Journées Neuchâtel-Besançon d'Analyse Fonctionnelle

21-23 June 2018
Institut de Mathématiques, Salle B013
Unimail, 11 Rue Emile Argand, CH-2000 Neuchâtel

Program:

Thursday June 21:
From 11.00: Welcome
12.00-13.30: Lunch
13.30-14.20: Isabelle BARAQUIN (Besançon): *Asymptotic distribution for characters of irreducible representations of some groups*

14.30-15.20: Matthew TOINTON (Neuchâtel): *The Mahler conjecture in 2 dimensions via the probabilistic method.*
15.30-16.00: Coffee break
16.00-16.50: Anthony GENEVOIS (Aix-Marseille): *Lamplighter groups, a-T-menability, and median spaces.*

17.30: Bathing in the lake? (weather permitting)

Friday June 22:
9.30-10.20: François THILMANY (San Diego): *Lattices of minimal covolume in SL_n*
10.30-11.00: Coffee break
11.00-11.50: Catalin BADEA (Lille): *Escape the neighborhood (in Lie groups and Banach algebras)*

12.00-13.30: Lunch
13.30-14.20: Thiebout DELABIE (*Neuchâtel*): *A survey on superexpanders*
14.30-15.20: Pieter SPAAS (San Diego): *Non-classifiability of Cartan subalgebras for a class of von Neumann algebras.*
15.30-16.00: Coffee break
16.00-16.50: Yulia KUZNETSOVA (Besançon): *A survey of quantum semigroups*

19.30 Conference dinner
Saturday June 23:
9.30-10.20: Tom KAISER (Neuchâtel): *Combinatorial cost of some graph sequences*
10.30-11.00: Coffee break
11.00-11.50: Colin PETITJEAN (Besançon): *Coarse embeddings of Kalton's interlaced graphs*

Lunch; hike for those interested.

Abstracts

Catalin BADEA, *Escape the neighborhood (in Lie groups and Banach algebras)*

We study the existence of elements of topological groups with no small subgroups, or of Banach algebras, which escape a given neighborhood of the identity after a number of steps belonging to a prescribed sequence of integers. If time permits we plan to discuss the related problem of characterizing (self-adjoint) positive elements of C*-algebras by the accretiveness of some of its powers.

Isabelle BARAQUIN, *Asymptotic distribution for characters of irreducible representations of some groups*

In this talk, we will first present a result from Diaconis, Shahshahani and Evans. Let M be a random matrix chosen from the unitary group U(n) and distributed according the Haar measure. Then, for $j \in N$, $Tr(Mj)$ are independent and distributed as some complex normal variables when $n \to \infty$. Then we will turn to quantum groups, on which Banica, Curran and Speicher did similar computations, for instance, for the free unitary case. Finally, we will look at finite quantum groups, like the Kac-Palyutkin group KP and the Sekine groups KPn.

Thiebout DELABIE, *A survey on superexpanders*

Expanders are graph sequences with interesting properties. One of these properties is that they do not coarsely embed into a Hilbert space. In fact they have a stronger property: they satisfy a Poincaré inequality, this is an inequality that holds for every embedding in a Hilbert space. This is an alternative definition of being an expander. For this inequality we can replace the Hilbert space by any other Banach space. A superexpander has this Poincaré inequality for every embedding into a superreflexive Banach space.

Tom KAISER, *Combinatorial cost of some graph sequences*

In a 2006 paper Gabor Elek introduces the combinatorial cost of a graph sequence as an analogue of the cost for measured equivalence relations. We will give its definition and prove some analogues of results by Damien Gaboriau in our combinatorial setting.
Take a group Γ, a generating set S and a descending sequence of finite index normal subgroups $(N_k)_{k\in\mathbb{N}}$ with trivial intersection. This is a filtration of Γ. The box space with respect to this filtration is defined as $\square_{N_k} \Gamma = \{Cay(\Gamma/N_k, \overline{S}) \}_{k\in \mathbb{N}}$. This is a graph sequence, hence we can calculate its cost. We show that if Λ is a finite index subgroup that contains the filtration, then $[\Gamma:\Lambda] (c(\square_{N_k} \Gamma)-1) = c(\square_{N_k} \Lambda)-1$.

Yulia KUZNETSOVA, *A survey of quantum semigroups*

Quantum groups in their topological setting are noncommutative analogues of function algebras on topological groups. Every class of quantum (semi)groups corresponds to a classical family of (semi)groups, varying by the degree of continuity of the multipication, absence or presence of compactness, presence of additional structures. In my talk, I list known families of quantum (semi)groups and certain maps between them.

Anthony GENEVOIS, *Lamplighter groups, a-T-menability, and median spaces.*

The goal of the talk is to describe the construction of an action of a wreath product on a median space from similar actions of the factors. As a consequence, we reprove that Gromov's a-T-menability (also known as Haagerup property) is stable under wreath products.

Colin PETITJEAN, *Coarse embeddings of Kalton's interlaced graphs.*

In 2007, Kalton introduced a property of metric spaces that he named property $\mathcal Q$. In particular, its absence served as an obstruction to coarse embeddability into reflexive Banach spaces. This property is related to the behavior of Lipschitz maps defined on a particular family of graphs that we shall denote $(G_k(\mathbb N))_{k \in \mathbb N}$. Let us just say, vaguely speaking, that a Banach space X has property $\mathcal Q$ if for every Lipschitz map f from $G_k(\mathbb N)$ to X, there exists a full subgraph $G_k(\mathbb M)$ of $G_k(\mathbb N)$, with $\mathbb M$ infinite subset of $\mathbb N$, on which f satisfies a strong concentration phenomenon. It is then easy to see that if a Banach space X has property $\mathcal Q$, then the family of graphs $(G_k(\N))_{k\in \N}$ does not equi-coarsely embed into X. The main purpose of the presentation is to prove that the converse is false. Indeed, Kalton proved that the most famous example of a quasi-reflexive space, namely the James space $\mathcal J$, as well as its dual $\mathcal J^*$, fail property $\mathcal Q$. However, we will see that the family of graphs $(G_k(\mathbb N))_{k\in \mathbb N}$ does not equi-coarsely embed into $\mathcal J$ and $\mathcal J^*$. This provides a coarse invariant, namely ``not containing equi-coarsely the $G_k(\N)$'s'', that is very close to but different from property $\mathcal Q$.

Pieter SPAAS, *Non-classifiability of Cartan subalgebras for a class of von Neumann algebras.*

We study the complexity of the classification problem for Cartan subalgebras in von Neumann algebras. In particular, we will discuss a construction that leads to a family of II$_1$ factors whose Cartan subalgebras, up to unitary conjugacy, are not classifiable by countable structures. We do this via establishing a strong dichotomy, depending if the action is strongly ergodic or not, on the complexity of the space of homomorphisms from a given equivalence relation to E_0. We will start with some of the necessary preliminaries, and then outline the proofs of the aforementioned results.

François THILMANY , *Lattices of minimal covolume in SL_n* »

A classical result of Siegel asserts that the (2,3,7)-triangle group attains the smallest covolume among lattices of $\mathrm{SL}_2(\mathbb{R})$. In general, given a semisimple Lie group G over some local field F, one may ask which lattices in G attain the smallest covolume. A complete answer to this question seems out of reach at the moment; nevertheless, many steps have been made in the last decades. Inspired by Siegel's result, Lubotzky determined that a lattice of minimal covolume in $\mathrm{SL}_2(F)$ with $F=\mathbb{F}_q((t))$ is given by the so-called p-adic modular group $\mathrm{SL}_2(\mathbb{F}_q[1/t])$. He noted that, in contrast with Siegel's lattice, the quotient by $\mathrm{SL}_2(\mathbb{F}_q[1/t])$ was not compact, and asked what the typical situation should be: « for a semisimple Lie group over a local field, is a lattice of minimal covolume a cocompact or nonuniform lattice? ». In the talk, we will review some of these known results, and then discuss the case of $\mathrm{SL}_n(\mathbb{R})$ for $n > 2$. It turns out that, up to automorphism, the unique lattice of minimal covolume in $\mathrm{SL}_n(\mathbb{R})$ is $\mathrm{SL}_n(\mathbb{Z})$. In particular, it is not uniform, giving a partial answer to Lubotzky's question in this case.

Matthew TOINTON, *The Mahler conjecture in 2 dimensions via the probabilistic method.*

The "Mahler volume" is, intuitively speaking, a measure of how "round" a centrally symmetric convex body is. In one direction this intuition is given weight by a result of Santalo, who in the 1940s showed that the Mahler volume is maximized, in a given dimension, by the unit sphere and its linear images, and only these. A counterpart to this result in the opposite direction is proposed by a conjecture, formulated by Kurt Mahler in the 1930s and still open in dimensions 4 and greater, asserting that the Mahler volume should be minimized by a cuboid. In this talk I will prove the 2-dimensional case of this conjecture via the probabilistic method. The central idea is to show that either deleting a random pair of edges from a centrally symmetric convex polygon, or deleting a random pair of vertices, reduces the Mahler volume with positive probability.