Université de Sherbrooke

34e rencontre sur la théorie des représentations des algèbres et sujets connexes

Résumés/abstracts

Lattice of submodules and knot theory.

Véronique Bazier-Matte

In previous work, we associated a module $T(i)$ to every segment i of a link diagram K and showed that there is a poset isomorphism between the submodules of $T(i)$ and the Kauffman states of K relative to i. In this talk, I will demonstrate that these posets form distributive lattices and that the subposet of join irreducible Kauffman states is isomorphic to the poset of the coefficient quiver of $T(i)$. Finally, I will describe a method to identify the join irreducible Kauffman states.

Some components of the moduli space of Koszul Artin-Schelter regular algebras of dimension four.

Vishal Bhatoy

We compute Hochschild cohomology and the Kodaira spencer map for known families of Koszul Artin-Schelter regular algebras of dimension four. We show that when the Kodaira Spencer map of a point is a surjection, the image of the family is a component of the moduli space, and when the Kodaira Spencer map is a bijection, the map to the moduli space is finite. We identify components of the moduli space. This is joint work and work in progress by Professor Colin Ingalls, Vishal Bhatoy and Ravali Nookala.

g-finiteness, cotorsion pairs and thick subcategories of the category of projective presentations.

Monica Garcia

An algebra is said to be g-finite if it admits finitely many isomorphism classes of tau-tilting pairs. This notion was introduced and thoroughly studied by L. Demonet, O. Iyama and G. Jasso, who showed that this property is equivalent to the module category admitting finitely many isomorphism classes of bricks (which is equivalent to having finitely many wide subcategories), finitely many functorially finite torsion classes, and equivalent to all torsion classes being functorially finite. Many of these concepts and their relationships have been shown to have counterparts in the extriangulated category of two-term complexes of projective modules. In this talk, we introduce new equivalent conditions to an algebra being g-finite in the context of the category of 2-term complexes. Namely, we establish that being g-finite is equivalent to the category of 2-term complexes admitting finitely many thick subcategories, finitely many complete cotorsion pairs and equivalent to all cotorsion pairs being complete.

Mutation of tau-exceptional sequences.

Eric Hanson

By the work of Crawley-Boevey and Ringel, the set of complete exceptional sequences over a finite-dimensional hereditary algebra admits a transitive braid group action. This can also be viewed as a "mutation theory" for exceptional sequences. In this talk, we discuss recent joint work with Aslak Buan and Bethany Marsh which extends this into a mutation theory for (complete) tau-exceptional sequences over an arbitrary finite-dimensional algebra. In addition to giving the formulas for this mutation, we discuss the existence of non-mutable sequences, the problem of transitivity, and the (lack of) braid relations.

Comparing two biperfect bases using category O.
Alexis Leroux-Lapierre

The apparently elementary question of writing down perfect bases for the irreducible representations of semisimple Lie algebras is a problem which finds its source in surprisingly involved mathematical tools. Two such sources are a version of the geometric Satake equivalence (giving rise to the so-called Mirkovic-Vilonen bases) and a categorification of U_q^- using KLR algebras (giving rise to the so-called dual canonical bases). It has been shown that those two families of bases do not coincide, raising the question of understanding the change of basis matrix. Building upon results of Kamnitzer-Tingley-Webster-Weekes-Yacobi, we show how one can compute this change of basis matrix using category O for truncated shifted Yangians. This is joint work with Joel Kamnitzer.

Schur Algebras in Type B.
Dinushi Munasinghe

We look at two generalizations of the q-Schur algebra to type B: the cyclotomic q-Schur algebra of Dipper, James, and Mathas, and the unequal parameter construction of Lai and Luo, compatible with the Schur duality of Bao, Wang, and Watanabe. By writing the latter algebra as an idempotent truncation of the former, we leverage its cellular structure and established results to study the representation theory of the newer algebra.

Quivers with homotopies.
Jie Pan

We introduce homotopies to a loop-free quiver to extend mutations to them, and then talk about "cluster algebras" associated to them. This is joint work with Fang Li, Siyang Liu and Lang Mou.

Hom-orthogonal modules, bricks and τ-tilting.
Charles Paquette

This is joint work with Kaveh Mousavand. We study Hom-orthogonal sets of modules in the module category of a finite dimensional algebra, and in an irreducible component of a module variety. We prove that the existence of some orthogonal sets of modules imply τ-tilting infiniteness (or equivalently, brick-infiniteness) of the algebra. We apply this to the study of the second brick Brauer-Thrall conjecture. We also derive some results for tame algebras, and for those algebras admitting a generalized standard AR component.

Bethe bases in representations of the symmetric group.
Leonid Rybnikov

A Gelfand-Tsetlin basis is a particularly nice construction of a basis in any irreducible complex representation of the symmetric group that is compatible with restrictions to smaller symmetric groups. This basis is naturally indexed by standard Young tableaux. I will explain how to include Gelfand-Tsetlin bases into a continuous family of bases in the same representations coming from Bethe ansatz in quantum spin chains. The monodromy of the bases along the parameter space gives some interesting combinatorial bijections on standard Young tableaux, in particular, the Schutzenberger involution arises this way. I will discuss various generalizations of this construction.

Bound quiver algebras that are Morita-equivalent to the one-boundary Temperley-Lieb algebras.
Yvan Saint-Aubin

The one-boundary Temperley-Lieb algebras TLb are finite-dimensional unital associative algebras. The family is related to those of Hecke algebras and Khovanov-Laura-Rouquier algebras (KLR), and its representation theory is rich. Moreover it is a partner of $U_q(\mathfrak{sl}_2)$ in the Schur-Weyl duality of some tensor products of modules over the latter algebra. The talk constructs a quiver with relations whose associated path algebra is Morita-equivalent to the blocks of TLb. The existence of bound quivers for finite-dimensional algebras is ensured by fundamental theorems. But their actual construction is usually difficult. In the present case, it is possible due to recent results tying the Hom-spaces of Soergel modules and those of the projective ones of some quotient of the KLR family. The computation to get the relations for the quiver relies on Elias-Soergel-Williamson diagrammatic calculus.
This is work in progress with Alexis Leroux-Lapierre and Théo Pinet. The relations on the bound quiver were also checked independently by Philippe Petit using KLR diagrammatics.
The talk will be in English, avec des diapos en français.

Classifying modules with submodules determined by dimension vector.
Ryan Schroeder

Let A be an algebra over a field k. An A-module M is said to be grin if each submodule is uniquely determined by its dimension vector. Modules of this type have a relatively simple submodule structure, and thus the associated F-polynomial is also quite simple, with coefficients only 0 or 1. In this talk, we provide a classification of grin nilpotent modules, as well as a classification of grin indecomposable modules when A is gentle.

The representation theory of persistence theory.
Luis Scoccola

Persistence theory was born from the observation that the critical values of a Morse function admit a canonical pairing, which induces a direct sum decomposition of the sublevel set homology of the function into interval poset representations. What makes persistence theory distinct from Morse theory - besides the fact that it is usually framed using the language of representation theory - is its focus on perturbation-stability, providing answers to questions such as: How can the critical values of a Morse function change when the function is perturbed? The initial motivation for the study of perturbation-stability came from problems in geometric data science, but has since found applications in symplectic geometry as well as in complex and functional analysis. I will give an overview of the representation theoretic and combinatorial aspects of persistence theory, including motivation and applications.