GROUPOIDS AND OPERATOR ALGEBRAS
Applications to Analysis, Geometry and Dynamics

Tuesday 21 May 2019 – Friday 24 May 2019

Abstracts

Iakovos Androulidakis (University of Athens)

Title: Diffeological groupoids and their operator algebras

Abstract: Diffeological groupoids appear in several singular situations, for instance foliations and more generally for subalgebroids of integrable algebroids. We give an overview of the construction of groupoids as such, as well as their associated operator algebras.

Claire Debord (Université Paris-Diderot)

Title: Blowup and deformation groupoids in relation with index theory

Abstract: In this talk, we will present natural constructions of Lie groupoids resulting from the deformation and blowing procedure. We will see that these constructions are very relevant for the study of index theory for singular geometrical spaces (e.g. deformation of a foliation, manifold with fibered corners or conical pseudo-manifolds etc..). It is part of joint work with G. Skandalis and with J.M. Lescure.

Siegfried Echterhoff (Westfälischen Wilhelms-Universität in Münster)

Title: Crossed products and amenability of group actions

Abstract: In this lecture we report on some recent joint work with Alcides Buss and Rufus Willett on various notions of amenability for actions of discrete groups on C*-algebras and the question under what conditions for an action of a discrete group the maximal and the reduced crossed products coincide.

Ruy Exel (Universidade Federal de Santa Catarina)

Title: Weak Cartan subalgebras of C*-algebras

Abstract: In 2008 Renault showed how to characterize the reduced C*-algebra of an essentially principal, étale, Hausdorff groupoid using the notion of Cartan subalgebras. In this talk we will exhibit a recent generalization of Renault's result, obtained in collaboration with David Pitts, which also applies to non-Hausdorff groupoids.

Damien Gaboriau (CNRS, ENS Lyon)

Title: On non-standard limits of graphs and some orbit equivalence invariants

Abstract: Limits of discrete structures have attracted a lot of interest in the last decade. We are interested in sequences of pmp group actions, of graphs or of graphings and in the asymptotic behavior of such invariants as the groupoid-cost or the L^2-Betti numbers. We consider the corresponding their ultra-limits. This allows us to study the rank gradient and the behaviour of the Betti numbers for sequences of finite index subgroups in a given group under various mild assumptions. We interpret such invariants as the combinatorial cost or the beta-invariant of sequences of graphs in terms of cost and L^2-Betti numbers of ultra-limit objects. This is joint work with A. Carderi and M. de la Salle.

Thierry Giordano (Université d'Ottawa)

Title: On the first cohomology group of a free minimal $\mathbb{Z}^d$-action on the Cantor set

Abstract: In this talk, I will review properties of the first cohomology group $H^1(X, \phi)$ of a free minimal $\mathbb{Z}^d$-action(X, ϕ) on the Cantor set. In particular, I will indicate that how to obtain complete invariants of conjugacy, isomorphism and continuous orbit equivalence of $\mathbb{Z}^d$-odometers using their first cohomology groups. In the last part of my presentation I plan to describe new partial results for free minimal $\mathbb{Z}^2$-actions on the Cantor set beyond the odometer case (Joint work with Iain Putnam and Christian Skau).

Alex Kumjian (University of Nevada, Reno)

Title: The homology of ample groupoids and the Matui conjecture

Abstract: We review the definition and elementary properties of the Crainic-Moerdijk homology in the setting of ample groupoids. Given an ample groupoid G with compact unit space which is minimal and effective, Matui conjectured that the K-theory of the reduced C*-algebra of G is isomorphic to the homology and verified his conjecture in a number of important cases. In joint work my coauthors, Carla Farsi, David Pask and Aidan Sims, and I have shown that the isomorphism in the conjecture holds for the path groupoids of higher rank graphs of ranks one or two even when the unit space is no longer compact

Xin Li (Queen Mary University of London)

Title: A groupoid approach to classifiable C*-algebras

Abstract: I will explain how to construct Cartan subalgebras in all classifiable stably finite C*-algebras, and I will discuss the Jiang-Su algebra as a particular example.

Omar Mohsen (Université Paris-Diderot)

Title: Déformation de Witten et groupoïdes de Lie

Résumé: En 1982, Witten a donné une démonstration analytique d'inégalité de Morse en utilisant une déformation du Laplacien. Cette déformation est beaucoup utilisée depuis. Dans cet exposé je vais donner un autre point de vue de cette déformation en utilisant des groupoïdes de Lie construits récemment par Debord et Skandalis.

Paul Muhly (University of Iowa)

Title: Groupoid Methods and Singular Spaces in Free Analysis

Abstract: The current theory of noncommutative holomorphic functions, which arose in part in free analysis, leads one to view such functions as functions on what appear to be singular spaces. Inspiration from groupoid theory that I learned from Jean and others, coupled with the methodology of geometric invariant theory, led me to my current understanding of where such functions really live. I will describe some of Baruch Solel's and my recent results in this area.

Hervé Oyono-Oyono (Université de Lorraine)

Title: K-theory, groupoids and propagation

Abstract: Let G be a locally compact étale groupoid and let $X = V_1 \cup V_2$ be a decomposition of the space of units as the union of two open subsets. We show that this decomposition gives rise to a Mayer-Vietoris six-term exact sequence in quantitative K-theory. We give application of this exact sequence to some computations in K-theory.

Arlan Ramsay (University of Colorado at Boulder)

Title: Some Observations Regarding the Contributions of Jean Renault, as Seen from Boulder

Abstract: This title is partly an apology for any omissions that seem regrettable to anyone in the audience, but I hope to give an indication of where to look for at least some of Jean's important insight into ways to understand mathematical situations by looking at them through the lens of groupoids. .

Georges Skandalis (Université Paris-Diderot)

Title: Stability of Lie groupoid C*-algebras and of C*-algebras of singular foliations

Abstract: We will prove that if the anchor map is nowhere zero, the C*-algebra of a Lie groupoid is always stable. We will also consider the analogous result for singular foliations. This is based on a joint paper with Claire Debord.

Sobers Sundar (Chennai Mathematical Institute)

Title: CCR flows associated to closed convex cones

Abstract: Let P be a closed convex cone in a Euclidean space. An E_0-semigroup over P on the algebra of bounded operators on an infinite dimensional separable Hilbert space is a semigroup of unital normal endomorphisms satisfying a natural continuity condition. One of the basic examples is the CCR construction which associates an E_0-semigroup to an isometric representation of P.

The most natural examples of isometric representations of P arise out of translation action on P-invariant subsets of the underlying Euclidean space. I will explain how groupoids can be used to distinguish the resulting E_0-semigroups. This groupoid approach was first systematically explored by Muhly and Renault in their seminal paper "C*-algebras of multivariable Wiener-Hopf operators". This is joint work with Anbu Arjunan

Karen Strung (Radboud Universiteit in Nijmegen)

Title: Groupoids from minimal dynamical systems

Abstract: This talk is based on joint work with Robin Deeley and Ian Putnam, where we study the existence of minimal dynamical systems, their orbit and minimal orbit-breaking equivalence relations, and their applications to C^*-algebras and K-theory. In particular, we show that given any finite CW-complex there exists a space with the same K-theory and cohomology that admits a minimal homeomorphism. The proof relies on the existence of homeomorphisms on point-like spaces constructed by the authors in previous work, together with existence results for skew product systems due to Glasner and Weiss. To any minimal dynamical system one can associate minimal equivalence relations by breaking orbits at small subsets. Using Renault's groupoid C^*-algebra construction we can associate K-theory groups to minimal dynamical systems and orbit-breaking equivalence relations. We show that given arbitrary countable abelian groups G_0 and G_1 we can find a minimal orbit-breaking relation such that the K-theory of the associated C^*-algebra is exactly this pair. These results have important applications to the Elliott classification program for C^*-algebras. In particular, we make a step towards determining the range of the Elliott invariant of the C^*-algebras associated to minimal dynamical systems with mean dimension zero and their minimal orbit-breaking relations.

Stefaan Vaes (KU Leuven)

Title: Classification of regular subalgebras of the hyperfinite $\mathbf{II}_1$ factor

Abstract: I present a joint work with Sorin Popa and Dimitri Shlyakhtenko. We prove that under a natural condition, the regular von Neumann subalgebras B of the hyperfinite II_1 factor R are completely classified (up to conjugacy by an

automorphism of R) by the associated discrete measured groupoid. We obtain a similar result for triple inclusions of A in B in R, where A is a Cartan subalgebra in R and the intermediate von Neumann algebra B is regular in R. The two key steps in proving these results are the vanishing of the 2-cohomology for cocycle actions of amenable discrete measured groupoids and the approximate vanishing of the 1-cohomology

Stéphane Vassout (Université Paris-Diderot)

Title: Fourier Integral Operators on Lie Groupoids

Abstract: Based on our work with Jean-Marie Lescure, I will explain the construction of Fourier Integral Operators recently developed in the framework of Lie groupoids. This calculus not only contains the original calculus for smooth compact manifolds, but also fits with many different generalizations of this calculus developped in various geometric situations. This calculus is in particular based on the Coste-Dazord-Weinstein sypmplectic Lie groupoid structure of the cotangent space T^*G of a given Lie groupoid G.

Robert Yuncken (Université Clermont-Auvergne)

Title: Pseudodifferential operators from tangent groupoids

Abstract: Inspired by a result of Debord-Skandalis, we will discuss the following principal: In order to construct an algebra of pseudodifferential operators adapted to a given geometrical situation, it suffices to construct an appropriate tangent groupoid. We will explain the construction and illustrate it with several examples, such as the Heisenberg calculus, Melrose's b-calculus, and Rodino's calculus of bisingular operators (joint work with E. van Erp)