

The Sixth Northwest Functional Analysis Seminar
Schedule

Saturday, April 11th

- 7:00–9:00 **Breakfast**
- 9:00–9:30 Phillips (Variations on the theme, Index = Winding Number)
- 9:40–10:10 Kim (Strict convexity and smoothness on iterated intersection bodies)
- 10:10–10:40 **Coffee**
- 10:40–11:10 Tahmasebi (Geometric properties on Banach spaces associated to hypergroups)
- 11:20–11:50 Tanko (Approximate indicators for closed subgroups of locally compact groups)
- 12:00–14:00 **Lunch**
- 14:00–14:30 Raouafi (Pseudospectra and holomorphic functions of matrices)
- 14:40–15:10 Killough (Correspondences for Smale Spaces)
- 15:10–15:40 **Coffee**
- 15:40–16:10 Chen (Property T for locally compact quantum groups)
- 16:10–17:00 Round Table

Sunday, April 12th

- 7:00–9:00 **Breakfast**
- 9:00–9:30 Williamson (A Cuntz-Pimsner Algebra Associated with a Substitution Tiling)
- 9:40–10:10 Girard (Quantum information theory and conversion witnesses)
- 10:10–10:40 **Coffee**
- 10:40–11:10 Laca (Perron-Frobenius for commuting matrices)
- 12:00–14:00 **Lunch, wrap up (check out by noon)**

North West Functional Analysis Seminar (NWFAS)
April 11 and 12, 2015

ABSTRACTS

(in alphabetic order by speaker surname)

Speaker: **Xiao Chen** (University of Alberta)

Title: *Property T for locally compact quantum groups.*

Abstract: In my talk, I will give some equivalent formulations of property T for a general locally compact quantum group \mathbb{G} , in terms of the full quantum group C^* -algebras $C_0^u(\widehat{\mathbb{G}})$ and the $*$ -representation of $C_0^u(\widehat{\mathbb{G}})$ associated with the trivial unitary corepresentation (that generalize the corresponding results for locally compact groups). Moreover, if \mathbb{G} is of Kac type, I will show that \mathbb{G} has property T if and only if every finite dimensional irreducible $*$ -representation of $C_0^u(\widehat{\mathbb{G}})$ is an isolated point in the spectrum of $C_0^u(\widehat{\mathbb{G}})$ (this also generalizes the corresponding locally compact group result). In addition, I will give a way to construct property T discrete quantum groups using bicrossed products.

Speaker: **Mark Girard** (University of Calgary)

Title: *Quantum information theory and conversion witnesses.*

Abstract: The mathematics of quantum mechanics is formulated in the language of functional analysis. States of a quantum system are represented as positive operators on a Hilbert space. Quantum processes are given by completely positive linear maps on this space of operators. Given a limited set of quantum processes, one question that arises is: Can we get from one state to another? In this talk, I will introduce the concept of conversion witnesses that determine whether one state can be converted into another using only a certain class of such maps. This is of particular interest in entanglement theory, where quantum entanglement is a useful resource in various applications (such as quantum cryptography and quantum computation). I will present a new conversion witness for special class of maps related to entanglement in quantum systems; namely, those maps that preserve positivity under partial transposition (PPT).

Speaker: **Brady Killough** (Mount Royal University)

Title: *Correspondences for Smale Spaces.*

Abstract: Smale spaces make up a class of hyperbolic dynamical systems which are (hopefully) of interest to operator algebraists. In particular, from a Smale space one can construct several C^* -algebras. The basic building blocks of Smale space theory are the shifts of finite type (SFTs), in which case the C^* -algebras are AF with obvious Bratteli diagrams. Computing the K-theory of these AF algebras reproduces the dimension group of the SFT. As such, the K-theory of a C^* -algebra computed from a Smale space can be seen as a generalization of a dimension group for a SFT. In this talk we introduce a notion of generalized morphisms between Smale spaces, which we call correspondences. We show that correspondences extend the notion of finite equivalence for SFTs to the general Smale space setting, and hence provide a framework to extend notions such as shift equivalence from SFTs to Smale spaces. We also discuss the functoriality of the construction of the C^* -algebras, as well as the maps induced by correspondences on

another generalization of the dimension group: Putnam's homology theory for Smale spaces. This is joint work with Robin Deeley and Michael Whittaker.

Speaker: **Jaegil Kim** (University of Alberta)

Title: *Strict convexity and smoothness on iterated intersection bodies.*

Abstract: A classical theorem of H. Busemann states that the intersection body of a symmetric convex body is convex. In this talk we discuss how much of convexity is improved under the intersection body operation. We provide a quantitative version of Busemann's theorem in terms of modulus of convexity and give several results about convexity and smoothness on the iterated intersection bodies.

Speaker: **Marcelo Laca** (University of Victoria)

Title: *Perron-Frobenius for commuting matrices and equilibrium for higher rank graphs.*

Abstract: The C^* -algebras of higher rank graphs exhibit equilibrium states only for a specific combination of a 'preferred' dynamics and a 'critical' inverse temperature. We will discuss a version of Perron-Frobenius theory suitable for commuting matrices and use it to analyze the existence and uniqueness conditions and to classify the type III factors that arise as extremal KMS states for the preferred dynamics at the critical inverse temperature. This generalizes work of Dilian Yang for k -graphs with one vertex and is based on my joint work with Astrid an Huef, Iain Raeburn and Aidan Sims, and with Nadia Larsen, Sergey Neshveyev, Aidan Sims and Sam Webster.

Speaker: **John Phillips** (University of Victoria)

Title: *Variations on the theme, Index = Winding Number.*

Abstract: We begin with the original theorem of Gohberg-Krein, and proceed first to the generalizations of M. Lesch and Phillips-Raeburn. In these cases the index is a real number. We then describe the the most recent continuous centre-valued winding "number" index theorem of Phillips-Raeburn. Time permitting we show how these often give rise to "continuous" fibrations of Fredholm operators and a corresponding fibrations of their indexes and winding numbers.

Speaker: **Samir Raouafi** (University of Regina)

Title: *Pseudospectra and holomorphic functions of matrices.*

Abstract: Pseudospectra are a useful tool for analyzing non-normal matrices, furnishing information well beyond that provided by classical eigenvalue analysis. It is well known that the pseudospectra of a matrix more or less determine its norm. More precisely, if A and B are $n \times n$ matrices with identical pseudospectra, then $1/2 \leq \|A\|/\|B\| \leq 2$. What about higher powers or other functions such as exponentials? I shall discuss this question in the talk. (This is joint work with Thomas Ransford.)

Speaker: **Nazanin Tahmasebi** (University of Alberta)

Title: *Some geometric properties on Banach spaces associated to hypergroups.*

Abstract: A hypergroup is a locally compact Hausdorff space equipped with a convolution product which maps any two points to a probability measure with a compact support. Hypergroups generalize locally compact groups in which the above convolution reduces to a point mass measure. It was in the 1970's that Dunkl, Jewett and Spector began the study of hypergroups.

Let K be a hypergroup with a Haar measure. In this talk I construct two correspondences: one, between closed Weil subhypergroups and certain left translation invariant w^* -subalgebras of $L_\infty(K)$, and another between compact subhypergroups and a specific subclass of the class of left translation invariant C^* -subalgebras of $C_0(K)$. By the help of these two characterizations, I extract some results about invariant complemented subalgebras of $L_\infty(K)$ and $C_0(K)$.

Speaker: **Zsolt Tanko** (University of Alberta)

Title: *Approximate indicators for closed subgroups of locally compact groups.*

Abstract: We define the notion of an approximate indicator for a closed subgroup H of a locally compact group G and show that such nets exist under rather weak hypotheses on G and H . These nets yield invariant projections onto $VN_H(G)$, the von Neumann algebra generated in $VN(G)$ by the operators implementing left translation by elements of H . The easy availability of approximate indicators allows us to obtain results on the existence and non-existence of invariant projections onto invariant W^* -subalgebras of $VN(G)$. In particular, we exhibit groups G and H such that $VN_H(G)$ fails to be invariantly complemented in $VN(G)$. A class of locally compact groups whose Fourier algebras are not operator biflat will also be discussed.

Speaker: **Peter Williamson** (University of Victoria)

Title: *A Cuntz-Pimsner Algebra Associated with a Substitution Tiling.*

Abstract: A Cuntz-Pimsner algebra is a quotient of a generalized Toeplitz algebra. It is completely determined by a C^* -correspondence, which consists of a right Hilbert A -module, E , and a $*$ -homomorphism from the C^* -algebra A into $L(E)$, the adjointable operators on E . Some familiar examples of C^* -algebras which can be recognized as Cuntz-Pimsner algebras include the Cuntz algebras, Cuntz-Krieger algebras, and crossed products of a C^* -algebra by the integers. In this talk, I will discuss how this construction can be applied to a dynamical system of a substitution tiling, and outline the method for computing the associated K -groups.