Daniel Beltiță, Institute of Mathematics "Simion Stoilow" of the Romanian Academy

Finite-dimensional approximations of convolution operators on groups

Abstract. We discuss the C^*-algebras generated by convolution operators on locally compact topological groups, with focus on finite-dimensional approximation properties of these C^*-algebras. These properties include quasidiagonality and embeddability as closed subalgebras of suitable approximately finite-dimensional C^*-algebras. We actually establish these finite-dimensional approximation properties for the C^*-algebras of many differing classes of groups as for instance compact groups, motion groups, nilpotent Lie groups(e.g., Heisenberg groups), and, perhaps unexpectedly, for the celebrated Mautner groups which possess representations that generate von Neumann algebras without finite nonzero projections. The presentation is based on joint work with Ingrid Beltita.

Tirthankar Bhattacharyya, Indian Institute of Science

Distinguished varieties with respect to the bidisc

Abstract. A variety in $\mathbb{C}^2$ is the zero set of a polynomial. A variety is said to be distinguished with respect to the bidisc $\mathbb{D}^2$ if its intersection with the bidisc is non-empty and if the intersection of the variety with the topological boundary of the bidisc is the same as the intersection of the variety with the distinguished boundary of the bidisc ($\mathbb{T}^2$). Such varieties hold an important place in Hilbert space operator theory. An example is the Neil parabola $\{(z, w) : z^3 = w^2\}$. There is a very well-known characterization of distinguished varieties with respect to the bidisc by Agler and McCarthy. This talk will present a newly obtained characterization based on `https://arxiv.org/abs/2001.01410`.

Marek Bożejko, Wrocław University

Bargmann representation for Fock space of type B

Abstract. Let $\nu_{\alpha,q}$ be the probability and orthogonality measure for the q-Meixner-Pollaczek orthogonal polynomials, which has appeared in the work of Bożejko, Ejsmont, and Hasebe [J. Funct. Anal. **269**, 1769-1795 (2015)] as the distribution of the (α, q)-Gaussian process (the Gaussian process of type B) over the (α, q)-Fock space (the Fock space of type B). The main purpose of this paper is to find the radial Bargmann representation of $\nu_{\alpha,q}$. Our main results cover not only the representation of q-Gaussian distribution by van Leeuwen and Maassen [J. Math. Phys. **36**, 4743-4756 (1995)] but also of q^2-Gaussian and symmetric free Meixner distributions on $\mathbb{R}$. In addition, non-trivial commutation relations satisfied by (α, q)-operators are presented.

Christian Budde, North West University

Positive Miyadera-Voigt perturbations of bi-continuous semigroups

Abstract. Various models of physical processes ask for positive solutions in order to have a reasonable interpretation, e.g., consider solutions containing the absolute temperature or a density. The maximum principle for elliptic and parabolic partial differential equations guarantees positive solutions under positive initial data. This demonstrates the importance of positivity in the theory of operator semigroups on Banach spaces, which in fact appear as solutions of a special class of PDEs, the so called evolution equations. Markov processes associated to stochastic differential equations or jointly continuous flows on metric spaces give rise to semigroups which are in general not strongly continuous with respect to the norm

of the Banach space the semigroup is working on but they enjoy strong continuity with respect to a weaker additional locally convex topology on the Banach space. This leads to the concept of bi-continuous semigroups which was firstly introduced by F. Khnemund. We will discuss positive Miyadera-Voigt type perturbations for bi-continuous semigroups on AL-spaces with an additional locally convex topology generated by additive seminorms. Our main example is the space of bounded Borel measures.

M. Cristina Câmara, Instituto Superior Técnico, Universidade de Lisboa, Portugal

Scalar-type kernels for Toeplitz operators with matrix symbols

Abstract. We show that, in many cases, kernels of block Toeplitz operators may be described as the product of a space of scalar complex-valued functions by a fixed vector function. Such kernels are said to be of scalar type, and can be described explicitly in many concrete situations. Applications are given to the study of kernels of truncated Toeplitz operators.

Based on joint work with Jonathan R. Partington.

Henk de Snoo, University of Groningen

Operational calculus for rows, columns, and blocks of linear relations

by Seppo Hassi, Jean-Philippe Labrousse, and Henk de Snoo

Abstract. Columns and rows are operations for pairs of linear relations in Hilbert spaces, modelled on the corresponding notions of the componentwise sum and the usual sum of such pairs. The introduction of matrices whose entries are linear relations between underlying component spaces takes place via the row and column operations. The main purpose here is to offer an attempt to formalize the operational calculus for block matrices, whose entries are all linear relations. Each block relation generates a unique linear relation between the Cartesian products of initial and final Hilbert spaces that admits particular properties which will be characterized. Special attention is paid to the formal matrix multiplication of two blocks of linear relations and the connection to the usual product of the unique linear relations generated by them. In the present general setting these two products need not be connected to each other without some additional conditions.

Jan Dereziński, University of Warsaw, Faculty of Physics

On some families of exactly solvable Schrödinger operators

Abstract. I will discuss various realizations of 1-dimensional Schrödinger operators with $1/x^2$ and $1/x$ potentials as closed operators on $L^2[0,\infty[$. It is natural to organize them into holomorphic families, allowing for complex coupling constants. Their properties are sometimes quite surprising: they undergo "phase transitions", they show various patterns of the action of the "renormalization grou", singularities appear unexpectedly, etc.

Andrzej Horzela, H. Niewodniczański Institute of Nuclear Physics, Polish Academy of Sciences

Coherent states and their resolution of the identity: A fistful of physicists' remarks

by Katarzyna Górska and Andrzej Horzela

Dedicated to Professor Franciszek Hugon Szafraniec, our Mentor and indefatigable Teacher, on the occasion of his 80th birthday.

Abstract. The resolution of the identity has been long ago noticed and investigated property of the harmonic oscillator coherent states (HOCS). It is widely accepted requirement to be satisfied by generalizations of the HOCS, especially if one's efforts are focused on using coherent states as a tool which enables one to apply new quantization methods. However, formalisms which put the resolution of the identity as a cornerstone of constructions availing generalized coherent states suffer from the fact that they may hide ambiguities which need clarification. Example are cases for which the resolution of the identity is satisfied by non unique measures and namely this situation we illustrate on a model of the Mittag-Leffler coherent states. Using the Hadamard theorem we show that generalized coherent states whose resolution of the identity is given in terms of the non-unique measures does not admit physical applications required from the standard examples of coherent states.

Palle Jorgensen, University of Iowa, USA

Operator algebras, representations, and quantum physics

Abstract. We offer an operator theoretic approach to multiresolutions in noncommutative analysis. In the Hilbert space framework, multiresolutions (multiscale analysis) will be presented; as a noncommutative and algorithmic construction. They offer fast algorithms, and a host of other applications. One such is the renormalization group in quantum field theory, and another is wavelets; a proven and successful alternative to classical Fourier methods, Fourier series and integrals.

In general, with multiresolutions, one obtains recursive and computational spectral resolutions for multivariable operator systems. They are localized, so better adapted to discontinuities. They offer better numerical schemes. Multiresolutions are further useful in the study of self-similarity, in the analysis of fractals, and of non-linear dynamical systems. A special case of this is illustrated by the renormalization property for scaling functions from wavelet theory; and renormalization more generally.

Applications include an analysis of frequency sub-bands in signal or image-processing, and associated multi-band filters.

This suggests a representation theoretic framework; realizations of certain representations on Hilbert spaces H having associated families of closed subspaces in such a way that "non-overlapping frequency bands" correspond to orthogonal subspaces in H; or equivalently to nested systems of selfsimilar orthogonal projections. Since the different frequency bands must exhaust the range for signals in the entire system, one looks for specific representations of Cuntz algebras. From representations we obtain classification of families of multiresolutions and multi-band filters. Representations allow us to deal with non-commutativity as it appears in both time/frequency analysis, and in scale-similarity.

Tomasz Kania, Jagiellonian University

Vector-valued invariant means and complementability of Banach spaces in their second duals

Abstract. Let X be a Banach space. Then X is complemented in X^{**} if and only if there exists an invariant mean $\ell_\infty(G, X) \to X$ with respect to a free Abelian group G of rank equal to the cardinality of X^{**}, and this happens if and only if there exists an invariant mean with respect to the additive group of X^{**}. This improves upon previous results due to Bustos Domecq and myself, where certain idempotent

semigroups of cardinality equal to the cardinality of X^{**} were considered. Thereby, we answer a question of J.M.F. Castillo. This is joint work with Adam P. Goucher (Cambridge).

Mark Malamud, Mathematical Institute, RUDN University

To the spectral theory of infinite quantum graphs

Abstract. Quantum graphs with infinitely many vertices and edges without the common restriction on the geometry of the underlying metric graph that there is a positive lower bound on the lengths of its edges will be discussed. Our central result is a close connection between spectral properties of a quantum graph and the corresponding properties of a certain weighted discrete Laplacian on the underlying discrete graph. Using this connection together with spectral theory of (unbounded) discrete Laplacians on infinite graphs, we will discuss certain new results on spectral properties of quantum graphs. Namely, we discuss several self-adjointness results including a Gaffney-type theorem. We investigate the problem of lower semiboundedness, discreteness property, CLR-type estimates) and spectral types.

The talk is partially based on the results of the paper:

P. Exner, A. Kostenko, M.M. Malamud, and H. Neidhardt, Spectral Theory of Infinite Quantum Graphs, Annales Henri Poincare, V. 19, No 11, (2018), p. 3457-3510.

Lajos Molnár, University of Szeged, and Budapest University of Technology and Economics, Hungary

Transformations on positive cones in operator algebras preserving means

Abstract. In this talk we survey our recent work on transformations on positive cones in operator algebras which preserve certain operator means or norms of such means. The investigations are motivated, on the one hand, by the problem of the description of certain isometries on positive definite cones and, on the other hand, have some connection to the description of certain quantum mechanical symmetry transformations.

Lourdes Palacios, Universidad Autónoma Metropolitana, Iztapalapa

On some properties of $CV(0)(X, A)$

Abstract. Let X be a completely regular Hausdorff space and V a Nachbin family on X. For A, a locally convex algebra, let $CV(0)(X, A)$ be the algebra of all weighted vector-valued continuous functions with the topology given by the uniform seminorms induced by V. In this paper we study some properties of A that are inherited by $CV(0)(X, A)$.

Anna Pelczar-Barwacz, Jagiellonian University

Closed operator ideals on Schlumprecht space

Abstract. The structure of the lattice of closed operator ideals in the algebra of bounded linear operators on a Banach space is known only in certain particular cases. We discuss briefly the following result: there are uncountably many pairwise different closed operator ideals on the Schlumprecht space, one of the spaces created as a counterexample in Banach space theory, now becoming classical, and other spaces of its type. The ideals in question are "small" in the sense defined by W.B. Johnson, i.e. they are contained in the ideal of strictly singular operators.

The talk is based on a joint paper with Antonis Manoussakis.

A.C.M. Ran, Vrije Universiteit Amsterdam

Equivalence after extension and Schur coupling of operators

Abstract. The concepts of equivalence after extension and Schur coupling have been used to study properties of compicated operators in terms of simpler operators. For instance, they were used to study Fredholm properties of integral operators in terms of matrices connected to these operators. From a study by Bart and Tsekanovskii arises the question whether the two notions are equivalent. It was shown that on Hilbert spaces this is indeed the case, however for Banach space operators it was only recently proved that the two notions do not coincide in general. Classes of Banach space operators for which the notions do coincide have also been identified.

This will be discussed in the talk with the addition of some new material and examples. The geometry of the underlying Banach spaces plays a crucial role in these investigations.

The talk is bases on joint work with Sanne ter Horst, Miek Messerschmidt, Mark Roelands and Marten Wortel.

Adrian Sandovici, "Gheorghe Asachi" Technical University of Iasi

Adjoint to each other linear relations. Nieminen type criteria

Abstract. Assume that H and K are two real or complex Hilbert spaces, A a linear relation from H to K and B a linear relation from K to H, respectively. Necessary and sufficient conditions for B to be equal to the adjoint of A are provided. New characterizations for closed, skew-adjoint and selfadjoint linear relations are obtained. This talk is based on a joint work with Marcel Roman.

Stephen Sontz, Centro de Investigación en Matemáticas, A.C.

Coherent States for Toeplitz Quantizations: A Non-commutative Example

Abstract. In the theory of Toeplitz quantization of not necessarily commutative algebras the coherent states are defined as eigenvectors of a Toeplitz annihilation operator. These coherent states are then studied when the algebra is the generically non-commutative Manin plane. We introduce a resolution of the identity, upper and lower symbols and a coherent state quantization which in turn quantizes the Toeplitz quantization. The upper and lower symbols for the annihilation operator are then calculated. We also define a generalized Segal–Bargmann space $\mathcal{SB}$ of square–integrable, anti–holomorphic functions as the image of a coherent state transform. We then show that $\mathcal{SB}$ has a reproducing kernel function which defines a secondary Toeplitz quantization, whose symbols are functions.

Sanne ter Horst, North West University, Pure and applied Analytics, Department of Mathematics, Potchefstroom, South Africa

Unbounded Toeplitz operators with rational symbols

Abstract. In this talk we consider an unbounded Toeplitz-like operator on H^p with a rational symbol that has poles on the unit circle. In case $p = 2$, the symbol is proper and only has poles on the unit circle, such operators appear as adjoint of an unbounded Toeplitz operator studied by Sarason. Since the symbol is rational, it is possible to describe Fredholm properties and various parts of the spectrum explicitly. Also, for $p = 2$ symmetricness and the existence of a selfadjoint

extension can be characterized. The talk is joint work with Gilbert Groenewald, Jacob Jaftha and André Ran.

Jani Virtanen, University of Reading, England

Toeplitz and Hankel operators on Fock spaces

Abstract. I discuss recent results on the Fredholm properties of Toeplitz operators acting on weighted Fock spaces, including standard, generalized and doubling weights, and compactness of Hankel operators, which are intimately related. We will also revisit an old problem of Berger and Coburn on whether the Hankel operator with a bounded symbol is compact if and only if the Hankel operator with the conjugate of the symbol is compact. In 1987 Berger and Coburn showed that this is indeed true for Hankel operators acting from the classical Fock space (the Segal-Bargmann space) while it is well known that this phenomenon fails in Hardy and Bergman spaces. I discuss the Berger-Coburn phenomenon in other Fock spaces and present a new proof which explains that this striking result is caused by the lack of nonconstant bounded analytic functions in the complex plane unlike in Bergman spaces. I will also compare two approaches, limit operators and function theory, to these types of problems, and briefly comment on their pros and cons, and finally list open problems.

[1] R. Hagger, J. A. Virtanen: Compact Hankel operators with bounded symbols. J. Operator Theory (to appear) https://arxiv.org/abs/1906.09901

[2] Z. Hu, J. A. Virtanen: Fredholm Toeplitz operators with VMO symbols and the duality of generalized Fock spaces with small exponents, Proc. Roy. Soc. Edinburgh Sect. A (to appear) https://doi.org/10.1017/prm.2019.65

Gary Weiss, University of Cincinnati

Universal block tridiagonalization in B(H) and beyond

by Sasmita Patnaik, Srdjan Petrovic and Gary Weiss

The Mathematical Legacy of Victor Lomonosov, De Gruyter, 2020, to appear

Abstract. We prove every $B(H)$ operator on a separable infinite dimensional complex Hilbert space has a basis for which its matrix is finite block tridiagonal, each with the same fixed precise block sizes given in a simple exponential form. An extension to unbounded operators occurs when a certain domain of definition condition is satisfied. And an extension to finite collections of operators holds, each finite collection with the same block sizes of larger exponential growth depending on the number of operators. In this lecture we describe a commutator problem from where and to which these ideas evolved.

Anna Wysoczańska-Kula, Wrocław University

Joint monotone and boolean numerical radii of d-tuples of operators

Abstract. We study joint numerical radii defined for d-tuples of bounded operators on a Hilbert space and related to noncommutative notions of independence. The definitions are in analogy with the ones of Popescu, where his formulations turned out to be related with free creation operators, and in this way related to the free independence of Voiculescu. In our study the definitions are related with either weakly monotone creation operators, and thus associated with the monotone independence of Muraki, or with boolean creation operators, and hence related with the boolean independence. This is joint work with Janusz Wysoczański.