Operator Spaces, Quantum Probability and Applications

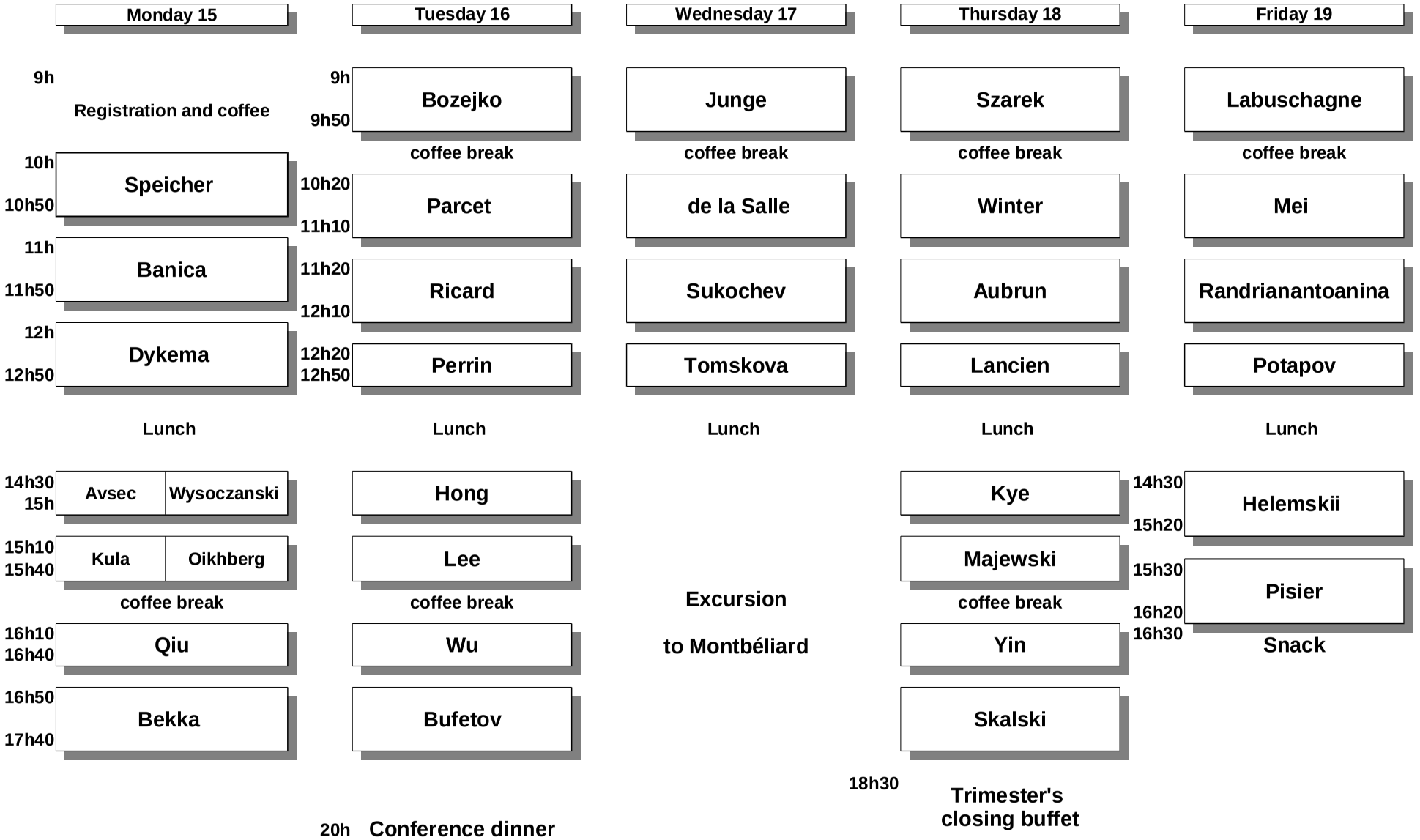
Besançon, 15-19 December 2014

SCHEDULE and ABSTRACTS

Notices:

- Except the two talks in the second parallel session in Monday afternoon, all lectures will take place in **Amphitheater C** in the building perpendicular to that where Laboratoire de Mathématiques is located, the two buildings are connected together and form the letter **T**.
- The two talks in the second parallel session on Monday (14:00 - 15:40) will be in **Room 316** in Laboratoire de Mathématiques, which is in the front of the **coffee room** where we will have coffee breaks.
- We will have lunch everyday at 12:50 in the university restaurant **Lumière**, just after the last morning talk. Note that this restaurant is open to all students and staff of the campus, so it is quite crowded from 11:30 to 12:30. In principle, a special waiting line (probably on the extreme right) and a number of tables should be reserved to our conference; moreover, our lunch menu is slightly different from the others.
  All participants will receive lunch coupons at their arrival. Please return back to us the non used coupons at the end of the conference.
- The bus stop for the campus is **CROUS Université**. The two bus lines 3 (from the city center via the train station Viotte) and 14 (from Hotel Zénitude) stop there. Please go to the conference's website for more information on public transportation.
  The restaurant Lumière is at 30 meters from the right of the bus stop (if you come from the city center by Bus 3), and the building where Amphitheater C is located is at 200 meters from the left. It is easy to get Amphitheater C from the bus stop: this is a straight pedestrian path, Amphitheater C is located immediately after the entrance of the building at the same level as the pedestrian path.
  Note, however, that if you take bus 14 from Hotel Zénitude, the nearest stop is **Bibliothèque Universitaire** which is just at 50 meters to Amphitheater C; but you can also get off at the stop **Gray** or **UFR Sciences** that are in the front of the math building.
- Every (external) participant will get a bus card of 10 tickets valid both for bus and tram. Note that one ticket is valid for one trip, including possible changes (between buses and tram) during one hour.

Conference Operator Spaces and Quantum Probability
December 15-19, 2014



Monday

09:00 - 10:00 **Registration and coffee in the coffee room of Laboratoire de Mathématiques**

10:00 - 10:50 **Roland Speicher** (Saarland University):
On the question of zero divisors for non-commuting variables

11:00 - 11:50 **Teodor Banica** (Université de Cergy-Pontoise):
Liberation tricks in noncommutative geometry

12:00 - 12:50 **Ken Dykema** (Texas A & M University):
Tail algebras for symmetric states and de Finetti theorems

14:30 - 15:00 <u>Parallel session</u>
(takl 1: Amphitheater C; talk 2: Room 316B)

- **Stephen Avsec** (Texas A & M University) (Amphi C):
  Symmetries of noncommutative Brownian motions
- **Janusz Wysoczanski** (Wroclaw University) (Room 316B):
  Rank 2 deformations of operators with applications to quantum probability

15:10 - 15:40 <u>Parallel session</u>

- **Anna Wysoczanska-Kula** (Wroclaw University) (Amphi C):
  Generalization of the Hunt formula on compact quantum group
- **Timur Oikhberg** (University of Illinois) (Room 316B):
  Multinormed spaces

15:40 - 16:10 **Coffee break**

16:10 - 16:40 **Yanqi Qiu** (Université d'Aix-Marseille):
Blaschke products and Palm distributions of the determinantal point process with the Bergman kernel

16:50 - 17:40 **Bachir Bekka** (Université de Rennes):
Rigidity of group actions on noncommutative L^p-spaces

Tuesday

09:00 - 09:50 **Marek Bożejko** (Wroclaw University):
Noncommutative Riesz product on the free groups and Coxeter groups with applications to operator spaces and free probability

09:50 - 10:20 **Coffee break**

10:20 - 11:10 **Javier Parcet** (Instituto de Ciencias Matematicas, Madrid):
Noncommutative Riesz transforms and Fourier multipliers in group algebras

11:20 - 12:10 **Eric Ricard** (Université de Caen):
Noncommutative De Leeuw's theorems

12:20 - 12:50 **Mathilde Perrin** (Instituto de Ciencias Matematicas, Madrid):
Hypercontractivity for the free group (and other related results)

14:30 - 15:00 **Guixiang Hong** (Instituto de Ciencias Matematicas, Madrid):
Noncommutative ergodic averages of balls and spheres, dimension free estimates

15:10 - 15:40 **Hun Hee Lee** (Seoul National University):
p-Fourier algebras on compact groups

15:40 - 16:10 **Coffee break**

16:10 - 16:40 **Jinsong Wu** (University of Science and Technology of China):
Noncommutative uncertainty principles

16:50 - 17:40 **Alexander Bufetov** (Université d'Aix-Marseille):
Quasi-symmetries of determinantal point processes

20:00 **Banquet in Restaurant Bistrot La Charrette**

Wednesday

09:00 - 09:50 **Marius Junge** (University of Illinois at Urbana-Champaign):
Calderon-Zygmund theory for quantum euclidean spaces

09:50 - 10:20 **Coffee break**

10:20 - 11:10 **Mikael de la Salle** (CNRS - ENS de Lyon):
Noncommutative L^p spaces of very high rank lattices without the completely bounded approximation property

11:20 - 12:10 **Fedor Sukochev** (University of NSW):
Fréchet differentiability of the norm of L_p-spaces: resolution and main ideas, Part I

12:20 - 12:50 **Anna Tomskova** (University of NSW):
Fréchet differentiability of the norm of L_p-spaces, Part II: key steps of the proof

Afternoon: Excursion to Montbéliard

Thursday

09:00 - 09:50 **Stanislaw Szarek** (Case Western Reserve University and Université Paris 6):
Triangles in the set of states and quantum games

09:50 - 10:20 **Coffee break**

10:20 - 11:10 **Andreas Winter** (Universitat Autònoma de Barcelona):
Zero-error quantum communication assisted by no-signalling correlations and a capacity interpretation of the Lovasz number of a graph

11:20 - 12:10 **Guillaume Aubrun** (Université Lyon 1):
Locally restricted quantum measurements and generic data hiding

12:20 - 12:50 **Cécilia Lancien** (Université Lyon 1 and Universitat Autònoma de Barcelona):
The k-extendibility criterion for separability on high dimensional bipartite quantum systems

14:30 - 15:00 **Seung-Hyeok Kye** (Seoul National University):
Simplex structures arising from quantum information theory

15:10 - 15:40 **Wladyslaw A. Majewski** (Gdansk University):
Quantum correlations

15:40 - 16:10 **Coffee break**

16:10 - 16:40 **Zhi Yin** (Gdansk University and Wuhan University):
Unbounded largest violation for quantum steering

16:50 - 17:40 **Adam Skalski** (IMPAN and University of Warsaw):
Abstract viewpoint on Schönberg correspondence: the Haagerup property via approximating semigroups and their generators

18:30 **Trimester's closing buffet in Aquarium**

Friday

09:00 - 09:50 **Louis E. Labuschagne** (North-West University, Potchefstroom):
Outers for noncommutative H^p

09:50 - 10:20 **Coffee break**

10:20 - 11:10 **Tao Mei** (Wayne State University):
Heat semigroups and L_p Fourier analysis on free group von Neumann algebras

11:20 - 12:10 **Narcisse Randrianantoanina** (Miami University, Oxford):
Martingale inequalities in noncommutative symmetric spaces

12:20 - 12:50 **Denis Potapov** (University of NSW):
Lipschitz estimate of absolute value map in noncommutative weak L_1 space

14:30 - 15:20 **Alexander Helemskii** (Moscow State (Lomonosov) University):
TBA

15:30 - 16:20 **Gilles Pisier** (Université Paris 6 and Texas A & M University):
A continuum of C*-norms on $\mathbb{B}(H) \otimes \mathbb{B}(H)$ and related tensor products

16:30 **Snack**

List of abstracts

1) **Guillaume Aubrun:** Locally restricted quantum measurements and generic data hiding

Abstract: The problem of the discrimination by distant observers between two quantum states can be quantified by a norm on the space of operators over a bipartite Hilbert space. Different levels of allowed communication between observers lead to different norms. We compare these norms ; using geometric tools we show that in large dimensions, the phenomenon of quantum data hiding is generic : most pairs of quantum states can be distinguised globally but not locally. Joint work with Cécilia Lancien (arxiv:1406.1959).

2) **Stephen Avsec:** Symmetries of noncommutative Brownian motions

Abstract: Classically, Freedman's theorem characterizes classical (conditional) brownian motion as the only process with increments which are rotatable, meaning the joint probability distribution of the increments is invariant under the action of the orthogonal group. In this talk, we shall discuss noncommutative processes with rotatable increments and their connection with a recent definition of noncommutative brownian motion due to B. Collins and M. Junge. This will include some joint work with M. Junge.

3) **Teodor Banica:** Liberation tricks in noncommutative geometry

Abstract: The liberation procedure, taking as input a suitable Lie group $G \subset U_n$, replaces the commutation relations $ab = ba$ between the standard coordinates $u_{ij} : G \to \mathbb{C}$ by some weaker relations (e.g. no relation at all), as to produce a quantum group $G^\times$. Based on the simple observation that we have $G \subset U_n \subset S^{n^2-1}$, I will discuss how some of these techniques can be extended to the case of more general algebraic manifolds, $M \subset S^{N-1}$. The problem is then that of understanding the geometry of $M^\times$, and I will present here some concrete results, regarding the associated quantum isometry group.

4) **Bachir Bekka:** Rigidity of group actions on noncommutative L^p-spaces

Abstract: Given a group G and a von Neumann algebra M, one may study the orthogonal representations of G in the L^p-space $L^p(M)$ of M. We will be concerned with rigidity properties of such actions for $p \neq 2$. We will report on results concerning analogues of Kazhdan's Property (T) for G with respect to various von Neumann algebras M as well as on local rigidity results (à la Mostow) when M is a type II_1 factor.

5) **Marek Bożejko:** Non-commutative Riesz product on the free groups and Coxeter groups with applications to operator spaces and free probability

Abstract: In my talk we will consider the following subjects:

1) Classical Riesz product measures on abelian groups
2) Non-commutative Riesz product on free groups as example of the regular free product of positive definite functions and operator Sidon sets.
3) Coxeter-Riesz product positive definite function on Coxeter groups (W, S), where S is the set of Coxeter generators and a connection with the new length function L on W.
4) On Coxeter groups (W, S), the set S is strong Sidon set and non-commutative operator $\Lambda(p)$ for each $p > 2$.
5) Applications to free probability: Normal law $N(0, 1)$, $1/\cosh$ and almost all classical Meixner laws are free infinitely divisible and also classically infinitely divisible.

References:

1. M. Bożejko. Positive definite functions on the free group and the noncommutative Riesz product. *Boll. U. M. Ital.* 1986, 13-21.

2. M. Bożejko. Uniformly bounded representations of free group. *J . Reine Angew. Math.* 377, 1987,170-186.

3. M. Bożejko. Positive and negative definite kernels on discrete groups. Lectures at Heidelberg University 1987.

4. M. Bożejko. Deformed Fock Fock spaces, Hecke operators and monotone Fock space of Muraki, Demonstratio Math. XLV, 2012, 399-413.

5. M. Bożejko, W. Bożejko. Generalized Gaussian processes and relation with random matrices and positive definite functions on permutation groups. arXiv 2012, 19 pp.

6. M. Bożejko, W. Ejsmont and T. Hasebe. Fock space associated to Coxeter group of type B. Preprint 2014, 19 pp.

7. M. Bożejko, and T.Hasebe. On the free infinitely divisibility for classical Meixner distributions. *Prob. Math. Stat.* 33, 2013, 363-375.

8. M. Bożejko, and T.Hirai. Gelfand-Raikov representation of Coxeter groups associated with positive definite norm functions. *Prob. Math. Stat.* 34, 2014, 161-180.

9. M. Bożejko, S. Gal, W. Mlotkowski. Positive definite functions on Coxeter groups with applications to operator spaces and noncommutative probability, Wroclaw 2014.

10. M. Bożejko, and R. Szwarc. Algebraic length and Poincare series on refelection groups with applications to representations theory. Springer Lecture Notes in Math. 1815, 2003, 201-221.

11. A.Harrcharras. Fourier analysis,Schur multipliers on S^p and non-commutative $\Lambda(p)$ sets. *Studia Math.* 137,1 999, 203-260.

6) **Alexander I. Bufetov:** Quasi-symmetries of determinantal point processes

Abstract: It will be proved in the talk that determinantal point processes on the real line corresponding to projection operators with integrable kernel, are quasi-invariant under the group of diffeomorphisms with compact support. The talk is based on the preprint http://arxiv.org/pdf/1409.2068v1.pdf

7) **Ken Dykema:** Tail algebras for symmetric states and de Finetti theorems

Abstract: We study symmetric states on the universal free product $\mathfrak{A} = *_1^\infty A$ of a unital C^*-algebra A with itself infinitely many times. The tail algebra $\mathcal{T}_\psi$ of such a state is a naturally defined von Neumann subalgebra of the von Neumann algebra $\mathcal{M}_\psi$ generated by the image of $\mathfrak{A}$ under the GNS representation. The classical and noncommutative de Finetti theorems are concerned with independence and free independence over the tail algebra.

An example of Weihua Liu shows that there need not be a normal conditional expectation from $\mathcal{M}_\psi$ onto $\mathcal{T}_\psi$. We consider several related issues, and construct a *tail C^*-algebra* and associated conditional expectation. There are some open questions about these constructions. Specializing to the case of quantum symmetric states, these constructions allow a classification of quantum symmetric states in terms of free products with amalgamation. This talk is based on joint work with Claus Koestler and John Williams.

8) **Alexander Helemskii:** TBA

9) **Guixiang Hong:** Noncommutative ergodic averages of balls and spheres, dimension free estimates

Abstract: In this talk, we would like to present some recent results on noncommutative ergodic theorems. Precisely, we establish the maximal ergodic theorem for the ergodic averages of balls and spheres in noncommutative L_p spaces. As a consequence, we obtain noncommutative analogues of Wiener's and Jone's pointwise ergodic theorems. Moreover, using the noncommutative spherical maximal inequality, we prove that the bounds in the noncommutative Wiener's maximal inequalities are dimension free when the underlying von Neumann algebras are group measure spaces.

10) **Marius Junge:** Calderon-Zygmund theory for quantum euclidean spaces

Abstract: There are other Calderon-Zygmund operators than just Fourier multipliers, and these operators have so far been slightly neglected in noncommutative analysis. In joint work with Parcet and Gonzalez we introduce quantum euclidean space, which include commutative and fully noncommutative examples and show how to define smoothness and L_2 condition for pseudo-differential operators.

11) **Seung-Hyeok Kye:** Simplex structures arising from quantum information theory

Abstract: We investigate conditions on a finite set of multi-partite product vectors for which separable states with corresponding product states have unique decomposition, and show that this is true in most cases if the number of product vectors is sufficiently small. In the three qubit case, generic five dimensional spaces give rise to faces of the convex set consisting of all separable states, which are affinely isomorphic to the five dimensional simplex with six vertices. As a byproduct, we construct three qubit entangled PPT edge states of rank four with explicit formulae. This covers those entanglement which cannot be constructed from unextendible product basis. This is a co-work with Kil-Chan Ha.

12) **Louis E. Labuschagne:** Outers for noncommutative H^p

Abstract: We study outer elements of the noncommutative H^p spaces associated with Arveson's subdiagonal algebras. Specifically we present a characterization of such elements which includes the very general case of elements with zero geometric mean. We then use this result to obtain a noncommutative Riesz-Szegö theorem which canonically contains the classical result. We also make several further contributions to the theory of outers; for example we generalize the classical fact that outers in H^p actually satisfy a stronger condition that may be dubbed *uniform outerness*. This is based on joint works with David Blecher.

13) **Cécilia Lancien:** The k-extendibility criterion for separability on high dimensional bipartite quantum systems

Abstract: Deciding whether a bipartite quantum state is separable or entangled is a central problem in quantum information theory. It is known, though, to be a computationally hard task. The idea of detecting entanglement of a given bipartite state by searching for a symmetric extension of this state was first introduced by Doherty, Parrilo and Spedalieri. This approach provides a hierarchy of increasingly constraining necessary conditions for separability which is known to be asymptotically also sufficient. I will first explain in more details what this so-called k-extendibility criterion for separability is, and review some of the known results regarding its "strength". I will then be interested in trying to quantify how powerful this test is to detect the entanglement of high dimensional quantum states, following mainly two strategies. The first one consists in comparing the volumes of the sets of either separable or k-extendible states. The second one consists in looking at when random states obtained by partial tracing pure states over an environment are with high probability either entangled or violating the k-extendibility criterion. The techniques used come from random matrix theory.

14) **Hun Hee Lee:** p-Fourier algebras on compact groups

Abstract: Let G be a compact group. For $1 \leq p \leq \infty$ we introduce a class of Banach function algebras $\mathrm{A}^p(G)$ on G which are the Fourier algebras in the case $p = 1$, and for $p = 2$ are certain algebras discovered in a recent paper by Forrest/Samei/Spronk. In the case $p \neq 2$ we find that $\mathrm{A}^p(G) \cong \mathrm{A}^p(H)$ if and only if G and H are isomorphic compact groups. These algebras admit natural operator space structures, and also weighted versions, which we call p-Beurling-Fourier algebras. We study various operator amenability properties and representability as operator algebras. For a connected Lie G and $p > 1$, our techniques of estimation of when certain p-Beurling-Fourier algebras are operator algebras rely more on the fine structure of G, than in the case $p = 1$. We also study restrictions to subgroups. In the case that $G = SU(2)$, restrict to a torus and obtain some exotic algebras of Laurent series. This is a joint work with Ebrahim Samei and Nico Spronk.

15) **Wladyslaw A. Majewski:** Quantum correlations

Abstract: We present the new rigorous approach for description of correlations of quantum systems. Centered on quantum probability we describe mathematical structures related to an analysis of correlations. In particular, guided by certain results from operator spaces the difference between the theory of entanglement for C^*-algebra and W^*-algebra case will be pointed out. Moreover, an analysis of quantumness of correlations will be given.

16) **Tao Mei:** Heat semigroups and L_p Fourier analysis on free group von Neumann algebras

Abstract: This talk is based on joint work with M. de la Salle. Let $\mathbb{F}_n, 1 \le n \le \infty$ be the group of n free generators. Let λ_g be the left regular representations of $g \in G$. One may consider the analogue of the classical Poisson (heat) semigroups on free group von Neumann algebra $\mathcal{L}(\mathbb{F}_n)$,

$$S_t^r : \lambda_g \to e^{-t|g|^r}\lambda_g,$$

with $|g|$ the reduced word length of g.

17) **Timur Oikhberg:** Multinormed spaces

Abstract: The theory of multinormed spaces has its origins in the early 1990s, when the foundations were laid by, among other, G. Pisier, J. Marcolino-Nhany, and L. McClaran. The goal was to "quantize" the theory of subspaces of Banach lattices, in the same way as operator spaces are "quantized" Banach spaces. More precisely, X is a p-multinormed space if there exists a sequence of cross-norms on the tensor products $l_n^p \otimes X$, satisfying the compatibility condition: for $u \in B(l_n^p, l_m^p)$, $\|u \otimes I_X : l_n^p \otimes X \to l_m^p \otimes X\| = \|u\|$. Recently, the theory of p-multinormed spaces was used by Dales, Daws, Pham, and Ramsden to prove that $L^p(G)$ is injective as an $L^1(G)$-module iff the locally compact group G is amenable. In this talk, we survey the theory of p-multinormed spaces, including duality, representations as subquotients of Banach lattices, and interpolation. Joint work with G. Dales, N. Laustsen, and V. Troitsky.

18) **Javier Parcet:** Noncommutative Riesz transforms and Fourier multipliers in group algebras

Abstract: C. Fefferman observed in 1970 that

$$g_\lambda^*(f)(x) = \Big(\int_{\mathbb{R}_+} \int_{\mathbb{R}^n} \Big[\frac{t}{|x-y|+t}\Big]^{n\lambda} t^{1-n} |\nabla P_t f(y)|^2 \, dy \, dt \Big)^{\frac{1}{2}}$$

is not in $L_p(\mathbb{R}^n)$ when $\lambda \le 2/p$. As a consequence, one can see that Meyer's 1984 formulation for Riesz transforms associated to diffusion semigroups fails for the Poisson process and $p \le 2n/n+1$. In this talk, we shall reformulate Meyer's problem to incorporate any fractional Laplacian and solve it with dimension free estimates. It turns out that all Hörmander-Mihlin multipliers are Littlewood-Paley averages of our Riesz transforms. This is surprising and also useful since it yields new Sobolev/Besov type endpoint conditions. The Sobolev type condition we give refines the classical one and yields dimension free constants. The novelty of these "classical" estimates is explained from the appearance of (intrinsic) noncommutative phenomena in the problem, even for the Poisson process in the Euclidean space. Our approach holds in fact for arbitrary Markov convolution semigroups on group von Neumann algebras associated to any locally compact unimodular group. Other new estimates also include the word length of free groups. Lust-Piquard's recent work for discrete laplacians on LCA groups is also generalized in several ways. This is joint work with Marius Junge and Tao Mei.

19) **Mathilde Perrin:** Hypercontractivity for the free group (and other related results)

Abstract: Hypercontractivity, which is closely related to log-sobolev inequalities, is a widely studied topic in many different situations. Most of the works so far adopt a gaussian point of view and deal with the Ornstein-Ulhenbeck semigroup. In this talk, in the line of Bonami ($\mathbb{Z}_2$) and Weissler ($\mathbb{Z}$), we will consider instead the trigonometric point of view by studying Poisson-like semigroups acting on von Neumann algebras associated to discrete groups, and given by a length function. More precisely, given a discrete group G equipped with a length function ψ, we will consider the semigroup

$$\mathcal{P}_t\Big(\sum_{g \in \mathrm{G}} \widehat{f}(g)\lambda(g)\Big) = \sum_{g \in \mathrm{G}} e^{-t\psi(g)} \widehat{f}(g)\lambda(g)$$

and study the contractivity of $\mathcal{P}_t$ between the noncommutative L_p-spaces $L_p(\mathcal{L}\mathrm{G})$ and $L_q(\mathcal{L}\mathrm{G})$ for $1 < p \le q < \infty$. In particular, we will focus on the free group $\mathbb{F}_n$ equipped with the word length, which was our original motivation. Some probabilistic and combinatorial approaches have been developed to attack this problem, giving partial results. Recently, by generalizing a noncommutative convexity inequality due to Ball, Carlen and Lieb, Ricard and Xu deduced from these partial results optimal hypercontractive estimates in some range for the Poisson semigroup acting on $\mathcal{L}\mathbb{F}_n$. But this still does not close the question, and the problem of getting

optimal hypercontractivity results in full range is still open ! On the other hand, the methods used to solve the free group case also apply to other situations, and give nice hypercontractivity results for other groups. In particular, optimal hypercontractive estimates for the cyclic groups $\mathbb{Z}_n$ are obtained, improving known results in the commutative setting. Joint work with Marius Junge, Carlos Palazuelos, Javier Parcet and Éric Ricard.

20) **Gilles Pisier:** A continuum of C*-norms on $\mathbb{B}(H) \otimes \mathbb{B}(H)$ and related tensor products

Abstract: This is mainly an account of joint work with N. Ozawa. For any pair M, N of von Neumann algebras such that the algebraic tensor product $M \otimes N$ admits more than one C*-norm, the cardinal of the set of C*-norms is at least $2^{\aleph_0}$. Moreover there is a family with cardinality $2^{\aleph_0}$ of injective tensor product functors for C*-algebras in Kirchberg's sense. Let $\mathbb{B} = \prod_n M_n$. We also show that, for any non-nuclear von Neumann algebra $M \subset \mathbb{B}(\ell_2)$, the set of C*-norms on $\mathbb{B} \otimes M$ has cardinality *equal to* $2^{2^{\aleph_0}}$. The talk will also recall the connection of such questions with the non-separability of the set of finite dimensional (actually even of 3-dimensional) operator spaces which goes back to a 1995 paper with Marius Junge, and several recent "quantitative" refinements obtained using an estimate of the metric entropy of the set of quantum expanders.

21) **Denis Potapov:** Lipschitz estimate of absolute value map in noncommutative weak L_1 space

Abstract: I will discuss my recent result which shows that the absolute value map is Lipschitz continuous when the perturbation comes from noncommutative weak L_1 space.

22) **Yanqi Qiu:** Blaschke products and Palm distributions of the determinantal point process with the Bergman kernel

Abstract: In this talk, I will explain explicit formulae for the Radon-Nikodym derivatives between the reduced Palm distributions for the determinantal point process with the Bergman kernel on the unit disk, the point process describing zeros of the i.i.d. Gaussian power series. The Radon-Nikodym derivatives are expressed as regularized multiplicative functionals related to Blaschke products. This computation gives a new proof of the equivalence of the reduced Palm distributions of this determinantal point process, established by Holroyd and Soo. As a corollary, we establish the quasi-invariance of this determinantal point process, under the action of the group of diffeomorphisms with compact supports in the open unit disk. This is a joint work with Alexander I. Bufetov.

23) **Eric Ricard:** Noncommutative De Leeuw's theorems

Abstract: A classical compactification theorem by De Leeuw asserts that a continuous function on $\mathbb{R}$ is a Fourier multiplier on $L_p(\mathbb{R})$ iff it is also a Fourier multiplier on $L_p(\mathbb{R}_d)$ where $\mathbb{R}_d$ is $\mathbb{R}$ with the discrete topology. We look forward generalizations to non commutative groups. This is a joint work with M. Caspers, J. Parcet and M. Perrin.

24) **Narcisse Randrianantoanina:** Martingale inequalities in noncommutative symmetric spaces

Abstract: We consider generalization of Burkholder's inequalities involving conditioned square functions in the general context of noncommutative symmetric spaces. More precisely, we will discuss the validity of Burkholder's inequalities for noncommutative martingales in noncomutative space constructed from a symmetric function space defined on the interval $(0, \infty)$ whose Boyd indices are strictly between 1 and 2. The case where the Boyd indices are finite and strictly larger than 2 is previously known.

25) **Mikael de la Salle:** Noncommutative L^p spaces of very high rank lattices without the completely bounded approximation property

Abstract: I will explain a recent joint work with Tim de Laat, where we prove that for all $p \neq 2$, the non commutative L^p space of $SL_n(\mathbf{Z})$ does not have the completely bounded approximation property for n large enough depending on p. This complements previous results that I obtained with Vincent Lafforgue in the p-adic setting. I might explain how the tools developped in the proof can be used to attack the problem of the coarse embeddability into Banach spaces of the expanders coming from $SL_n(\mathbf{Z})$.

26) **Adam Skalski:** Abstract viewpoint on Schönberg correspondence: the Haagerup property via approximating semigroups and their generators

Abstract: The classical Haagerup property for a discrete group G is defined in terms of an approximating sequence of positive-definite functions. An equivalent definition can be given in terms of a proper conditionally positive definite function. The Schönberg correspondence connects the two viewpoints, allowing us to interpret conditionally positive definite functions as generators of semigroups of positive definite ones. We will explain how this guiding principle applies in the setting of discrete quantum groups and also for general von Neumann algebras, and leads to new characterizations of the Haagerup property in these contexts. The talk is based on joint work with Martijn Caspers, Matthew Daws, Pierre Fima and Stuart White

27) **Rolan Speicher:** On the question of zero divisors for non-commuting variables

Abstract: In order to understand the "non-commutative" distribution of a tuple of variables, it is important to be able to decide whether the distribution of selfadjoint polynomials in those variables can have atoms. I will show how this is related with the free entropy and free Fisher information of those variables. This is joint work with Tobias Mai and Moritz Weber.

28) **Stanislaw Szarek:** Triangles in the set of states and quantum games

Abstract: The starting point is the following observation: if f, g_1, g_2 are probability densities such that $\|f - g_j\|_1 \approx 2$ (the diameter of the set of densities), then also $\|f - g\|_1 \approx 2$ for every g that is a convex combination of g_1, g_2. We discuss non-commutative analogues of this fact and their implications in the theory of quantum games.

29) **Fyodor Sukochev:** Fréchet differentiability of the norm of L_p-spaces: resolution and main ideas, Part I

Abstract: Let $\mathcal{M}$ be a von Neumann algebra and let $(\text{Ł}_p(\mathcal{M}), \|\cdot\|_p)$, $1 \le p < \infty$ be Haagerup's L_p-space associated with $\mathcal{M}$. We prove that the differentiability properties of $\|\cdot\|_p$ are precisely the same as those of classical (commutative) L_p-spaces. Joint work with D. Potapov, A. Tomskova and D. Zanin.

30) **Anna Tomskova:** Fréchet differentiability of the norm of L_p-spaces, Part II: key steps of the proof

Abstract: We discuss some important technical details of the proof that the differentiability properties of the norm of Haagerup's L_p-space associated with an arbitrary von Neumann algebra $\mathcal{M}$ are the same as those of classical (commutative) L_p-spaces. Our main instruments are the theories of multiple operator integrals and singular traces. In particular, we discuss the usage of multiple operator integrals in the proof of corresponding Taylor expansion. Joint work with D. Potapov, F. Sukochev and D. Zanin.

31) **Andreas Winter:** Zero-error quantum communication assisted by no-signalling correlations and a capacity interpretation of the Lovasz number of a graph

Abstract: We study the one-shot zero-error classical capacity of a quantum channel assisted by quantum no-signalling correlations, and the reverse problem of exact simulation of a prescribed channel by a noiseless classical one. Quantum no-signalling correlations are viewed as two-input and two-output completely positive and trace preserving maps with linear constraints enforcing that the device cannot signal. Both problems lead to simple semidefinite programmes (SDPs) that depend only the Kraus operator space of the channel. In particular, we show that the zero-error classical simulation cost is precisely the conditional min-entropy of the Choi-Jamiolkowski matrix of the given channel. The zero-error classical capacity is given by a similar-looking but different SDP; the asymptotic zero- error classical capacity is the regularization of this SDP, and in general we do not know of any simple form.

Interestingly however, for the class of classical-quantum channels, we show that the asymptotic capacity is given by a much simpler SDP, which coincides with a semidefinite generalization of the fractional packing number suggested earlier by Aram Harrow. This finally results in an operational interpretation of the celebrated Lovasz ?number of a graph as the zero-error classical capacity of the graph assisted by quantum no-signalling correlations, the first information theoretic interpretation of the Lovasz number. [Joint work with Runyao Duan, arXiv:1409.3426]

32) **Jinsong Wu:** Noncommutative uncertainty principles

Abstract: The uncertainty principle is a fundamental phenomenon related to a pair of objects dual to each other, such as the Heisenberg uncertainty principle for the position and momentum of a particle. Uncertainty principles of abelian groups were well studied. Recently uncertainty principles for finite groups, quantum groups, were discussed from different perspectives.

We prove uncertainty principles and related results for subfactors which covers those for finite groups and finite dimensional quantum groups, as well as the Hausdorff-Young inequality, Young's inequality, the Hirschman-Beckner uncertainty principle, the Donoho-Stark uncertainty principle. We characterize the minimizers of the uncertainty principles. We also show that the minimizer is uniquely determined by the supports of itself and its Fourier transform. The proofs take the advantage of the analytic and the categorial perspectives of subfactor planar algebras. Our method to prove the uncertainty principles also works for more general cases, such as Popa's λ-lattices, modular tensor categories etc.

33) **Anna Wysoczanska-Kula:** Generalization of the Hunt formula on compact quantum group

Abstract: The Hunt formula provides a classification of convolution semigroups of probability measures, or equivalently, of Levy processes on Lie groups in terms of their genererator. It shows how such processes are combinations of a continuous (or Gaussian) part and a jump part. Since 1998, it is known that an analoguous decomposition into "Gaussian" and the remaining part is also true for generators of Levy processes on $SU_q(2)$. Here, the definition of Gaussian processes is the one by M. Schürmann, in the framework of bialgebras. We shall discuss the problem of generalization of this result to the compact quantum groups, in particular to $SU_q(N)$ and $U_q(N)$ for $N \geq 2$. The talk bases mainly on the joint work with Uwe Franz, Martin Lindsay, and Michael Skeide.

34) **Janusz Wysoczanski:** Rank 2 deformations of operators with applications to quantum probability

Abstract: We shall present rank 2 deformations of operators, study their spectral properties, and show the relation with t-transformation of (probability) measures, which appeared in Quantum Probability. The talk is based on joint work with Michal Wojtylak and Anna Wysoczanska-Kula.

35) **Zhi Yin:** Unbounded largest violation for quantum steering

Abstract: The aim of this talk is to derive steering inequalities with unbounded largest violation. We will introduce a Junge-Palazuelos approach to Bell inequality, where they applied operator space theory to violation of Bell inequality. With their method, we are able to derive a random steering inequality with unbounded largest violation of order $\sqrt{\frac{d}{\log d}}$. On the other hand, we analyze steering inequalities which are constructed by mutually unbiased bases (MUBs) and Clifford algebra. For MUBs, we can obtain an unbounded largest violation of order $\sqrt{d}$, where d is the dimension of Hilbert space. By using operators of Clifford algebra, we are able to derive a dichotomic steering inequality with unbounded largest violation of order $\sqrt{\frac{n}{2}}$, where n is the number of settings. This unbounded largest violation shows that quantum steering is quite different to Bell nonlocality in the asymptotic sense. Because there is no unbounded violation when the number of outcomes in Bell scenario is fixed. This is a joint work with M. Marciniak, A. Rutkowski, M. Horodecki and R. Horodecki.