

ALGEBRAIC METHODS
IN MATHEMATICAL PHYSICS

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ABSTRACTS OF TALKS

On triplet vertex algebras and their logarithmic representations

Dražen Adamović, University of Zagreb

In this talk we shall review our recent results on the representation theory of certain families of \mathcal{W} -algebras which appear in logarithmic conformal field theory in physics. These vertex algebras have finitely many irreducible representations, but also admit indecomposable and logarithmic representations. The corresponding Zhu's algebras and C_2 algebras will be described. We shall also discuss the connection between triplet vertex algebras and quantum groups at root of unity. (This talk is based on joint work with A. Milas).

Vector-valued modular forms and string theory

Peter Bantay, Eötvös Lorand University, Budapest

We review the present status of the theory of vector-valued modular forms, emphasizing the potential applications to mathematics (VOA trace functions, Jacobi forms, non-congruence subgroups) and physics (string theory and 2d CFT).

Weak wreath products and weak factorizations

Gabriella Böhm, RMKI Budapest

An algebra A (say, over a field or more generally, in an arbitrary bicategory) is said to have a *strict factorization* in terms of algebra homomorphisms $L \rightarrow A$ and $R \rightarrow A$ provided that the map

$$(1) \quad L \otimes R \longrightarrow A \otimes A \xrightarrow{\text{multiplication}} A$$

is an isomorphism (of vector spaces). An algebra A is known to have such a factorization if and only if it is isomorphic to the *wreath product* of L and R corresponding to a distributive law.

In the talk we shall investigate algebra homomorphisms $L \rightarrow A$ and $R \rightarrow A$ for which (1) is no longer an isomorphism but it admits an L - R bimodule section. Such *weakly factorizing* algebras will be characterized as *weak wreath products* corresponding to weak distributive laws introduced recently by Ross Street. In more categorical terms, a (bi)equivalence will be established between the (bi)category of weak factorization systems and the (bi)category of weak distributive laws (in any locally Cauchy complete bicategory).

The talk will be based on the following works.

- [1] G. Böhm. *Factorization systems induced by weak distributive laws*. Appl. Categ. Structures, in press. doi:10.1007/s10485-010-9243-y arXiv:1009.0732.
- [2] G. Böhm and J. Gómez-Torrecillas. Work in preparation.

Scaling Lee-Yang model

Zoltan Bajnok, Eötvös Lorand University, Budapest

I pedagogically review the connection between integrable scattering theories and conformal field theories on the example of the scaling Lee-Yang model.

κ -Poincaré Algebra and Differential Forms on κ -Minkowski Space

Saša Krešić-Jurić, University of Split

We discuss realizations of the κ -Minkowski space and κ -Poincaré algebra as formal power series in the Weyl algebra. We show that the realizations correspond to deformations of the Heisenberg and Poincaré algebras, and present some concrete examples of such deformations. We also use realizations to construct a differential calculus on κ -Minkowski space which is compatible with an action of the Lorentz algebra. In this construction the number of one-forms is the same as the number of Minkowski coordinates, but the exterior derivative is not Lorentz invariant. This talk is based on joint work with Stjepan Meljanac.

Conformal embeddings of affine vertex operator algebras

Ozren Perše, University of Zagreb

Conformal embeddings have been extensively studied in conformal field theory, the representation theory of affine Kac-Moody Lie algebras and the theory of affine vertex operator algebras. The construction and classification of conformal embeddings have mostly been studied in the case of positive integer levels. In this talk, we present a general criterion for conformal embeddings at arbitrary levels, within the framework of vertex operator algebra theory. Using that criterion, we construct new conformal embeddings at admissible rational and negative integer levels. In particular, we construct all remaining conformal embeddings associated to automorphisms of Dynkin diagrams of simple Lie algebras. The talk is based on joint work with Dražen Adamović.

Morphisms of noncommutative spaces

Zoran Škoda, IRB, Zagreb

Large part of noncommutative algebraic geometry is based on the identification of noncommutative spaces with Abelian categories viewed as the categories of quasicoherent sheaves; the morphisms should therefore be functors of certain kind. I will make introduction to the present understanding of the three classes of questions concerning the morphisms of noncommutative spaces.

1. The general restrictions on functors, and identifications of functors when defining morphisms of noncommutative spaces; including different approaches of taking care of removing the spurious Morita equivalences.
2. The sketch of the passage between global and local description of functors (this is a part of ongoing work with Gabi Böhm).
3. Extending some classes of morphisms in algebraic geometry like affine, faithfully flat, formally smooth to the noncommutative case. Most of the understanding in this approach is due A. Rosenberg; I will also show some new observations and somewhat different point of view.

Combinatorial bases of principal subspaces for affine lie algebras

Goran Trupčević

We consider a particular type of principal subspace $W(\Lambda)$ of a standard module $L(\Lambda)$ for an affine Lie algebra of the type $C_\ell^{(1)}$. We find a combinatorial basis of $W(\Lambda)$ given in terms of difference and initial conditions. Linear independence of the generating set is proved inductively by using coefficients of intertwining operators. (This talk is based on joint work with I. Baranović and M. Primc.)