GroupoidFest – November 10 & 11, 2018 – University of Illinois at Chicago

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Titles & Abstracts

Speaker: Valentin Deaconu, University of Nevada, Reno
Title: *Symmetries of the C^*-algebra of a vector bundle*

Abstract: We recall the definition of the Cuntz-Pimsner algebra $\mathcal{O}_E$ of a Hermitian vector bundle $E \to X$ and discuss some results related to K-theory. We review certain facts about the structure of G-vector bundles for G a compact group. Since G acts on $\mathcal{O}_E$, our goal is to study the crossed product $\mathcal{O}_E \rtimes G$ using the Hao-Ng Theorem. We focus on the particular cases when the action on $E \to X$ is free, trivial on X, or transitive. We discuss the possibility of similar results for groupoid actions.

Speaker: Leonard Huang, University of Nevada, Reno
Title: *Bundles of Generalized Fixed-Point Algebras for Proper Groupoid Dynamical Systems*

Abstract: In a seminal 1990 paper, Marc Rieffel defined proper C^*-dynamical systems to describe proper actions of a locally compact Hausdorff group on a "non-commutative space". In his 2009 PhD thesis, Jonathan Brown generalized Rieffel's definition to groupoid dynamical systems. The most important aspect of a proper groupoid dynamical system is that we can construct a generalized fixed-point algebra from it. Recently, Brown and I discovered how, given a locally compact Hausdorff space X and a proper groupoid dynamical system $\mathscr{G}$, to equip the generalized fixed-point algebra of $\mathscr{G}$ with a $\mathrm{C}_0(X)$-algebra structure if there exists a continuous map q from $\mathcal{G}^{(0)}$ — the unit space of the underlying groupoid $\mathcal{G}$ of $\mathscr{G}$ — to X such that the pre-image of each point in X under q is $\mathcal{G}$-invariant. This completes the generalization of Rieffel's 1990 paper to the groupoid setting. I will present this result and show that the fibers of the $\mathrm{C}_0(X)$-algebra are generalized fixed-point algebras themselves. I will also describe the relevance of this result to current research. This is joint work with Jonathan Brown of the University of Dayton, Ohio.

Speaker: Marius Ionescu, United States Naval Academy
Title: *The homology of ample groupoids and the Matui conjecture*

Abstract: In this talk based on joint work with Alex Kumjian, Aidan Sims, and Dana Williams, I present an explicit formula for the Dixmier–Douady invariant of the C^*-algebra of the groupoid extension associated to a Čech 2-cocycle in the sheaf of germs of continuous G-valued functions, where G is a locally compact abelian group G. We then exploit the blow-up construction for groupoids to extend this to some more general central extensions of étale equivalence relations.

Speaker: 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-Moedijk homology in the setting of ample groupoids. We show that there is a natural homomorphism from the homology of a higher rank graph to that of its path groupoid. 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.

Speaker: Olga Lukina, University of Illinois at Chicago
Title: *Non-Hausdorff groupoids and Galois groups*

Abstract: The asymptotic discriminant is an invariant classifying equicontinuous group actions on Cantor sets up to return equivalence. The asymptotic discriminant of such an action can be stable or wild. In particular, if the germinal groupoid of local homeomorphisms, associated to the action is non-Hausdorff, then the asymptotic discriminant is wild.

In the talk, we consider group actions on Cantor sets arising from representations of absolute Galois groups of fields of functions into the automorphism group of a binary tree. We investigate the asymptotic discriminant for such actions, as well as the properties of the associated groupoid of local homeomorphisms. This talk is based on the preprints arxiv:1702.03032, 1801.01440, and 1809.08475.

Speaker: Constantine Medynets, United States Naval Academy
Title: *On Algebraic Properties of Full Groups*

Abstract: For any countable group G acting by homeomorphisms on the Cantor set X, we can associate a larger group $[[G]]$, dubbed *the full group of* (X, G), consisting of homeomorphisms that locally coincide with elements of G. The full group as an abstract group is a complete invariant for continuous orbit equivalence of (X, G). Thus, $[[G]]$ possesses a great deal of information about the underlying dynamical system. These groups were recently used to construct examples of infinite simple finitely generated amenable groups [Juschenko-Monod].

In the talk we will give a survey of known algebraic properties of full groups, present a complete description of generators and defining relations for full groups associated with minimal $\mathbb{Z}$-subshifts, and give an elementary proof that these groups cannot be finitely presented. The talk is based on joint work with Grigorchuk.

Speaker: Jeffrey Morton, SUNY Buffalo State
Title: *Groupoidification and the Fock Pseudomonad*

Abstract: The process of "Groupoidification", introduced by Baez and Dolan, has proved useful in a variety of of contexts, from quantum field theory to geometric representation theory. It consists of finding structures in a category whose objects are groupoids, and whose morphisms are "spans" of groupoids (a generalization of what are known in various contexts as "Morita morphisms" or "Hilsum-Skandalis morphisms"). In this talk, I will discuss a construction, known as the Fock pseudomonad, which is involved in the groupoidification of Fock space in quantum mechanics. I will describe how this, and the program of groupoidification itself, are based on certain free constructions, with illustrative examples.

Speaker: Paul S. Muhly, University of Iowa
Title: *Groupoid Methods in Wavelet and Fractal Analysis. Redux*

Abstract: In *Groupoid Methods in Wavelet Analysis* (Contemp. Math. **449**, 193-208, 2008) we made the case that the Deaconu-Renault groupoid is the "tool of choice" for analyzing the Hilbert space representations and parameters that arise in wavelet and fractal analysis. Of course, there is an underlying local homeomorphism in these situations and the Deaconu-Renault groupoid is the groupoid that one associates to the local homeomorphism.

In this talk, we discuss how to build the imprimitivity groupoid of the Deaconu-Renault groupoid that is naturally associated to a transfer operator for the local homeomorphism. In very rough terms, we aspire to build analogues of the well-known process of forming the minimal unitary extension of a Hilbert space isometry. This is joint work with Marius Ionescu.

Speaker: Khashayar Sartipi, University of Illinois at Chicago
Title: *The Paschke Categories, K-homology, and the Riemann-Roch Transformation.*

Abstract: For a separable C^*-algebra A, we introduce an exact C^*-category called the Paschke Category of A, which is completely functorial in A, and show that its K-theory groups are isomorphic to the topological K-homology groups of the C^*-algebra A. Then we use the Dolbeault complex and ideas from the classical methods in Kasparov K-theory to construct an acyclic chain complex in this category, which in turn, induces a Riemann-Roch transformation in the homotopy category of spectra, from the algebraic K-theory spectrum of a complex manifold X, to its topological K-homology spectrum. This talk is based on the preprint arxiv:1810.11951.