Special Session for the first AMS-UMI

Joint Meeting to be held in Pisa June 12-16 2002:

OPERATOR ALGEBRAS
Saturday June 15, 2002

(S.Doplicher, E.G.Effros)

SCHEDULE:

9:00 – 9:45	E.G.Effros
9:50 – 10:20	C.Pinzari
10:50 – 11:35	D.V.Voiculescu
11:40 – 12:10	D.Guido
12:20 – 12:50	N.P.Brown
15:00 – 15:45	M.Roerdam
15:50 – 16:20	J.E.Roberts
16:40 – 17:25	R.Longo
17:30 – 18:15	S.Popa
18:20 – 18:35	T.Isola
18:35 – 18:50	S.Carpi

TITLES and ABSTRACTS:

Nathaniel P. Brown: Aspects of Representation Theory of C*-algebras

Abstract

We discuss some general questions in the representation theory of C*-algebras and how these questions are related to other (non-representation theoretic) questions in operator algebras.

Sebastiano Carpi: The Virasoro algebra and sectors with infinite statistical dimension

Abstract

We describe recent results on the existence of sectors with infinite statistical dimension for the local net of von Neumann algebras on the circle associated to the Virasoro algebra with central charge c=1.

Edward G.Effros: Aspects of smoothness and rotundity for operator spaces

Abstract

We show that the classical geometrical notions of smoothness and rotundity indeed have operator space analogues.

Daniele Guido: Modular localization and Wigner particles

Abstract

A framework for the free field construction of algebras of local observables is proposed, which uses as an input the Bisognano-Wichmann relations and a representation of the Poincare' group on the one-particle Hilbert space. The abstract real Hilbert subspace version of the Tomita-Takesaki theory enables one to bypass some limitations of the Wigner formalism by introducing an intrinsic spacetime localization. This approach works also for continuous spin representations to which a net of von Neumann algebras on spacelike cones with the Reeh-Schlieder property is associated. The positivity of the energy in the representation turns out to be equivalent to the isotony of the net, in the spirit of Borchers theorem. This procedure extends to other spacetimes homogeneous under a group of geometric transformations as in the case of conformal symmetries and de Sitter spacetime. (Joint work with Romeo Brunetti and Roberto Longo)

Tommaso Isola: Fractals in Noncommutative Geometry

Abstract

To any spectral triple (A, D, H) of the Alain Connes' noncommutative geometry a dimension d is associated, in analogy with the Hausdorff dimension for metric spaces. Indeed d is the unique number, if any, such that $|D|^{-d}$ has non trivial logarithmic Dixmier trace. Moreover, when d

is finite nonzero, there always exists a singular trace which is nontrivial on $|D|^{-d}$, giving rise to a noncommutative integration on A. However d is not characterized by this property in general: such numbers form an interval, the traceability interval. Such results are applied to fractals in R, using Connes' spectral triple, and to limit fractals in R^n, a class which generalises self-similar fractals, using a new spectral triple. The noncommutative dimension or measure can be computed in some cases. They are shown to coincide with the (classical) Hausdorff dimension and measure in the case of self-similar fractals. For a class of fractals, the endpoints of the traceability interval coincide with some (upper and lower) dimensions. (Joint work with D. Guido)

Roberto Longo: Classification of Local Conformal Nets. The Discrete Series

Abstract

We explain the structure of diffeomorphism invariant local conformal nets of von Neumann algebras on the circle (chiral components of 2-dimensional conformal quantum field theories). Each net corresponds to an extension of an infinite dimensional Lie algebra, the Virasoro algebra. The case the central charge of the Virasoro algebra is less than 1 gives the discrete series. We give a complete classification of the discrete series (joint work with Y. Kawahigashi).

Claudia Pinzari: Jones index for countably generated Hilbert C*-bimodules.

Abstract

We introduce a notion of Jones index in the C*–category of (countably generated) Hilbert C*-bimodules over nonunital C^*–algebras with centres. Our definition relies on two axioms: an anlytic one and an algebraic one. The analytic axiom is essentially a Pimsner–Popa inequality, while the algebraic axiom requires that the left actions are contained in the compact operators. We then show the existence of countable unconditionally convergent bases, and we construct the index value as a central element in the coefficient algebra of the bimodule. Frank and Kirchberg have recently developped an index theory for conditional expectations requiring only a Pimsner–Popa inequality. However, the Jones basic construction does not exist in general. We show that under our additional algebraic axiom, a Jones basic construction can always be performed. We characterize bimodules of finite index algebraically as those with finite intrinsic dimension in the sense of Longo and Roberts. We discuss several examples. In particular we show that a typical inclusion of commutative unital C*-algebras for which a finite Watatani basis does not exist is actually determined by a nonunital subinclusion with finite Jones index in our sense. (Joint work with T. Kajiwara and Y. Watatani)

Sorin Popa: Betti numbers and rigidity for group-measure space factors.

Abstract

I will explain a new strategy for studying cross product algebras $M = B \rtimes_\sigma \Gamma_0$, which works whenever a combination of rigidity and weak-amenability properties for Γ_0 and σ are met. This method allows to obtain very fine invariants and rigidity results for large classes of factors, and solve a multitude of problems, including partial answers to some conjectures of Connes. A key application is the consideration of a notion of Betti numbers for factors $M = L^\infty(X, \mu) \rtimes_\sigma \Gamma_0$, by proving that the L^2-Betti numbers for the groups Γ_0 considered by Cheeger-Gromov, and Gaboriau's L^2-Betti numbers for the measurable equivalence relations implemented by Γ_0 on the probability space (X, μ), pass to the factors M.

John E.Roberts: Sector Structure in Curved Spacetime

Abstract

We discuss the extent to which results on sector structure can be generalized to curved spacetime pointing out the problems that arise and the new techniques designed to overcome them.

Mikael Roerdam : A nuclear simple C*-algebra with a finite and an infinite projection

Abstract

It was asked around 1980 if every simple finite C*-algebra must be stably finite and if every infinite simple C*-algebra must be purely infinite. These questions are also relevant in the current classification program of Elliott.

In this talk I will present a nuclear, separable counterexample to both questions. More specifically, there is a C*-algebra A, which is an inductive limit of type I C*-algebras (hence nuclear and in the UCT class) and an automorphism on A such that the crossed product, B, of A by the Z-action induced on A by that automorphism, is simple, separable, and contains an infinite and a non-zero finite projection.

The C*-algebra B provides a counterexample to Elliott's classification conjecture (as it is formulated today - but if one replaces K_0 with the dimension range, then the conjecture is still open). The C*-algebra B is also an example of a nuclear, simple C*-algebra that is tensorially prime (i.e, is not a tensor product of two non-type I C*-algebras).

The example is a refinement of an earlier, non-nuclear example of the same type of phenomenon, and its construction uses ideas of Villadsen.

Dan V.Voiculescu: Topics in free probability theory.

Abstract

Free probability theory is a highly noncommutative probability theory , with independence modelled on free products instead of tensor products. There are important applications to operator algebras and to random matrices . The talk will deal with recent advances in the theory .