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Συντονιστές: Μ. Ανούσης, Ε. Κακαριάδης, Α. Κατάβολος

Ομιλητές

Δημήτριος Ανδρέου (Εθνικό και Καποδιστριακό Πανεπιστήμιο Αθηνών)

Approximation properties of group von Neumann algebras

This talk focuses on approximation properties of locally compact group von Neumman algebras, which are weaker than the approximation property (AP) introduced by Haagerup and Kraus. We present how such approximation properties can be reduced to algebraic ones in a certain category of (dual) operator modules over the Fourier algebra, including jointly harmonic operators in the sense of Anoussis, Katavolos and Todorov, as well as crossed products of dual operator spaces.

Ιάκωβος Ανδρουλιδάκης (Εθνικό και Καποδιστριακό Πανεπιστήμιο Αθηνών)

Hypoellipticity and the Helffer-Nourrigat conjecture

A linear differential operator D on a manifold M is called hypoelliptic when for every $f \in C^\infty(M)$, the PDE $Du = f$ admits a smooth solution u. In 1979, Helffer and Nourrigat conjectured that hypoellipticity is determined by a certain set of representations, associated with the symmetries of D, in the form of nilpotent Lie algebras. These representations are easily computable by a recursive formula. In this talk we will overview the proof of this conjecture, which we gave together with Omar Mohsen and Robert Yuncken.

Σωτήριος Αρμενιάκος (TU Wien, Austria)

Maximal Monotone Operators with unique Representation

For a monotone operator $A : X \rightrightarrows X^*$, we define $\mathcal{F}_A$ as the family of all representations of A through convex lower semicontinuous functions on $X \times X^*$. In this talk we shall discuss the singular case, that is, the family collapses to a singleton. We show that every such operator is cyclically monotone (hence, $A = \partial f$ for some convex function f) if and only if it is 3-monotone. In Radon–Nikodým spaces, under mild conditions (which become superfluous in finite dimensions), we prove that a subdifferential operator $A = \partial f$ is uniquely representable if and only if f is the sum of a support and an indicator function of suitable convex sets.

This is joint work with Aris Daniilidis.

Δημήτριος Γεροντογιάννης (TU Wien, Austria)

The noncommutative geometry of Cuntz-Krieger algebras

Cuntz-Krieger algebras, introduced in the early 1980s, are the prototypical examples of C^*-algebras associated with chaotic dynamical systems. Specifically, they encode topological dynamics on directed graphs and can be viewed as C^*-algebras of certain foliations on the Cantor space. In view of the Gelfand duality and other classical results, Cuntz-Krieger algebras are considered as noncommutative topological spaces.

The next step in the evolution of C^*-algebras into geometric objects is found in Connes' noncommutative geometry programme (since mid 1980s). The gist is to equip C^*-algebras with differential-geometric data in order to access finer structures, which are otherwise unreachable. Until very recently, it was an open problem to equip Cuntz-Krieger algebras with a canonical noncommutative geometry.

In this talk, I outline the solution to this problem, following recent advances in noncommutative geometry, diffusion on metric-measure spaces, and quantum groups. The talk is based on several joint works with Amaury Freslon (Paris), Magnus Goffeng (Lund), Bram Mesland (Leiden), and Adam Skalski (Warsaw).

Άρης Δανιηλίδης (TU Wien, Austria)

Pathological differentiable Lipschitz functions

We focus on the difference between differentiable versus strict differentiable locally Lipschitz functions from the view point of nonsmooth analysis: while in the latter class, all limiting Jacobians are singletons, we show that there exists a differentiable locally Lipschitz function for which the image of the limiting Jacobian map contains all nonempty compact connected subsets of matrices. In the particular case of real-valued functions, we obtain differentiable functions with surjective limiting and Clarke subdifferentias. In this case, our concrete example-scheme will also reveal that the class of such pathological locally Lipschitz differentiable functions is dense (for the topology of the uniform convergence) and spaceable (for the Lip-norm topology).

The talk is based on joint works with R. Deville and S. Tapia-Garcia.

Δημοσθένης Δριβαλιάρης (Πανεπιστήμιο Αιγαίου)

The angle of an operator and range-kernel complementarity

Let X be a complex Banach space with a semi-inner product $[\cdot,\cdot]$ and $A : X \to X$ be a bounded linear operator. The cosine of A is

$$\cos A = \inf\left\{\frac{\mathrm{Re}[Ax,x]}{\|Ax\|\,\|x\|} \,:\, x \notin N(A)\right\}$$

and the angle $\phi(A)$ of A is

$$\phi(A) = \arccos(\cos A).$$

We will discuss the relation between the angle of A being less than π and the range $R(A)$ and the kernel $N(A)$ of A being complementary, i.e.

$$X = R(A) \oplus N(A).$$

Ευγένιος Καχαριάδης (Εθνικό και Καποδιστριακό Πανεπιστήμιο Αθηνών)

Stabilisations of operator systems

Recently Connes and van Suijlekom used operator systems to study objects appearing naturally in truncations in Mathematical Physics, comparing them up to stabilisations. In their work they ask if there is a general Morita theory for this category, similar to Rieffel's notion for unital C^*-algebras introduced in the 60s. In this talk I will give equivalent characterizations via

Morita contexts, bihomomoprhisms and a symmetrisation product, while I will highlight properties that are invariant. Time permitted I will provide applications to rigid systems, function systems and non-commutative graphs.

This talk is based on joint works with George Eleftherakis and Ivan Todorov.

Ελευθέριος Καστής (Lancaster University)

Geometric Rigidity from an Operator Theoretic Approach

A (bar-joint) framework is a representation of a graph in a d-dimensional space, such that each vertex is placed as a point (called a joint), and each edge is shown as a straight line (called a bar) connecting two joints. The joints are free to move, but the length of the bars remains fixed. In geometric rigidity, research focuses in determining whether a given framework is rigid, meaning it cannot be deformed without changing the lengths of its bars. The linear constraints imposed by the length of the bars on the joints are encoded in a matrix called the rigidity operator $R(G)$. When the underlying graph is infinite, operator theory becomes relevant.

In this talk we will discuss recent developments on periodic frameworks, such as the two-dimensional grid. Central to this theory is the symbol function $\Phi_{\mathcal{G}}(\omega)$, a matrix-valued function on the d-dimensional torus, which is Fourier equivalent to the rigidity matrix. Its kernel reveals the ω-phase-periodic flexes and the set of the ω forms the RUM spectrum $\Omega(\mathcal{G})$.

Γεώργιος Κατσίμπας (Harbin Engineering University)

Non-commutative distributions in free and bi-free probability theory

Developed by Voiculescu in the 1980's, free probability theory provides a non-commutative framework for studying algebras of bounded, linear operators on Hilbert spaces through probabilistic tools and has led to major operator-algebraic breakthroughs. A central notion is the non-commutative distribution of tuples of operators and of their matricial polynomials. Recent years have seen substantial progress in the study of the regularity properties of these non-commutative distributions (including their atoms, zero divisors and densities) in conjunction with analytic invariants such as free Fisher information, free entropy dimension and the algebraicity of the Cauchy transform. More recently, in 2013 Voiculescu laid the foundations of bi-free probability theory, which extends the free setting and involves the simultaneous study of left and right actions of algebras on reduced free product spaces. In this talk, we will give an overview of the central developments and applications of non-commutative distributions and discuss recent advancements and regularity results within the context of bi-free probability theory.

Μαρία Κούρου (University of Wuerzburg)

Eigenvalues for infinitesimal generators of semigroups of composition operators

We study the eigenvalues for infinitesimal generators of semigroups of composition operators acting on the Dirichlet space. Such semigroups are induced by semigroups of holomorphic functions. Depending on the type of the holomorphic semigroup and the Euclidean geometry of its Koenigs domain, we find containment relations as well as sufficient conditions for the characterization of the point spectrum of the induced infinitesimal generator.

This is a joint work with E. K. Theodosiadis and K. Zarvalis.

Νικόλαος Κουτσονίκος-Κουλουμπής (Πανεπιστήμιο Πατρών)

Unital operator spaces that contain a discrete masa

A classical and motivating example of a unital operator system, that is also a bimodule over a masa (maximal abelian self-adjoint algebra), is the operator system S_G associated to a (finite) graph G. In 2015, C. M. Ortiz and V. I. Paulsen showed that two finite graphs are isomorphic if and only if their associated operator systems are unitally completely order isomorphic. We consider a larger class, namely unital operator spaces acting on $\ell^2(\Gamma)$ for any set Γ, which contain the discrete masa $\ell^\infty(\Gamma)$. We show that two such spaces are unitally completely isometric if and only if they are unitarily equivalent. Finally, for an infinite countable graph G, we define an associated unital operator system S_G acting on ℓ^2 that is also a ℓ^∞-bimodule and we show that two graphs G, H are isomorphic if and only if S_G, S_H are unitally completely order isomorphic.

Γρηγόριος Κοψαχείλης (KU Leuven)

Uniform property Γ *and the small boundary property*

In this talk we discuss a version of a tracial divisibility property of C*-algebras, namely uniform property Γ, defined for sub-C*-algebras. Conceptually, uniform property Γ has its origins in the very work of Murray and von Neumann who introduced property Γ for II_1 factors in the context of von Neumann algebras.

For sub-C*-algebras $(C(X) \subset C(X) \rtimes_{\mathrm{r}} G)$ canonically arising from a topological dynamical system $G \curvearrowright X$ with G an amenable group, we will discuss how uniform property Γ characterizes the so-called small boundary property of $G \curvearrowright X$ (as defined by Shub and Weiss), and we will go over some consequences of this characterization regarding almost finiteness, Jiang-Su stability and product actions.

This is joint work with H. Liao, A. Tikuisis and A. Vaccaro.

Αλέξανδρος Κυριάκης (Boston College-United Kingdom)

A collection of inequalities involving non-linear functions via functional estimates

In this talk, the author will present novel inequalities involving non-linear real valued functions of a single variable such as trigonometric, logarithmic, and hyperbolic functions which are new in the mathematical literature to the best knowledge of the author. There are various works in Analysis for obtaining various types of inequalities involving this class of functions, and many great analysts have presented the results worldwide. However, the most dominant techniques to derive these inequalities are the following: monotonicity properties and series expansion techniques. All analysts in their work employ these classical analysis techniques to derive results. The author takes another path to derive inequalities, by using functional estimates involving Lebesgue norms, which is a machinery used mostly in Functional Analysis and Partial Differential Equations. Using functional estimates to derive inequalities involving trigonometric, hyperbolic and logarithmic functions is underexplored in the literature, not to say not explored at all. Recently, a famous analyst from France, Christophe Chesneau published a work on trigonometric inequalities via integral methods where he used primitive integral inequalities to derive new trigonometric inequalities and to replicate some old ones such as Cusa-Huygens type and other known inequalities in the literature. However, the author and speaker of this topic (Dr Kyriakis) goes further by employing functional inequalities to derive results. The main results will be presented in the conference, and these results are published in two articles

in recognized peer-reviewed journals. One article is under peer-review process and one is under preparation. Rigorous proofs of the results will be presented and graphical illustrations to validate the rigorous results stemming from analysis.

Χαράλαμπος Μαγιάτης (Πανεπιστήμιο Αιγαίου)

Compactness Conditions in Crossed and Semicrossed Products

We characterize the compact elements and the hypocompact radical of a crossed product $C_0(X) \times_\phi \mathbb{Z}$ and of a semicrossed product $C_0(X) \times_\phi \mathbb{Z}_+$, where X is a locally compact metrizable space and $\phi : X \to X$ is a homeomorphism, in terms of the corresponding dynamical system (X, ϕ).

Χριστίνα Μιχαηλίδου (Εθνικό Μετσόβιο Πολυτεχνείο)

Gershgorin type inclusion-exclusion sets for matrix polynomials

The topic of this talk is the improvement of classical spectrum localization results for matrix polynomials associated with the Gershgorin, Brauer, and Dashnic-Zusmanovich sets. We present a refined approach that excludes regions of the complex plane which do not contain eigenvalues, leading to sharper localization results. The geometrical and topological structure of these exclusion regions will be discussed, and several illustrative examples will be shown to highlight the effectiveness of the method.

The talk is based on joint works with V. Panagakou and P. Psarrakos.

Ιάσων Μουτζούρης (Sam Houston State University)

C^*-rigidity properties for crystallographic groups

For every discrete group G we can define its full group C^*-algebra, $C^*(G)$, as an appropriate completion of its group algebra. A natural question to ask is what properties of the group can be recovered from its full group C^*-algebra. In other words, if we fix a discrete group G and take any discrete group H such that $C^*(G) \cong C^*(H)$, what can be said about the relationship between G and H? In this talk I will mention results on the context of crystallographic groups. These are examples of virtually abelian groups that are also being studied by physicists and chemists. I will show that if G is crystallographic, then H is also a crystallographic group, with the same dimension as G. The above result can be used to show that if G is a 2-dimensional crystallographic group, then $G \cong H$.

This is joint work with Frankie Chan, S. Joseph Lippert, and Ellen Weld.

Γεώργιος Μπαζιώτης (University of Delaware)

Cantor correlations I. Operator systems and Cantor games

A non-local game is one where two players play cooperatively against a referee, trying to convince the latter of the joint possession of a certain predescribed knowledge, without any in-game communication allowed. Given a non-local game G, the n-fold repetition can be viewed as a game over the n-th cartesian product of the question and answer sets. When considering the infinite repetition of G, Cantor spaces arise naturally as infinite cartesian products of finite sets. In this talk, we introduce no-signalling correlations and subclasses thereof over a quadruple of Cantor spaces and describe them as states on tensor products of inductive limits of operator systems. En route, we establish a correspondence between no-signalling (resp. quantum approximate, quantum commuting) Cantor correlations and inductive sequences of no-signalling

(resp. quantum approximate, quantum commuting) correlations acting on finite components. We introduce Cantor games and canonically associate one to a sequence of finite input/output games. As an application, we show that the numerical sequence of values of the games converges to the value of the Cantor game.

This is joint work with Alexandros Chatzinikolaou, Ivan Todorov and Lyudmila Turowska.

Βασιλική Παναγάκου (Εθνικό Μετσόβιο Πολυτεχνείο)

Birkhoff-James ε-orthogonality sets in normed vector spaces

Motivated by the classical numerical range of matrices and operators, and recent works on rectangular matrices, we study the Birkhoff-James ε-orthogonality set of vectors and explore its rich structure. Based on our study, we define a cosine function in normed linear spaces. We also introduce the Birkhoff-James ε-orthogonality set of polynomials in one complex variable whose coefficients are vectors, and survey and record extensions of results on matrix polynomials to these vector-valued polynomials.

The talk is based on joint works with G. Katsouleas, P. Psarrakos, and N. Yannakakis.

Νικόλαος Παναγόπουλος

On invariant subalgebras of group C^* and von Neumann algebras

In 2006, Bekka provided a complete description of all finite factor representations of $PSL(n,\mathbb{Z})$, when $n \geq 3$. The subsequent work on character rigidity and its connection to some of the most prominent results in ergodic theory of lattices in semisimple Lie groups, led to breakthrough results both in ergodic and operator algebra theory.

In this talk we will present a structural result for every non-amenable unitary representation of $PSL(n,\mathbb{Z})$. Given an irreducible lattice Γ in the product of higher-rank simple Lie groups, we prove that: (i) every Γ-invariant von Neumann subalgebra of $\mathcal{L}(\Gamma)$ is generated by a normal subgroup; and (ii) given a non-amenable unitary representation π of Γ, every Γ-equivariant conditional expectation on $C^*_\pi(\Gamma)$ is the canonical conditional expectation onto the C^*-subalgebra generated by a normal subgroup.

This is joint work with Mehrdad Kalantar.

Ευάγγελος Παπαπέτρος (Πανεπιστήμιο Πατρών)

On hyperreflexivity of w-TRO's*

We prove that all w*-closed essential ternary rings of operators (w*-TRO's) $\mathcal{T}$ of type $i \in \{I,\, II_{\infty,\infty},\, II_{1,\infty},\, III\}$ as well as all essential and injective w*-TRO's are hyperreflexive. It is also shown that every w*-closed essential operator space which is weak-TRO equivalent to an essential w*-TRO of the above types or an injective one is hyperreflexive as well.

Ιωάννης Απόλλων Παρασκευάς (Εθνικό και Καποδιστριακό Πανεπιστήμιο Αθηνών)

Embeddings and Extension Theorems of Selfadjoint Operator Spaces

Operator systems, i.e., closed, selfadjoint subspaces of $\mathcal{B}(H)$ containing its unit, play a central role in the theory of Operator Algebras. Lately, the community has been actively considering selfadjoint operator subspaces, but which need not be unital. In this talk we focus on Werner's unitisation of such spaces and on embeddings between them, that is, completely isometric complete order maps whose unitisation remains completely isometric. The notion of

embeddings is closely related to gauge maximal inclusions of Russell and to having an Arveson's Extension Theorem for completely contractive completely positive maps. We give a characterisation of embeddings and several intrinsic conditions of the selfadjoint operator space that allows various type of extensions of maps. We focus on two classes that have tractable cone structure: approximately positively generated and singly generated selfadjoint operator spaces. Finally, we give applications of the characterisation of embeddings in terms of co-universal objects and hyperrigidity.

Based on a joint work with Alexandros Chatzinikolaou, Evgenios Kakariadis and Se Jim Kim.

Σπυρίδων Πετράκος (University of Gothenburg / Chalmers University of Technology)

Almost finiteness and groups of dynamical origin

With the conclusion of the Elliott Classification Programme about a decade ago, a lot of research has been conducted on determining which C^*-algebras are classifiable, i.e. satisfy the conditions of the classification theorem. After reviewing the relevant machinery developed to address this problem for crossed products of actions of discrete groups on compact metrizable spaces, I will present some recent results on actions of several groups of dynamical origin.

This is based on joint work with Petr Naryshkin.

Χρήστος Ταντταλάκης (University of Warsaw)

The multidimensional truncated moment problem on the vertices of the hypercube

Let d be an arbitrary positive integer, $\mathbb{N}_0^d$ be the set of all d-tuples of non-negative integers, and for any $\alpha = (\alpha_1, \ldots, \alpha_d) \in \mathbb{N}_0^d$ let $|\alpha| = \alpha_1 + \cdots + \alpha_d$. If n is a non-negative integer and K a closed subset of $\mathbb{R}^d$, the truncated K-moment problem examines the existence of a non-negative measure μ, supported on K, such that, for a given (real valued) sequence $\{s_\alpha\}_{0 \leq |\alpha| \leq n}$,

$$s_\alpha = \int_K x^\alpha \mathrm{d}\mu(x), \text{ for any } \alpha \in \mathbb{N}_0^d \text{ such that } |\alpha| \leq n.$$

The talk deals with the case of K being the set of the vertices of the d-hypercube, i.e. $K_d = \{\pm 1\}^d$. By exploiting the group structure of K_d and some simple Fourier analysis machinery, we derive necessary and sufficient conditions for a solution when $n \geq d$. Finally, a simple separation argument from functional analysis, combined with the previous results, yields a concrete description of the set of non-negative polynomials on K_d of degree at most n, for any $n \geq d$.

The talk is based on a joint work with C. Emary and D. Kimsey.

Ευστράτιος Τσουκάνης (Claremont Graduate University)

G-Invariant Representations using Coorbits

In this talk we present a framework for constructing low-dimensional, injective, and stable embeddings of orbit spaces V/G using sorting-based coorbit representations. The method combines coorbit feature maps with a sorting operator and linear projection to produce invariant representations. We outline key injectivity and stability results, as well as a universality property. Examples from finite rotation groups illustrate this approach.

Μαρία Φραγκουλοπούλου (Εθνικό και Καποδιστριακό Πανεπιστήμιο Αθηνών)

Some unbounded extensions of C^*-algebras

C^*-algebras constitute one of the main concepts in functional analysis. They immensely contributed in comprehension of operator theory and quantum mechanics.

Historically, C^*-algebras are connected with the evolution of quantum mechanics through the outstanding work of John von Neumann, around the end of 20's, in the last century. Gradually, various extensions of C^*-algebras were constructed, which formed the yeast, for the theory of unbounded operator algebras.

We shall refer to some of them, like for instance, the GB*-algebras and quasi C^*-algebras, where both are based on locally convex $*$-algebras.

Αλέξανδρος Χατζηνικολάου (Εθνικό Μετσόβιο Πολυτεχνείο)

Cantor correlations II. Synchronicity

We continue the study of Cantor correlations, focusing on the case of synchronous Cantor games and their perfect strategies. In particular we introduce graded Cantor correlations. A graded correlation describes a scenario where Alice and Bob receive infinite sequences as inputs and produce infinite sequences as outputs but their behaviour is locally determined and level-consistent. We show that graded synchronous Cantor correlations correspond to traces on an inductive limit of C*-algebras. In the bisynchronous case, graded quantum commuting correlations correspond to traces on the quantum automorphism group of a rooted tree extending the connections between nonlocal games and quantum symmetries to the infinite setting.

We introduce Cantor graphs and study perfect strategies for the Cantor isomorphism game between them, characterising the existence of perfect strategies in terms of representations of the graded game *-algebra. Finally, we investigate factorisable maps on Cantor spaces and show that these correspond to bisynchronous graded Cantor correlations of quantum commuting type.

The talk is based on an unpublished work with G. Baziotis, I. G. Todorov and L. Turowska.

Παναγιώτης Ψαρράκος (Εθνικό Μετσόβιο Πολυτεχνείο)

An envelope for the spectrum of a square matrix

We introduce and study the envelope of a given square complex matrix, that is, an envelope-type region in the complex plane that contains the eigenvalues of the matrix. This set is the intersection of an infinite number of regions defined by cubic curves. The method of its construction extends the notion of the numerical range, which is known to be an intersection of an infinite number of half-planes. As a consequence, the envelope is contained in the numerical range and represents an improvement in localizing the spectrum of the matrix. The envelope is compact but not necessarily convex or connected, and its connected components have the potential of isolating the eigenvalues of the matrix. We study its geometry, boundary, and number of components, and also examine the envelope of normal matrices and similarities. Moreover, we obtain symmetries of the envelope of a tridiagonal Toeplitz matrix, and explicity characterize envelopes of block-shift matrices, Jordan blocks and two-by-two matrices.

The results are from joint works with Aik. Aretaki and M. Tsatsomeros.