Colloque de l'ANR NCGQG

17-18 juin 2021

	Jeudi	Vendredi
10:00 - 11:00	**Jinghao Huang**	**Dmitriy Zanin**
11:00 - 12:00	**Mikaël de la Salle**	**Isabelle Baraquin**
13:30 - 14:30	**Roland Vergnioux**	**Mateusz Wasilewski**
14:30 - 15:30	**Purbayan Chakraborty**	**Amaury Freslon**
16:00 - 17:00	**Li Gao**	**Léonard Cadilhac**

Isabelle Baraquin

De Finetti Theorems

In classical probability theory, de Finetti Theorem studies the symmetries of the joint distribution of random variables. It states that exchangeable random variables are conditionally independent. In this talk, we will present some similar results in noncommutative probability. After looking at the quantum case, we will study a de Finetti theorem in the dual unitary group.

Léonard Cadilhac

Caractérisation métrique de la liberté

Dans son doctorat, H. Kesten a étudié la norme de l'opérateur de Markov associé a une marche aléatoire symétrique sur un groupe discret et ainsi obtenu une caractérisation de la liberté du groupe. On peut, plus généralement, considérer des opérateurs unitaires (non nécessairement liés à la représentation régulière d'un groupe), et par une formule analogue à celle de l'opérateur de Markov, se demander si le résultat de Kesten reste valide. J'expliquerai pourquoi c'est le cas si ces unitaires sont contenus dans une algèbre de von Neumann finie. Le résultat est essentiellement obtenu par des méthodes combinatoires. Il s'agit d'un travail en collaboration avec B. Collins.

Purbayan Chakraborty

Discrete Weyl relations, Error base and study of CP maps

Projective representation of finite abelian group using discrete Weyl relations provide us an orthonormal basis of $M_n(\mathbb{C})$, consisting of uniteries. Moreover, trace of each such unitery operator(other than the identity) is zero, which technically in quantum information called nice error basis. For the non-commutative case, we can get similar projective representation on any finite group of central type. We can use this nice error basis of $M_n(\mathbb{C})$ to construct a convenient basis of $L(M_n, M_n)$ and study completely positive maps utilizing that construction.

Mikaël de la Salle

Orthogonalization of Positive Operator Valued Measures

Last year, the spectacular resolution of Connes' embedding problem has been announced by Ji-Natarajan-Vidick-Wright-Yuen. The proofs are very long and rely on several years of developpments of techniques in quantum information theory. Central in the general strategy is a concept of stability of partitions of unity on finite dimensional Hilbert spaces, parallel to a much studied analogue for groups. I will comment on a very specific aspect of it, and on a generalization that I recently obtained in infinite dimension, that came out in my attempts to understand the proof. Specifically, I will show that a partition of the unity (or POVM) on a Hilbert space that is almost orthogonal is close to an orthogonal partition of unity in the same von Neumann algebra, for a quite general way of measuring closedness. This generalizes to infinite dimension and slightly strengthens previous results in matrix algebras by Kempe-Vidick and Ji-Natarajan-Vidick-Wright-Yuen.

Amaury Freslon

How to (badly) quantum shuffle cards

Card shuffles can be thought of as random walks on the symmetric group, and the study of these random walks has been a subject of interest for more than forty years. Even for one of the simplest examples, the random transposition walk, precise results concerning the convergence to equilibrium were only very recently obtained. After briefly describing that setting, I will report on a joint work with L. Teyssier and S. Wang where we study an analogue of the random transposition walk on the quantum symmetric group, therefore a kind of "quantum card shuffle". In particular, we obtain a similar asymptotic description of the convergence to equilibrium, called the "limit profile", involving the free Poisson distribution while the classical case involves the usual Poisson distribution.

Jinghao Huang

Isometries on noncommutative symmetric spaces

The study of the description of isometries on symmetric spaces was initiated by Banach [8] who obtained the general form of isometries between L_p spaces on a finite measure space. Representation of linear isometries between more general symmetric function spaces were later obtained by Lumer, Zaidenberg and Kalton, etc. In the 1950s, Kadison showed that a surjective linear isometry between two von Neumann algebras can be written as a Jordan *-isomorphism followed by a multiplication of a unitary operator. The complete description (for the semifinite case) of isometries on noncommutative L_p-spaces for was obtained by Yeadon. However, for general separable noncommutative symmetric spaces E, the description of surjective isometries on E was obtained by Sourour (1981) and by Sukochev (1996) in some special settings. In our joint paper with Sukochev, we provide a complete description of all surjective linear isometries on separable noncommutative symmetric spaces affiliated with a semifinite von Neumann algebra, which answers a long-standing open question raised in the 1980s.

Li Gao

Complete Log-Sobolev inequalities

Quantum Markov semigroups are noncommutative generalization of Markov process, which models the time evolution of dissipative open quantum systems. For both classical and quantum Markov semigroups, modified log-Sobolev inequality serves as a powerful tool to study the convergence property via the exponential decay of entropy. In this talk, I'll present some recent progress on complete bounded version of log-Sobelev inequalities for finite dimensional quantum Markov semigroups. This talk is based on a joint work with Cambyse Rouzé.

Roland Vergnioux

Hypercontractivité du semigroupe de la chaleur sur les groupes quantiques libres orthogonaux

Dans un travail en commun avec Brannan et Youn, nous étudions les propriétés d'hyper- et ultra-contractivité d'un analogue du semigroupe de la chaleur sur les groupes quantiques libres orthogonaux. Nous améliorons les résultats de Franz-Hong-Lemeux-Ulrich-Zhang dans le cas tracial, et obtenons de nouveaux résultats dans le cas non tracial. Les preuves reposent sur des inégalités de type Khintchine/RD dont nous précisons l'étude dans le cas non tracial.

Mateusz Wasilewski

Random quantum graphs are asymmetric

The study of quantum graphs emerged from quantum information theory. One way to define them is to replace the space of functions on a vertex set of a classical graph with a noncommutative algebra and find a satisfactory counterpart of an adjacency matrix in this context. Another approach is to view undirected graphs as symmetric, reflexive relations and "quantize" the notion of a relation on a set. In this case, quantum graphs are operator systems and the definitions are equivalent. Doing this has some consequences already for classical graphs; viewing them as operator systems of a special type has already led to the introduction of a few new "quantum" invariants. Motivated by developing the general theory of quantum graphs, I will take a look at random quantum graphs, having in mind that the study of random classical graphs is very fruitful. I will show how having multiple perspectives on the notion of a quantum graph is useful in determining the symmetries of these objects. As expected, a generic quantum graph is asymmetric. Joint work with Alexandru Chirvasitu.

Dmitriy Zanin

Distributional inequalities in non-commutative probability theory

Various inequalities used in non-commutative probability (such as martingale transform inequality) do not require any space at all. Instead, they can be formulated as an estimate on the distribution function, very much in spirit of the classical probability theory. We also demonstrate distributional versions of Burkholder-Gundy inequality, Dual Doob inequality and Stein inequality. We also show that those inequalities cannot be improved.