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Workshop on  
“Monoidal and 2-categories in representation theory and  
categorification”

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organized by  
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Abstracts

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Chris Bowman (University of Kent)

**Tautological  $p$ -Kazhdan–Lusztig Theory for cyclotomic Hecke algebras.**

**Abstract:** We discuss a new explicit isomorphism between (truncations of) quiver Hecke algebras and Elias–Williamson’s diagrammatic endomorphism algebras of Bott–Samelson bimodules. This allows us to deduce that the decomposition numbers of these algebras (including as examples the symmetric groups and generalised blob algebras) are tautologically equal to the associated  $p$ -Kazhdan–Lusztig polynomials, provided that the characteristic is greater than the Coxeter number. This allows us to give an elementary and explicit proof of the main theorem of Riche–Williamson’s recent monograph and extend their categorical equivalence to cyclotomic Hecke algebras, thus solving Libedinsky–Plaza’s categorical blob conjecture.

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Juliet Cooke (Université catholique de Louvain)

**Skein categories**

**Abstract:** In this talk we will talk about skein categories which are a categorical analogue of skein algebras based on coloured ribbon tangles. We shall then see how these skein categories satisfy excision and therefore fit within the framework of factorisation homology as  $k$ -linear factorisation homology theories of surfaces. We shall conclude by discussing how to relate them to Alekseev’s moduli algebras and stated skein algebras.

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Ben Elias (University of Oregon)

**Categorifying Hecke algebras at prime roots of unity**

**Abstract:** Thirty years ago, Soergel changed the paradigm with his algebraic construction of the Hecke category. This is a categorification of the Hecke algebra at a generic parameter, where the parameter is categorified by a grading shift. One key open problem in categorification is to categorify

Hecke algebras not at a generic parameter, but at a root of unity. In this talk I will explain how one can utilize the technology of p-DG categories to provide such a conjectural categorification. This is joint work with Y. Qi.

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**Inna Entova-Aizenbud** (Ben Gurion University)

### **Jacobson–Morozov Lemma for Lie superalgebras using semisimplification**

**Abstract:** I will present a generalization of the Jacobson–Morozov Lemma for quasi-reductive algebraic supergroups (respectively, Lie superalgebras), based on the idea of semisimplification of tensor categories, which will be explained during the talk. This is a joint project with V. Serganova.

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**Iva Halacheva** (Northeastern University)

### **The cactus group, crystals, and perverse equivalences**

**Abstract:** Suppose  $C$  is a category equipped with a categorical action of a (simply-laced) semisimple Lie algebra  $\mathfrak{g}$ . Chuang and Rouquier construct equivalences on its derived category  $D^b(C)$  via the so called Rickard complexes, one for each simple root of  $\mathfrak{g}$ . These complexes satisfy the braid relations for  $\mathfrak{g}$ , as shown by Cautis and Kamnitzer, and hence give an action of the braid group. We show that the complex corresponding to the positive lift of the longest Weyl group element (of any parabolic in  $\mathfrak{g}$ ) is a perverse equivalence on  $D^b(C)$ . Hence, it induces a bijection on the irreducible objects of  $C$ , and recovers the cactus group action on the corresponding  $\mathfrak{g}$ -crystal. This is joint work in progress with Tony Licata, Ivan Losev, and Oded Yacobi.

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**Thorsten Heidersdorf** (Universität Bonn)

### **On fusion rules for supergroups**

**Abstract:** I will report on some recent progress to understand the indecomposable summands in tensor products of irreducible representations of an algebraic supergroup. I will focus on the  $GL(m|n)$  and  $OSp(m|2n)$ -case.

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**Matt Hogancamp** (Northeastern University)

### **Soergel bimodules and the Carlsson–Mellit algebra**

**Abstract:** The dg cocenter of the category of Soergel bimodules in type A, morally speaking, can be thought of as a categorical analogue of the ring of symmetric functions, as in joint work of myself, Eugene Gorsky, and Paul Wedrich. Meanwhile, the ring of symmetric functions is the recipient of actions of various interesting algebras (affine Lie algebras in type A, Heisenberg algebra, elliptic hall algebra, etc). It is therefore natural to wonder if the actions of such algebras have categorical analogues acting on the cocenter of SBim. In this talk we give precisely such a Soergel bimodule interpretation to the action of the Carlsson–Mellit algebra  $e_0 A_{q,t} e_0$  on symmetric functions. By considering in addition various “dg cocentralizers” of SBim we obtain a categorical analogue of the full polynomial representation of the Carlsson–Mellit algebra  $A_{q,t}$ . A key component in this work is a skein theoretic interpretation of the polynomial representation of  $A_{q,t}$ . This is joint work with Nicolle Sandoval Gonzalez.

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**Lars Thorge Jensen** (University of Clermont Auvergne)

### **Cellularity of the p-Kazhdan–Lusztig Basis for Symmetric Groups**

**Abstract:** After recalling the most important results about Kazhdan–Lusztig cells for symmetric groups, I will introduce the p-Kazhdan–Lusztig basis and give a complete description of p-cells for symmetric groups. After that I will mention important consequences of the Perron–Frobenius theorem for p-cells which provide one of the last missing ingredients for the proof of the cellularity of the p-canonical basis in finite type A.

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**Mikhail Khovanov** (Columbia University)

### **Universal construction in ultra low dimensions**

**Abstract:** We'll explain the notion of the universal construction, which can be viewed as a weakening of the TQFT axioms, and demonstrate how it works in dimensions one and two.

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**Martina Lanini** (Università degli studi di Roma Tor Vergata)

### **Attractive forests and torus actions**

**Abstract:** Attractive forests are well behaved quiver representations, examples of which are nilpotent representations of the equioriented cycle. In ongoing joint work with Alexander Puetz, we define and investigate torus actions on quiver Grassmannians of attractive forests. In the case of nilpotent representations of the equioriented cycle, our torus action equips the quiver Grassmannian with a structure of an equivariantly formal space, the corresponding moment graph can be combinatorially described and exploited to compute equivariant cohomology. We expect the same results to hold true for any attractive forest. Our construction generalises the very much investigated (maximal) torus actions on type A flag varieties.

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**Vanessa Miemietz** (University of East Anglia)

### **A categorified double centraliser theorem and applications to Soergel bimodules**

**Abstract:** I will explain how notions from classical representation theory, including a double centraliser theorem, lift to finitary 2-representation theory, and how this helps in classifying simple 2-representations of Soergel bimodules of finite Coxeter type in characteristic zero.

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**Victor Ostrik** (University of Oregon)

### **Two dimensional topological field theories and partial fractions**

**Abstract:** This talk is based on joint work with M.Khovanov and Y.Kononov. By evaluating a topological field theory in dimension 2 on surfaces of genus 0,1,2 etc we get a sequence. We investigate which sequences occur in this way depending on the assumptions on the target category.

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**Laura Rider** (University of Georgia)

### **Modular Perverse Sheaves on the affine Flag Variety**

**Abstract:** There are two categorical realizations of the affine Hecke algebra: constructible sheaves on the affine flag variety and coherent sheaves on the Langlands dual Steinberg variety. A fundamental problem in geometric representation theory is to relate these two categories by a category equivalence. This was achieved by Bezrukavnikov in characteristic 0 about a decade ago. In this talk, I will discuss a first step toward solving this problem in the modular case joint with R. Bezrukavnikov and S. Riche.

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**Raphael Rouquier** (University of California, Los Angeles)

### **Affinizations and modular representations of finite groups**

**Abstract:** We will discuss affinizations of 2-Kac–Moody algebras and their role in degenerations of categories of modular representations of finite groups of Lie type.

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**Monica Vazirani** (University of California, Davis)

### **Representations of the affine BMW category**

**Abstract:** The BMW algebra is a deformation of the Brauer algebra, and has the Hecke algebra of type A as a quotient. Its specializations play a role in types B, C, D akin to that of the symmetric group in Schur–Weyl duality. I will discuss Walker’s TQFT-motivated 1-handle construction of a family of representations of the affine BMW category and the resulting representations of the affine BMW algebra. These representations are “integral” and X-semisimple, or calibrated. While the construction is topological, the resulting representation has a straightforward combinatorial description. This is joint work with Kevin Walker.

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