Workshop on von Neumann algebras and group actions
Copenhagen, February 1-5, 2010
Titles and abstracts

Goulnara Arzhantseva (Université de Geneve) :

(2 lectures)

Compression functions of uniform embeddings of groups into Hilbert and Banach spaces.

The concept of uniform embedding was introduced by Gromov in 1993. It plays an important role in the study of large-scale geometry of groups and the Novikov higher signature conjecture. We focus on a group invariant $R(G)$ with values in $[0, 1]$, called Hilbert space compression. It describes how close any uniform embedding of the group into a Hilbert space can be to a quasi-isometry. We overview recent advances and outline some open problems.

Approximations of hyperbolic groups.

We discuss various (still open) questions on approximation of Gromov's hyperbolic groups. We focus on finite-dimensional approximations such as residual finiteness and soficity.

Nate Brown (Penn State) :

Embeddings into $\mathbb{R}^\omega$.

Though I will spend a few minutes reviewing Connes' Embedding Problem, the main topic of my talk will be metric spaces associated to factors that are assumed to be embeddable into $\mathbb{R}^\omega$. In particular, we will answer a question of Shlyakhtenko regarding the discreteness of these spaces in the property T case.

Yves de Cornulier (CNRS, Université de Rennes 1) :

On relative property T for semidirect products with abelian groups.

I'll give a few necessary and sufficient conditions for relative Property T for a pair (G, V), where V is abelian and the normal subgroup in a semidirect decomposition of the locally compact group G. The conditions are given in terms of means or probabilities at the neighborhood of the identity in $\hat{V}$, the Pontryagin dual of V.

Gabor Elek (Alfred Renyi Institute of Mathematics) :

Sofic equivalence relations.

We introduce the notion of sofic equivalence relation. Treeable equivalence relations, relations defined by profinite actions are sofic. We prove that the factor associated to an ergodic sofic relation is embeddable (in the sense of Connes). Also, we prove that the Determinant Conjecture of Lueck, Sauer and Wegner holds for sofic equivalence relations. We are not aware of any countable equivalence relations that is not sofic. (Joint work with Gabor Lippner).

Cyril Houdayer (CNRS, ENS Lyon) :

Structural results for von Neumann algebras associated with free Bogoljubov shifts.

Using Voiculescu's free Gaussian functor, one can associate to any orthogonal representation of a countable group G, an action of G, called the free Bogoljubov shift, on the corresponding free group factor (or on the free Araki-Woods factor in the type III case). I will present new structural properties for the corresponding crossed product von Neumann algebras (lack of Cartan subalgebra/strong solidity). This is joint work with D. Shlyakhtenko.

Adrian Ioana (UCLA/Clay Institute) :

W-superrigidity for Bernoulli actions of property (T) groups*

I will present a new result proving that Bernoulli actions $\Gamma \curvearrowright X$ of ICC property (T) groups Γ are W*-superrigid. This means that if $\Lambda \curvearrowright Y$ is any other free, ergodic, measure preserving action such that the associated group measure space II_1 factors are isomorphic, then the groups are isomorphic and the actions are conjugate.

Paul Jolissaint (Université de Neuchatel) :

Mixing MASAs in group factors

In 1954, J. Dixmier identified three types of maximal abelian $*$-subalgebras in finite factors in terms of the size of their normalizer in the ambient factor. Since then, interested subclasses have been identified, in particular in the class of singular MASAs. We will present the subclasses of so called weakly mixing and respectively strongly mixing MASAs. We will focus attention on pairs $A = L(H)$ and $M = L(G)$ where H is an abelian subgroup of an ICC group G.

David Kyed (Göttingen University) :

Property (T) for quantum groups from the dual point of view.

The notion of property (T) was recently introduced in the class of discrete quantum groups by P. Fima. In the talk I will explain how this property can be expressed using the dual

compact quantum group and furthermore how certain classical characterizations of property (T) can be generalized in the compact setup.

Sergey Neshveyev (University of Oslo) :

The Connes-Marcolli GL_2-system and adelic mixing.

We show that the KMS_β-states of the Connes-Marcolli GL_2-system for $1 < \beta \leq 2$ have type III_1. This is equivalent to ergodicity of various actions on adelic spaces. For example, the case $\beta = 2$ corresponds to ergodicity of the action of $\mathrm{GL}(\mathbb{Q})$ on $\mathrm{Mat}_2(\mathbb{A})$ with its Haar measure. The proof uses a form of adelic mixing and the distribution of prime numbers.

Jesse Peterson (Vanderbilt University) :

(2 lectures)

Cocycle Superrigidity for Bernoulli Shift Actions.

A celebrated theorem of Popa states that for a class of groups including property (T) groups and nonamenable direct product groups, the Bernoulli shift action is essentially determined by the orbits of the group. Popa achieves this result by showing that such actions are U_{fin}-cocycle superrigid, meaning that any cocycle of such an action into a closed subgroup of the unitary group of a II_1 factor must be cohomologous to a homomorphism. I will review Popa's cocycle superrigidity theorem and (in joint work with Thomas Sinclair) investigate whether or not nonamenable groups satisfying this theorem can be characterized by the vanishing of their first ℓ^2-Betti number.

Mikael Pichot (Tokio University) :

Random groups of intermediate rank.

I will discuss some new constructions of random groups, which are symmetric to those of the well-known models of Gromov but which produce groups of intermediate rank. Part of the talk will be devoted to explaining rank interpolation in general. This is joint work with Sylvain Barre.

Roman Sasyk (Instituto Argentino de Matematicas) :

Descriptive set theory and von Neumann algebras.

We will describe a joint work with A. Tornquist where we use methods from descriptive set theory to study the global structure of the set of separable von Neumann algebras. Specifically, in this talk we will show that the isomorphism problem of Araki-Woods factors is not classifiable by countable structures using Hjorth's notion of turbulence for equivalence relations.

Roman Sauer (Münster University) :

Computing L^2-Betti numbers using a spectral sequence for discrete measured groupoids

This is joint work with Andreas Thom. We construct a spectral sequence for L^2-type cohomology groups of discrete measured groupoids. Based on the spectral sequence, one can prove the Hopf-Singer conjecture for aspherical manifolds with poly-surface fundamental groups. As further sample applications of the spectral sequence, we obtain new vanishing theorems and explicit computations of L^2 -Betti numbers of groups and manifolds.

Yves Stalder (Université Blaise Pascal, Clermont-Ferrand) :

Stability properties for a-T-menability (II).

In this talk, I will explain how to prove the Haagerup property for some special kinds of semidirect products, like (standard) wreath products of a-T-menable groups. Two important tools which will be introduced in the talk are measured walls structures (which are inspired from Robertson-Steger and Cherix-Martin-Valette), and gauges (generalizations of the support function). This is joint work with Y. Cornulier and A. Valette.

Romain Tessera (CNRS, ENS Lyon) :

A geometric decomposition property for linear groups.

In a joint work with Erik Guentner and Guoliang Yu, we prove that any countable subgroup of the linear group over a field $\mathbb{K}$ has "finite decomposition complexity". As a result, we obtain a topological rigidity property for any closed aspherical manifold whose fundamental group is linear.

Andreas Thom (Leipzig University) :

(2 lectures)

Almost representations, uniformly bounded representations and uniform deformations of unitary representations.

In these lectures I will give a survey about some results relating the existence of nonunitarizable representations, uniform deformations of unitary representations and almost representations in the sense of David Kazhdan. I will also show that certain arithmetic lattices in semi-simple groups do not admit finite dimensional almost representation other than perturbations of unitary representations.

Stefaan Vaes (K.U. Leuven) :

(4 lectures)

W^*-superrigidity for group measure space II_1 factors.

I will explain a joint work with Sorin Popa in which we prove a unique crossed product decomposition result for group measure space II_1 factors arising from arbitrary free ergodic probability measure preserving actions of any group Γ in a fairly large family G. This family G contains all free products of a Kazhdan group and a non-trivial group, as well as certain

amalgamated free products over amenable subgroups. The latter allow to give examples of W*-superrigid group actions, i.e. group actions for which the associated II_1 factor entirely remembers the group and the action that it was constructed from.

Alain Valette (Université de Neuchatel) :

(2 lectures)

Stability properties for a-T-menability (I).

A group has the Haagerup property, or is a-T-menable, if it admits a metrically proper, isometric action on a Hilbert space. By a celebrated result of Higson-Kasparov, groups with the Haagerup property satisfy the Baum-Connes conjecture with coefficients. We shall explain how the Haagerup property can be established geometrically for groups acting properly on trees and more generally on spaces with walls. The class of Haagerup groups is closed under direct and free products, but not under arbitrary semi-direct products. In the second talk of the series, it will be explained why certain semi-direct products like wreath products, do preserve a-T-menability. This is joint with Y. Cornulier and Y. Stalder.

The Howe-Moore property and isometric actions on Hilbert spaces.

A locally compact group G has the Howe-Moore property if every unitary representation of G without fixed vectors, has C_0-coefficients. The well-known importance of the Howe-Moore property in ergodic theory, comes from the fact that every ergodic, finite-measure preserving actiong of a Howe-Moore group, is mixing. We prove that, for second countable groups, this really characterizes the Howe-Moore property. We prove that every isometric action of a Howe-Moore group on a Hilbert space, either is metrically proper or has a fixed point (this provides an easy proof of a result by Shalom on $SO(n,1)$, $SU(n,1)$). Finally we introduce a notion of relative Howe-Moore property and we classify all pairs (G,N) with the relative Howe-Moore property, assuming that G is an analytic subgroup in some $GL_n(\mathbb{K})$ ($\mathbb{K}$ a local field of characteristic 0), and N is a closed normal subgroup of G. This is joint work with R. Cluckers, Y. Cornulier, N. Louvet and R. Tessera.

Andrzej Zuk, Université Paris 7 :

L^2-Betti numbers of closed manifolds.