Operator Theory and Operator Algebras
Théorie des opérateurs et algèbres d'opérateurs
(Org: **Ken Davidson**, **Evgenios Kakariadis** and/et **Laurent Marcoux** (Waterloo))

SERBAN BELINSCHI, Queen's University
Using fully matricial functions to compute distributions of polynomials in unitarily invariant random matrices

In this talk we will indicate how fully matricial (or non-commutative) functions can be used to great effectiveness to find the asymptotic distributions of selfadjoint polynomials in unitarily invariant random matrices, as the size of the matrices tends to infinity. We will show that fully matricial functions remain somewhat useful also in studying some aspects of distributions of random matrices before letting the size of the matrix tend to infinity. The talk will be mostly a survey of recent and ongoing joint works with several co-authors.

GEORGE ELLIOTT, University of Toronto
What does classification mean?

From the point of view of C*-algebras, one should perhaps agree that classification means determining in some useful way the approximate unitary equivalence class of a morphism—as these form a category, which for separable C*-algebras distinguishes isomorphism classes. (An analogous situation holds for countable discrete groups.) For interesting classes of separable (amenable) C*-algebras, this has been achieved, by means of K-theoretical invariants. (On the other hand, no such generic invariants seem to work for countable groups.) A way of testing how difficult various cases are—the especially well behaved amenable case, in the sense of Toms and Winter, the general amenable case, or the general separable case—might be to look at the Borel complexity of the isomorphism relation (with respect to a natural Borel structure), in the sense of descriptive set theory. As it happens (work of many hands), except for the special case of AF algebras (dealt with by Bratteli and me forty years ago), which is simpler than the other cases, there would seem to be no noticeable variation at all in the Borel complexity (among all three of the cases mentioned above).

DOUGLAS FARENICK, University of Regina
Operator systems from discrete groups

If $\mathfrak{u}$ is a set of generators for a discrete group G, then the operator system $\mathcal{S}(\mathfrak{u})$ generated by $\mathfrak{u}$ is the operator subsystem of the group C*-algebra $C^*(G)$ spanned by the identity, the elements of $\mathfrak{u}$, and their inverses. This lecture will report on joint work with A. Kavruk, V. Paulsen, and I.G. Todorov concerning tensor products of such operator systems. A special case of interest occurs with the generators of a finitely generated free group.

MICHAEL HARTZ, University of Waterloo
Universal operator algebras associated to homogeneous varieties

In this talk, we will consider universal operator algebras generated by commuting row contractions satisfying homogeneous polynomial relations. These algebras can be realized as algebras of functions on the varieties defined by the relations. It turns out that their structure is closely related to the geometry of the associated algebraic varieties.

We will discuss the question of when two algebras of this are type isomorphic. In particular, we obtain a geometric condition for two such algebras being topologically isomorphic, thereby giving a positive answer to a conjecture of Davidson, Ramsey and Shalit.

ELIAS KATSOULIS, East Carolina University
C-algebras and equivalences for C*-correspondences*

We study several notions of shift equivalence for C*-correspondences and the effect that these equivalences have on the corresponding Pimsner dilations. Among others, we prove that non- degenerate, regular, full C*-correspondences which are shift equivalent have strong Morita equivalent Pimsner dilations. We also establish that the converse may not be true. These results settle open problems in the literature.

In the context of C*-algebras, we prove that if two non-degenerate, regular, full C*- correspondences are shift equivalent, then their corresponding Cuntz-Pimsner algebras are strong Morita equivalent. This generalizes results of Cuntz and Krieger and Muhly, Tomforde and Pask. As a consequence, if two subshifts of finite type are eventually conjugate, then their Cuntz-Krieger algebras are strong Morita equivalent. (Joint work with E. Kakariadis)

MATTHEW KENNEDY, Carleton University
A universal F. & M. Riesz theorem

We generalize the F. & M. Riesz theorem and Lebesgue's decomposition theorem to operator algebras generated by certain contractive tuples of operators. This class of algebras includes the multiplier algebra of every complete Nevanlinna-Pick space, for example the Hardy space, the Dirichlet space and the Drury-Arveson space. One consequence of our results is that these algebras have a unique Banach space predual. This is joint work with Dilian Yang.

DAVID KERR, Texas A&M University
Combinatorial independence and sofic entropy

I will discuss some recent work with Hanfeng Li in which we initiate a study of combinatorial independence in the context of sofic entropy. The project involves, among other things, ergodic theory on ultraproducts and applications to the Fuglede-Kadison determinant in group von Neumann algebras.

MARCELO LACA, University of Victoria
Phase transitions from dilation matrices and self similar actions

I will talk about some recent computations of equilibrium states for the natural periodic dynamics of Cuntz-Pimsner algebras and their Toeplitz extensions. The main examples arise from integer dilation matrices, and, more generally, from self-similar group actions. This is joint work with Iain Raeburn, Jacqui Ramagge, and Michael Whittaker.

ZHIQIANG LI, University of Toronto
On simple inductive limits of splitting interval algebras with dimension drops

In this talk, we are going to investigate simple inductive limits built on splitting interval algebras with dimension drops, which are typcial subhomogeneous building blocks on the unit interval. Actually, a classification will be given in both unital and certain nonunital cases. In the nonunital cases, such inductive limits give us simple stably projectionless C*-algebras with nontrivial K-theory.

JAMES MINGO, Queen's University
Second Order Freeness and Orthogonal Random Matrices

Second order freeness is a property exhibited by many ensembles of random matrices. In recent work with Mihai Popa and Emily Redelmeier we have shown that independent ensembles of random matrices are real asymptotically free of second order if one of the ensembles is invariant under conjugation by an orthogonal matrix.

SARAH PLOSKER, University of Guelph
Private Quantum Codes

Private quantum codes are a basic tool in quantum key distribution and quantum cryptography. We define private quantum channels mathematically, and consider a general notion of private quantum codes wherein qubits are encoded into quantum subsystems. Private quantum channels, private subspaces, and a previously considered notion of private subsystems are all captured as special cases of this general phenomena. We provide a simple example that highlights the main differences between mappings on subsystems and subspaces and show that certain classes of channels can only be private in this subsystem setting. We also set out testable conditions for deciding when a code is private for a given channel and we discuss connections with quantum error correction. These conditions can be regarded as the private analogue of the Knill-Laflamme conditions for quantum error correction. Joint work with T. Jochym-O'Connor, D. W. Kribs, and R. Laflamme.

ALEXEY POPOV, University of Waterloo
Every operator has an almost-invariant subspace

We show that any bounded operator on a separable, reflexive, infinite-dimensional Banach space admits a rank-one perturbation which has an invariant subspace of infinite dimension and codimension. In the non-reflexive spaces, we show that the same is true for operators which have non-eigenvalues in the boundary of their spectrum. In the Hilbert space, our methods produce perturbations that are also small in norm.

This is a joint work with Adi Tcaciuc.

HEYDAR RADJAVI, University of waterloo
Semigroups of Partial Isometries

We present results on the spatial structure of semigroups of partial isometries on a Hilbert space. If these semigroups are also assumed to be selfadjoint, then they coincide precisely with faithful representations of abstract inverse semigroups. We obtain a generalized weighted-composition form for the members of such semigroups. In the presence of additional hypotheses, e.g., when the semigroup is finitely generated, we get a simpler, matricial form for it. This is joint work with Alexey Popov.

CHRIS RAMSEY, University of Waterloo
Triangular UHF algebras

Triangular UHF algebras are direct limits of full triangular matrix algebras. I will talk about their isometric automorphism groups and dilation theory. In particular, we know what is the C*-envelope of the semidirect product of one of these algebras by an automorphism.

PAUL SKOUFRANIS, UCLA
Normal Limits of Nilpotents in C-Algebras*

In 1974 Herrero completely classified when a bounded normal operator on a complex, infinite dimensional, separable Hilbert space was a norm limit of bounded nilpotent operators. In this brief talk I will examine the C^*-analog of this problem; that is, given a C^*-algebra $\mathfrak{A}$ and a normal operator $N \in \mathfrak{A}$, when is N a norm limit of nilpotent operators from $\mathfrak{A}$? In particular, I will discuss this problem for von Neumann algebras (based on type decomposition), unital simple purely infinite C*-algebras (which include the Cuntz algebras), and approximately finite dimensional C^*-algebras. It is surprising that Herrero's result generalize to many of these C^*-algebras yet in others this classification problem is incredibly complex.

AHMED SOUROUR, University of Victoria
Semigroups of matrices generated by a unitary orbit

I will discuss some recent - and some not so recent - results about the structure of multiplicative semigroups of matrices generated by a unitary orbit or a similarity orbit of one matrix. The recent results are based on joint work with H. Radjavi.

ROLAND SPEICHER, Saarland University
Sharp bounds for sums associated to graphs of matrices

We provide a simple algorithm for finding the optimal upper bound for sums of products of matrix entries of the form $S(N) := \sum_{j_1,\ldots,j_{2m}=1}^{N} t_{j_1 j_2} t_{j_3 j_4} \cdots t_{j_{2m-1} j_{2m}}$ where some of the summation indices are constrained to be equal. The upper bound is easily obtained from a graph associated to the constraints in the sum.

DILIAN YANG, University of Windsor
The structure of nonself-adjoint 2-graph algebras

A nonself-adoint 2-graph algebra is a unital WOT-closed algebra generated by 2 isometric tuples satisfying some commutation relations. In this talk, we show that such an algebra has a 2×2 lower triangular form, whose 1st column is a slice of its enveloping von Neumann algebra. We will also discuss that, in the case of atomic representations, one could decompose further to obtain a 3×3 lower triangular form, whose $(3,3)$-entry is an analytic 2-graph algebra.

This talk is based on recent joint work with Adam Fuller.