Noncommutative Geometry and Topology
Géométrie et topologie non commutatives
(Org: **Branimir Ćaćić** (University of New Brunswick), **Dan Kucerovsky** (University of New Brunswick) and/et **Martin Mathieu** (Queen's University Belfast))

TRISTAN BICE, IMPAN (Institute of Mathematics of the Polish Academy of Sciences)
Generalised Non-Commutative Stone Dualities between Étale Groupoids and Inverse Semigroups

In recent years, étale groupoids have become an indispensible tool for constructing and analysing C*-algebras. At the next level of abstraction, inverse semigroups can be used to construct and analyse étale groupoids. On the one hand, we have Exel's ample (i.e. totally disconnected) tight groupoid construction, while on the other we have Lawson and Kudryavtseva's non-commutative Stone duality between ample groupoids and Boolean inverse monoids. In this talk we outline our work extending these to more general non-ample groupoids. (joint work with Charles Starling)

SARAH BROWNE, Penn State University
Quantitative E-theory

Quantitative E-theory is an ongoing project joint with Nate Brown which aims to create a new approach to tackling results like the Universal Coefficient Theorem for new classes of C*-algebras. In recent years, many people have been working on classifying C*-algebras and these results assume the UCT, which requires further understanding. The inspiration is work by Oyono-Oyono-Yu, who used a quantitative approach of K-theory to prove the Künneth Theorem for new classes of C*-algebras. An ongoing project of Willett-Yu extends the quantitative approach to the KK-context. Quantitative E-theory is a generalisation of E-theory and so I will begin my talk by defining the notion of E-theory and talk about how we get the definition of Quantitative E-theory. Then I will state results connecting this definition to E-theory.

RÉAMONN Ó BUACHALLA, Université libre de Bruxelles
The noncommutative geometry of the quantum flag manifolds

Flag manifolds are a beautiful family of projective Kähler manifolds lying at the crossroads of many approaches to geometry. More recently, quantum flag manifolds are emerging as an analogous point of communication between the various appraoches to noncommutative geometry. In this talk we give an overview of these connections, discussing in particular noncommutative complex and Kähler structures, Nichols algebras, spectral triples, and noncommutative projective algebraic geometry.

KENNY DE COMMER, VUB
The continuous field of quantum $GL(N, \mathbb{C})$

Given a unital $*$-algebra A together with a good filtration by positive reals on its set of irreducible (bounded) representations, one can construct a C*-algebra A_0 with a dense two-sided ideal A_c such that A maps densely into the multiplier algebra of A_c. When the filtration is induced from a central element in A, we say that A is an s^*-algebra. We also introduce the relative notion of R-algebra over a commutative s^*-algebra R, and of Hopf R-algebra. We formulate conditions such that the completion of a Hopf R-algebra gives rise to a continuous field of Hopf C*-algebras over the spectrum of R_0. We apply the general theory to the case of quantum $GL(N, \mathbb{C})$ as constructed from the FRT-formalism. This is joint work with M. Floré.

ASGHAR GHORBANPOUR, Western University

PIOTR HAJAC, IMPAN
AN EQUIVARIANT PULLBACK STRUCTURE OF TRIMMABLE GRAPH C*-ALGEBRAS

We introduce a class of graphs called trimmable. Then we show that the Leavitt path algebra of a trimmable graph is graded-isomorphic to a pullback algebra of simpler Leavitt path algebras and their tensor products. Next, specializing the ground field to the field of complex numbers and completing Leavitt path algebras to graph C*-algbras, we prove that the graph C*-algebra of a trimmable graph is $U(1)$-equivariantly isomorphic with an appropriate pullback C*-algebra. As a main application, we consider a trimmable graph yielding the C*-algebra $C(S_q^{2n+1})$ of the Vaksman-Soibelman quantum sphere, and use the resulting pullback structure of its gauge invariant subalgebra $C(CP_q^n)$ defining the quantum complex projective space to show that the generators of the even K-group of $C(CP_q^n)$ are given by a Milnor connecting homomorphism applied to the (unique up to sign) generator of the odd K-group of $C(S_q^{2n-1})$ and by the generators of the even K-group of $C(CP_q^{n-1})$. Based on joint works with Francesca Arici, Francesco D'Andrea, Atabey Kaygun and Mariusz Tobolski.

CRISTIAN IVANESCU, MacEwan University
The Cuntz semigroup and the classification of C*-algebras

An important class of C*-algebras (that announced by George Elliott in early 1990s) has been recently classified by means of K-theory. This class is referred to as the class of $\mathcal{Z}$-stable C*-algebras. However examples of C*-algebras have been shown to exist outside of this class, requiring an enlargement of the Elliott invariant. There is evidence that the Cuntz semigroup is useful in the classification theory. In this talk I will discuss the Cuntz semigroup as an invariant for C*-algebras and its applications to the classification theory.

ANAMARIA SAVU, University of Alberta
Discrete Solid-on-Solid models

A crystal is a solid in which the atoms form a periodic arrangement. For many practical applications, understanding structural atomic arrangement and processes governing formation of crystals are essential to obtain useful properties. A special class of models so called Solid-on-Solid models are used to study the equilibrium statistical mechanics of surfaces. Several discrete Solid-on-Solid models and partial differential equations for surface diffusion are discussed.

CHRISTOPHER SCHAFHAUSER, University of Waterloo

ILYA SHAPIRO, University of Windsor
Categorified Chern character and Hopf-cyclic cohomology

For a Hopf algebra H, motivated by some results in derived algebraic geometry, we propose a generalization of stable anti-Yetter-Drinfeld contramodules as an analogue of S^1-equivariant quasi-coherent sheaves on the derived loop space of X. This category serves both as the target for categorified Chern characters of H-module algebras and also as the source of coefficients for cohomology. The Hopf-cyclic cohomology is then recovered as an Ext in this category as was done by Connes and Kassel for cyclic cohomology using cyclic objects and mixed complexes respectively. This places Hopf-cyclic cohomology into the same framework as de Rham cohomology.

ANDRZEJ SITARZ, Jagiellonian University
Twisting and untwisting reality.

Conformally rescaled spectral triples that were studied in recent years are not real (with the first-order condition for the Dirac operator) yet they could have a twisted version of a real structure and first-order condition. We study the possible twists

and relations between various versions of reality (real twisted spectral triples, spectral triples with twisted real structure) and discuss the untwisting procedure. Based on joint work with T. Brzezinski and L.Dabrowski.

KAREN STRUNG, Radboud University
Unitary orbits via transportation theory

Results from the Elliott classification programme can be used to translate theorems of optimal transport into calculations of the distance between unitary orbits of normal elements in well-behaved C^*-algebras. In particular, in certain simple Jiang—Su stable C^*-algebras with real rank zero and trivial K_1, the distance between full-spectrum unitaries can be computed in terms of spectral data. This talk is based on joint work with Bhishan Jacelon and Alessandro Vignati.

VICTOR VINNIKOV, Ben Gurion University of the Negev
Hermitian noncommutative kernels and their factorizations

Free noncommutative function theory originated in the work of Taylor in the early 1970s. It became an active field in the last decade with a large body of results and numerous relations to free algebra, operator space theory, free probability, etc. The main idea is to replace functions between vector spaces by graded functions between square matrices of all sizes over these vector spaces that preserve direct sums and similarities. In this talk I will discuss completely positive noncommutative kernels which are the analogue of usual positive kernels as well as of completely positive maps, and a factorization result for hermitian noncommutative kernels which is analogous to Positivstellensaetze in real algebraic geometry (and closely related to Positivstellensaetze for the free algebra due to Helton, McCullough-Putinar, and others). The talk is based on joint work with G. Marx and J. Ball.