

Mathematical Physics Seminars

2011 - 2012

4 October 2011 in Room M/1.10 at 4:00pm

Speaker: [Otogo Uuye](#) (Cardiff)

Title: Operator Algebras Seminar - Connective K-theory I. Homotopy and homology theories for C^* -algebras.

Abstract: K-theory is nowadays a standard item in the toolkit of a noncommutative geometer. In this series of talks, I will give a gentle introduction to a version of K-theory, called connective K-theory, and discuss applications.

6 October 2011

Speaker: Vassili Kolokoltsov (Warwick)

Title: Nonlinear kinetic equations as dynamic Laws of Large Numbers for Markov models of interacting particles.

Abstract: We shall present a systematic discussion of the link between nonlinear positivity preserving equations (nonlinear kinetic equations) and Markov models of interacting particles. Approximating evolution of interacting particles is described by the first order linear approximation (evolution of derivatives with respect to initial data) to a nonlinear evolution, and the limit of the normalized fluctuations is described by the second order linear approximation to a nonlinear evolution (evolution of second derivatives with respect to initial data).

11 October 2011 in Room M/1.10 at 4:00pm

Speaker: [Otogo Uuye](#) (Cardiff)

Title: Operator Algebras Seminar - Connective K-theory II. Connective K-theory and applications.

13 October 2011 in Room M/0.40

Speaker: Raymond Russell (CORVIL)

Title: Measuring Entropy - from Statistical Mechanics to Latency Management.

Abstract: Corvil is a company founded by John Lewis to turn insights of his about the role of entropy in queuing systems into practical industrial applications. Originally the goal of Corvil's work was to understand and manage queuing in IP networks, but today we focus largely on latency within trading systems. We will present how the company started, and how measurements of entropy are used to understand queuing behaviour, but will also describe how Corvil has evolved to operate in the high-performance trading market-place. We will finish by describing one or two interesting problems in this area that might benefit from a mathematical approach.

18 October 2011 in Room M/1.10 at 4:00pm

Speaker: [Otogo Uuye](#) (Cardiff)

Title: Operator Algebras Seminar - Connective K-theory III. Unstable version of connective K-theory.

20 October 2011

Speaker: Tomasz Brzezinski (Swansea)

Title: Toward synthetic non-commutative geometry.

Abstract: The aim of the talk is to give categorical (or synthetic) reasons why faithfully flat Hopf-Galois extensions or principal comodule algebras are considered to play the role of principal bundles in non-commutative geometry. More specifically, in the first part of the talk we review the synthetic definition of a principal bundle (within a Cartesian category) and in the second we translate this definition to a braided monoidal category. Principal comodule algebras are then obtained as principal bundles within the category opposite to the category of vector spaces.

25 October 2011 in Room M/2.01 at 4:00pm

Speaker: Claus Koestler (Aberystwyth)

Title: Operator Algebras Seminar - Braidability from deformed tensor shifts. Part 1.

Abstract: Deformed tensor shifts on the hyperfinite II_1 factor were studied by Jones and Sunder from the perspective of subfactor theory. Recently Rolf Gohm and I have introduced 'braidability' as new distributional symmetry in noncommutative probability. I will illustrate at hands of deformed tensor shifts how 'braidability' emerges. Finally, I will address more recent work on central limit theorems in the context of these deformed tensor shifts. Quite surprisingly these central limit laws are those of q -Gaussian random variables, which are known to generate non-hyperfinite II_1 factors for $-1 < q < 1$.

1 November 2011 in Room M/2.01 at 4:00pm

Speaker: Claus Koestler (Aberystwyth)

Title: Operator Algebras Seminar - Braidability from deformed tensor shifts. Part 2.

3 November 2011

Speaker: Stefan Grosskinsky (Warwick)

Title: Condensation and metastability in stochastic particle systems.

Abstract: We study zero-range and inclusion processes where particles move on a lattice according to a simple on-site or nearest neighbour interaction. The processes exhibit a condensation transition, where a finite fraction of all particles accumulates on a single site when the total density exceeds a critical value, which is a classical analogue of Bose-Einstein condensation. This has been understood on a rigorous level in great detail, and I will give a short account of those results and some recent developments regarding the metastable dynamics in the condensed phase.

This is joint work with Ines Armendariz, Michalis Loulakis and Paul Chleboun.

8 November 2011 in Room M/2.01 at 4:00pm

Speaker: Claus Koestler (Aberystwyth)

Title: Operator Algebras Seminar - Braidability from deformed tensor shifts. Part 3.

10 November 2011

Speaker: Damian JJ Farnell (Glamorgan)

Title: A Brief Introduction to Quantum Magnetism.

Abstract: Quantum magnetism is a fascinating subject dealing with the interactions of quantum spins that are localized to points on a crystallographic lattice and that interact via the laws of quantum mechanics. The interactions between spins are modeled via a Hamiltonian and a prototypical example is given by the Heisenberg model. "Complexity" in these systems comes from: strong quantum interactions; the large (often infinite) numbers of particles; the underlying crystallographic lattice; quantum "frustration"; and, the various terms within the Hamiltonian. Such systems are of interest as models of insulating quantum magnetic materials as well as also of the undoped phases of high temperature superconductors; e.g., the cuprate and/or the more recent oxypnictide (iron-based) superconductors. Note that the terms "quantum magnetism" and "quantum spin systems" are often used inter-changeably. The simplicity of these systems (e.g., spins can only point "up" or "down" for a "spin-half" system) makes them ideal choices for understanding strong quantum effects in many-body systems, and many of the problems encountered in treating spin systems occur also in other areas of quantum many-body theory. They can be used to study quantum entanglement and so are of interest to quantum information theorists. Finally, phase transitions may occur between different areas of quantum order (or alternatively into regions of disorder) as one "tunes" parameters in the Hamiltonian, and so these systems are also strongly relevant to statistical physics. In this talk, I will present results from a variety of techniques for a "canonical" system called the "J1-J2 model" for a spin-half system on the square lattice; this system illustrates many of the problems typically seen in this area. By using a range of approximate techniques, I hope to show that a detailed picture of the basic behavior of this system can emerge. I will also discuss the existence of spin plateau (due purely to quantum effects) in the (infinite) triangular lattice Heisenberg antiferromagnet in an external magnetic field. I will demonstrate that these theoretical calculations agree very well with experimental results for the magnetic material Ba₃CoSb₂O₉ when placed in an external field. Finally, I will go on to describe some other topical problems in this field and also some of the possible areas of future research.

22 November 2011 in Room M/2.01 at 4:00pm

Speaker: Claus Koestler (Aberystwyth)

Title: Operator Algebras Seminar - Braidability from deformed tensor shifts. Part 4.

24 November 2011

Speaker: Iain Gordon (Edinburgh)

Title: Quantization of some Poisson Varieties arising in Representation Theory.

Abstract: There are several new families of algebras in Lie theory that are, to some extent, constructed from an underlying symplectic variety. These include finite W-algebras, deformed preprojective algebras, symplectic reflection algebras. A good way to study the rich representation theory of these algebras is to consider them as quantizations of the underlying varieties and so introduce a mixture of geometry and deformation quantization. I'll discuss the history of this idea, explain the relatively general situation, present some specific recent results, and mention what would be good to know.

1 December 2011

Speaker: Roger Plymen (Southampton)

Title: The idea of a noncommutative quotient, with applications to representation theory.

Abstract: Noncommutative quotients appear in several versions, but the simplest and most useful version is the extended quotient of a space by a finite group. The extended quotient is a down-to-earth object which is quite easy to calculate. I will illustrate this with some examples. The extended quotient has applications in

representation theory, especially the representation theory of p-adic groups and affine Hecke algebras. This will be a non-technical talk.

Joint work with Anne-Marie Aubert and Paul Baum.

<http://arxiv.org/pdf/1110.6596>.

15 December 2011

Speaker: Gwyn Bellamy (Manchester)

Title: Symplectic reflection algebras and symplectic resolutions.

Abstract: In this talk I shall describe a class of algebras called "symplectic reflection algebras". These algebras are related to several other areas of mathematics. In particular, they can be used to answer a question from symplectic algebraic geometry on the existence of certain symplectic resolutions. I'll say exactly what this question is and give an idea of how one goes about answering it using the representation theory of symplectic reflection algebras.

26 January 2012

Speaker: Diane Macglagan (Warwick)

Title: Tropical Geometry.

Abstract: Tropical geometry is geometry over the tropical semiring, where multiplication is replaced by addition and addition is replaced by minimum. This turns algebraic varieties into piecewiselinear objects. I will introduce these objects, and indicate some connections to the moduli space of curves, particularly in genus zero.

2 February 2012

Speaker: David Barnes (Sheffield)

Title: Rational G-equivariant cohomology theories.

Abstract: Cohomology theories are of great importance for studying topological spaces. They take as input topological spaces and as output give a collection of abelian groups. They satisfy a useful collection of axioms which (in theory) make these groups computable.

If X is a space with an action of a compact Lie group G and E is a cohomology theory, then $E^*(X)$ also has a G -action. But this doesn't usually tell us a great deal about the action, for example if G is the circle group, then the action on cohomology is always trivial.

So there is a need for cohomology theories that use the G -action in a more fundamental way. These are called equivariant cohomology theories, we discuss the definition, consider some examples and show that rationally, they are very well-behaved.

9 February 2012

Speaker: Elmer Rees (Bristol)

Title: Real division algebras, linear algebra and topology.

Abstract: The quaternions and octonions were constructed in the early 19th century. It was soon believed that the dimension of a real division algebra could only be 1, 2, 4 or 8. However a proof had to wait until about 1960 and uses algebraic topology in an essential way.

I will briefly explain constructions of the algebras and give some history of related problems including a review of various attempts to prove the result stated above. I will present a new variant of the proof; it is easily adapted to give solutions of other problems of linear algebra that could be stated in a first course on linear algebra but for which algebraic proofs are not known.

23 February 2012

Speaker: Graham Niblo (Southampton)

Title: Topological superrigidity.

Abstract: (Joint work with Aditi Kar) We provide a new topological splitting theorem for aspherical manifolds of high dimension in the spirit of the sphere theorem and Waldhausen's torus theorem. The result uses a mixture of ideas from geometric group theory, surgery theory, Poincaré duality and rigidity which I will outline together with applications.

1 March 2012

Speaker: Tamás Hausel (Oxford)

Title: Symmetries of $SL(n)$ Hitchin fibers

Abstract: In this talk we will motivate by mirror symmetry considerations a topological mirror symmetry conjecture comparing the cohomology of $SL(n)$ and $PGL(n)$ Hitchin spaces. Following Ngo's proof of the fundamental lemma in the Langlands program, we will study a certain symmetry of the $SL(n)$ Hitchin fibration. This will lead to an agreement of the cohomology of the $SL(n)$ and $PGL(n)$ Hitchin spaces up to the degree predicted by topological mirror symmetry.

8 March 2012

Speaker: Brian Bowditch (Warwick)

Title: Asymptotic cones and median algebras

Abstract: An asymptotic cone of a finitely generated group is a metric space which describes the large-scale geometry of the group. They were introduced Van den Dries and Wilkie as a convenient means of formalizing various arguments of Gromov in more succinct terms. They have since been used for a wide variety of applications. We aim to give a brief survey of this topic. We hope to mention some connections with median algebras, which set some recent results by a number of people in a broader context.

22 March 2012

Speaker: Keith Hannabuss (Oxford)

Title: Algebras, categories, and QED;

Abstract: This talk will use techniques which have recently proved useful in T-duality to examine the structure of the algebra of Quantum Electrodynamics.

29 March 2012

Speaker: David Preiss FRS (Warwick)

Title: Fréchet differentiability of Lipschitz functions and porous sets in Banach spaces

Abstract: I will discuss some of the results of joint work with Joram Lindenstrauss and Jaroslav Tišer (recently published in the Annals of Mathematics Studies), in which we have finally proved that complex-valued Lipschitz functions on Hilbert spaces have points of differentiability (in the strong, i.e., Fréchet sense). As the proof is

rather involved (even in the case of real-valued functions which was known since 1990), the talk intends to concentrate on background, connections and methods that are of independent interest.

16 - 20 April 2012

[INI-WIMCS Meeting on Noncommutative Geometry](#)

17 April 2012

6.00 pm in Large Chemistry Lecture Theatre, Main Building

LSW Distinguished Frontiers Lecture

Speaker: Lyn Evans (CERN)

Title: Back to the Big Bang, the Large Hadron Collider

Abstract: After 15 years in construction, the LHC has started its physics program. It is the most complex scientific instrument ever built, bringing together science and engineering on a grand scale. The 6000 superconducting magnets weighing nearly 50000 tons in total are cooled with 100 tons of superfluid helium. The machine has been built to address some of the most fundamental scientific questions including the origin of mass, dark matter and dark energy and the subtle asymmetry between matter and antimatter responsible for our very existence. Some of these questions will be discussed as well as the engineering principles of this unique instrument. [Click here for more details.](#)

18 April 2012

7.15 pm in Wallace Lecture Theatre, Main Building

LSW Distinguished Frontiers Lecture

Isaac Newton Institute 20th Anniversary Lecture

Speaker: Alain Connes (College de France, IHES and Vanderbilt)

Title: The spectral point of view on geometry and physics.

[Click here for more details.](#)