List of Abstracts
First SWAN Workshop

September 17-18, 2018 at the University of Stuttgart, Germany
All lectures will take place in room V57.8.122.

Susumu Ariki
Lifting Schur positive functions to Kashiwara crystals

I will give an example that the expansion of a Schur positive function into Schur functions is lifted to an isomorphism of $\mathfrak{gl}(d)$-crystals. Then, after referring to the result by Morse and Schilling that the Edelman-Greene insertion gives an isomorphism of $\mathfrak{gl}(d)$-crystals, I will explain a result by my student Toya Hiroshima that the Kraskievicz insertion gives an isomorphism of $\mathfrak{q}(d)$-crystals, where $\mathfrak{q}(d)$ is the queer Lie superalgebra.

Frédéric Chapoton
Representations of finite partial orders: some results and questions

There are plenty of finite partial orders of combinatorial interest, that provide a rich playground for representation theory, namely the study of modules over their incidence algebras. I will present some general and particular results, in particular about derived equivalences and posets of intervals. I will also describe some interesting open questions related to the fractional Calabi-Yau property and weaker periodicity properties.

Bernhard Mühlherr
Root graded groups

A root graded group is a group containing a family of subgroups that is indexed by a root system and satisfies certain commutation relations. The standard examples are Chevalley groups over rings. The definition of a root grading of a group is inspired by corresponding notion for Lie algebras for which there are classification results of Berman, Moody Benkart and Zelmanov from the 1990s. Much less is known in the group case.
In my talk I will address the classification problem for root graded groups and its connection to the theory of buildings. It turns out that the Tits indices known from the classification of the semi-simple algebraic groups provide an interesting class of root gradings which are called stable. Any group with a stable root grading of rank 2 acts naturally on a bipartite graph which is called a Tits polygon and this action can be used to obtain classification results for groups with a stable root grading. I will report on several results in this direction. These have been obtained recently in joint work with Richard Weiss.

Changchang Xi
From stable to derived equivalences with applications to Broué's Conjecture

In this talk, we start with a stable equivalence of Morita type between two algebras (with some often satisfied conditions), and then lift it to a derived equivalence between them. This is carried out by a reduction technique which reduces the lifting question to the one between two corner algebras such that the numbers of simple modules decrease after each step. The technique can be applied to verify Broué's Abelian Defect Group Conjecture for many block algebras of finite groups. We illustrate this by an example.

Eirini Chavli
Representation theory for the Hecke algebras on 3 strands

Between 1994 and 1998, M. Broué, G. Malle, and R. Rouquier generalized the definition of the Iwahori-Hecke algebra to the case of an arbitrary complex reflection group W. This generalized algebra is known as the *generic Hecke algebra*. It is defined over the Laurent polynomial ring $\mathbb{Z}[u_1^{\pm}, \ldots, u_k^{\pm}]$, where $\{u_i\}_{1\leq i\leq k}$ is a set of parameters whose cardinality depends on W. For many of the applications of the generic Hecke algebras it is important to know how the simple characters behave after specializing the parameters u_i to arbitrary complex numbers. If the specialized Hecke algebra is semisimple, Tits' deformation theorem applies; the simple characters of the specialized Hecke algebra are parametrized by Irr(W). However, this is not always the case. In this talk, we explain the modular representation theory of the specialized Hecke algebras on 3 strands and we prove that all its simple representations are obtained as modular reductions of simple representations of the generic algebra.

Julia Heller
Automorphisms of non-crossing partitions

Non-crossing partitions are subsets of finite reflection groups and have the combinatorial structure of lattices. First we introduce non-crossing partitions and then focus on their groups of lattice automorphisms. In particular, we show that the automorphisms, interpreted in the right way, uniquely extend to automorphisms of spherical buildings of type A.

Artem Lopatin
Indecomposable, free and separating $O(n)$-invariants of several matrices

All vector spaces are over an infinite field $\mathbb{F}$ of the characteristic $p = \mathrm{char}\,\mathbb{F} \neq 2$. To define the algebra of $O(n)$-invariants of matrices, consider the polynomial algebra $R = R_n = \mathbb{F}[x_{ij}(k)\,|\,1 \leq i,j \leq n,\ 1 \leq k \leq d]$ together with $n \times n$ *generic* matrices $X_k = (x_{ij}(k))_{ij}$. Denote by $\sigma_t(A)$ the t^{th} coefficient of the characteristic polynomial of A. As an example, $\mathrm{tr}(A) = \sigma_1(A)$ and $\det(A) = \sigma_n(A)$. The action of the orthogonal group $O(n)$ over R is defined by the formula: $g \cdot x_{ij}(k) = (g^{-1}X_k g)_{ij}$, where $(A)_{ij}$ stands for the $(i,j)^{\mathrm{th}}$ entry of an matrix A, M_n is the space of all $n \times n$ matrices over $\mathbb{F}$. The set of all elements of R that are stable with the respect of the given action is called the algebra of *$O(n)$-invariants of matrices* and is denoted by $R^{O(n)}$. This algebra is generated by $\sigma_t(b)$, where $1 \leq t \leq n$ and b runs over all monomials in the generic matrices $X_1, \ldots, X_d$ and the transposed generic matrices. Note that in case $\mathbb{F} = \mathbb{R}, \mathbb{C}$ the $O(n)$-orbits of $M(n)^{\oplus d}$ are separated by elements of $R^{O(n)}$.
In the case of an arbitrary characteristic $p \neq 2$ the ideal of relations between generators of $R^{O(n)}$ was described by Lopatin in 2012. Denote by $D_{\max}(R^{O(n)})$ the maximal degree of *indecomposable* invariants, i.e., the maximal degree of elements of a minimal generating set for $R^{O(n)}$. We obtained that

- the algebra $R^{O(n)}$ is not a polynomial for all $d > 1$;
- $D_{\max}(R^{O(n)}) \to \infty$ when $d \to \infty$, in case $2 < \mathrm{char}\,\mathbb{F} \leq n$;
- a minimal separating set in case of skew-symmetric 3×3 matrices is described (together with Ronaldo Ferreira).

Jordan McMahon
Higher cluster-tilting for algebras of type $A_2^d \otimes A_2^d$ via abstract barycentric algebras

The homogeneous coordinate ring of the Grassmannian $\mathrm{Gr}(k,n)$ has the structure of a cluster algebra, as described by Scott. This cluster structure is closely related to mutations of the quiver $A_{k-1} \otimes A_{n-k-1}$. We take mutation classes of quivers based on the product $A_2^d \otimes A_2^d$ of quivers of higher Auslander algebras and describe d-cluster-tilting subcategories of these algebras. The use of abstract barycentric algebras allows us to simultaneously describe mutations as a local operation as well as give a geometric interpretation. We define superimposed triangulations of cyclic polytopes, and use them to classify the mutation class of quivers described above.

René Marczinzik
Locally minimal Auslander-Gorenstein algebras

Recently Iyama and Solberg introduced minimal Auslander-Gorenstein algebras that provide a generalisation of higher Auslander algebras and introduced precluster tilting objects as a generalisation of cluster-tilting objects. We present a further generalisation of minimal Auslander-Gorenstein algebras and generalise previous results such as the higher Auslander correspondence and a classification of Gorenstein projective modules for such algebras. We present several examples of algebras that show that those algebras occur naturally. This is joint work with Aaron Chan and Osamu Iyama.

Inga Paul
Restriction of cell modules of partition algebras

In this talk we discuss the restriction of a cell module of the partition algebra $P_k(r,\delta)$ to the category of modules of a symmetric group algebra $k\Sigma_l$ with $l \leq r$. We describe it as induced tensor product of various permutation modules (Young permutation modules and Foulkes modules with various parameters). From this structure we can deduce criteria for the restriction of the cell module to admit a (dual) Specht filtration.

Matthew Pressland
Calabi–Yau categories from Gorenstein algebras

I will explain how to construct Gorenstein algebras whose category of Gorenstein projective modules is stably Calabi–Yau. Moreover, I will show how (at least some of) Amiot's 2-Calabi–Yau generalised cluster categories may be realised in this way, avoiding the usual construction via dg-algebras. Time permitting, I will also discuss some examples in other dimensions.

Stefano Sannella
Broué's conjecture for some groups of Lie type and some sporadics

The representation theory of a finite group G over a field F of positive characteristic carries a family of questions known as local/global conjectures: in various forms, they state that the representation theory of G is somehow controlled by its p-local subgroups. We will focus on one in particular, Broué's Conjecture, which might be considered an attempt to give a structural explanation of what is actually connecting G and its local p-subgroups in the abelian defect case. In particular, we explain how the strategy of looking for a perverse equivalence (a specific type of derived equivalence) introduced by Chuang and Rouquier works successfully in some cases and how this procedure is related to some Deligne-Lusztig varieties. This relies on a (sometimes heavy) computational method.

Shraddha Srivastava
Schur Algebras for Alternating group and Koszul duality

The alternating Schur algebra $AS_F(n,d)$ is defined as the commutant of the action of the alternating group A_d on the d-fold tensors of an n-dimensional F-vector space. It contains the Schur algebra as a subalgebra. We find a basis of the alternating Schur algebra in terms of bipartite graphs. We give a combinatorial interpretation of the structure constants of the alternating Schur algebra with respect to this basis. What additional structure does being a module for the alternating Schur algebra impose on a module for the Schur algebra? Our answer to this question involves the Koszul duality functor of Krause, and leads to a simple interpretation of his functor. Krause's work implies that derived Koszul duality is an equivalence when $n \geq d$. Our combinatorial methods prove the converse. This is a joint work with Amritanshu Prasad and Geetha Thangavelu.

Jacinta Torres
Generalizing LS galleries in affine buildings

In 2005, Gaussent-Littelmann have interpreted LS galleries in terms of the geometry of affine grassmannians. I will present a generalization of this notion for any Littelmann model of galleries by keeping careful track of the "load bearing walls" of these galleries. Finally I will present an interpretation of these load-bearing walls in terms of retractions. This is joint work in progress with Petra Schwer.

Alexandra Zvonareva
On gluing silting objects

Silting objects play an important role in the study of finite dimensional algebras. The problem of gluing silting objects with respect to a recollement has been studied by Liu, Vitoria and Yang, who describe the silting object corresponding to a glued co-t-structure. In this talk I will revise the connection between the construction of (pre)envelopes, t-structures and co-t-structures, which will provide an explicit construction of silting objects corresponding to a glued t-structure.