Representation Theory and Related Topics

UConn (May 11-12, 2015)

- Bojko Bakalov (NC State)

  "*Kac-Wakimoto hierarchies and their symmetries*"

  Soliton equations, such as the Korteweg-de Vries equation, have remarkable properties and many appplications. They belong to integrable hierarchies of infinitely many PDEs that can be constructed from representations of affine Kac-Moody algebras. In this talk I will present a new approach to these hierarchies and their symmetries using the language of vertex algebras. In the case of type $sl(N)$ or $so(2N)$, the Kac-Wakimoto hierarchies will be realized as reductions of the N-component KP and DKP hierarchies, respectively.

- Cristina Ballantine (Holy Cross)

  "*The Kronecker product for symmetric group representations indexed by a hook and a rectangle*"

  The representations of the symmetric group are indexed by Schur functions. Recently Blasiak gave a combinatorial interpretation for the coefficients in the Schur basis decomposition of the Kronecker product when one representations is indexed by a hook. The case when one representation is indexed by a hook and the other is indexed by a rectangle is helpful in understanding the quantum Hall effect. Using Blasiak's interpretation, we show that, as the size of the symmetric group grows, the decomposition of the Kronecker product of a hook and a rectangle displays an interesting stability property which allows for the decomposition to be completely determined from a minimal size case. (This is joint work with Bill Hallahan.) If time permits, I will also talk about another result related to the Kronecker product of a hook and a rectangle, the Schur-positivity of symmetric functions of the form $s_{\mu'}s_{\mu^c} - s_{\nu'}s_{\nu^c}$, where ν is a partition of weight $|\mu| - 1$ contained in μ and the complements of μ^c and ν^c are taken in the same square partition. (This is joint work with Rosa Orellana.)

- Georgia Benkart (U of Wisconsin–Madison)

  "*Affine nilTemperley-Lieb algebras*"

  This talk will survey results on the affine nilTemperley-Lieb algebras. The faithful representation on fermionic particle configurations enables us to give a description of the center and to obtain a useful basis for the algebra. Applications include a natural embedding of the affine nilTemperley-Lieb algebra on N generators into the affine nilTemperley-Lieb algebra on $N + 1$ generators, and a proof that the nilTemperley-Lieb algebra is finitely generated over its center. This is joint work with Joanna Meinel.

- Corina Calinescu (CUNY)

  "*Vertex-algebraic structure of principal subspaces of certain $A_{2n}^{(2)}$-modules*"

  The theory of principal subspaces of standard modules for untwisted affine Lie algebras was initiated by Feigin and Stoyanovsky, and has been further developed by several authors from different standpoints. In this talk we study the principal subspace of the basic module for the twisted affine Lie algebra associated to A_{2n}, by using vertex algebras. We give a description of the principal subspace via generators and relations. As a consequence of this result we obtain the character of the principal subspace. This talk is based on joint work with Antun Milas and Michael Penn.

- Paul Hacking (UMass)

  "*Canonical bases for cluster algebras*"

  I'll describe a construction of canonical bases for cluster algebras motivated by mirror symmetry, proving conjectures of Fomin–Zelevinsky and Fock–Goncharov. Applied to the base affine space G/U our construction produces a canonical basis of each irreducible representation of G in type A (and conjecturally in all types). This is joint work with Mark Gross, Sean Keel, and Maxim Kontsevich.

- Jae-Hoon Kwon (Sungkyunkwan)

  "*Crystal bases for the quantum ortho-symplectic Lie superalgebras*"

  We introduce a semisimple tensor category of modules over a quantum ortho-symplectic superalgebra. It is a natural counterpart of the category of finitely dominated integrable modules over the quantum classical (super) algebra of type B, C, D from a viewpoint of super duality. We classify the irreducible modules in this category and show that each irreducible module has a unique crystal base. An explicit description of the crystal graph is given in terms of a new combinatorial object called ortho-symplectic tableaux.

- Cristian Lenart (Albany)

  "*A combinatorial model for Kirillov-Reshetikhin crystals and applications*"

  Kirillov-Reshetikhin (KR) crystals describe the finite-dimensional modules of affine Lie algebras with the same name. I will present a combinatorial model which realizes tensor products of (column shape) KR crystals uniformly across untwisted affine types. Several applications of this model are discussed, which include those to: nonsymmetric Macdonald polynomials, the energy function, and the combinatorial R-matrix. The talk is based on a series of papers with A. Lubovsky, S. Naito, D. Sagaki, A. Schilling, and M. Shimozono.

- Antun Milas (Albany)

  "*False modular forms and representation theory*"

  False theta functions are theta-like series with "wrong" signs in the q-expansion. They have appeared in various parts of mathematics including number theory and topology. I will first review how false theta functions naturally arise in representation theory of certain infinite dimensional algebras and vertex algebras. Then I'll explain how ideas of conformal field theory can be used to deduce their modular-like transformation properties and how these considerations lead to Verlinde-type formula for the fusion rules and higher rank generalizations. This talk is largely based on joint works with T. Creutzig and K. Bringmann.

- Eric Sommers (UMass)

  "*The singularities of orbit closures in the nilpotent cone*"

  We report on the classification of singularities of transverse slices between orbits in nilpotent cones in simple Lie algebras, a story begun by Brieskorn and Slodowy for the regular and subregular nilpotent orbits and solved completely by Kraft and Procesi in the classical groups for adjacent orbits. Of particular interest are slices associated to special pieces and between adjacent special orbits, which leads to a conjectural duality. This is joint work with Fu, Juteau and Levy.

- Anton Zeitlin (Columbia)

  "*Superopers and their properties*"

  Opers (certain local systems on curves) show up in many areas in mathematics and mathematical physics, and appear to be important ingredients in the Geometric Langlands correspondence. I will define the modification of the notion of oper (superoper) in the case of a large class of simple supergroups. Relevant properties of superopers will be discussed, in particular, relationship with the corresponding Gaudin Models.