ABSTRACTS OF TALKS OF 15th WORKSHOP:
NON-COMMUTATIVE HARMONIC ANALYSIS,
23-29.09.2012, Będlewo, Poland

1. **Helene Airault (Université de Picardie Jules Verne, Insset & LAMFA)**

Vector fields and Laplacians related to the infinitesimal representation of the symplectic group

Abstract: For the infinitesimal holomorphic representation of $Sp(2n)$, the symplectic group of order n, into the set $\mathcal{D}_n$ of symmetric complex $n \times n$ matrices, let $\rho(v) = L(v) + \beta(v)\, I$, the first order differential operator on $\mathcal{D}_n$ associated to the element v in the Lie algebra $\mathcal{G}$ of $Sp(2n)$. We show the existence of a basis (e_k) in the Lie algebra $\mathcal{G}$ and of constants (a_k) such that the operator $\sum_k a_k \rho(e_k)^2$ is equal to the multiplication by a constant. We discuss the operators on $\mathcal{D}_n$ of the form $\sum_k a_k \rho(e_k)\overline{L(e_k)}$ where $\overline{L(e_k)}$ is the complex conjugate of $L(e_k)$ and show that the Kählerian Laplacian on $\mathcal{D}_n$ is expressed as $\sum_k a_k L(e_k)\overline{L(e_k)}$. The imaginary part of the vector field $\sum_k a_k \beta(e_k)\overline{L(e_k)}$ is divergence free for the measure of the holomorphic representation. This extends for the symplectic group, identities obtained for the Poincaré disk in [1], [2].

References:

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[3] F. A. Berezin, Quantization in complex symmetric spaces, *Izv. Akad. Nauk SSSR* **39** (1975) 341-379.
[4] H. Airault, Identities for vector fields in the infinitesimal representation of the symplectic group into the Siegel disk of complex symmetric matrices. *Bull. Sci. Math. (2012)*

2. **Daniel Alpay (Ben-Gurion University of the Negev)**

Non commutative linear system theory and white noise space theory

Abstract: The theory of linear systems has been extended to the stochastic setting using Hida's white noise space theory and Kondratiev's space of stochastic distributions in joint work with David Levanony. Using the already known definition of the non commutative white noise space we introduce a non commutative counterpart to the Kondratiev space, which allows us to develop a theory of non commutative stochastic linear systems. This is joint work with Guy Salomon.

3. **Hiroshi Ando (Kyoto University)**

Ultraproducts of von Neumann algebras

Abstract: We study the non-tracial ultraproduct of Neumann algebras. There are at least two approaches, one given by A. Ocneanu and the one by U. Groh-Y. Raynaud. We explain how they are related, and show some properties of the modular operator of ultrapower states. Moreover, we answer a question of Y. Ueda about the relative commutant of a full factor M inside its Ocneanu ultrapower M^ω. (Joint work with Uffe Haagerup)

4. **Abdelhamid Boussejra (University Ibn Toufail, Morocco)**

The Hua operators on Homogeneous Line Bundles on Bounded Symmetric Domains of Tube Type

Abstract: Let $\mathcal{D} = G/K$ be a bounded symmetric domain of tube type. We show that the image of the Poisson transform on the degenerate principal series representation of G attached to the Shilov boundary of $\mathcal{D}$ is characterized by a K–covariant differential operator on a homogeneous line bundle on $\mathcal{D}$.

5. **Marek Bożejko (University of Wrocław)**

New non-commutative Gaussian processes and relation with random matrices and positive definite function on permutation (Coxeter) groups

Abstract: We consider new classes of non-commutative Gaussian processes related to the random matrices model done by Bryc,Dembo,Jiang for Markov matrices. They are related to the free product of free Gaussian and classical Gaussian processes . New positive definite functions on permutation (Coxeter) groups will be also done. They are related to recent paper of A.Buchholz:("New interpolation between classical and free Gaussian processes") and our paper with Ś.Gal and W.Młotkowski. Some interesting combinatorial formulas will be also presented.

6. **Jacek Brodzki (University of Southampton)**

Subspaces of groups and generalised Pimsner-Voiculescu extensions

Abstract: A metric subspace X of a discrete group G carries a natural C*-algebra induced from the (right) reduced C*-algebra of the group. When the complement of X is not coarsely dense in G, there exists a homomorphism from the C*-algebra of X to the reduced C*-algebra of G which is a part of a C*-algebra extension. Extensions of this type generalise those studied by Pimsner and Voiculescu in the case of free groups and groups acting on trees. I will illustrate this construction in a number of cases, including almost-invariant subspaces of groups, amalgamated free products, and others. An important motivation for this study is the problem of computing the K-theory of the reduced C*-algebra of G and I will indicate how our construction might help with that. This is joint work with Graham A Niblo and Nick Wright.

7. **Zdzisław Burda (Jagiellonian University, Kraków)**

Universal microscopic correlation functions for products of independent Ginibre matrices

Abstract: We consider the product of n complex non-Hermitian, independent random matrices, each of size $N \times N$ with independent identically distributed Gaussian entries (Ginibre matrices). The joint probability distribution of the complex eigenvalues of the product matrix is found to be given by a determinantal point process as in the case of a single Ginibre matrix, but with a more complicated weight given by a Meijer G-function depending on n. Using the method of orthogonal polynomials we compute all eigenvalue density correlation functions exactly for finite N and fixed n. They are given by the determinant of the corresponding kernel which we construct explicitly. In the large-N limit at fixed n we first determine the microscopic correlation functions in the bulk and at the edge of the spectrum. After unfolding they are identical to that of the Ginibre ensemble with $n = 1$ and thus universal. In contrast the microscopic correlations we find at the origin differ for each n and generalise the known Bessel-law in the complex plane for $n = 2$ to a new hypergeometric kernel ${}_0F_{n-1}$.

8. **P.K. Das (Indian Statistical Institute, Kolkata)**

Optimal Control of Two-level Pauli Spin System with Weighted Energy Cost Functional

Abstract: This paper describes optimal control of quantum mechanical system with weighted energy cost function by representing the unitary operator in terms of the projection operators of the Hamiltonian of the control system. The admissible Hilbert space of controllers of the system is expressed as the direct sum of the Hilbert spaces corresponding to the weights of the controllers of the quantum mechanical system. The optimal control which steers the state of the quantum mechanical system from the initial state to a target state, minimizing the weighted energy, is formulated in terms of the controllability operator of the system.As an example, the weighted optimal control problem of the time evolution of quantum spin of Pauli two-level system subjected to an external field with the minimum energy function is illustrated and formulated in terms of the quantum spin up and spin down states of the Pauli two-level system.

9. **Tim de Laat (University of Copenhagen)**

Approximation properties of noncommutative Lp-spaces associated with lattices in Lie groups

Abstract: In 2010, Lafforgue and de la Salle gave examples of noncommutative L^p-spaces without the operator approximation property (OAP), and hence, without the completely bounded approximation property (CBAP). To this purpose, they introduced the property of completely bounded approximation by Schur multipliers on S^p, denoted $\mathrm{AP}^{\mathrm{Schur}}_{p,cb}$, and proved that for $p \in [1, \frac{4}{3}) \cup (4, \infty]$, the groups $\mathrm{SL}(n, \mathbb{Z})$ for $n \geq 3$ do not have the $\mathrm{AP}^{\mathrm{Schur}}_{p,cb}$. Since for $p \in (1, \infty)$ the $\mathrm{AP}^{\mathrm{Schur}}_{p,cb}$ is weaker than the Approximation Property of Haagerup and Kraus (AP), these groups were also the first examples of exact groups without the AP. Recently, in a joint work with Uffe Haagerup, we showed that $\mathrm{Sp}(2, \mathbb{R})$ does not have the AP, without using the $\mathrm{AP}^{\mathrm{Schur}}_{p,cb}$. In this talk, I will explain that $\mathrm{Sp}(2, \mathbb{R})$ does not have the $\mathrm{AP}^{\mathrm{Schur}}_{p,cb}$ for $p \in [1, \frac{12}{11}) \cup (12, \infty]$. It follows that a large class of noncommutative L^p-spaces does not have the OAP or CBAP.

10. **Santanu Dey (Indian Institute of Technology Bombay)**

Repeated interaction model with a subprocess

Abstract: Using a scheme involving a lifting of a row contraction we introduce a toy model of repeated interactions between quantum systems. In this model there is an outgoing Cuntz scattering system involving two wandering subspaces. We associate to this model an input/output linear system which leads to a transfer function. This transfer function is a multi-analytic operator, and we show that it is inner if we assume that the system is observable. Finally it is established that transfer functions coincide with characteristic functions of associated liftings.

11. **Wiktor Ejsmont (University of Wrocław)**

Characterizations of some free random variables

Abstract: I will speech about Laha-Lukacs properties of random variables (noncommutative processes). I prove that some families of free Meixner distributions can be characterized by the conditional moments of polynomial functions of degree 3. I also show that this fact has consequences in describing some free L´evy processes. The proof relies on a combinatorial identity.

12. **Rachid El Harti (University Hassan I, Settat)**

Profinite pro-C*-algebras and pro-C*-algebras of profinite groups

Abstract: We define the profinite completion of a C*-algebra, which is a pro-C*-algebra, and we define the pro-C*-algebra of a profinite group. We show that the continuous representations of the pro-C*-algebra of a profinite group correspond to the unitary representations of the group which factor through a finite group. We define natural homomorphisms from the C*-algebra of a locally compact group and its profinite completion to the pro-C*-algebra of the profinite completion of the group. We give some conditions for injectivity or surjectivity of these homomorphisms, but an important question remains open.

13. **Gero Fendler (University of Vienna)**

Aspects of Uncertainty: Eigenfunctions of the Fourier Transform with small Support

Abstract: For an Abelian group the uncertainty principle gives restrictions on the support of a function and the support of its Fourier transform. This is interresting even in the case of finite cyclic groups. In this case the the group and its dual can be identified so that the Fourier transform becomes a unitary operator. For prime order we shall construct a basis of the respective eigenspaces such that the elements have smallest possible support.

14. **Uwe Franz (Université de Franche-Comté, Besançon)**

Heat semigroups on compact quantum groups

Abstract: We try to find analogues of the heat semigroup on compact quantum groups. We develop a method for classifying heat semigroups on compact quantum groups of Kac type that are invariant under the adjoint action. We apply this method to the free orthogonal quantum group O_N^+ and the free permutation quantum group S_N^+. Joint work with Anna Kula and Fabio Cipriani.

15. **Malte Gerhold (Ernst-Moritz-Arndt-Universität Greifswald)**

Finite dimensional subproduct systems

Abstract: We will reduce the question, which sequences of dimensions are possible for a finite dimensional subproduct systems of Hilbert spaces, to a purely combinatorical question related to the number of words not containing certain subwords. To this end, we introduce the notion of "word systems", which are a kind of analogue to subproduct systems, where Hilbert spaces are replaced by sets and tensor products are replaced by cartesian products. We will prove that for a given sequence of natural numbers, there exists a subproduct system with this sequence of dimensions iff there exists a word system with this sequence of cardinalities.

16. **Uffe Haagerup (University of Copenhagen)**

Approximation properties for groups and von Neumann algebras

Abstract: This talk is about recent advances concerning approximation properties for groups and group von Neumann algebras. In 1994 Jon Kraus and I introduced a new approximation property (AP) for locally compact groups and we proved that for dicrete groups AP is equivalent to the property W^*-OAP of Effros and Ruan for the group von Neumann algebra. Recently Vincent Lafforgue and Michael de la Salle has proved that $SL(n, \mathbb{R})$ and $SL(n, \mathbb{Z})$ does not have the property AP for $n \geq 3$. In a joint work with Tim de Laat we extend their result by proving that Sp(2,R) and more generally all simple connected Lie groups of real rank ≥ 2 and with finite center do not have the AP. The proof uses some careful estimates of Jacobi polynomials obtained in collaboration with Henrik Shlichtkrull.

17. **Uffe Haagerup (University of Copenhagen)**

TBA

Abstract:

18. **Jan Hamhalter (Czech Technical University)**

Affiliated subspaces, states, and structure of von Neumann algebras - joint work with E.Turilova (Kazan Federal University)

Abstract: The study of classes of subspaces in inner product spaces that generalize properties of closed subspaces of a Hilbert space has shown interesting connections between order structure, measure theoretic structure, and metric completeness. Classical result in this direction is the Amemiya-Araki theorem saying that an inner product space S is complete if and only if orthogonally closed and splitting subspaces of S coincide. (A closed subspace X of an inner product space S is called orthogonally closed (resp. splitting), if $X = X^{\perp\perp}$ (resp. if $S = X + X^{\perp}$)). Measure theoretic completeness criterion due to J.Hamhalter and P.Pták states that a separable inner product space S is complete if and only if there is a nonzero σ-additive probability measure on the structure of all orthogonally closed subspaces. New insight in this field was given by A.Sherstnev and E.Turilova who initiated the study of subspace classes affiliated with von Neumann algebras. We present new results in this area illustrating interplay between the structure of the underlying von Neumann algebra and the properties of affiliated subspace classes. We generalize both Amemyia-Araki theorem and measure theoretic completeness criterion and demonstrate that new phenomena can occur for algebras different from Type I factors. For example, we show that any infinite von Neumann algebra admits an affiliated subspace for which all relevant subspace classes are different. We provide characterization of important subspace classes for the GNS representation space corresponding to a faithful normal state or weight on von Neumann algebra. Among others we show in this connection that σ- finite von Neumann algebra is infinite if and only if for each GNS representation space corresponding to a faithful normal state there is an affiliated subspace that is not closed and such that the corresponding ideal in the commutant is strongly closed. The question of automatic completeness of affiliated subspaces and GNS representation space is also considered.

19. **Takahiro Hasebe (Kyoto University)**

Infinitesimals of natural independences

Abstract: Type B freeness was defined by Biane, Nica and Goodmann '03 in the context of combinatorics of non-crossing partitions. Belinschi and Shlyakhtenko proved that type B freeness appears as a first order derivative of freeness. In this talk, the infinitesimal aspect is extended to higher order derivatives and is applied to other independences: tensor, Boolean and monotone ones.

20. **Jaeseong Heo (Hanyang University)**

Asymptotic derivations on C^*–algebras

Abstract: We introduce a notion of asymptotic derivations on C^*–algebras, which naturally arises from a one-parameter group of automorphisms. We give an example which can not induce an asymptotic derivation and an example which shows that the limit of an asymptotic derivation is a derivation, but it is not induced by a derivation. We show that every asymptotic derivation on finite dimensional C^*–algebras is induced by an inner derivation. We prove that any asymptotic derivation on commutative von Neumann algebras have a strong limit zero. An asymptotic derivation on the hyperfinite II_1–factor given by some one-parameter group of automorphisms can be induced by a (inner) derivation.

21. **Takeshi Hirai (Kyoto)**

Gelfand-Raikov representations of Coxeter groups associated to positive definite norm functions

Abstract: Let (W, S) be a finite or infinite Coxeter group and, for a fixed $s \in S$, an s-norm $|\sigma|_s$ ($\sigma \in W$) is defined as $|\sigma|_s = 1$ or 0 according as a reduced expression of σ contains s or not. As is proved by Bożejko and Speicher, for a set $Q = (q_s)_{s\in S}$ of constants $0 \le q_s \le 1$ and a subset $F \subset S$, the following functions on W

$$f_{Q,F}(\sigma) := \prod_{s\in F} q_s^{|\sigma|_s} \quad \text{and} \quad f_Q(\sigma) := f_{Q,S}(\sigma) = \prod_{s\in S} f_{q_s,s}(\sigma)$$

are positive definite. We discuss the structure of Gelfand-Raikov representations associated to these non-central positive definite functions $f_{Q,F}$. Are they irreducible or factorial ?

22. **Robin Hudson (Loughborough University)**

A unitary operator determined by its subdiagonal part

Abstract: We consider unitary operators on the Hilbert space $L^2([a, b[)$ of the form $U = I + F + G$ where I is the identity operator and F and G are integral operators whose kernels f and g are such that $f(x, y) = 0$ on the subdiagonal $(x, y) : a < y < x < b$ whereas $g(x, y) = 0$ on the superdiagonal $(x, y) : a < x < y < b$. When g is known, the condition that U is coisometric gives a system of equations which determine f; isometry gives a different system. In a particular case, the two solutions for f coincide. In this case the second quantization of the unitary operator U is related to the Fock space quantum Lévy area.

23. **Anna Jencova (Slovak Academy of Sciences, Bratislava)**

Generalized POVMs and measurements on quantum channels

Abstract: Let $\mathcal{A}$ be a finite dimensional C^* algebra and let $\mathcal{S}(\mathcal{A})$ be the set of density operators. Let $K \subseteq \mathcal{S}(\mathcal{A})$ be a convex subset. A measurement on K is defined as an affine mapping from K to the set of probability distributions on the set of outcomes. If K is a section of $\mathcal{S}(\mathcal{A})$ by a vector subspace, then any measurement on K is given by a so-called generalized POVM, but in general, there exist more equivalent generalized POVMs giving the same outcome probabilities and hence defining the same measurement. The set of quantum channels $B(\mathcal{H}) \to B(\mathcal{K})$ for finite dimensional $\mathcal{H}$ and $\mathcal{K}$ can be identified with a section of $\mathcal{S}(\mathcal{K} \otimes \mathcal{H})$, via the Choi isomorphism. In this case, the generalized POVMs are the so-called quantum 1-testers. In a similar way, generalized POVMs can be used to describe measurements on general quantum protocols. We also find conditions for extremality of generalized POVMs and the corresponding measurements and apply the results to quantum channels.

24. **Un Cig Ji (Chungbuk National University)**

Annihilation and Creation Derivatives on Operators on q-Fock Space

Abstract: We study the q-creation and q-annihilation derivatives of operators on q-Fock space and then the derivatives are ϕ-derivations with respect to the q-Wick product, where ϕ is a $*$-homomorphism with respect to the q-Wick product.

25. **Dorota Kępa (Maria Curie-Skłodowska University, Lublin)**

Coarse-graining and almost sure uniqueness of Gibbs fields on graphs

Abstract: There is considered a countable graph each vertex of which is given a Polish space, whereas its edges bear continuous functions (potentials) of two variables taking values in the spaces of vertices incident to the edge. Under certain conditions, these objects define a family of Gibbs random fields on the product space. One of the main questions herein is the uniqueness of such fields which often occurs if the potentials are small – if all of them equal zero there exists only one Gibbs field. The problem gets much more complicated if the potentials are random and unbounded. We consider exactly such a case assuming that the probability distribution of the potentials satisfies a certain condition. By means of a "coarse graining" technique we prove the almost sure uniqueness of Gibbs fields in this case. The key idea of the technique is to pass to the graph the vertices of which are certain subgraphs of the initial graph (we call them ?-animals), whereas the edges bear only "small" potentials.

26. **Bartosz Kwaśniewski (University of Białystok)**

On transfer operators for C*-dynamical systems

Abstract: We discuss the question of existence, uniqueness and basic structure of non-degenerate transfer operators for endomorphisms of (not necessarily unital) C^*-algebras. In particular, we give necessary and sufficient conditions for existence of transfer operators for commutative systems, discuss their form for endomorphisms of $B(H)$, and present a new (not classical) "non-commutative shift" on the core subalgebra of a graph C^*-algebra whose crossed product yields the graph algebra.

27. **Seung-Hyeok Kye (Seoul National University)**

On the structural physical approximation conjecture

Abstract: The structural physical approximation of an entanglement witness W is the positive one which is nearest to W on the line segment between W and the identity. The SPA conjecture claims that if W is optimal then the SPA of W is separable.

We introduce the notions of positive and copositive types for entanglement witnesses, depending on the distance to the positive part and copositive part. An entanglement witness W is of positive type if and only if its partial transpose W^Γ is of copositive type. We show that if the SPA of W is separable then W should be of copositive type, and the SPA of W^Γ is never separable unless W is of both positive and copositive type. This shows that the SPA conjecture is meaningful only for those of copositive type. We also provide examples to show that the SPA conjecture fails even for the case of copositive types. This talk is based on a joint work with Kil-Chan Ha.

28. **Romuald Lenczewski (Wrocław University of Technology)**

Limit distributions of the ensemble of Gaussian symmetric random blocks

Abstract: We study limit joint distributions of the ensemble of symmetric blocks of independent Gaussian random matrices with block-identical variances (Gaussian Symmetric Block Ensemble). Our approach is based on the concept of noncommutative independence called matricial freeness which reminds freeness, but describes the asymptotics of symmetric blocks rather than that of the whole matrices. The main result can be viewed as a block refinement of Voiculescu's asymptotic freeness of the ensemble of independent Gaussian random matrices. We also show that this concept provides a unified framework for studying the asymptotic distributions of sums and products of independent Gaussian random matrices, including random matrices of Wishart type and random matrix models for free Bessel laws.

29. **Andrzej Łuczak (University of Łódź)**

Quantum Blackwell-Sherman-Stein theorem and related results

Abstract: We investigate comparing quantum statistical models in the general operator algebra framework in arbitrary dimension, generalizing thus results obtained so far in finite dimension, and for the full algebra of operators on a Hilbert space. In particular, the quantum Blackwell-Sherman-Stein theorem is obtained, and informational subordination of quantum information structures is characterized.

30. **Eugene Lytvynov (Swansea University)**

Determinantal point processes with J-Hermitian correlation kernels

Abstract: Let X be a locally compact Polish space and let m be a reference Radon measure on X. Let Γ_X denote the configuration space over X, i.e., the space of all locally finite subsets of X. A point process on X is a probability measure on Γ_X. A point process μ is called determinantal if its correlation functions have the form $k^{(n)}(x_1, \dots, x_n) = \det[K(x_i, x_j)]_{i,j=1,\dots,n}$. The function $K(x, y)$ is called the correlation kernel of the determinantal point process μ. Assume that the space X is split into two parts: $X = X_1 \sqcup X_2$. A kernel $K(x, y)$ is called J-Hermitian if it is Hermitian on $X_1 \times X_1$ and $X_2 \times X_2$, and $K(x, y) = -\overline{K(y, x)}$ for $x \in X_1$ and $y \in X_2$. We derive a necessary and sufficient condition of existence of a determinantal point process with a J-Hermitian correlation kernel $K(x, y)$.

31. **Adam Majewski (University of Gdańsk)**

On the structure of positive maps

Abstract: A natural and intrinsic characterization of the structure of positive maps is given. This seems to be a partial answer to an old open problem studied both in Quantum Information and Operator Algebras. Our arguments are based on the concept of exposed points and links between tensor products and mapping spaces. The detailed analysis of low dimensional case as well illustrative examples will be presented.

32. **Naofumi Muraki (Iwate Prefectural University)**

Twisted independence for noncommutative random variables

Abstract: In this talk, we introduce a new example of independence in noncommutative probability theory, which we call twisted independence. By the word noncommutative probability space we mean a pair of unital *- algebra and state. Given any family of noncommutative probability spaces, we construct a certain product state on the free product algebra which we call twisted product state. The twisted product induces the twisted independence. Here the word independence means a universal clculation rule for mixed moments of noncommutative random variables in the sense of R. Speicher but with some modification. The construction was inspired by the twisted canonical anticommutation relations of W. Pusz.

33. **Ivan Nourdin (Université Henri Poincaré, Nancy 1)**

Chaos and the Fourth Moment

Abstract: In 2005, Nualart and Peccati proved a very surprising central limit theorem for multiple stochastic integrals with respect to a classical Brownian motion B: if X_k is a (variance-normalized) sequence of qth Wiener-Itô integrals (for fixed $q \leq 1$), then $X_k \to N(0,1)$ in distribution if and only if $E[X_k^4] \to 3$. That is to say: in a fixed order of Wiener chaos, convergence to a normal distribution is equivalent to the a priori

dramatically weaker convergence of the fourth moment alone. In this talk, I will discuss extensions of this theorem to the case where the classical Brownian motion B is replaced by a q-Brownian motion. This is joint work with Aurélien Deya and Salim Noreddine.

34. **Maciej Nowak (Jagiellonian University, Kraków)**

Spectral shock waves in dynamical random matrix theories

Abstract: We obtain several classes of non-linear partial differential equations for various random matrix ensembles undergoing Brownian type of random walk. These equations for spectral flow of eigenvalues as a function of dynamical parameter ("time") are exact for any finite size N of the random matrix ensemble and resemble viscid Burgers-like equations known in turbulence. In the limit of infinite size of the matrix, these equations reduce to complex inviscid Burgers equations, proposed originally by Voiculescu in the context of free processes. We identify spectral shock waves for these equations in the limit of the infinite size of the matrix, and then we solve exact, finite N nonlinear equations in the vicinity of the shocks, obtaining in this way universal, microscopic scalings equivalent to Airy, Bessel and cuspoid kernels.

35. **Nobuaki Obata (Tohoku University)**

Localization of quantum walks on spidernets

Abstract: A spidernet is a graph obtained from a rooted tree by suitably adding large cycles in each stratum defined by the distance from the root. The free Meixner distribution appears as the spectral distribution of a spidernet [1], where the quantum probabilistic techniques are applied effectively [2]. It is well known that the spectrum of a graph is related to many properties of random walks. In this talk, we focus on the so-called Grover walk, a quantum extension of a random walk, on a spidernet and discuss its localization in terms of the spectrum. We will see that a spidernet has an interpolating property of the 2-dimensional lattice and a homogeneous tree [3].

References:

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[2] A. Hora and N. Obata: Quantum Probability and Spectral Analysis of Graphs Springer, 2007.
[3] N. Konno, N. Obata and E. Segawa: Localization of the Grover walks on spidernets and free Meixner laws, arXiv:1206.4422 (June 2012)

36. **Carlos Vargas Obieta (Universität des Saarlandes)**

Applications of operator-valued free probability to random matrix problems

Abstract: We summarize the most recent techniques for the treatment of random matrix ensembles (most of them arising from models in Wireless Communications) using Voiculescu's Operator-valued free probability. In particular,

we show how Dykemas' S-transform approach to operator-valued Free Multiplicative Convolution allows to treat a new large class of ensembles. This is joint work with Serban Belinschi, Roland Speicher and John Treilhard.

37. **Izumi Ojima (Research Institute for Mathematical Sciences, Kyoto University)**

Unification of four interactions in composition series

Abstract: A new scheme is proposed for unifying the four interactions governing nature, i.e., strong, weak, electromagnetic and gravitational ones, based on the triangular matrix features of the coupling scheme which constitutes mathematically a composition series of the characteristic dynamical laws and their underlying stabilized hierarchical domains.

38. **Adam Paszkiewicz (University of Łódź)**

Projections in a Hilbert space, solution of Amemiya-Ando conjecture, maximal measurements

Abstract:

39. **Karol Penson (Université Pierre et Marie Curie, Paris 6)**

Rational Raney distributions and Mellin transform with some bearings on free probability

Abstract: The Hausdorff moment problem for moments that are a generalization of Catalan numbers, the so called Raney numbers, defined as $A_n(p,r) = \frac{r}{pn+r}\binom{pn+r}{n}$, $n = 0, 1, ...$, is solved for rational values of $p > 1$ and arbitrary $r > 0$. Employing the method of the inverse Mellin transform explicit forms of all solutions are furnished. We determine the condition on p and r for which the resulting solutions are probability distributions. As a function of parameters these probability distributions constitute generalizations of both Marchenko Pastur and Wignesr's semicircle distributions. As a consequence for free probability, we provide close forms for the multiplicative free rational roots and free rational powers of the Marchenko-Pastur distribution. In particular, the free square root of Marchenko-Pastur distribution turns out to be an elementary function.

Joint work with W. Młotkowski (Wrocław) and K. Życzkowski (Cracow).

40. **Jesse Peterson (Mathematics Department, Vanderbilt. University)**

Stabilizers of ergodic actions of lattices and commensurators

Abstract: A strong generalization of the Margulis Normal Subgroup Theorem, due to Stuck and Zimmer, states that any properly ergodic probability measure-preserving action of an irreducible lattice in a center-free semisimple Lie group with all simple factors of higher-rank is essentially free. I will present a similar result generalizing the Creutz-Shalom Normal Subgroup Theorem for Commensurators of Lattices to actions of commensurators. As a consequence, it follows that S-arithmetic lattices enjoy the same properties as the arithmetic lattices (the Stuck-Zimmer result) and that lattices in certain product groups do as well. For example, any nontrivial ergodic measure-preserving action of $\mathrm{PSL}_n(\mathbb{Q})$, for n at least three, is essentially free. This is joint work with Darren Creutz.

41. **Denes Petz (Budapest University of Technology and Economics)**

Matrix variances with projections

Abstract:

42. **Gilles Pisier (Université Pierre et Marie Curie, Paris 6 & Texas A&M University)**

Operator space structures on L_p-spaces

Abstract: We will describe a new operator space structure on L_p $(1 < p < \infty)$ and compare it with the one introduced in our previous work using complex interpolation. For the new structure, the Khintchine inequalities and Burkholder's martingale inequalities have a very natural form: the span of the Rademacher functions is completely isomorphic to the operator Hilbert space OH, and the square function of a martingale difference sequence d_n is $\Sigma\, d_n \otimes \bar{d}_n$.

43. **Hanna Podsękowska (University of Łódź)**

State determination and sufficiency of algebras

Abstract: Informational completeness and the possibility of state distinction and determination are among the more important issues of quantum statistics. We use spectral and semispectral (POV) measures to analyse these questions. For a given von Neumann algebra and a family of normal states on it we investigate the relation between sufficiency in Petz's sense of a von Neumann subalgebra generated by a semispectral (spectral) measure, and the possibility of determination of these states by means of an observable.

44. **Yanqi Qiu (Université Paris VI)**

The OUMD property for column Hilbert space

Abstract: The operator space OUMD property was introduced by Pisier in the context of vector-valued noncommutative L_p-spaces. Recently, we proved that the column Hilbert space C is OUMD$_p$ for all $1 < p < \infty$. This answers positively a question asked by Zhong-Jin Ruan.

45. **Hayato Saigo (Nagahama Institute of Bio-Science and Technology)**

New look at the Arcsine law and "Quantum-Classical Correspondence"

Abstract: We prove that the Arcsine law as the "time-averaged distribution" for classical harmonic oscillator emerges from the distributions for quantum harmonic oscillators in terms of noncommutative algebraic probability.

This is nothing but a simple and rigorous realization of "Quantum-Classical Correspondence" for harmonic oscillators.

Moreover, it shows an important aspect of the Arcsine law as a universal distribution for many kinds of "interacting Fock spaces" which are deeply connected to the theory of orthogonal polynomials.

46. **Guy Salomon (Ben-Gurion University of the Negev)**

Topological convolution algebras

Abstract: Let G be a locally compact group, with a Haar measure μ. Then, $L^1(G,\mu)$ is a convolution Banach-algebra (but not an Hilbert space). On the other hand, $L^2(G,\mu)$ is a Hilbert space, but is closed under convolution if and only if G is compact. In this talk we want to bridge the gap and present convolution algebras which behave locally as Hilbert spaces. More precisely, we introduce a new family of topological convolution algebras of the form $\bigcup_{p\in\mathbb{N}} L_2(G,\mu_p)$, which carries an inequality of the type $\|f*g\|_p \leq A_{p,q}\|f\|_q\|g\|_p$ for $p > q+d$ where d pre-assigned, and $A_{p,q}$ is a constant. We give a sufficient condition on the measures (μ_p) for such an inequality to hold, and show that the spectrum of any element in such an algebra is closed and is included in a specific disk in the complex plane. We also present two examples, one in the setting of non commutative stochastic distributions, and the other related to Dirichlet series.

This is a joint work with Daniel Alpay.

47. **David Shoikhet (ORT Braude College, Karmiel)**

Asymptotic behavior of holomorphic flows rigidity and interpolation

Abstract: In this talk we give a brief description of the classical statements which combine the celebrated Julia's Lemma of 1920, Wolff's boundary version of the Schwarz Lemma of 1926 and Carathéodory's contribution in 1929 with their modern interpretations for discrete and continuous semigroups of holomorphic mappings. Also, we study the asymptotic behavior of one-parameter continuous semigroups (flows) of holomorphic mappings and present angular characteristics of the flows trajectories at their boundary fixed points. Finally, we discuss a problem of separation of boundary singularities for generators of continuous semigroups of holomorphic self-mappings. This enables us to recover the famous Cowen-Pommerenke inequalities as well as to establish some quantitative algebraic and geometric characteristics related to the linearization models for semigroups of holomorphic mappings and the geometry of backward flow invariant domains. Yet, another look at the question leads to a solution of boundary interpolation problem in the spirit of Pick and Nevanlinna.

This talk is based on the joint works with Vladimir Bolotnikov, Mark Elin, Simeon Reich, Nikolay Tarkhanov and Larry Zalcman.

48. **Piotr Śniady (Polish Academy of Sciences, Warsaw)**

Jack deformation of characters of the symmetric groups

Abstract: Jack polynomials are a rather mysterious deformation of Schur polynomials. It was observed by Lasalle that it is possible to study their dual combinatorics which gives rise to a deformation of the characters of the symmetric groups. Computer experiments suggest that these characters have a surprisingly rich and beautiful structure. During the talk we will present some open conjectures and partial results.

49. **Aurel Stan (Ohio State University)**

Some inequalities about the norms of Poissonian Wick products. Joint work with Professor Alberto Lanconelli, University of Bari, Italy

Abstract: We define first the Poissonian Wick product and second quantization operator of a constant times the identity operator, in terms of the Charlier polynomials. We then find pointwise definitions of the Poissonian Wick product and second quantization operator. We use the pointwise definitions to find inequalities about the L^1 and L^∞ norms, and the definitions in terms of the Charlier polynomials to find inequalities about the L^2 norms, of the Poissonian Wick products. Finally, we use Stein Analytic Interpolation Theorem to find inequalities governing the L^p norms of the Poissonian Wick products, for p other than 1, 2, and ∞.

50. **Anatolij Vershik (Steklov Mathematikal Institue of Russian Academy, St. Petersburg)**

Infinitedimensional version of Schur-Weyl duality and Coxeter-Laplace operator

Abstract:

51. **Anatolij Vershik (Steklov Mathematikal Institue of Russian Academy, St. Petersburg)**

What does it mean "Asymptotic representation theory" and what was its history

Abstract:

52. **Jiun-Chau Wang (University of Saskatchewan)**

Monotone Probability and Infinite Ergodic Theory

Abstract: We will discuss how to apply the monotonic central limit theorem to infinite ergodic theory for inner functions on the complex upper half-plane. The main result is a probabilistic criterion for the ergodicity of the boundary restrictions of inner functions on the real line equipped with Lebesgue measure. One example is Boole's transformation whose ergodicity was first proved by Adler and Weiss in 1973.

53. **Michał Wojciechowski (Polish Academy of Sciences, Warsaw)**

On the Wiener - Pitt sets

Abstract:

54. **Michał Wojtylak (Jagiellonian University, Kraków)**

On a class of H-selfadjont random matrices with one eigenvalue of nonpositive type

Abstract: Large H-selfadjoint random matrices are considered. The matrix H is assumed to have one negative eigenvalue, hence the matrix in question has precisely one eigenvalue of nonpositive type. It is showed that this eigenvalue converges in probability to a deterministic limit. The weak limit of distribution of the real eigenvalues is investigated as well.

55. **Hiroaki Yoshida (Ochanomizu University, Tokyo)**

On derivation of the relative free entropy and the Talagrand's inequality for the semi-circle law

Abstract: For compactly supported probability measures μ and ν on $\mathbb{R}$, we take the semi-circular perturbations μ_t and ν_t, respectively. That is, $mu_t = \mu \boxplus \omega_{0,t}$ and $nu_t = \nu \boxplus \omega_{0,t}$, where $\omega_{0,t}$ is the centered semi-circle law of variance t.

We introduce the quantity $\mathcal{D}(\mu \parallel \nu)$ by the following integral formula:

$$\mathcal{D}(\mu \parallel \nu) = \frac{1}{2}\int_0^\infty \Phi(\mu \parallel \nu),$$

where $\Phi(\mu \parallel \nu)$ is the relative free Fisher information.

This is another candidate of the relative free entropy. In this talk, we will see the Talagrand's inequality for the semi-circle law based on the above formula.

56. **Dmitriy Zanin (University of New South Wales, Sydney)**

Johnson-Schechtman inequalities in the free probability setting

Abstract: Rosenthal proved that, for every sequence x_k, $1 \le k \le n$, of independent positive random variables, we have

$$\|\sum_{k=1}^n x_k\|_p \sim \|\bigoplus_{k=1}^n x_k\|_{(L_1 \cap (L_p + L_\infty))(0,\infty)}.$$

Similar inequalities were also proved for mean zero random variables.

Johnson and Schechtman extended the above estimates to the large class of an arbitrary symmetric function space. If and only if condition for the validity of such estimates was given by Astashkin and Sukochev.

The following natural question arises in the noncommutative probability theory:

Question 1. *Is it possible to replace (commutative) independent random variables in the Johnson-Schechtman inequality with (noncommutative) independent random variables?*

This question can be answered in the affirmative if we deal with freely independent random variables.

Theorem 1. *Let $\mathcal{M}$ be a von Neumann algebra equipped with a faithful normal finite trace τ and let $E(\mathcal{M})$ be a symmetric space. Let $\mathcal{A}_k \subset \mathcal{M}$, $1 \le k \le n$, be freely independent subalgebras and let $0 \le A_k \in E(\mathcal{A}_k)$, $1 \le k \le n$. We have*

$$\|\sum_{k=1}^n A_k\|_E \sim \|\bigoplus_{k=1}^n A_k\|_{E_1(\mathcal{M}\otimes l_\infty)}.$$

Here, E_1 is a suitable symmetric operator space equipped with a norm

$$\|A\|_{E_1(\mathcal{M}\otimes l_\infty)} = \|\mu(A)\chi_{(0,1)}\|_E + \|A\|_1.$$

Similar estimate holds for mean zero random variables.

57. **Karol Życzkowski (Jagiellonian University, Kraków)**

On numerical range and numerical shadow of a random matrix

Abstract: