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Program

Constructions of non $C^*$-exact groups

Goulnara Arzhantseva, University of Vienna.
Monday 3, 15:00-15:45

A countable discrete group $G$ is $C^*$-exact or simply, exact, if its reduced $C^*$-algebra $C^*_r(G)$ is an exact $C^*$-algebra (i.e. if taking the minimal tensor product with $C^*_r(G)$ preserves short exact sequences of $C^*$-algebras). Equivalently, $G$ is exact if it admits an amenable action on some compact Hausdorff space. Exact groups are also said to be boundary amenable, amenable at infinity, to have Guoliang Yu’s property A or to be coarsely amenable. The exactness is viewed as a weak amenability type condition. All amenable groups, linear groups, Gromov’s hyperbolic groups, groups with finite asymptotic dimension, and many other familiar groups are known to be exact. In contrast, constructions of non-exact groups are rare and technically quite involved. We will discuss such constructions, indicate applications, and suggest some open problems.

Crossed-products of von Neumann algebras by actions of locally compact groups

Rémi Boutonnet, University of Bordeaux 1
Wednesday 5, 9:30-10:15

I will present joint work with Arnaud Brothier on actions of locally compact groups on von Neumann algebras. We study algebraic properties of the associated crossed-product algebras, and prove a correspondance result between certain subalgebras of this crossed-product and closed subgroups of the acting group. This generalizes results of Izumi-Longo-Popa. I will explain our (very different) approach and give related questions and conjectures.

Random interlacements and the von Neumann-Day problem

Lewis Bowen, University of Texas at Austin
Thursday 6, 15:00-15:45

The von Neumann-Day problem asks whether every non-amenable group contains a non-abelian free group. It was answered in the negative by Olshanskii in the 1980s. The measurable version is still open. I will explain a recent positive answer to the measurable version in the case of positive entropy. The proof uses an approximation to the random interlacement process by random collections of geometrically-killed random walk paths and Seward’s recent generalization of Sinaï’s Factor Theorem.
Uniform spectral gaps for algebraic actions

Emmanuel Breuilliard, University of Münster. 
Monday 3, 11:30-12:15

We show that there is a uniform lower bound on the Kazhdan constants of any non-amenable subgroup $G$ of $GL_d$ with respect to all algebraic quasi-regular representations $l^2(G/H)$. The bound depends only on the dimension $d$, not on $G$, $H$ nor the Kazhdan set.

Random groups and strong versions of Kazhdan’s property (T)

Cornelia Drutu, Oxford University. 
Thursday 6, 9:30-10:15

Kazhdan’s property (T) is a strong negation of amenability, relevant in the study of algebraic properties of groups, in the construction of expander graphs, in dynamics and in connection to the Baum-Connes conjectures. Various strengthened versions of property (T) have been formulated in recent years.

Local spectral gap for translation actions

Adrian Ioana, University of California at San Diego. 
Tuesday 4, 11:30-12:15

This talk will be devoted to the local spectral gap property for translation actions on locally compact groups $G$. I will present two results in the case when $G$ is (1) a connected simple Lie group, or (2) the group of isometries of the Euclidean space $\mathbb{R}^n$. I will also discuss applications of local spectral gap to strong ergodicity, orbit equivalence rigidity and the Banach-Ruziewicz problem. This is based on joint works with Remi Boutonnet and Alireza Salehi-Golsefidy.
Dimension, comparison, and almost finiteness

David Kerr, Texas A&M University.
Friday 7, 11:30-12:15

I will explain how one can develop a dynamical version of some of the theory surrounding the Toms-Winter conjecture for simple separable nuclear C*-algebras. In particular, I will introduce a notion of almost finiteness for group actions on compact spaces as an analogue of both hyperfiniteness in the measure-preserving setting and of $\mathcal{Z}$-stability in the C*-algebra setting. This generalizes Matui’s concept of the same name from the zero-dimensional context and is related to dynamical comparison in the same way that $\mathcal{Z}$-stability is related to strict comparison in the Toms-Winter context. For free minimal actions of countably infinite groups on compact metrizable spaces the property of almost finiteness implies that the crossed product is $\mathcal{Z}$-stable, which leads to new examples of classifiable crossed products.

Fixed-point properties beyond amenability: quelques côneries

Nicolas Monod, EPFL Lausane.
Tuesday 4, 15:00-15:45

Amenability is ubiquitous both as a tool and as an object of study for its own sake. It is often recalled that its original introduction by von Neumann was intended to shed light on paradoxes such as the Banach-Tarski duplication.

What is less often remembered is that amenability does not, in fact, fully address the core questions raised by von Neumann in that context. The questions naturally associated to paradoxical decompositions lead, for instance, to the much less successful concept of ”supramenability”.

This talk is an invitation to return to von Neumann’s questions. In parallel to the central position of amenability amongst fixed-point properties, we will be led to investigate fixed-point problems for cones.

Finite-dimensional representations constructed from random walks

Narutaka Ozawa, Kyoto University.
Friday 7, 15:00-15:45

Let an amenable group $G$ and a probability measure $\mu$ on it (that is finitely-supported, symmetric, and non-degenerate) be given. I will present a construction, via the $\mu$-random walk on $G$, of a harmonic cocycle and the associated orthogonal representation of $G$. Then I describe when the constructed orthogonal representation contains a non-trivial finite-dimensional subrepresentation (and hence an infinite virtually abelian quotient), and some sufficient conditions for $G$ to satisfy Shalom’s property HFD. (joint work with A. Erschler, arXiv:1609.08585)
Completely Sidon sets in discrete groups and $C^*$-algebras

Gilles Pisier, Texas A&M University and UPMC-Paris VI.
Monday 3, 10:30-11:15

A subset of a discrete group $G$ is called completely Sidon if its span in $C^*(G)$ is completely isomorphic to the operator space version of the space $\ell_1$ (i.e. $\ell_1$ equipped with its maximal operator space structure). The latter can also be described as the span of the free unitary generators in the (full) $C^*$-algebra of the free group $F_\infty$ with countably infinitely many generators. Our main result is a generalization to this context of Drury’s classical union theorem for Sidon sets: we prove that completely Sidon sets are stable under finite unions. Our method actually allows us to consider completely Sidon subsets of an arbitrary $C^*$-algebra $A$ in place of $C^*(G)$. In this framework, we prove several non-commutative generalizations of our recent work on uniformly bounded orthonormal systems to the case of von Neumann algebras equipped with normal faithful tracial states.

Spectral gap and absolutely continuous measures

Jean François Quint, University of Bordeaux 1.
Thursday 6, 11:30-12:15

In this talk, I will present a joint work with Yves Benoist: a spectral gap property allows us to ensure that certain stationary measures are absolutely continuous.

Strong property (T) for $SL(3, \mathbb{Z})$

Mikael de la Salle, École Normale Supérieure de Lyon.
Tuesday 4, 9:30-10:15

Property (T) is a rigidity property for unitary representations for a group. Vincent Lafforgue’s strong property (T) (as its Banach-space variants) is a strengthening of property (T) where one allows to work with representations which are not uniformly bounded. It has been known for a couple of years that higher rank Lie/algebraic groups, as well as their cocompact lattices, have strong (T). The aim of my talk, which is motivated by recent applications of strong (T) to the study of group actions on manifolds, will be to generalize these results to cover non-uniform lattices as well. I will explain why this is difficult, and how these difficulties can be overcome. This involves a form of representation induction which leaves to world of representations, and a (to me) surprisingly strong form of property (T) for higher rank algebraic groups which allows to deal with these objects.
Groups of finite type

Andreas Thom, Technische Universität Dresden.
Friday 7, 9:30-10:15

We will present joint work with Hiroshi Ando, Yasu Matsuzawa and Asger Tornquist on a construction of a unitarily representable SIN polish group which is not of finite type. This answers a question of Sorin Popa. Moreover, we will provide an example of an amenable SIN polish group that contains a discrete free subgroup; this is joint work with Alessandro Carderi.

Incidences and the polynomial method

Miguel Walsh, University of Oxford.
Wednesday 5, 11:30-12:15

In recent years, the polynomial method has proven a powerful tool in different areas of mathematics, including number theory, harmonic analysis, computer science and combinatorics. We will discuss some improvements of this method over Euclidean space, including a sharp polynomial partitioning theorem over arbitrary varieties and new estimates on the behavior of the connected components of real algebraic sets. As an application of these results, we provide a general degree-sensitive incidence bound for families of algebraic varieties of arbitrary degree and dimension.

Limits of Betti numbers

Alessandro Carderi, Technische Universität Dresden.
Thursday 6, 10:45-11:15

I will report on a work in progress in which we study ultraproducts of probability measure preserving actions of locally compact groups. Even though the standard ultraproduct construction gives us a highly non measurable action, this ultraproduct often admits a non-trivial factor on which the action is continuous. Moreover this construction commutes with cross sections: a cross section of the ultraproduct can be naturally identified with the ultraproduct of the cross sections. Combining the above mentioned result with a joint work with Gaboriau and de la Salle (also in progress), we will be able to study asymptotics of Betti numbers of lattices in locally compact groups. This will give us a new approach to deduce a recent theorem proved by Abert, Bergeron, Biringer, Gelander, Nikolov, Raimbault and Samet.
Obstructions to coarse embeddability of expanders into Banach spaces

Tim de Laat, University of Münster.
Tuesday 4, 10:45-11:15

Expanders are sequences of finite sparse graphs with strong connectivity properties. It is well known that expanders do not coarsely embed into Hilbert spaces (or even into uniformly curved spaces). However, the question whether there exists an expander that admits a coarse embedding into a uniformly convex space remains open. In this talk, I will first explain how strengthenings of Kazhdans property (T) can be used to show that certain Margulis-type expanders, which are expanders that are constructed in a specific way from higher rank lattices, do not embed into various classes of Banach spaces. This is based on fundamental work of Vincent Lafforgue and on joint work of Mikael de la Salle and myself. I will also comment on some very recent work that shows that certain expanders that are not of Margulis-type also have bad embeddability properties.

Local weak-* convergence and the entropy of algebraic actions

Benjamin Hayes, Vanderbilt University.
Friday 7, 10:00-10:30

I will discuss the entropy of probability measure-preserving actions of sofic groups, due to Bowen and Kerr-Li. I will focus on the case when the action is by automorphisms of a compact metrizable group (these are called algebraic actions). I will give an abstract criterion, in terms of measures on model spaces, which guarantees that the measure-theoretic entropy and topological entropy agree. Some of the techniques required involve ultraproducts of von Neumann algebras and other metric spaces. Knowledge of sofic groups/sofic entropy is not assumed.
Prime \( \text{II}_1 \) factors arising from irreducible lattices in products of simple Lie groups of rank one

Daniel Hoff, University of California at San Diego.
Friday 7, 10:45-11:15

This talk will focus on structural properties of the \( \text{II}_1 \) factors associated to icc lattices in products of connected non-compact rank one simple Lie groups with finite center. In joint work with Daniel Drimbe and Adrian Ioana, we show that when such a lattice \( \Gamma \) is irreducible, the associated \( \text{II}_1 \) factor \( L(\Gamma) \) is prime, that is, cannot be decomposed as a tensor product of \( \text{II}_1 \) subfactors. This gives the first examples of prime \( \text{II}_1 \) factors arising from lattices in higher rank Lie groups. More generally, we show that whenever \( \Gamma \) is a countable icc group that is measure equivalent to a product of non-elementary hyperbolic groups, it decomposes uniquely as a product \( \Gamma = \Gamma_1 \times \cdots \times \Gamma_k \) such that \( L(\Gamma) = L(\Gamma_1) \otimes \cdots \otimes L(\Gamma_k) \) is a unique prime factorization in the sense introduced by Ozawa and Popa in 2003.

Prime factorization for infinite tensor product factors

Yusuke Isono, Kyoto University.
Thursday 17:00-17:30

Ozawa and Popa proved that tensor products of finitely many free group factors “remember” their tensor components in an appropriate sense. In this talk, I discuss a similar property for tensor products of infinitely many factors. I particularly focus on the case when each tensor component is of type III.

Thin \( \text{II}_1 \) factors with no Cartan subalgebras

Anna Sofie Krogager, K U Leuven.
Tuesday 4, 17:00-17:30

It is a wide open problem to give an intrinsic criterion for a \( \text{II}_1 \) factor to admit a Cartan subalgebra. Recently, Popa discovered such a criterion for the closely related thinness property, defined as admitting a ‘simple’ maximal abelian subalgebra. The question whether all \( s \)-thin \( \text{II}_1 \) factors admit a Cartan subalgebra was left open. I will present a negative answer to this question from a joint work with Stefaan Vaes. This is done by applying Popa’s deformation/rigidity theory to Shlyakhtenko’s A-valued semicircular systems and using probability measures on compact groups with peculiar analytic properties.
Dynamics on the space of abelian subalgebras of a II$_1$ factor

François Le Maître, University Paris Diderot.
Monday 3, 17:00-17:30

The Effros-Maréchal topology is a natural Polish topology on the space of von Neumann subalgebras of a separable von Neumann algebra which was studied by Haagerup and Winslow mostly in the case where the ambient algebra is $B(H)$.

I will present a work in progress on the space of subalgebras of a II$_1$ factor where this topology admits a natural reformulation in terms of pointwise convergence of conditional expectations. I will actually focus on the closed space of abelian subalgebras and the continuous action of the unitary group on it by conjugacy.

Using work of Popa, we will see that singular masas always form a dense $G_δ$ set in the space of abelian subalgebras of a II$_1$ factor, that simple spectrum masas form a dense $G_δ$ set when the factor is $s$-thin and that the conjugacy equivalence relation is always generically ergodic. I will also present a dynamical proof that there is a continuum of pairwise non-intertwinable simple spectrum singular masas with non-trivial central sequences in the hyperfinite II$_1$ factor.

A spectral gap characterization of full type III factors

Amine Marrakchi, University Paris-Sud.
Tuesday 4, 16:15-16:45

A factor $M$ is full if it has no non-trivial centralizing sequence. In 1974, Connes proved a very strong spectral gap characterization of full II$_1$ factors which had many important applications. In this talk, we will present a generalization of this spectral gap characterization to type III factors. As an application, we prove that the continuous core of a type III$_1$ factor $M$ is full if and only if $M$ itself is full and its tau invariant is the usual topology. I will also talk about a joint work with Cyril Houdayer and Peter Verraedt where we obtain a similar spectral gap characterization of strongly ergodic equivalence relations.
C*-superrigidity of virtually abelian groups

Sven Raum, École Polytechnique Fédérale de Lausanne.
Thursday 16:15-16:45

A basic question connecting group theory and algebra asks whether a group can be recovered from either of its group algebras. Algebraic results considering for example the integral or the complex group ring are very classical. The same question for the group von Neumann algebra experienced a breakthrough several years ago with the W*-superrigidity result of Ioana-Popa-Vaes. The reduced C*-algebra however, stayed almost untouched so far. In their article on W*-superrigidity the authors remark that "It seems not even known whether the reduced group C*-algebra always remembers a torsion free group." Indeed, the most optimistic point of view on C*-superrigidity draws parallels to the unit conjecture for complex group rings and predicts that every torsion-free discrete group can be recovered from its reduced group C*-algebra. This stands in strong contrast to the state-of-art, which only knows how to recover torsion-free abelian groups.

I will talk about recent work on torsion-free virtually abelian groups, which brought forth new examples of C*-superrigid groups. Despite these groups being so close to the well-understood torsion-free abelian case, an attempt to prove C*-superrigidity for all finitely generated torsion-free abelian groups leads us to study Cartan subalgebras - a topic which is a centre piece of modern structure theory of von Neumann algebras and recently attracted interest in the C*-algebra setting too.

Ergodic Hyperfinite Subgraphs and Primitive Subrelations

Robin Tucker-Drob, Texas A&M University.
Monday 3, 16:15-16:45

We show that every ergodic p.m.p. graph contains an ergodic hyperfinite subgraph. This implies a conjecture of Bowen: every ergodic p.m.p. treeable equivalence relation contains an ergodic hyperfinite primitive subrelation. It also implies the following strengthening of Hjorth's Lemma on cost attained: every ergodic p.m.p. treeable equivalence relation of cost n is generated by a free action of the free group of rank n in which one of the generators acts ergodically. As another Corollary we show that for any p.m.p. ergodic nonamenable graph, there exist sets of arbitrarily small measure where the restriction of the graph remains ergodic and nonamenable.
Fullness of type III tensor product factors

Peter Verraedt, University Paris-Sud.
Wednesday 10:45-11:15

In recent joint work with Amine Marrakchi and Cyril Houdayer, we show that the tensor product $M \otimes N$ of any two full factors $M$ and $N$ (possibly of type III) is full, and that Connes' invariant $\tau(M \otimes N)$ of the tensor product can be computed in terms of $\tau(M)$ and $\tau(N)$. In this talk, I will present the key novelty in the proof, which is an enhanced spectral gap property for full factors of type III. I will moreover show that for full factors of type III with almost periodic states, we obtain an optimal spectral gap property.
Dinner Reception

All participants are cordially invited to a diner party on Wednesday 5th at 19:00 at the top floor of the central tower, called Tour Zamansky, of the Université Pierre et Marie Curie - Paris 6. The entrance is at Place Jussieu, 75005 Paris.

Wifi

The password for the wifi of the Institute will be communicated on Monday 3.