Plenary

Georgia Benkart  Centralizer Algebras - A Multidimensional Point of View

This talk will focus on various approaches to computing dimensions of centralizer algebras and their modules, multiplicities of representations, and dimensions of invariants using the representation theory of groups.

Zajj Daugherty  Centralizers of the Lie superalgebra p(n), where loops go to die

The Brauer algebra arises in Schur-Weyl duality with orthogonal and symplectic groups and Lie algebras. Recently, D. Moon, followed by J. Kujawa and B. Tharp, studied a related algebra that centralizes the action of the Lie superalgebra p(n), where sign changes appear in some relations and the parameter associated to closed loops is set to 0. I will discuss these algebras, and explore how to construct degenerate affine and cyclotomic versions. This is joint work with Martina Balagovic, Maria Gorelik, Iva Halacheva, Johanna Mennig, Mee Seong Im, Gail Letzter, Emily Norton, Vera Serganova, and Catharina Stroppel, and a project begun at the BIRS workshop Women in Noncommutative Algebra and Representation Theory.

Maud De Visscher  Non-semisimple representation theory of the partition algebras

The partition algebras P_n(\delta) (n \geq 0) form a tower of cellular algebras. Its branching graph encodes the restriction of the cell modules along this tower. In this talk I will explain how to define a reflection geometry on the branching graph which describes much of the non-semisimple representation theory of the partition algebras.

Stephen Doty  Canonical idempotents in multiplicity-free families of algebras

(This is joint work with Aaron Lauve and George Seelinger.)

I will discuss an elementary problem: how to compute a complete set of primitive orthogonal idempotents in a split semisimple finite dimensional algebra. It turns out that if the algebra in question fits into a multiplicity-free family, then one can solve this problem by computing the eigenspectrum of a sequence of Jucys-Murphy operators on the simple representations. This extends some well-known combinatorics associated with symmetric groups to other, more exotic, multiplicity-free families, of which there are many examples in the recent literature. This approach is based on the new approach to the representations of symmetric groups as explained in two papers of Vershik and Okounkov (1996, 2004). I will outline the results (many of which are easy extensions of previous known results scattered across the literature) and discuss how they apply to symmetric group algebras and Brauer algebras.

Karin Erdmann  Drinfeld doubles of a family of Hopf algebras

(Mostly joint with E. L. Green, N. Snashall and R. Taillefer)

Fusion rules, that is, the decomposition of tensor products of modules as a direct sum of indecomposable modules over a Hopf algebra, have been studied in several contexts, such as quantum groups or conformal field theory. We study these for the Drinfeld doubles D(Λ_n,d) constructed from extended Taft algebras, via a new approach exploiting stable homomorphisms. This in particular corrects errors in previous work.

John Graham  Birman-Murakami-Wenzl algebras for Weyl groups

Volodymyr Mazorchuk  Spectral properties of bipartite graphs and 2-representations of Soergel bimodules

This is a report on a joint work with Tobias Kildetoft, Marco Mackaay and Jakob Zimmermann. The aim of this talk is to describe recent progress in the study of 2-representations of the 2-category of Soergel bimodules over the coinvariant algebra of a finite Coxeter group. For finite Weyl groups this 2-category is biequivalent to the 2-category of projective functors on the principal block of the BGG category O associated with the corresponding finite dimensional simple complex Lie algebra. In many
cases, it turns out that simple transitive 2-representations of the 2-category of Soergel bimodules have Lie-theoretic interpretation, which we will try to explain. Finally, we will also explain an ADE-type classification of certain integral matrices related to bipartite graphs which popped up in the study of Soergel bimodules for general dihedral groups.

**Arun Ram** *A combinatorial gadget for decompositions numbers for quantum groups at roots of unity*

This is joint work with Martina Lanini and Paul Sobaje in which we produce a generalization of the q-Fock space (as used, for example, by Ariki, Lascoux-Leclerc-Thibon, Hayashi, Misra-Miwa, Kashiwara-Miwa-Stern) to all Lie types. This gadget captures the decomposition numbers of standard modules for representations of quantum groups at roots of unity in the same way that the usual q-Fock space does for type A. In classical type, via Schur-Weyl duality, it will also see the decomposition numbers of affine BMW algebras in the same way that the usual q-Fock space does for affine Hecke algebras of type A.

**Steen Ryom-Hansen** *Jucys-Murphy elements for the diagrammatical category of Soergel bimodules*

Soergel introduced his category of bimodules in the nineties during his new proof of the Kazhdan-Lusztig conjectures. In the last decade, a diagrammatical version $\mathcal{D}$ of this category has been developed which is better behaved in positive characteristic than the original category. Elias and Williamson proved that $\mathcal{D}$ is cellular, where the cellular basis is a diagrammatical version of Libedinsky’s light leaves.

In this talk we construct of family of Jucys-Murphy elements for $\mathcal{D}$. We show that they satisfy a separation criterion over the field of fractions of the ground ring which leads to a formula for the determinant of the bilinear form on the cell modules. We use certain exact sequences found by D. Plaza to give a Shapovalov type expression for the determinant. This leads to a Jantzen type filtration and associated sum formula.

**Hubert Saleur** *Fusion in the affine Temperley-Lieb algebra*

**Catharina Stroppel** *Brauer algebras and representations of the supergroup OSP*

### Contributed

**Chwas Ahmed** *Representation theory of the planar d-tonal partition algebras*

**Alexander Baranov** *Lie ideals of associative algebras*

Any associative algebra $A$ becomes a Lie algebra $A(-)$ under $[x, y] = xy - yx$. Let $A^{(1)} = [A, A]$ be the derived subalgebra of $A(-)$ and let $Z$ be its center. In the early 1950s Herstein initiated a study of Lie ideals of $A$ in case of a simple ring. In particular, he showed that in that case $A^{(1)}/Z$ is simple, $A^{(1)}$ generates $A$ and $A^{(1)}$ is perfect (i.e. $[A^{(1)}, A^{(1)}] = A^{(1)}$), except if $A$ is of characteristic 2 and is of dimension 4 over its center. Most root graded Lie algebras of type $A$ can be obtained as $A^{(1)}$ for suitable $A$ (up to central extensions). For other classical types one should use skew-symmetric elements of an algebra with involution instead.

Let $F$ be an algebraically closed field of characteristic $p \geq 0$ and let $A$ be an associative algebra over $F$ containing a matrix subalgebra $M_n$ ($n \geq 2$). We show that if $A$ is generated by $M_2$ ($M_3$ if $p = 2$) as an ideal, then $A^{(1)}$ is perfect and $A = A^{(1)}A^{(1)} + A^{(1)}$. Moreover, most Lie ideals of $A(-)$ and $A^{(1)}$ are induced by the ideals of $A$. In particular, if $A$ is any finite dimensional associative algebra over $F$ without one-dimensional quotients and $p \neq 2$ then $A^{(1)}$ is perfect.

We also describe Jordan-Lie inner ideals of $A(-)$ for finite dimensional $A$. Recall that a subspace $B$ of a Lie algebra $L$ is an *inner ideal* of $L$ if $[B, [B, L]] \subseteq B$. An inner ideal $B$ of $A(-)$ is said to be *Jordan-Lie* if $B^2 = 0$ (in that case $B$ is also an inner ideal of the Jordan algebra $A(+)$. This is a joint work with H. Shlaka (University of Leicester).
Yuri Berest  *Representation homology*

The set of all representations of a Lie algebra $\mathfrak{a}$ in a finite-dimensional Lie algebra $\mathfrak{g}$ has a natural structure of an affine scheme, called the representation scheme $\text{Rep}_\mathfrak{g}(\mathfrak{a})$. The representation functor $\text{Rep}_\mathfrak{g}$ is not ‘exact’ and can be derived in the sense of (non-abelian) homological algebra. In this talk, we will discuss the construction and properties of derived representation schemes of Lie algebras and their homology. As a key example, we will consider the derived schemes related to the classical commuting schemes of complex reductive Lie algebras. We will present a general conjecture on the structure of these derived schemes motivated by the well-known Macdonald conjectures. Time permitting, we will also discuss a topological version of representation homology, replacing Lie algebras by (simplicial) spaces, and prove a remarkable relation between representation homology and higher order Hochschild homology.

Chris Bowman  *Cellularity of Brauer centralizer algebras*

In previous work, John Enyang and Fred Goodman produced Murphy type cellular bases for towers of algebras which generically are produced by repeated Jones basic constructions. Examples include the Brauer algebras, BMW algebras, partition algebras, and others. The bases are indexed by paths on the generic branching diagram for the tower.

In current work, we show that the Murphy bases of the Brauer algebras yield cellular bases for the Brauer centralizer algebras acting on symplectic or orthogonal tensor space. These bases are valid over the integers. A similar result holds for the walled Brauer algebra acting on mixed tensor space.

In each case the rank of the cell modules is in general strictly smaller than that of corresponding cell modules of the abstract diagram algebra. The cellular basis of the centralizer algebra is a proper subset of the cellular basis of the abstract diagram algebra.

This is joint work with Fred Goodman and John Enyang.

Iva Halacheva  *An action of the cactus group on crystals*

For any finite-dimensional, complex, reductive Lie algebra $\mathfrak{g}$, we consider the corresponding cactus group $J_\mathfrak{g}$ (a cousin of the braid group) defined using the Dynkin diagram. We further describe an action of $J_\mathfrak{g}$ on any $\mathfrak{g}$-crystal coming from a representation. Under skew Howe duality for $\mathfrak{gl}(n) \times \mathfrak{gl}(m)$-crystals, this inner cactus action agrees with an outer action on tensor products previously defined by Henriques and Kamnitzer.

Sanjaye Ramgoolam  *Permutation Centralizer algebras, polynomial invariants and super-symmetric states*

I describe a class of permutation centralizer algebras which underlie the combinatorics of gauge invariant polynomials in matrix or tensor variables. One family of such algebras, closely related to Littlewood-Richardson coefficients, organises the counting and correlators of 2-matrix invariants, related to supersymmetric states in super-Yang Mills theory. The structure of the algebras contain precise information about the enhanced symmetry charges which distinguish the invariants.

The talk will be based on [http://arxiv.org/abs/1601.06086](http://arxiv.org/abs/1601.06086)

Vidas Regelskis  *Twisted Yangians for symmetric pairs of types B, C, D and their representations*

In this talk I will present extended twisted Yangians for the classical Lie algebras of types B, C and D: they are in bijection with the symmetric pairs of types BDI, CI, CII and DIII. (This notation refers to Cartan’s classification of symmetric spaces.) I will also introduce twisted Yangians of type BCD0 corresponding to the symmetric pair $(\mathfrak{g}(N)[x], \mathfrak{g}(N)[x^2])$, when $\mathfrak{g}(N)$ is $\mathfrak{so}(N)$ or $\mathfrak{sp}(N)$ Lie algebra. I will then explain the isomorphisms between the newly introduced twisted Yangians the well-known Olshanetskii’s twisted Yangians and Molev-Ragoucy reflection algebras when the rank is small and discuss some results and open problems in the theory of highest weight representations. This talk is based on a joint work with Nicolas Guay and Curtis Wendlandt.
Jacinta Torres  *Non-Levi branching rules and Littelmann paths*

The study of restrictions of representations is basic in representation theory. I will introduce the path model associated to an irreducible finite dimensional representation of a simple Lie algebra (focusing on examples) and explain how it can be used to produce branching rules for Levi subalgebras. I shall mention why in branching rules for non-Levi subalgebras (in particular sp2n as a sub Lie algebra of sl2n) cannot be obtained in the same way and present a mysterious conjecture by Naito-Sagaki, of which we have proofs in several cases.