

Conference on vertex algebras and related topics

TU Darmstadt, September 21-24, 2021

Tuesday

Noriyuki Abe: A Hecke action on G_1T -modules

Let G be a connected reductive group over an algebraically closed field of positive characteristic, G_1 the Frobenius kernel of G and T a maximal torus of G . We give an action of the Hecke category on the principal block of the category of representations of G_1T . This is an analogue of a conjecture of Riche-Williamson.

Veronika Pedic: Beta-gamma ghosts: Whittaker modules and fusion rules

The bosonic ghost vertex algebra (beta-gamma ghosts) is an important object both in physics (string theory) and in mathematics (representation theory), arising as a module for the Weyl associative algebra. In this talk we give some information on beta-gamma ghosts and their modules. In particular, in the first part we prove that irreducible modules of a VOA are also irreducible for orbifolds under some conditions, and demonstrate this on the example of Whittaker modules for bosonic ghosts. In the second part, we describe fusion rules in the category of weight modules for the beta-gamma ghost and explicitly construct the associated intertwining operators. This talk is based on two papers, first one joint with D. Adamovic, C.-H. Lam and N. Yu, and the second one with D. Adamovic.

Sven Möller: On the classification of holomorphic vertex operator superalgebras

The odd, unimodular, positive-definite lattices of rank at most 24 can be classified by enumerating the edges in the Kneser 2-neighbourhood graph of the even, unimodular, positive-definite lattices of rank 24 (the Niemeier lattices) and splitting off copies of the 1-dimensional "standard lattice". Similarly, we classify the "nice" holomorphic vertex operator superalgebras (VOSAs) of central charge at most 24 by enumerating the edges in the orbifold 2-neighbourhood graph of the "nice" holomorphic vertex operator algebras (VOAs) of central charge 24 and splitting off tensor copies of a certain VOSA of central charge 1/2 (whose even part is the Virasoro VOA $L_{1/2}(0)$). These computations are facilitated by recent advancements in orbifold and coset theory for holomorphic VOAs. This is joint work in progress with Gerald Höhn.

Andrew Linshaw: Trialities of W-algebras

Gaiotto and Rapcak recently conjectured a family of trialities of W-algebras, which are isomorphisms between the affine cosets of three different W-(super)algebras. I will outline my recent proof with Thomas Creutzig of these conjectures, and will also discuss some applications.

Gerald Höhn: The conformal packing and dual packing problem

I will formulate the packing and the related dual packing problem for vertex operator algebras in analogy to the classical sphere packing problem and the packing problem for binary codes. The modular bootstrap technique used in quantum gravity allows to obtain explicit numerical upper bounds for the minimal dual conformal weight for fixed central charge c of the vertex operator algebra. By using methods from the solution of the sphere packing problem in dimensions 8 and 24 by Viazovska resp. Cohn et al., I am able to obtain sharp bounds for central charges $c = 8$ and $c = 24$. The two vertex operator algebras realizing these bounds are a vertex operator algebra with the Lie group E_8 as automorphism group and the moonshine module with the Monster simple group as automorphism group.

Wednesday**Hiroshi Yamauchi: Holomorphic extensions related to a basic set of the 2nd largest Fischer group**

A basic set is a maximal collection of mutually commutative transpositions in a 3-transposition group. We will construct 2+23 Ising vectors corresponding to a basic set of the 2nd largest Fischer 3-transposition group explicitly and then consider extensions of the subalgebra generated by them. We will show that up to isomorphisms there exist 8 extensions to holomorphic vertex operator algebras of central charge 24. This is a joint work with T. Creutzig and C.H. Lam.

Shoma Sugimoto: On the Feigin-Tipunin algebra

The Feigin-Tipunin algebra is the *ADE* generalization of the triplet VOA, one of the most famous examples of a C_2 -cofinite and irrational VOA. Many properties of the triplet VOA have been expected to hold for the Feigin-Tipunin algebra as well, but its complexity makes a direct and algebraic approach difficult. In this talk, I will illustrate that a geometric approach can be very effective in studying the Feigin-Tipunin algebra and similarly structured VOAs. If time permits, I will also discuss some difficulties and approaches to the C_2 -cofiniteness conjecture of the Feigin-Tipunin algebra.

Christoph Schweigert: Rigidity in conformal field theory and (vertex) algebras beyond rigidity

Rigidity of tensor categories plays an important role, in quantum topology and in the representation theory of many algebraic objects, in particular of Hopf algebras and vertex algebras. In this talk, we discuss inherent restrictions of the notion of rigidity. We then explain why rigidity is so useful in the study of bulk fields of conformal field theories.

Thursday

Yuto Moriwaki: Non-chiral conformal field theory and its application to vertex algebras

The moduli space of chiral conformal field theories with only one irreducible module (holomorphic vertex operator algebras) is discrete, while the moduli space of non-chiral conformal field theories is continuous. In other words, we can deform a non-chiral conformal field theory along the lines of the moduli space. Although non-chiral conformal field theories do not satisfy the axioms of vertex algebras, they are still mathematically definable algebras. In this talk, we will discuss the construction and deformation of non-chiral conformal field theories and their applications to vertex algebras.

Cuipo Jiang: The structure of the parafermion VOAs associated to $\mathfrak{osp}(1|2n)$

In this talk, we will give generators of the universal parafermion VOAs $N(\mathfrak{osp}(1|2n), k)$ associated to the affine super VOAs $V^k(\mathfrak{osp}(1|2n))$. We will also give the structure of the simple quotient of $N(\mathfrak{osp}(1|2n), k)$ when k is a positive integer, including its generators and building blocks.

Anne Moreau: Nilpotent orbits arising from admissible affine vertex algebras

In this talk, I will give a simple description of the closure of the nilpotent orbits appearing as associated varieties of admissible affine vertex algebras in terms of primitive ideals. This is a joint work with Tomoyuki Arakawa and Jethro van Ekeren.

Reimundo Heluani: Finite dimensionality of conformal blocks

We will discuss some conditions on a vertex algebra V to guarantee that the space of degree 0 and 1 chiral homology of an elliptic curve with coefficients in V is finite dimensional. In the case of degree 0 this leads to a condition closely related to C_2 -cofiniteness, while in the case of degree 1 we find in addition a condition on the singular support of V (that it is of finite differential codimension in the arc space of its C_2 -scheme). This is joint work with J. van Ekeren.

Chiara Damiolini: Geometric properties of sheaves of coinvariants and conformal blocks

One method to study the moduli space of stable pointed curves is via the study of vector bundles on them as they can yield interesting maps to projective spaces. An effective way to produce such vector bundles is through representations of vertex operator algebras: more precisely attached to n simple modules over a "nice" vertex operator algebra, we can construct sheaves of coinvariants over the space of stable n -pointed curves. This generalizes the construction of coinvariants associated with representations of affine Lie algebras and extends prior results over rational curves. In this talk I will focus on some geometric properties of these sheaves, especially on global generation. Investigating this property we can see phenomena that did not occur for coinvariants associated with affine Lie algebra representations. This is based on joint work with A. Gibney and N. Tarasca, and with A. Gibney.

Friday**Tomoyuki Arakawa: Admissible affine vertex algebras and small quantum groups****Andre Henriques: Every conformal net has an associated vertex algebra**

We show that every conformal net has an associated vertex algebra, thus identifying the class of conformal nets with a sub-class of the class of unitary vertex algebras. We also characterise those unitary vertex algebras that arise from a conformal net. (We conjecture that every unitary vertex algebra arises in this way, and hence that there is a bijective correspondence between conformal nets and unitary vertex algebras.) To construct the correspondence between conformal nets and unitary vertex algebras, we introduce a new notion of "field localised in a segment embedded in a Riemann surface", which could be of independent interest. This is joint work with James Tener.