Dr Aidan Sims, University of Wollongong
Operator Algebras Seminar Programme

This series of three seminars is supported in part by an LMS Scheme 2 grant.

C^*-algebras associated to product systems

Venue: Room C4, Mathematics & Physics Building, University of Nottingham.
Time and Date: 3.00pm on 30th September 2009.
Local organiser: Joachim Zacharias, jz@maths.nottingham.ac.uk.

Abstract: A product system, over a semigroup P, of Hilbert A–A bimodules is a semigroup fibred over P such that each fibre is a right-Hilbert A–A bimodule and such that multiplication is consistent with the internal tensor product operation. Fowler associated to each product system X a covariant Toeplitz algebra $\mathcal{T}_{\text{cov}}(X)$, which simultaneously generalises Pimsner's Toeplitz algebra for a single bimodule and Nica's Toeplitz algebras for non-abelian semigroups.
Pimsner also introduced a quotient $\mathcal{O}_X$ of his Toeplitz algebra (indeed, this was his primary object of study); and recently Crisp and Laca have introduced corresponding "boundary quotients" of Nica's Toeplitz algebras. In this talk, we discuss the identification of a quotient of Fowler's $\mathcal{T}_{\text{cov}}(X)$ which simultaneously generalises Pimsner's $\mathcal{O}_X$ and Crisp and Laca's boundary quotients. It turns out that the most natural way to define this algebra is in terms of what we call its "co-universal property," and we will take some time discuss the advantages of this viewpoint.
This is joint work with Yeend, and with Carlsen, Larsen and Vittadello.

Simplicity and structure of k-graph C^*-algebras

Venue: Main Lecture Theatre (A54), Postgraduate Statistics Centre, Lancaster University.
Time and Date: 4.00pm on 2nd October 2009.
Local organiser: Niels Jakob Laustsen, n.laustsen@lancaster.ac.uk.

Abstract: A graph C^*-algebra is a C^*-algebra determined by generators and relations encoded by a directed graph. There is a theorem going back to the genesis of the subject that states that the C^*-algebra of a graph in which each vertex receives at least on and at most finitely many edges is simple if every loop in the graph has an entrance, and every vertex can be reached from every right-infinite path. Relatively soon thereafter, it was demonstrated that this condition was also necessary, and also that the same theorem persisted for arbitrary graphs.
A k-graph is a higher-dimensional analogue of a directed graph. The C^*-algebras of k-graphs have been much studied in recent years, and have much in common with graph C^*-algebras which they generalise. However, the conditions on theorems tend to be more complicated and the theorems not so sharp. In particular, the obvious generalisation of the simplicity theorem for C^*-algebras of k-graphs where each vertex receives at least one and at most finitely many edges of each dimension gave only an sufficient condition, and this condition involved periodicity of infinite paths, making it very hard to check. Moreover, removing the hypotheses on the k-graphs in question yielded variations on the simplicity criterion, and it was unclear how the different conditions related to one another.
In this talk we discuss reformulations of the conditions in the simplicity theorem which only involve finite paths, and discuss a recent proof that these conditions are both necessary and sufficient for the k-graph C^*-algebra to be simple for the most general class of k-graphs considered to date.
This is joint work with Robertson and with Lewin.

A Dixmier-Douady classification for Fell algebras

Venue: Room 321, Physical Sciences Building, Aberystwyth University.
Time and Date: 3.00pm on 7th October 2009.
Local organiser: Gwion Evans, dfe@aber.ac.uk.

Abstract: A liminary C^*-algebra A is a continuous trace C^*-algebra if the positive elements a such that $\pi \mapsto \mathrm{Tr}(\pi(a))$ is continuous on $\widehat{A}$ generate A as an ideal. The spectrum $\widehat{A}$ is automatically Hausdorff. Roughly speaking, the Dixmier-Douady classification of continuous-trace C^*-algebras assigns to each continuous-trace C^*-algebra A with spectrum X an element $\delta(A)$ in a homology group over X in such a way that two continuous trace C^*-algebras A and B with spectrum X are Morita equivalent if and only if $\delta(A) = \delta(B)$.
A Fell algebra is a C^*-algebra A such that every irreducible representation π of A satisfies Fell's condition: there is a positive element a and a neighbourhood U of π so that every element of U sends a to a rank-one projection. Gert Pedersen showed that Fell algebras are "locally" continuous trace; but globally, their spectra need not be Hausdorff. In this talk we describe an extension of the Dixmier-Douady theorem to Fell algebras based on Kumjian's machinery of C^*-diagonals.
This is joint work with an Huef and Kumjian.