

List of Abstracts

Workshop Algebraic Representation Theory

July 23-25, 2018 at the University of Stuttgart, Germany
All lectures will take place in room V57.06 on Monday and Tuesday
and in Room V55.21 on Wednesday.



Stephen Donkin

Title: Lie modules and double centralisers

Abstract: In a recent paper Doty and Douglass consider the double centraliser property for the degree r component of the free Lie algebra on n generators over a field K of characteristic not dividing r , regarded as a module for the general linear group of degree n . We show that in this situation, assuming that K is infinite, the double centraliser property fails for at most one block component and give some examples of cases in which the property fails.

Karin Erdmann

Title: Homological algebra of Iwahori-Hecke algebras

Abstract: Let $A = H_q(n)$ be the Iwahori-Hecke algebra associated to the symmetric group \mathcal{S}_n , where q is a primitive ℓ -th root of unity. This is a deformation of a group algebra, and one would expect that the homological properties of A should be similar to that of a group algebra. However if the coefficient field has non-zero characteristic, this is not well understood. In this lecture we give a survey on some open questions. As well, we discuss a new approach to rank varieties for A -modules.

Ming Fang

Title: Jantzen filtration of Weyl modules in type A and Young's seminormal basis for dual Specht modules

Abstract: We compare the Jantzen filtration of Weyl modules of different highest weights by studying the splitting property of certain canonical epimorphisms. In type A, the splitting condition is characterized in terms of the greatest common divisor of coefficients in a product of three Young symmetrizers, and in certain cases, further in terms of the denominator of certain Young's seminormal basis element. We then show how to compute these denominators in some cases. This talk is based on the ongoing joint work with KaiMeng Tan and KayJin Lim.

Jun Hu

Title: Grassmannian, symmetric functions and cyclotomic nilHecke algebras

Abstract: The cohomology of Grassmannian is isomorphic to the basic algebra of the cyclotomic nilHecke algebra of type A. We show that the isomorphism can be chosen such that the geometrically defined Schubert class basis corresponds exactly the purely algebraically defined basis of the basic algebra introduced in an earlier paper. Meanwhile, we establish nilHecke analogues of Jacobi-Trudi and Giambelli formulae for symmetric functions. This is a joint work with Kai Zhou.

Alexander Kleshchev

Title: Blocks of symmetric groups, generalized Schur algebras, and KLR algebras, I, II, III

Abstract: : In the first talk we motivate the introduction of generalized Schur algebras through Broué's Abelian Defect Conjecture for blocks of finite groups.

In the second talk we discuss generalized Schur algebras. We outline a schurification procedure which associates to any quasihereditary (resp. cellular) algebra the corresponding generalized Schur algebra which is again quasihereditary (resp. cellular). A special case corresponding to zigzag algebras appears in Turner's conjecture providing "local" description of blocks of symmetric groups up to derived equivalence.

In the third talk, we sketch a proof of Turner's conjecture in the heart of which is a category of cuspidal representations of KLR algebras of affine type.

The talks are based on joint work with A. Evseev and R. Muth.

Friedrich Knop

Title: The dual group of a spherical variety

Abstract: Let X be a spherical variety for a reductive group G . Work of Gaitsgory-Nadler indicates that the Langlands dual group G^\vee should contain a reductive subgroup G_X^\vee whose Weyl group coincides with the little Weyl group of X . We show that such a subgroup indeed exists (even for any G -variety). We also mention some functoriality properties of G_X^\vee . This is joint work with Barbara Schalke.

Andrew Mathas

Title: Cyclotomic tensor space and Fayers' conjecture

Abstract: Dipper and James used q -tensor space to understand the representation theory of the q -Schur algebras. We prove an analogue of their result in the very general setting of Schur pairs. As an application we show that the socle of a Weyl module of a cyclotomic q -Schur algebra is a sum of simple modules labelled by Kleshchev multipartitions and we use this result to prove a conjecture of Fayers that leads to an efficient LLT algorithm for the higher level cyclotomic Hecke algebras of type A. Finally, we prove a cyclotomic analogue of the Carter-Lusztig theorem, generalising results of Dipper and James to the cyclotomic Schur algebras. This is joint work with Jun Hu.

Volodymyr Mazorchuk

Title: Simple transitive 2-representations of projective bimodules over associative algebras

Abstract: The aim of the talk is to provide a classification of simple transitive 2-representations for the 2-category of projective bimodules over an associative algebra and describe the techniques developed to prove the result. This is a joint work with Vanessa Miemietz and Xiaoting Zhang.

Vanessa Miemietz

Title: Analogues of centraliser subalgebras for fiat 2-categories

Abstract: I will introduce the notion of fiat 2-categories, which form a 2-analogue of finite-dimensional algebras with involutions (such as, for example, Hecke algebras, universal enveloping algebras of Lie algebras, etc), and will then explain how an analogue of centraliser subalgebras can be used to help with the classification of their simple 2-representations. Time permitting, I will give some applications to Soergel bimodules, which categorify Hecke algebras.

Daniel Nakano

Title: Complexity and support varieties for Hecke algebras

Abstract: Let $He_q(d)$ be the Iwahori-Hecke algebra for the symmetric group, where q is a primitive l th root of unity. In this talk we develop a theory of support varieties which detects natural homological properties such as the complexity of modules. The theory has a canonical description in an affine space where computations are tractable. The ideas involve the interplay with the computation of the cohomology ring due to Benson, Erdmann and Mikaelian, the theory of vertices due to Dipper and Du, and branching results for cohomology by Hemmer and Nakano. Calculations of support varieties and vertices are presented for permutation, Young and classes of Specht modules. Furthermore, a discussion of how the authors' results can be extended to other Hecke algebras for other classical groups is presented at the end of the talk.

Catharina Stroppel

Title: Standardly stratified algebras and tilting - "rediscovered"

Abstract: This talk will go back to classical constructions and definitions by Dlab, Cline-Parshall-Scott, Ringel, Donkin etc. in the context of stratified algebras (which are an interesting generalization of quasi-hereditary algebras), revisit this construction and then explain in particular their specific role and natural occurrence in modern developments (like tensor product categorifications, web-calculus and tilting theory). This is joint work with Jon Brundan.

Mark Wildon

Title: The multistep homology of the simplex and representations of symmetric groups

Abstract: The k -faces of a $(n - 1)$ -dimensional simplex correspond to k -subsets of $\{1, \dots, n\}$. These subsets are permuted transitively by the symmetric group S_n . The boundary maps from simplicial homology, defined with mod 2 coefficients, give homomorphisms between the corresponding permutation modules. In recent work I consider generalized 'multistep' boundary maps, defined by jumping down by two or more dimensions at once. Their homology groups give a family of intriguing representations of S_n . In my talk, I will characterize when the homology is zero. The special case of two-step boundary maps gives a new construction of the basic spin representations of the symmetric groups. We will see that the corresponding chain complex categorifies the binomial coefficient identity

$$\binom{4m}{0} - \binom{4m}{2} + \binom{4m}{4} - \dots + \binom{4m}{4m} = (-2)^m.$$

I will end with some deeper identities that, conjecturally, are categorified by an extension of these results to odd characteristic.

Haralampos Geranios

Title: New Families of Decomposable Specht Modules

Abstract: The Specht modules are the key players in the representation theory of the symmetric groups. If the characteristic of the field is different than 2, it is well-known that these modules are indecomposable. However, in characteristic 2 there exist decomposable Specht modules and the first example was found by Gordon James in the 70s. Surprisingly enough, only few other examples of such modules have been discovered since then. In this talk I will present several new families of decomposable Specht modules and describe explicitly their indecomposable summands. This is a joint work with Stephen Donkin.

Ana Paula Santana

Title: Projective resolutions of Weyl modules for Schur algebras

Abstract: We are interested in the construction of projective resolutions of Weyl modules for Schur algebras.

Let R be a commutative ring. Denote by $\mathcal{U}_n^+(R)$ the Kostant form over R of the universal enveloping algebra of the Lie algebra of $n \times n$ complex nilpotent upper triangular matrices. In this talk I will explain the construction of functors that map (minimal) projective resolutions of the trivial rank-one $\mathcal{U}_n^+(R)$ -module to (minimal) projective resolutions of rank-one modules for the Borel-Schur algebra. Using Woodcock's Theorem and these resolutions, one can easily obtain projective resolutions of the Weyl modules for the Schur algebra.

This is joint work with I. Yudin.

Vladimir Shchigolev

Title: Categories of Bott-Samelson varieties

Abstract: We consider all Bott-Samelson varieties $BS(s)$ for a fixed connected semisimple complex algebraic group with maximal torus T as the class of objects of some category. The class of morphisms of this category is an extension of the class of canonical (inserting the neutral element) morphisms $BS(s) \hookrightarrow BS(s')$, where s is a subsequence of s' . Every morphism of the new category induces a map between the T -fixed points but not necessarily between the whole varieties. We construct a contravariant functor from this new category to the category of graded $H_T^\bullet(pt)$ -modules coinciding on the objects with the usual functor H_T^\bullet of taking T -equivariant cohomologies. We also discuss the problem how to define a functor to the category of T -spaces from a smaller subcategory. The exact answer is obtained for groups whose root systems have simply laced irreducible components by explicitly constructing morphisms between Bott-Samelson varieties (different from the canonical ones).

Ivan Yudin

Title: Representation type of Borel-Schur algebras

Abstract: The representation type of the Borel-Schur algebra $S_{\mathbb{K}}^+(n, r)$ depends on the characteristic p of the field \mathbb{K} and the parameters n and r . For each triple we determine the representation type of $S_{\mathbb{K}}^+(n, r)$.

In the finite case we perform an explicit computation of Auslander-Reiten quivers. To prove that an algebra $S_{\mathbb{K}}^+(n, r)$ has infinite/wild type we use theory of coverings for quivers. For the tame case, we adopt deformation theory and poset representation techniques.

This is joint work with Karin Erdmann and Ana Paula Santana.