Representation theory of algebras and related topics
Théorie des représentations des algèbres et sujets connexes
(Org: **Colin Ingalls** (University of New Brunswick) and/et **Charles Paquette** (Royal Military College of Canada))

IBRAHIM ASSEM, Université de Sherbrooke
Hochschild cohomology of partial relation extensions

This is a report on a joint work with Ralf Schiffler and Maria Andrea Gatica. We show how to compute the low Hochschild cohomology groups of a partial relation extension algebra.

EMILY BARNARD, Northeastern University
Cover relations in the Lattice of Torsion Classes.

Let Λ be a finite-dimensional associative algebra. The torsion classes of mod Λ form a lattice under containment, denoted by tors Λ. In this talk, we characterize the cover relations in tors Λ by certain indecomposable modules which we call *minimal extending modules*.

THOMAS BRÜSTLE, Bishop's University and Université de Sherbrooke
Matrix reduction and exact structures

Matrix reduction techniques have been used by the Kiev school to prove fundamental results in representation theory, such as the Brauer-Thrall conjectures or the tame and wild dichotomy. To formalize the matrix reduction techniques, Roiter introduced the notion of a bocs, which models matrix reductions by iterated change of categories - their objects and morphisms. We propose instead to model matrix reduction by keeping the same additive category, but changing the exact structure. A path of reductions is thus modeled by a path in the lattice of exact structures.

ALEXANDER GARVER, Université du Québec à Montréal
Wide shadows and biclosed sets

In recent work of Marks and Stovicek, they established a bijection between the torsion classes in the module category of a representation finite algebra and wide subcategories of the same module category. Given a gentle algebra A all of whose indecomposable modules are bricks, we study a family of subcategories of mod$(\Pi(A))$, where $\Pi(A)$ is as in the previous talk, that are intersections of wide subcategories of mod$(\Pi(A))$ with a certain subcategory of mod$(\Pi(A))$. We refer to these subcategories as wide shadows. We show that the shard intersection order of the lattice of torsion shadows is isomorphic to the poset of wide shadows. From this it follows that there is a bijection between torsion shadows of A and wide shadows of A. This is joint work with T. McConville and K. Mousavand.

VINCENT GELINAS, University of Toronto
Failure of coherence for higher preprojective algebras

Given a finite acyclic quiver Q, it is well-known that the representation type of Q is characterised by the growth properties of the preprojective algebra $\Pi(Q)$. More precisely, $\Pi(Q)$ is finite dimensional for Q Dynkin, Noetherian for Q Euclidean and non-Noetherian otherwise. In that last case, the graded algebra $\Pi(Q)$ is at least known to be coherent, a fact much exploited in Minamoto's geometric point of view.

In higher global dimension, for a d-representation infinite algebra Λ one can ask whether its $(d+1)$-preprojective algebra $\Pi(\Lambda)$ is always coherent. This question has natural interpretations in terms of higher Auslander-Reiten theory. We will show that

coherence can fail for any $d \geq 3$, although the counterexamples are somehow isolated and do not seem representative of typical behavior.

KIYOSHI IGUSA, Brandeis University
Maximal green sequences for cluster tilted algebras of finite type.

This talk is about the Appendix of this paper (arXiv:1706.06503) written jointly with Gordana Todorov which discusses the maximal length of a maximal green sequence (MGS) for cluster-tilted algebras of finite type. By Assem-Brustle-Schiffler (2006), cluster tilted algebras are relation extensions of tilted algebras. The indecomposable modules for such a tilted algebra gives a MGS for the cluster-tilted algebra and in many cases this is the MGS of maximal length. The classification of tilted algebras of type A by Assem (1982) is used to construct what we conjecture to be the longest MGS in the cluster-tilted algebras of type A.

MATTHEW LEWIS, University of New Brunswick
McKay Quivers of Complex Reflection Groups

In this talk, I will briefly discuss some results from my thesis regarding the McKay quiver associated the infinite family of complex reflection groups, $G(r, m, n)$. The irreducible representations of these groups and the quivers mentioned above can be completely described using novel variations of Young diagrams and the action of tensor products thereon.

SHIPING LIU, Université de Sherbrooke
Auslander-Reiten theory through triangulated categories

This is a joint work with Hongwei Niu. The Auslander-Reiten theory of almost split sequences and irreducible maps was originally studied in the representation theory of algebras and later introduced into other areas such as algebraic geometry and algebraic topology. In particular, the existence of almost split sequences and that of almost split triangles have been established by numerous authors in various categories such as module categories, abelian categories and triangulated categories. Working with extension-closed subcategories of triangulated categories, we shall be able to unify these existence theorems including Auslander's existence theorem of an almost split sequence in a module category over a ring and Krause's existence theorem of an almost split triangle in a triangulated category. We shall also talk about a generalization of a Serre functor introduced by Reiten and Van den Bergh.

FRANTISEK MARKO, Pennsylvania State University
Supersymmetric polynomials over fields of positive characteristic

Harish-Chandra isomorphism for Lie algebra $\mathfrak{g}$ over a field K of characteristic zero case yields a description of its central characters and central blocks. This is related to the invariants of the adjoint representation of $\mathfrak{g}$ and for $\mathfrak{g} = \mathfrak{gl}(m)$ to symmetric polynomials.

Such a result extends to Lie superalgebras $\mathfrak{g}$ over K of characteristic zero, and in the case of the general linear superalgebra $\mathfrak{gl}(m|n)$ it leads to supersymmetric polynomials. We review the description of supersymmetric polynomials in characteristic zero and $p > 2$.

For Lie algebras in characteristic $p > 0$, the Harish-Chandra isomorphism still exists but takes a slightly different form.

Our interest lies in the general linear supergroup $GL(m|n)$ in characteristic $p > 2$. We consider the distribution algebra $Dist(T)$ of the maximal torus T of G, which has a basis consisting of the product of certain binomial coefficients. We explain how to extend the supersymmetric property from the characteristic zero case to the case of positive characteristic and describe a basis of the supersymmetric elements of $Dist(T)$ as a union of supersymmetric elements in the Frobenius kernels.

KAVEH MOUSAVAND, Université du Québec à Montréal
Torsion Shadows and Biclosed Sets

Any gentle algebra gives rise to a poset of biclosed sets. For certain choices of algebras A, this poset is isomorphic to the weak order on the symmetric group and the lattice of torsion classes of the preprojective algebra associated to A. Given a gentle algebra A all of whose indecomposable modules are bricks, we introduce an algebra $\Pi(A)$ via a construction analogous to that of the preprojective algebra. We show the poset of biclosed sets of A is isomorphic to the poset of subcategories of $\mathrm{mod}\ (\Pi(A))$ consisting of torsion classes of $\Pi(A)$ intersected with a particular subcategory of $\mathrm{mod}\ (\Pi(A))$. We refer to the latter as torsion shadows. This is joint work with A. Garver and T. McConville.

AMIR NSAR, University of New Brunswick
Classification of Del Pezzo orders with canonical singularities

We classify del Pezzo non-commutative surfaces that are finite over their centres with terminal and canonical singularities. Using the minimal model program, we introduce the minimal model of the minimal resolution of the surfaces. This presents a complementary result and method to the classification given by Chan and Kulkarni in 2003.

GORDANA TODOROV, Northeastern University
Homology of Picture Groups

Joint work with: Kiyoshi Igusa, Kent Orr and Jerzy Weyman

To each Dynkin quiver, using domains of semi-invariants, we associate "spherical semi-invariant picture" L(Q). To such a picture L(Q) we associate the "picture group" G(Q). In order to compute the homology of the picture group G(Q), we construct the picture space X(Q) and show that X(Q) has only first homotopy group non-trivial, and that group is actually isomorphic to G(Q), i.e. X(Q) is a K(π,1) for G(Q). Using this, we can compute homology of the picture group G(Q) by computing homology of the picture space X(Q). For the quiver of type An, we show that the homology groups are free abelian groups of ranks given by ballot numbers. Some results for the quivers of type D will be stated.

TIANYUAN XU, Queen's University
On quivers and the subregular J-rings of Coxeter systems

Let (W, S) be an arbitrary Coxeter system and let G be its Coxeter diagram. We recall Lusztig's construction of the asymptotic Hecke algebra J of (W, S), an associative algebra closely related to the Iwahori–Hecke algebra of (W, S), and present some results on a subalgebra J_C of J that we call the subregular J-ring. We show that while products in J are defined in terms of Kazhdan–Lusztig polynomials, they can be computed by a simple combinatorial algorithm in J_C. We also relate J_C to the path algebra of a quiver constructed from G, and use the relation to deduce some results on the representations of J_C. (Joint work with Ivan Dimitrov, Charles Paquette, and David Wehlau.)

EMINE YILDIRIM, Université du Québec à Montréal
Associahedra via Quiver Representations

In this talk, we will discuss constructing generalized associahedra based on quiver representations for simply laced Dynkin quivers. Our inspiration comes from the paper Arkani-Hamed, Bai, He, Yan (2017) on scattering forms on the kinematic space. Their construction can be viewed as giving an associahedron associated to the linearly oriented type A quiver. Our approach generalizes this associahedron to all simply-laced Dynkin types. The correctness of our construction is proved using quiver representations. This is a joint work with Véronique Bazier-Matte, Nathan Chapelier, Aram Dermenjian, Guillaume Douville, Kaveh Mousavand, Franco Saliola, Hugh Thomas.