinite vertex algebras and representations of affine vertex algebras*

Abstract: We shall first recall the representation theory certain C2 cofinite vertex algebras appearing in logarithmic conformal field theory (joint work with A. Milas). We shall discuss classification of irreducible modules, the structure of Zhu's algebras and the construction of projective modules. We shall show that the representation theory of certain affine vertex algebras are related with these vertex algebras. New explicit realizations of modules for affine Lie algebras and superconformal algebras will be also presented.

Sylvain Carpentier *TBA*

Masahiko Miyamoto *Vertex Operator Algebra and Simultaneous Inversion*

Abstract: Let V be a C_2-cofinite vertex operator algebra. We define a multivariable trace functions on V-modules and show a modular invariance property. We would like to introduce a few applications of this result.

Pierluigi Mosender *Finite vs infinite decompositions in conformal embeddings*

Abstract:The talk will be a report on a work in progress aimed at the classification of conformal embeddings of affine vertex algebras exhibiting finite decompostion properties.

Anne Moreau *The symmetric invariants of centralizers and Slodowy grading*

Abstract: Let $\mathfrak{g}$ be a complex finite-dimensional simple Lie algebra, and let e be a nilpotent element of g. An interesting question, raised by Premet, is whether the algebra of symmetric invariants of the centralizer of e is polynomial. In 2007, Premet, Panyushev and Yakimova resolved the question in some special cases; in particular, the answer is positive for g of type A or C.

In this talk, I will present a joint work with Jean-Yves Charbonnel in which we continue the works of Premet et al. Our main result says that if for some homogeneous generators of $S(\mathfrak{g})^{\mathfrak{g}}$, the initial homogeneous components of their restrictions the to Slodowy slice of e are algebraically independent, then e satisfies the polynomiality condition. The key to the proof is the use of the Slowody grading induced from the finite W-algebra associated with $(\mathfrak{g}, e)$.

Daniele Valeri *Classical W-algebras and generalized Drinfeld-Sokolov hierarchies*

Abstract: I will describe the Poisson vertex algebra approach to classical W-algebras aimed at the study of integrability of the corresponding generalized Drinfeld-Sokolov hierarchies.

Jethro van Ekeren *Jacobi Invariance of SUSY Vertex Algebras*

Abstract: We explain how to construct conformal blocks over superelliptic curves associated to topologically twisted N=2 SUSY vertex algebras. The geometry of the moduli space of such supercurves leads to a natural action of the Jacobi group $SL(2,\mathbb{Z}) \times \mathbb{Z}^2$ which, in the presence of some regularity conditions on the vertex algebra, implies Jacobi invariance of its characters.