

## Arbre de Noël du GDR Géométrie non commutative

Orléans 12-13 décembre 2024

Jeudi 12 décembre

**9h30-10h30 Accueil-café** au bâtiment de Mathématiques

*Les exposés ont lieu dans l'amphi Herbrand, bâtiment d'Informatique*

10h30-11h30 **Indira Chatterji** : Minicours: The rapid decay property for discrete groups (1)

Résumé : *The rapid decay property for a discrete group gives a control on the norms of convolutions in the reduced  $C^*$ -algebra of the group. We will discuss consequences of this property, known results and open questions.*

11h40-12h10 **Lamine Messaci** Isometric action on finite rank median spaces

Résumé : *Median spaces have garnered attention in the field of geometric group theory due to the characterization that they provide to the Kazhdan property (T) and the Haagerup property. Addition to that, they give a common framework for studying isometric actions on real trees and  $CAT(0)$  cube complexes. In this talk, we will introduce the median geometry through definitions and examples. After that, we will state results in the case of finite rank locally compact median spaces.*

12h15-12h45 **Guillaume Dumas** Optimal regularity for  $K$ -finite matrix coefficients of Lie groups

Résumé : *Lafforgue showed that any  $SO(2)$ -invariant matrix coefficient of a unitary representation of  $SO(3)$  is  $1/2$ -Hlder continuous - outside some specific singular points. This fact is a key input in the proof of strong property (T) for  $SL(3, \mathbb{R})$  and several related advances in operator algebras. In this talk, I will explain how to interpret this regularity result in terms of Gelfand pairs and spherical functions. Thanks to this point of view, I will show a generalisation to any semisimple Lie group by studying the behaviour of these functions. When the group is non-compact, there exists a nice integral expression for spherical functions. Surprisingly, the compact case is harder and requires tools from complex analysis.*

**13h-14h déjeuner** au restaurant universitaire L'Anatidé

14h15-15h15 **Alessandro Vignati** Minicours: Roe-like algebras: between coarse geometry and operator algebras (1)

Résumé : *Roe-like algebras are  $C^*$ -algebras designed to catch algebraically the coarse geometric behaviour of metric spaces. They are fundamental in applications for their connections across mathematics and further. In this minicourse, after having defined (some of) these  $C^*$ -algebras, we will glance around their main properties, their structure, and some of their intricacies.*

15h25-15h55 **Arthur Troupel** On free wreath products of compact quantum groups

Résumé : *The free wreath product of a compact quantum group by the quantum permutation group  $S_N^+$  has been introduced by Bichon in order to give a quantum counterpart of the classical wreath product. In general, the definition makes sense for the free wreath product of a compact quantum group with a subgroup of a quantum automorphism group of a finite dimensional  $C^*$ -algebra. In a joint work with Pierre Fima, we extended the definition to allow the second quantum group to be any compact quantum group acting on such a  $C^*$ -algebra. We then studied what were the conditions on the action that ensured that approximation properties were preserved by taking free wreath product. In this talk I will explain the construction of the usual free wreath product, and then our definition. I will then describe the conditions we need on the action in order to be able to show that the resulting quantum group has the approximation properties we are interested in.*

**16h-16h30 pause café** (bâtiment de Mathématiques)

16h30-17h **Juan Paucar** On growth of cocycles for isometric representations on Banach spaces

Résumé : *It is known by the Delorme-Guichardet theorem that for  $\sigma$ -compact locally compact groups property (T) coincides with property FH, that is, the property that every continuous isometric action on a Hilbert space has a fixed point. Another rephrasing of this property is the fact that for any unitary representation all 1-cocycles have to be bounded. Inspired by the work of V.Lafforgue, we will explore the asymptotics of how unbounded can the 1-cocycles be in the case of a group without property FLp, an  $L^p$ -analogue of property FH, more precisely we will study the behaviour as  $n$  grows to infinity of  $\sup_{|g| \leq n} \|b(g)\|$ . This is based on a joint work with Antonio Lopez Neumann.*

17h05-17h35 **Florian Thiry** Index theory in manifolds with corners

Résumé : *In this talk we define the boundary index of a singular manifold in a general  $C^*$  algebraic framework following the Lescure and Carrillo Rouse approach. Then we explain how it encodes geometrical obstruction for symbols to be associated to nicer operators (Fredholm operators in the classical case). Eventually we extend Lescure and Carrillo Rouse's strategies to compute the associated  $K$ -theory groups in the case of families of manifolds with corners using iterated blow-ups.*

17h40-18h05 **Shuoxing Zhou** Noncommutative topological boundaries and amenable invariant random intermediate subalgebras

Résumé : *As an analogue of the topological boundary of discrete groups  $\Gamma$ , we define the noncommutative topological boundary of tracial von Neumann algebras  $(M, \tau)$  and apply it to generalize a recent result by Amrutam-Hartman-Oppelmayr, showing that for a trace preserving action of  $\Gamma$  on an amenable tracial von Neumann algebra  $(A, \tau)$ , any  $\Gamma$ -invariant amenable intermediate subalgebra between  $A$  and  $\mathcal{K}A$  is necessarily a subalgebra of  $\text{Rad}(\Gamma) \rtimes A$ . By considering a free pmp action, we obtain a similar result for invariant subequivalence relations.*

**20h dîner à L'Etage, 6 rue Jean Hupeau, Orléans**

## Vendredi 13 décembre

*Les exposés ont lieu dans l'amphi Herbrand, bâtiment d'Informatique*

9h-10h **Indira Chatterji** Minicours: The rapid decay property for discrete groups (2)

10h-10h30 **pause café** (bâtiment de Mathématiques)

10h30-11h **Enli Chen** Rigid Graph Products

Résumé : *Graph product of groups is an important construction in geometric group theory. In 2014, Caspers and Fima introduced its operator algebras counterpart, and then graph product of operator algebras became an increasingly important research topic in recent years. In this talk, we will introduce some rigidity property of graph product von Neumann algebras. First we will introduce the unique graph product decomposition result of a large class of graph product von Neumann algebra. That means for this von Neumann algebras, the graphs are isometric invariants. Then I will present other rigidity results such as primeness and strong solidity of graph product von Neumann algebras. This talk is based on joint work with Matthijs Borst and Martijn Caspers.*

11h05-11h35 **Clément Cren** Algèbre de Toeplitz et groupe de Heisenberg

Résumé : *Les représentations des groupes de Heisenberg sont intimement liées aux opérateurs de création et annihilation. Les algèbres de Toeplitz de leur côté sont engendrées par des opérateurs de shift. Ces derniers s'obtiennent naturellement partir des opérateurs de création et vice-versa. Je montre que cette observation peut-être promue en un isomorphisme entre une algèbre construite à partir de celle de Toeplitz et le noyau de la représentation triviale dans la  $C^*$ -algèbre du groupe de Heisenberg.*

11h40-12h10 **Axel Gastaldi** Local periodic cyclic homology of crossed product algebras

Résumé : *Crossed product algebras are fundamental objects that describe the actions of Lie groups on algebras. In this talk we will give a description of the periodic cyclic homology of such a crossed product algebra by a crossed product algebra relative to a maximal compact subgroup. We will distinguish the cases when we localize over a conjugacy class of a semi-simple and a unipotent element of the group. In both cases we will give new geometrical proofs of results established in the early 90' by V. Nistor.*

12h15-12h45 **Fabien Hoareau** Spatial models for boolean actions in the infinite measure-preserving setup

Résumé : *Any measure-preserving Borel action of a Polish group on a standard measured space -called a spatial action- gives a measure-preserving boolean action, an action on the Borel subsets up to measure zero. Conversely, a natural problem is the following: given a boolean action, does it come from a spatial action? Glasner, Tsirelson and Weiss gave a complete answer for finite measures. Moreover, when a spatial action exists, a theorem of Becker and Kechris implies that we can always take it to be a continuous action on a compact space. For the case of infinite measures however, we need to take into account the interplay between measure and topology, and to this end we aim to obtain a continuous action on a locally compact Polish space endowed with a Radon measure. In a joint work with François Le Maître, we show that it is possible to obtain such a model for actions of lcsc groups.*

**13h-14h déjeuner au restaurant universitaire L'Anatidé**

14h15-15h15 **Alessandro Vignati** Minicours: Roe-like algebras: between coarse geometry and operator algebras (2)

15h25-15h55 **Corentin Correia** Rank-one systems, flexible classes and Shannon orbit equivalence

Résumé : *At the level of ergodic probability measure-preserving bijections, quantitative orbit equivalence aims at bridging the gap between the well-studied but very complicated relation of conjugacy, and the trivial relation of orbit equivalence, which is equality of orbits up to conjugacy but is trivial by Dyes theorem. It proposes to add quantitative restrictions to the cocycles associated to an identification of orbits. In 2022, Kerr and Li explicitly built a Shannon orbit equivalence between the universal odometer and any other odometer, thus yielding explicit examples of Shannon orbit equivalent systems which are not conjugate. We will present a generalization of this result. We use the interesting class of rank-one systems, which look like odometers but have different properties, thus providing a natural generalization of their construction and many flexibility results. For instance, our result implies that strong mixing is not preserved under Shannon orbit equivalence.*

**15h55-16h25 pause café**(bâtiment de Mathématiques)

16h25-16h55 **Paul Meunier** A taste of noncommutative combinatorics

Résumé : *In this brief talk, we will have a glimpse into the emerging yet very active field of noncommutative combinatorics through two examples: a breakthrough thanks to operator algebraic techniques in the study of  $F$ -isomorphism of finite graphs – a notion going back to work of Laszlo Lovasz in the 1970s – and a combinatorial approach to the Connes' Embedding Problem, a long-standing open question (with a recent announced resolution in the negative) going back to work of Alain Connes in the same period of time. The first example is based on the beautiful preprint "Quantum isomorphism is equivalent to equality of homomorphism counts from planar graphs" by Mancinska and Roberson and the second one on the exciting preprint "MIP\*=RE" by Ji, Natarajan, Vidick, Wright, and Yuen.*

17h-17h30 **Thibaut Lescure** K-théorie des anneaux de Pimsner discrets

Résumé : *The Cuntz-Pimsner algebra associated to a  $C^*$ -correspondence over a  $C^*$ -algebra is a now classical object generalizing both  $C^*$ -algebras associated to graphs and crossed products by  $Z$ . Their  $K$ -theory was first calculated by Pimsner in 1997 with the use of a long exact sequence obtained by classical  $KK$ -theoretic computations. Purely algebraic analogues of these Cuntz-Pimsner algebras were introduced in 2011 for rings without topology, they generalize the corresponding constructions of rings. I will introduce the different analogies between the purely algebraic and  $C^*$ -algebraic formalisms and briefly show how one can adapt Pimsner's construction to establish a long exact sequence of the (algebraic)  $K$ -theory groups of algebraic Cuntz-Pimsner rings.*