

Workshop on Non-commutative Dynamics and Quantum Probability

Regina, Saskatchewan

May 15-17, 2010

Belinschi, Serban (University of Saskatchewan)

Title: Free infinite divisibility for q -deformations of the classical Gaussian

Abstract: Deformations of "classical" analytic objects have a very long history, and numerous applications/occurrences in various branches of mathematics. One such example is the classical normal distribution: considering its characterization in terms of its orthogonal polynomials (the well-known Hermite polynomials), certain " q -deformations" of these objects (obeying a few rules) can be shown to be orthogonal polynomials for other distributions of interest in analysis and probability.

Probably the earliest such example (which can be traced to a 1893 article of L. G. Rogers from Proc. London Math. Soc.) is the family of q -Hermite polynomials, $-1 \leq q \leq 1$. The distributions with respect to which they form an orthogonal family are called q -Gaussians. While studied by many authors for over a century, it was only towards the end of the twentieth century that the work of Bożejko and Speicher on Generalized Brownian Motions identified a prominent role for q -Gaussians in operator algebras and noncommutative probability in general.

However, the role of those distributions in free probability, despite important work of Shlyakhtenko and other authors, remains rather mysterious. This presentation will discuss one such connection, namely the free infinite divisibility of some q -deformations of the classical Gaussian. The results presented are part of work with M. Anshelevich, M. Bożejko, F. Lehner and R. Speicher.

Brenken, Berndt (University of Calgary)

Title: The C^* -algebra of a Partial Isometry

Abstract: In joint work with Zhuang Niu we consider the universal C^* -algebra of a partial isometry. It was shown decades ago that these operators may be viewed as intractable, nevertheless it is possible to say some things about this C^* -algebra which may be of interest to both operator algebraists and theorists. In particular we relate this C^* -algebra to the universal unital C^* -algebra generated by a contraction, and show it is non-unital, non-exact, and residually finite dimensional. Additionally, we compute its K -theory.

Florichel, Remus (University of Regina)

Title: Pure E_0 -semigroups

Abstract: An E_0 -semigroup $\rho = \{\rho_t\}_{t \geq 0}$ of $\mathcal{B}(H)$ is said to be pure if its tail algebra $\bigcap_{t \geq 0} \rho_t(\mathcal{B}(H))$ reduces to scalars. In this lecture, we discuss a purification procedure for arbitrary E_0 -semigroups, and present various results regarding classification of pure E_0 -semigroups up to conjugacy.

Giordano, Terry (University of Ottawa)

Title: TBA

Abstract: TBA

Jorgensen, Palle (University of Iowa)

Title: Representations of the Cuntz algebras, and some of their applications

Abstract: In multivariable operator theory, the role of representations of the Cuntz relations has gained much attention. In the talk we will show how problems in operator theory, harmonic analysis of fractal measures, in wavelets, signal processing, symbolic dynamics, and in mathematical physics hinge on multivariable operator theory of these representations. I hope to cover joint work with co-authors, Ola Bratteli, Dorin Dutkay, Steen Pedersen, Fred Roush, and K.-H. Kim. Analysis of fractals involves systems of transformations, and their recursive iterations. Geometric notions of selfsimilarity are naturally reflected in the intrinsic selfsimilar nature of the representations. Their invariant measures may be understood from states (via GNS) on the associated Cuntz algebras. The centralizers of appropriately chosen states (KMS) yield intriguing families of AF-algebras (and Bratteli diagrams). Applications. Wavelet theory and signal processing entail digitizing continuous data, and the synthesis, i.e., recreating a picture (or time signal) from encoded data. Algorithms involved are called filter banks, and their spectacular efficiency derives in part from the use of (hidden) self-similarity in the data which is analyzed. This in turn can be understood with the use of representations of Cuntz algebras. They encode relations between operations and are studied as symbols, representation theory. A main tool is intertwining operators between, on one side, the "discrete world" of high-pass/low-pass filters of signal processing, and on the other side, the "continuous world" of wavelets.

Kerr, David (Texas A&M)

Title: Topological entropy and a variational principle for actions of sofic groups

Abstract: Recently Lewis Bowen introduced a notion of entropy for measure-preserving actions of a countable sofic group on a standard probability space admitting a generating partition with finite entropy. I will show how one can use an operator algebra perspective to develop a more general approach to sofic entropy which produces both measure and topological dynamical invariants. One can then establish the variational principle in this context, and I will show how to use it to compute the topological entropy of certain algebraic actions of residually finite groups in terms of the Fuglede-Kadison determinant. This is joint work with Hanfeng Li.

Powers, Bob (University of Pennsylvania)

Title: Type III E_0 -semigroups, or “Where have all the units gone?”

Abstract: The talk concerns an example of a one parameter semigroup of $*$ -automorphisms of $B(H)$ that has no intertwining semigroup of isometries. Recently Izumi and Srinivasan have shown that the example of I constructed twenty years ago can be modified to give a one parameter family of non cocycle conjugate E_0 -semigroups. These examples and preliminary results about their gauge groups is discussed.

Price, Geoffrey (US Naval Academy)

Title: CP-flows and E_0 -semigroups

Abstract: A result of B. V. R. Bhat shows that unital completely positive semigroups of linear maps on $B(H)$ can be dilated to unital semigroups of endomorphisms called E_0 -semigroups. R. T. Powers has made an extensive study of the E_0 -semigroups obtained by dilating the CP-semigroups known as CP-flows. We discuss some of Powers’ theory of CP-flows, along with a result obtained with him on the cocycle conjugacy classes of a family of E_0 -semigroups obtained by dilating CP-flows.

Putnam, Ian (University of Victoria)

Title: K-theory duality and hyperbolicity

Abstract: Kasparov introduced the notion of duality for a pair of C^* -algebras which generalizes Poincare duality for topological spaces. I will present a short discussion and give examples which arise from hyperbolic dynamical systems. (Joint work with J. Kaminker and M. Whittaker.)

Shalit, Orr (University of Waterloo)

Title: Subproduct systems and dilation theory: comparing the old and the new

Abstract: Dilation theory of semigroups of completely positive maps has some close connections to the classical dilation theory of semigroups of contractions. It has been recently discovered that the dilation theory of semigroups of completely positive maps also has some striking differences from the dilation theory of contractions. Both the similarities and the differences between the theories can be explained within the framework of subproduct systems. The talk is based on joint work with Baruch Solel, and also some more recent joint work with Michael Skeide.

Singh, Dinesh (University of Regina)

Title: Signatures of Noncommutative Geometry in Muon Decay for Nonsymmetric Gravity

Abstract: It is shown how to identify potential signatures of noncommutative geometry within the decay spectrum of a muon in orbit near the event horizon of a microscopic Schwarzschild black hole. This possibility follows from a re-interpretation of J.W. Moffat's nonsymmetric theory of gravity, first published in Phys. Rev. D 19, 3554 (1979), where the antisymmetric part of the metric tensor manifests the hypothesized noncommutative geometric structure throughout the manifold. It is further shown that for a given sign convention, the predicted signatures counteract the effects of curvature-induced muon stabilization predicted by D. Singh and N. Mobed in Phys. Rev. D 79, 024026 (2009). While it is unclear whether evidence for noncommutative geometry may become observable anytime soon, this approach at least provides a useful direction for future quantum gravity research based on the ideas presented here.

Szafraniec, Franciszek (Jagiellonian University)

Title: Dilations as a fulfilment of the reproducing kernel property

Abstract: I intend to clarify the statement in the title under the circumstances of Hilbert C^* -modules. As a kind of extra an attempt at defining the creation operator in this context is given.