5^{th} Summer Workshop on Operator Theory

5–9 July, 2016
Kraków, Poland

The Workshop is organized by:

Department of Applied Mathematics
University of Agriculture in Krakow

Scientific Committee (Local):

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Kamila Piwowarczyk

Artur Płaneta

The conference will take place in the Main Building of the University of Agriculture in Krakow (al. Mickiewicza 24/28). Registration will be opened on Tuesday from 8.00 till 8.55 in the same building on the first floor. The opening of the conference will start at 9.00 in the room 120. Plenary talks will be held in the room 120, parallel sessions in rooms 120, 125.

An excursion to Pieskowa Skała is planned for Thursday (7^{th} July). A bus will leave at 13.30 from the parking in front of the Conference building.

The conference dinner will be held at Zajazd Zazamcze in Ojców just after the excursion (around 18.15). A bus for people not attending the excursion will leave at 17.00 from the parking in front of the Conference building. We plan to return to Krakow around 22.30.

There is a wireless connection available. To get the access choose network called *WISIG* and enter the first password: *Ur2014!#*. Then, you have to open any web page. You will be asked to enter another login and password. The login is *guest* and a password is *Ur2014#!*. Additionally, there are computers at 4^{th} and 5^{th} floor.

Tuesday, July 5th

Conference Hall: al. Mickiewicza 24/28

8:00 - 8:55	Registration
9:00 - 9:20	Opening
Plenary session (Room 120) Chair: Raúl Curto	
9:20 - 10:05	**Carl Cowen** *Recent progress in understanding the structure of composition operators on spaces of analytic functions*
10:10 - 10:55	**Moshe Goldberg** *Radii of elements in finite-dimensional power-associative algebras*
10:55 - 11:25	**Coffee break (Room 127)**
11:25 - 12:10	**Vladimir Müller** *On the joint numerical ranges*
12:10 - 14:30	**Lunch**

Tuesday, July 5th

Conference Hall: al. Mickiewicza 24/28

Parallel sessions		
	Session A (Room 120) Chair: Michał Wojtylak	**Session B (Room 125)** Chair: Carl Cowen
14:30 - 14:50	**László Zsidó** *Hilbert Space Geometry problems occurring in the Tomita-Takesaki Theory*	**Tirthankar Bhattacharyya** *Holomorphic functions on the symmetrized bidisk – Realization, Interpolation and Extension*
14:55 - 15:15	**Martin Argerami** *Invariants for operator systems*	**Aurelian Gheondea** *Operator models for locally Hilbert C^*-modules*
15:25 - 15:45	**Piotr Niemiec** *Models for subhomogeneous C^*- algebras*	**Maria Nowak** *Extremal functions for weighted Bergman spaces*
15:50 - 16:10	**Lourdes Palacios** *On barrelledness in locally convex algebras*	**Eungil Ko** *Properties of operator transforms*
16:10 - 16:40	**Coffee break (Room 127)**	
	Session A (Room 120) Chair: Muneo Cho	**Session B (Room 125)** Chair: Bruce Watson
16:40 - 17:00	**Manuel González** *Hypercyclicity of the commutant of Cesáro-like operators*	**Zoltán Léka** *Symmetric seminorms and the Leibniz property*
17:05 - 17:25	**Daniel Beltiţă** *Some special properties of group C^*-algebras*	**Paweł Pietrzycki** *On certain characterizations of quasinormal operators*
17:30 - 17:50	**Hugo Arizmendi Peimbert** *Pseudo-(normed Q) algebras*	

Wednesday, July 6th

Conference Hall: al. Mickiewicza 24/28

Plenary session (Room 120) Chair: Jan Stochel		
9:00 - 9:45	**Don Hadwin** *Tracially Stable C^*-algebras*	
9:50 - 10:35	**Cristina Câmara** *Asymmetric truncated Toeplitz operators and their symbols*	
10:35 - 11:05	**Coffee break (Room 127)**	
	Session A (Room 120) Chair: László Kérchy	**Session B (Room 125)** Chair: Jonathan Partington
11:05 - 11:25	**Dimosthenis Drivaliaris** *The angle of an operator and range - kernel complementarity*	**Wiesław Żelazko** *The Cauchy dual of 2-isometric operators*
11:30 - 11:50	**Nikos Yannakakis** *Range-kernel complementarity of linear operator*	**Zenon Jabłoński** *Maximal abelian subalgebras*
12:00 - 12:20	**Teresa Malheiro** *Model spaces and Toeplitz kernels*	**Marcin Moszyński** *Asymptotic properties of generalized eigenvectors for scalar- and block-Jacobi operators and H-class for the transfer matrix sequence. Some spectral consequences.*
12:25 - 12:45	**Sungeun Jung** *On (S, λ)-Toeplitz operators*	**Dong-O Kang** *Product of truncated Hankel operators*
12:45 - 14:30	**Lunch**	

Wednesday, July 6th

Conference Hall: al. Mickiewicza 24/28

Parallel sessions		
	Session A (Room 120) Chair: Wiesław Żelazko	**Session B (Room 125)** Chair: Eungil Ko
14:30 - 14:50	**Beyaz Basak Koca** *Invariant subspaces generated by a single function in the polydisc*	**Artur Płaneta** *Unbounded composition operators via inductive limits: cosubnormal operators with matrical symbols*
14:55 - 15:15	**Maria Malejki** *Eigenvalues for some complex infinite tridiagonal matrices*	**Mirosław Baran** *Markov's and Pleśniak's properties, capacities and extremal functions of elements in a normed algebra*
15:25 - 15:45	**Ekaterina Shulman** *Subadditive maps, group representations and addition theorems*	**Wen-Chi Kuo** *Mixing processes in Riesz spaces*
15:50 - 16:10	**Roksana Słowik** *Continuous maps on triangular matrices that preserve commutativity*	**Kamila Kliś-Garlicka** *Asymmetric truncated Toeplitz operators and reflexivity*
16:10 - 16:40	**Coffee break (Room 127)**	
	Session A (Room 120) Chair: Aurelian Gheondea	**Session B (Room 125)** Chair: Vladimir Müller
16:40 - 17:00	**Jacek Chmieliński** *On functional equations arising from a characterization of normed spaces*	**Lech Zielinski** *Application of inverse scattering transform method to study solutions of the short pulse equation*
17:05 - 17:25	**Jaroslav Zemánek** *On the structure of the set of algebraic elements in a Banach algebra*	**Renata Malejki** *On stability of a functional equation stemming from a characterization of inner product spaces*

Thursday, July 7th

Conference Hall: al. Mickiewicza 24/28

Plenary session (Room 120) Chair: Don Hadwin	
9:00 - 9:45	**Bruce Watson** *The weighted p-Laplacian problems on the half-line*
9:50 - 10:35	**Gustavo Corach** *On pairs of projections whose product is compact*
10:35 - 11:05	**Coffee break (Room 127)**
11:05 - 11:50	**Mostafa Mbekhta** *Product, Jordan and Triple product commuting maps with the λ-Aluthge Transform*
11:50 - 13:30	**Lunch**
13:30- 18.00	**Excursion**
18:00- 22:00	**Conference dinner**

Friday, July 8th

Conference Hall: al. Mickiewicza 24/28

Plenary session (Room 120) Chair: Gustavo Corach	
9:00 - 9:45	**László Kérchy** *Quasianalytic polynomially bounded operators*
9:50 - 10:35	**Michał Wojtylak** *The Sobolev moment problem and Jordan dilations*
10:35 - 11:05	**Coffee break (Room 127)**
	Chair: Cristina Câmara
11:05 - 11:50	**Jonathan Partington** *Semigroups of Bergman and Dirichlet shifts*
11:55 - 12:40	**Raúl Curto** *Moment Infinitely divisible weighted shifts*
12:40 - 14:30	**Lunch**

Friday, July 8th

Conference Hall: al. Mickiewicza 24/28

Parallel sessions		
	Session A (Room 120) Chair: László Zsidó	**Session B (Room 125)** Chair: Martin Argerami
14:30 - 14:50	**Chafiq Benhida** *On Jacobson's lemma and its applications in spectral theory*	**Agnieszka Kowalska** *Identities for a derivation operator*
14:55 - 15:15	**Ji Eun Lee** *On ∞-complex symmetric operators*	**Paweł Wójcik** *Orthogonality of compact operators*
15:25 - 15:45	**Marek Kosiek** *Some topological and geometrical properties of Gleason parts*	**Gabriel Kantun-Montiel** *Generalized inverses through spectral sets*
15:50 - 16:10	**Serdar Ay** *Positive semidefinite kernels with values continuously adjointable operators on VH-spaces*	**Hubert Klaja** *Non-commutativity of the exponential spectrum*
16:10 -	**Last Coffee (Room 127)**	

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Abstracts

Invariants for operator systems

Martin Argerami

Operator systems are unital, selfadjoint, subspaces of $B(H)$. They form a category with unital completely positive maps as their morphisms. The problem of classifying these structures is very hard, even in the finite-dimensional case; in fact, there is still no classification in the 3-dimensional case! We will show some positive classification results, both of an abstract and a concrete flavour.

Pseudo-(normed Q) algebras

Hugo Arizmendi Peimbert

G.R. Allan introduced what it is now known as the Allan-Waelbroeck spectrum for elements in a locally convex algebra. His idea derives from the spectral theory of a closed operator T on a Banach space E. In this theory the spectrum is the set of all the complex numbers λ for which $\lambda I - T$ has no bounded inverse. Allan establishes a suitable definition of bounded element in a locally convex algebra that, according to his own words, „is justified by the theory which stems from it". Similar ideas were discussed by L.Waelbroeck for unital commutative quasi-complete locally convex algebras.

We introduce the new concept of pseudo-(normed Q) algebra. This is a generalization of the notion of pseudo-complete algebra. Using it we study the Allan- Waelbroeck spectrum $\sigma_A(x)$ and the extended spectrum $\sum(x)$, given by W. Żelazko, for x in a unital locally convex algebra. In particular, we compare these two spectra.

Positive semidefinite kernels with values continuously adjointable operators on VH-spaces

Serdar Ay

We consider positive semidefinite kernels valued in the $*$-algebra of continuous and continuously adjointable operators on a VH-space (Vector Hilbert space in the sense of Loynes) that are invariant under an action of a $*$-semigroup. For such a kernel, we obtain two necessary and sufficient conditions in order for there to exist $*$-representations of the underlying $*$-semigroup on a VH-space linearisation, equivalently, on a reproducing kernel VH-space. The main theorem is used to provide a rather direct proof of the general dilation theorem of completely positive maps on locally C^*-algebras valued in adjointable operators of Hilbert modules over locally C^*-algebras.

This is a joint work with A. Gheondea.

Markov's and Pleśniak's properties, capacities and extremal functions of elements in a normed algebra

Mirosław Baran

Let $\mathbb{P}_n(\mathbb{C})$ be the linear space o polynomials of one variable of degree at most n. If x is an element a complex normed algebra with unicity $(\mathcal{A}, e, ||\cdot||)$ then

$x \in \mathcal{AM}(m, M)$ if $\forall n \geq 1$ $P \in \mathbb{P}_n(\mathbb{C})$

$$||P'(x)|| \leq Mn^m ||P(x)||$$

$x \in \mathcal{VM}(m, M)$ if $\forall k, n \geq 1$ $P \in \mathbb{P}_n(\mathbb{C})$

$$||P^{(k)}(x)|| \leq Mn^{km}(1/k!)^{m-1}||P(x)||.$$

Put

$$\Phi_n(x, \zeta) = \sup\{||P(x + \zeta e)|| : \ P \in \mathbb{P}_n(\mathbb{C}), ||P(x)|| \leq 1\},$$

$$\varphi_n(x, r) = \sup_{|\zeta| \leq r} \Phi_n(x, \zeta),$$

$$\Phi(x, \zeta) = \sup_{n \geq 1} \Phi_n(x, \zeta)^{1/n}, \ \varphi(x, r) = \sup_{n \geq 1} \varphi_n(x, r)^{1/n},$$

$$\mathcal{P}_m(x) = \sup_{n \geq 1} \varphi_n(x, 1/n^m), \mathcal{B}_m(x) = \sup_{n,k \geq 1} \varphi_n(x, (k/n)^m)^{1/k}.$$

Finally define

$$t(x) = \inf_{n \geq 1} \inf \left\{ \left\| x^n + \sum_{j=0}^{n-1} \alpha_j x^j \right\|^{1/n} : \ \alpha_j \in \mathbb{C} \right\},$$

$$C(x) = \lim_{r \to \infty} r/\varphi(x, r).$$

In the talk we shall speak on connections between above notions. In particular, we shall present an example of a normed algebra where $x \in \mathcal{AM}(m, M)$ but $x \notin \mathcal{VM}(m', M')$ for any m', M' and $t(x) = C(x) = 0$.

Some special properties of group C^*-algebras

Daniel Beltiţă

The C^*-algebras of locally compact groups encode important information on the groups themselves, and it is therefore natural to ask about their role in the classification of particular classes of groups. We will focus on the so-called exponential Lie groups, that is, vector spaces equipped with group structures that agree with the vector addition on each 1-dimensional subspace. The classification of these groups is an open problem even in the case when the group operations are polynomial maps. Examples include the underlying additive group of a vector space, the Heisenberg groups of quantum mechanics, various groups of triangular matrices etc. We discuss the C^*-algebra approach to the above classification problem and we show for instance that, up to its commutator subgroup, an exponential group is uniquely determined by the group C^*-algebra via its real rank. Time permitting, we will also show that Heisenberg groups are uniquely determined by their C^*-algebras within the exponential Lie groups as above, having polynomial group operations.

The talk is based on joint work with Ingrid Beltiţă and Jean Ludwig.

[1] I. Beltiţă, D. Beltiţă: On C^*-algebras of exponential solvable Lie groups and their real ranks. *J. Math. Anal. Appl.* 437 (2016), no. 1, 51–58.

[2] I. Beltiţă, D. Beltiţă, J. Ludwig: Fourier transforms of C^*-algebras of nilpotent Lie groups. *Int. Math. Res. Not. IMRN* (to apppear; see http://dx.doi.org/10.1093/imrn/rnw040).

On Jacobson's lemma and its applications in spectral theory

Chafiq Benhida

In a ring E with identity 1, for every two elements a and b in E, we have the equivalence: $(1-ab)$ is invertible if and only if $(1-ba)$ is invertible. This result, known as Jacobson's lemma, has many applications in spectral theory for bounded linear operators on Banach spaces and also many extensions and generalizations for operators and multioperators.

Holomorphic functions on the symmetrized bidisk — Realization, Interpolation and Extension

Tirthankar Bhattacharyya

There are three new things in this talk about the open symmetrized bidisk $\mathbb{G} = \{(z_1+z_2, z_1z_2) : |z_1|, |z_2| < 1\}$.

1. The Realization Theorem: A realization formula is demonstrated for every f in the norm unit ball of $H^\infty(\mathbb{G})$.
2. The Interpolation Theorem: Nevanlinna-Pick interpolation theorem is proved for data from the symmetrized bidisk and a specific formula is obtained for the interpolating function.
3. The Extension Theorem: A characterization is obtained of those subsets V of the open symmetrized bidisk $\mathbb{G}$ that have the property that every function f holomorphic in a neighbourhood of V and bounded on V has an H^∞-norm preserving extension to the whole of $\mathbb{G}$.

The talk is based on joint work with Dr. Haripada Sau.

Asymmetric truncated Toeplitz operators and their symbols

Cristina Câmara

Asymmetric truncated Toeplitz operators with L^2 symbols, defined between two model spaces such that one is contained in the other, are presented. The class of all possible symbols for a given asymmetric truncated Toeplitz operator is described, and the relations of the symbols with certain characterizations in terms of rank two operators are discussed.

Joint work with J. Blicharz, K. Kliś-Garlicka and M. Ptak.

On functional equations arising from a characterization of normed spaces

Jacek Chmieliński

With reference to [1] author gives a characterization of metrics generated by norms [2]. It leads to functional equations:

$$\left\| f\left(\frac{x+y}{2}\right) - f(x)\right\| = \frac{1}{2}\|f(x)-f(y)\|;$$

$$\left\| f\left(\frac{x-y}{2}\right)\right\| = \frac{1}{2}\|f(x)-f(y)\|;$$

$$\|f(x-y)\| = \|f(x)-f(y)\|$$

related to additive and isometric mappings [3].

[1] P. Šemrl: A characterization of normed spaces among metric spaces, *Rocky Mountain J. Math.*, 41 (2011), 293-298.

[2] J. Chmieliński: Note on a characterization of metrics generated by norms, *Rocky Mountain J. Math.*, 45 (2015), 1801-1805.

[3] J. Chmieliński: On functional equations related to additive mappings and isometries, *Aequationes Math.*, 87 (2015), 97-105.

On pairs of projections whose product is compact

Gustavo Corach

We study the set $\mathcal{C}$ of all pairs of orthogonal projections P, Q such that PQ is compact. For the Hilbert space $L^2(\mathbb{R})$, this class contains pairs of the form P_I, Q_J, if $P_I f = \chi_I f$, $Q_J = \mathfrak{F}^{-1}P_J\mathfrak{F}$, where χ_I denotes the characteristic function of I and $\mathfrak{F}$ denotes the Fourier-Plancherel transformation of $L^2(\mathbb{R})$. These pairs appear naturally in some mathematical formulations of Heisenberg uncertainty principle. The connected components of $\mathcal{C}$ are determined, as well as a smooth manifold structure on $\mathcal{C}$.

The talk is based on joint work with Esteban Andruchow.

Recent progress in understanding the structure of composition operators on spaces of analytic functions

Carl C. Cowen

If φ is an analytic map of the unit disk into itself and H is a Hilbert space of analytic functions on the unit disk, the composition operator C_φ is the operator given by $C_\varphi f = f \circ \varphi$ for f in H.

In the past decade or more, composition operators have been used and studied from a variety of different positions, increasingly being used as tools to study other problems. Several aspects and problems of interest will be described as examples of this breadth, including work on weighted composition operators, a composition operator followed by a multiplication operator. More examples and questions will be devoted to applications and discoveries related to invariant subspaces of operators generally. In particular, this will include questions regarding invariant subspaces of composition operators, results on self adjoint and normal weighted composition operators, and applications of properties of composition operators to the study of invariant subspaces of general operators.

Moment infinitely divisible weighted shifts

Raúl Curto

We say that a weighted shift W_α with (positive) weight sequence $\alpha : \alpha_0, \alpha_1, \dots$ is *moment infinitely divisible* (MID) if, for every $t > 0$, the shift with weight sequence $\alpha^t : \alpha_0^t, \alpha_1^t, \dots$ is subnormal; for example, the Agler shifts are MID. We give a complete characterization of MID shifts in terms of their weight sequences, as follows: W_α is MID if and only if (i) $\alpha_i \leq 1$ for all i, and (ii) the sequence α is log completely alternating. This enables us to recapture and improve a number of previous results proved rather differently, as well as to establish new results and examples.

Completely alternating sequences have been studied extensively, but it is important to note that usually there is the assumption that the sequence is positive (the study is in the context of semigroups, in particular $\mathbb{R}_+$) while we allow negative terms. We prove that the class of completely alternating sequences whose terms are all positive is a proper subset of the class of log completely alternating sequences (the argument uses Agler shifts). Moreover, if a sequence (x_n) is completely alternating then its Cesàro transform $(C(x_n))$ is completely alternating.

Our results allow us to establish that the Aluthge transform of a MID shift is again MID. Similarly, if the weights of a shift W_α form a completely alternating sequence, then the mean transform of W_α is MID, and hence subnormal; for example, the mean transform of the Bergman shift is MID. Finally, our results have applications to the class of Toeplitz operators on the Hardy space of the unit circle.

The talk is based on joint work with Chafiq Benhida (Université des Sciences et Technologies de Lille, France) and George R. Exner (Bucknell University, USA).

The angle of an operator and range - kernel complementarity

Dimosthenis Drivaliaris

In my talk I will discuss the relation between the angle of an operator $A : X \to X$ on a complex Banach space X and its range and kernel being complementary.

I will show that if the angle of A is less than π, and A has closed range and its range and kernel have closed sum, then its range and kernel are complementary. If X is a Hilbert space, then I will show that in the previous result we don't need to assume that the range and the kernel of A have closed sum.

I will also show that if X is a strictly convex, finite dimensional Banach space and $A : X \to X$, then the range and the kernel of A are complementary if and only if there exists $0 \neq t \in \mathbb{C}$ such that the angle of tA is less than π.

The talk is based on joint work with N. Yannakakis.

Operator models for locally C^*-modules

Aurelian Gheondea

We single out the concept of a concrete Hilbert module over a locally C^*-algebra by means of locally bounded operators on certain strict inductive limits of Hilbert spaces, prove that this concept makes the operator model for all Hilbert locally C^*-modules and, as an application, we obtain a direct construction of the exterior tensor product of Hilbert locally C^*-modules. These results are obtained as consequences of a general dilation theorem for positive semidefinite kernels with values locally bounded operators.

Radii of elements in finite-dimensional power-associative algebras

Moshe Goldberg

The purpose of this talk is to extend the notion of the spectral radius to elements in arbitrary finite-dimensional power-associative algebras over the field of real or complex numbers. As for examples, we shall discuss the new concept in matrix algebras and in the Cayley–Dickson algebras. We shall then illustrate the new concept by resorting to two applications: the Gelfand formula, and stability of norms and subnorms.

Hypercyclicity of the commutant of Cesàro-like operators

Manuel González

We say that a bounded operator T acting on a complex Banach space X is *Cesàro-like* if the spectrum of T contains a connected open subset U so that the following conditions are satisfied:

1. Every $\lambda \in U$ is a simple eigenvalue of T (i.e. $\dim \ker(T - \lambda I) = 1$), and $\operatorname{span}\{\ker(T - \lambda I) : \lambda \in U\}$ is dense in X.
2. There exists an holomorphic map $\phi : U \to X$ such that $\phi(\lambda) \neq 0$ and $\phi(\lambda) \in \ker(T - \lambda I)$ for each $\lambda \in U$.

We show several examples of Cesàro-like operators, and we prove that every operator $S \neq \mu I$ in the commutant of a Cesàro-like operator has a multiple cS which is hypercyclic.

We emphasize that we do not have a description of the commutant for most of the examples of Cesàro-like operators. We discuss a possible description of this commutant in some cases.

The talk is based on joint work with Fernando León Saavedra (Jerez de la Frontera).

Tracially stable C*-algebras

Don Hadwin

Weak semiprojectivity is a stability property for C*-algebras says that if its generators approximately satisfy the defining relations, then it is actually norm close to generators that actually satisfy the relations. For separable C*-algebras semiprojectivity can be expressed in terms of ultraproducts. This means that a unital *-homomorphism from the algebra into a C*-ultraproduct can be "eventually" lifted to unital $*$-homomorphisms into the factors. We introduce the notion of *tracially stable C*-algebra*, in which ultraproducts are replaced with tracial ultraproducts. We define different types of tracial stability. We completely characterize matricially tracially stable tracially nuclear C*-algebras and we show that tracial stability for a separable C*-algebra $C(X)$ is equivalent to an interesting topological property for X.

The talk is based on joint work with Tatiana Shulman.

The Cauchy dual of 2-isometric operators

Zenon Jabłoński

Let T be a bounded linear operator on a complex Hilbert space $\mathcal{H}$. We say that T is a 2-isometry, if $I - 2T^*T + T^{*2}T^2 = 0$. The Cauchy dual T' of T is given by $T' = T(T^*T)^{-1}$. In the talk we discuss several interesting fact about the Cauchy dual operator of a 2-isometric operators and present several classes of 2-isometries arising from weighted shifts on rooted and leafless directed trees.

The talk is based on joint work with A. Anand, S. Chavan and J. Stochel.

On (S, λ)-Toeplitz operators

Sungeun Jung

Let $\mathcal{H}$ be a separable, infinite dimensional complex Hilbert space, and let $\mathcal{L}(\mathcal{H})$ denote the algebra of all bounded linear operators on $\mathcal{H}$. Fix a unilateral forward shift $S \in \mathcal{L}(\mathcal{H})$ and a complex number λ with $|\lambda| \le 1$. An operator $A \in \mathcal{L}(\mathcal{H})$ is said to be (S, λ)-*Toeplitz* if $S^*AS = \lambda A$ holds. In particular, we simply say that $(S, 1)$-Toeplitz operators are S-*Toeplitz*. Furthermore, if S has multiplicity one, then (S, λ)-Toeplitz operators are called λ-*Toeplitz* operators; in this case, S-Toeplitz operators are unitarily equivalent to the classical Toeplitz operators on the Hardy space $H^2(\mathbb{D})$. We say that $A \in \mathcal{L}(\mathcal{H})$ is (S, λ)-*analytic* if $AS = \lambda SA$. It is easy to show that (S, λ)-analytic operators are (S, λ)-Toeplitz.

In this talk, we give a matrix representation of (S, λ)-Toeplitz operators. Moreover, we find an inner-outer factorization of (S, λ)-analytic operators. We also consider the product of (S, λ)-Toeplitz operators. Finally, we provide several spectral properties.

[1] M. C. Ho, *On the rotational invariance for the essential spectrum of λ-Toeplitz operators*, J. Math. Anal. Appl. **413** (2014), 557-565.

[2] S. Jung and E. Ko, *On T_u-Toeplitzness of weighted composition operators on H^2*, Complex Var. Elliptic Equ. **60** (2015), 1522-1538.

[3] V. Matache, *S-Toeplitz composition operators*, Complex and harmonic analysis, 189-204, DEStech Publ., Inc., Lancaster, PA, 2007.

[4] M. Rosenblum and J. Rovnyak, *Hardy classes and operator theory*, Oxford University Press, 1985.

Product of truncated Hankel operators

Dong-O Kang

Characterization of the pairs of truncated Hankel operators on the model spaces $K_u^2 (= H^2 \ominus uH^2)$ whose products result in truncated Toeplitz operators will be given when the inner function u has a certain symmetric property.

The talk is based on joint work with Hyoung Joon Kim.

[1] C. Gu and L. Patton, Commutation relations for Toeplitz and Hankel matrices, SIAM J. Matrix Anal. Appl., 24 (2003) 728–746.

[2] D. Sarason, Algebraic properties of truncated Toeplitz operators, Oper. Matrices, 1 (4) (2007) 491–526.

[3] D. Sarason, Sub-Hardy Hilbert spaces in the unit disc, John Wiley and Sons Inc., New York, 1994.

[4] N. Sedlock, Algebras of truncated Toeplitz operators, Oper. Matrices, 5 (2011) no. 2, 309–326.

Generalized inverses through spectral sets

Gabriel Kantun-Montiel

If an operator A is not invertible, then 0 is a point of the spectrum of A. If the point 0 is an isolated point of the spectrum, we can define the group, Drazin or Koliha-Drazin generalized inverses depending on the spectral set $\{0\}$ being a simple pole of the resolvent function, pole of finite order of the resolvent function, or isolated point of the spectrum, respectively. In case of an (isolated) spectral set σ containing the point 0, we have the σ-g-Drazin inverse of Koliha and Dajic. These inverses can also be studied in the framework of the inverse along an element or, more generally, the (b, c)-inverse. In this talk we pay special attention to generalized inverses related to circularly isolated spectral sets. Also, we will discuss a generalization of Mbekhta decomposition related to these spectral sets.

Quasianalytic polynomially bounded operators

László Kérchy

Quasianalytic contractions form the crucial class in the quest for proper invariant and hyperinvariant subspaces for asymptotically non-vanishing Hilbert space contractions. The property of quasianalycity relies on the concepts of unitary asymptote and H^∞-functional calculus. These objects can be naturally defined in the setting of polynomially bounded operators too, which makes possible to extend the study of quasianalycity from contractions to this larger class. Carrying out this program we pose also several interesting questions.

Non-commutativity of the exponential spectrum

Hubert Klaja

In a unital complex Banach algebra, the spectrum satisfies $\sigma(ab) \setminus \{0\} = \sigma(ba) \setminus \{0\}$ for each pair of elements a, b. In this talk, we will show that this is no longer true for the exponential spectrum, thereby solving a question of Murphy. Our proof depends on the following result of algebraic topology: the homotopy group $\pi_4(\mathrm{GL}_2(\mathbb{C}))$ is non trivial.

The talk is based on joint work with Thomas Ransford.

Asymmetric truncated Toeplitz operators and reflexivity

Kamila Kliś-Garlicka

Consider two nonconstant inner functions α and θ such that α divides θ. For a function $\varphi \in L^2$ we can define an asymmetric truncated Toeplitz operator

$$A_\varphi \colon H^2 \ominus \theta H^2 \to H^2 \ominus \alpha H^2$$

by the formula $A_\varphi f = P_\alpha(\varphi f)$, where $P_\alpha \colon L^2 \to H^2 \ominus \alpha H^2$ is the orthogonal projection.

During the talk we will discus some properties of bounded asymmetric truncated Toeplitz operators with L^2 symbols connected with the notion of reflexivity.

The talk is based on joint work with C. Câmara and M. Ptak.

Properties of operator transforms

Eungil Ko

In this talk, we give properties of operator transforms, namely the Aluthge transform, Duggal transform, and mean transform. Moreover, we provide various spectral and local spectral connections between a bounded lineat operator and its operator transforms. Finally, we consider the backward operator transforms of hyponormal operators.

[1] I. Colojoara and C. Foias: *Theory of generalized spectral operators*, Gordon and Breach, New York, 1968.

[2] I. B. Jung, E. Ko, and C. Pearcy, *Aluthge transforms of operators*, Int. Eq. Oper. Th. **37**(2000), 449-456.

[3] I. B. Jung, E. Ko, and C. Pearcy, *The iterated Aluthge transforms of operators*, Int. Eq. Oper. Th. **45**(2003), 375-387.

[4] S. Jung, E. Ko, and S. Park, *Subscalarity of operator transforms*, Math. Nachr. **288**(2015), 2042-2056.

[5] E. Ko, *Bachward Aluthge iterates of a hyponormal operator have scalar extensions*, Int. Eq. Oper. Th. **57**(2007), 567-582.

[6] E. Ko and M. Lee, *On bachward Aluthge iterates of hyponormal operators*, Math. Inequal. Appl **18**(2015), 1121-1133.

[7] K. Laursen and M. Neumann: *An introduction to local spectral theory*, Clarendon Press, Oxford, 2000.

[8] S. Lee, W. Lee, and J. Yoon, *The mean transform of bounded linear operators*, J. Math. Anal. Appl. bf 410(2014), 70-81.

Invariant subspaces generated by a single function in the polydisc

Beyaz Basak Koca

In this study, we partially answer the question left open in Rudin's book [1] on the structure of invariant subspaces of the Hardy space $H^2(U^n)$ on the polydisc U^n. We completely describe all invariant subspaces generated by a single function in the polydisc. Then, using our results, we give the unitary equivalence of this type invariant subspaces and a characterization of outer functions in $H^2(U^n)$.

[1] W. Rudin: *Function theory in polydiscs.* W. A. Benjamin, Inc., New York-Amsterdam 1969.

Some topological and geometrical properties of Gleason parts

Marek Kosiek

In 1957 A. M. Gleason introduced an equivalence relation on the spectrum $\sigma(A)$ of a uniform algebra A, which divides $\sigma(A)$ into equivalence classes called "Gleason parts". In 1965 H. S. Bear extended the notion of Gleason part to an arbitrary linear space B of continuous real functions on a compact space X (see [1]). The equivalence relation which he introduced is a generalization of Gleason's, in the sense that if A is an algebra on X, and B is the space of real parts, then the classes of X induced by B coincide with the Gleason parts. The parts introduced by Bear are characterized geometrically as the minimal faces of a certain compact convex subset of the dual space.

[1] H. S. Bear: A Geometric Characterization of Gleason Parts, *Proc. Amer. Math. Soc.*, 16 (1965), 407-412.

Identities for a derivation operator

Agnieszka Kowalska

We presented some identities for complex commutative algebra with unity **1** and a derivation operator $D : \mathcal{A} \longrightarrow \mathcal{A}$ (it means a linear operator with property $D(ab) = bD(a) + aD(b)$). If we consider the algebra $\mathbb{P}(\mathbb{C}^N)$ of polynomials in N complex variables these identities are related to the A. Markov type inequality $||DP|| \leq M(\deg P)^m ||P||$ and V. Markov type inequality $||D^{(k)}P|| \leq A^k (\deg P)^{km} \left(\frac{1}{k!}\right)^{m-1} ||P||$. In particular we give a nontrivial example of the A. Markov inequality in the normed algebra where the V. Markov type inequality is not fulfilled.

The talk is based on joint work with Mirosław Baran, Beata Milówka and Paweł Ozorka.

[1] M. Baran, A. Kowalska, B. Milówka, P. Ozorka: *Identities for a derivation operator and their applications*, Dolomites Research Notes on Approximation 8 (2015), 102-110.

Mixing processes in Riesz spaces

Wen-Chi Kuo

Various types of stochastic processes have been considered in the abstract setting of Riesz spaces (vector lattices) for example martingales, AMARTS, Markov processes and mixingales. However, the study of dependent processes in Riesz spaces is in its infancy with only mixingales being considered to far. In this talk we present a generalization of the concept of star-mixing to the

Riesz space setting and show that a so called *mixing inequality* can be obtained for such processes. Such theory can be obtained in a similar manner for other classes of mixing processes.

This talk is based on joint work with Michael Rogans and Bruce Watson.

On ∞-complex symmetric operators

Ji Eun Lee

In this talk, we introduce ∞-complex symmetric operators T and discuss spectral properties and local spectral properties of such operators. In particular, we verify that the class of ∞-complex symmetric operators is norm closed. Moreover, we prove that T has the decomposition property (δ) if and only if T is decomposable. Finally, we show that if T and S are ∞-complex symmetric operators, then so is $T \otimes S$.

The talk is based on joint work with Muneo Chō and Eungil Ko.

[1] M. Chō, C. Gu and W. Y. Lee: *Elementary properties of ∞-isometries on a Hilbert space*, preprint.

[2] M. Chō, J. Lee and H. Motoyoshi: *On $[m, C]$-isometric operators*, preprint.

[3] M. Chō, E. Ko, and J. Lee, *On m-complex symmetric operators*, Mediterranean J. Math., in press (2015).

[4] M. Chō, E. Ko, and J. Lee, *On m-complex symmetric operators* II, Mediterranean J. Math., in press (2016).

[5] M. Chō, S. Ota, K. Tanahashi, and M. Uchiyama: *Spectral properties of m-isometric operators*, Functional Analysis, Application and Computation 4(2)(2012), 33-39.

[6] I. Colojoara and C. Foias: *Theory of generalized spectral operators*, Gordon and Breach, New York, 1968.

[7] B. Duggal: *Tensor product of n-isometries*, Linear Alg. Appl., 437(2012), 307-318.

[8] S. R. Garcia and M. Putinar: *Complex symmetric operators and applications*, Trans. Amer. Math. Soc. 358(2006), 1285-1315.

[9] __________: *Complex symmetric operators and applications* II, Trans. Amer. Math. Soc. 359(2007), 3913-3931.

[10] S. Jung, E. Ko, M. Lee, and J. Lee: *On local spectral properties of complex symmetric operators*, J. Math. Anal. Appl. 379(2011), 325-333.

[11] S. Jung, E. Ko, and J. Lee: *On complex symmetric operator matrices*, J. Math. Anal. Appl. 406(2013), 373-385.

[12] K. Laursen and M. Neumann: *An introduction to local spectral theory*, Clarendon Press, Oxford, 2000.

Symmetric seminorms and the Leibniz property

Zoltán Léka

In this talk we show that certain symmetric seminorms on $\mathbb{R}^n$ satisfy the Leibniz inequality. As an application, we obtain that the L^p- norms of centered bounded real functions, defined on probability spaces, have the same property. Even though this is well-known for the standard deviation it seems that the complete result has never been established. In addition, we shall connect the results with the differential calculus introduced by Cipriani and Sauvageot and Rieffel's non-commutative Riemann metric.

Eigenvalues for some complex infinite tridiagonal matrices

Maria Malejki

The discrete spectrum for an unbounded operator J defined by a special class of infinite tridiagonal complex matrices, are approximated by the eigenvalues of its orthogonal truncations. Let $\sigma(J)$ means the spectrum of the operator J and

$$\Lambda(J) = \{\lambda \in \mathrm{Lim}_{n\to\infty}\lambda_n : \ \lambda_n \text{ is an eigenvector of } J_n\},$$

where $\mathrm{Lim}_{n\to\infty}\lambda_n$ is the set of limit points of the sequence (λ_n), and J_n is an orthogonal truncation of J.

We consider classes of tridiagonal complex matrices for which $\sigma(J) = \Lambda(J)$.

Keywords: tridiagonal matrix, complex Jacobi matrix, discrete spectrum, eigenvalue, unbounded operator.

2010 Mathematics Subject Classification: 47B36, 47B37, 47B06, 47A75, 15A18

On stability of a functional equation stemming from a characterization of inner product spaces

Renata Malejki

We present some stability and hyperstability results for a generalization of the well known Fréchet functional equation, stemming from one of the characterizations of the inner product spaces. As the main tool we use a fixed point theorem for some function spaces. We end the paper with some new inequalities characterizing the inner product spaces.

[1] R. Malejki, Stability of a generalization of the Fréchet functional equation, Ann. Univ. Paedagog. Crac. Stud. Math. 14 (2015) 69–79.

Model spaces and Toeplitz kernels

M. Teresa Malheiro

In this talk we consider Toeplitz kernels in an H_p setting, with particular attention being payed to the case when the kernel is a model space. We study in particular the maximal functions in these Toeplitz kernels and the dependence of the kernel on the symbol. Decomposition results of Toeplitz kernels in terms of model spaces are established.

This is based on joint work with Cristina Câmara and Jonathan Partington.

Product, Jordan and triple product commuting maps with the λ-Aluthge transform

Mostafa Mbekhta

Given a bounded operator $T \in B(H)$, H Hilbert space, let $T = V|T|$ be the polar decomposition of T and $\lambda \in (0,1)$. The λ-Aluthge transform $\Delta_\lambda : B(H) \to B(H)$ is defined by $\Delta_\lambda(T) = |T|^\lambda V|T|^{1-\lambda}$.

In this talk, we give the complete form of the maps $\Phi : B(H) \to B(K)$ between the algebra of bounded operators on Hilbert spaces H, K with $dim H \geq 2$, such that,

$$\Delta_\lambda(\Phi(A)\Phi(B)) = \Phi(\Delta_\lambda(AB)) \text{ for every } A, B \in B(H),$$

or

$$\Delta_\lambda(\Phi(A) \circ \Phi(B)) = \Phi(\Delta_\lambda(A \circ B)) \text{ for every } A, B \in B(H),$$

where $A \circ B = \frac{1}{2}(AB + BA)$ is the Jordan product of A and B.

or

$$\Delta_\lambda(\Phi(A)\Phi(B)\Phi(A)) = \Phi(\Delta_\lambda(ABA)) \text{ for every } A, B \in B(H).$$

The talk is based on joint work with Fadil Chabbabi.

Asymptotic properties of generalized eigenvectors for scalar- and block-Jacobi operators and H-class for the transfer matrix sequence. Some spectral consequences.

Marcin Moszyński

If J is the classical "scalar" self-adjoint Jacobi operator acting in the Hilbert space $l^2(N, C)$, then its n-th transfer matrix $T_n(\lambda)$ is the 2 by 2 matrix which shifts the "conditions at the point n" of any solution of the generalized eigenequation for J and λ onto its "conditions at the point $n+1$". The notion of the H-class (H for "Homogeneous") of sequences of 2 by 2 matrices was introduced in [1] to describe the case when all those solutions behave asymptotically in the same way.

As showed in [2], under some regularity assumptions on the weight sequence for J

$$H(J) := \{\lambda \in R : \{T_n(\lambda)\} \in H\} \subset \sigma_{ess}(J).$$

Moreover, the following result based on Gilbert-Pearson-Khan subordination theory is proved in [1]

Theorem
If $\{T_n(\lambda)\} \in H$ for any $\lambda \in G$ — an open subset of the real line, then J is absolutely continuous in G, and the closure of G is contained in $\sigma_{ac}(J)$.

For many classes of Jacobi operators with "sufficiently regular coefficients"

$$\sigma_{ess}(J) = \sigma_{ac}(J) = \overline{H(J)} = \sigma_{ac}(J).$$

My talk is devoted to some remarks about possible generalizations of such results onto block-Jacobi operators. For such operators Jacobi matrix terms are now "blocks"— d by d scalar matrices, transfer matrices $T_n(\lambda)$ are $2d$ by $2d$ scalar matrices and the operator J acts in the space $l^2(N, C^d)$. We define the H class for sequences of $2d$ by $2d$ matrices in a natural way, analogic to the case $d = 1$. We study the relations of the H-class condition for transfer matrix sequence with some asymptotic properties of generalized eigenvectors in block-Jacobi case. We also present some simple spectral results.

(This research is supported by Polish National Science Centre grant no. 2013/09/B/ST1/04319)

[1] M. Moszyński: Spectral properties of some Jacobi matrices with double weights, *J. Math. Anal. Appl.* 280 (2003), 400-412.

[2] M. Moszyński: Weyl sequences and the essential spectrum of some Jacobi operators, *Journal of Operator Theory* 67 no. 1 (2012), 237-256.

On the joint numerical ranges

Vladimir Müller

Let $T = (T_1, \dots, T_n) \in B(H)^n$ be an n-tuple of operators on a Hilbert space H. The joint numerical range is defined by

$$W(T) = \big\{ (\langle T_1 x, x\rangle, \dots, \langle T_n x, x\rangle) : x \in H, \|x\| = 1 \big\}.$$

We give a survey of results concerning this and related subsets of $\mathbb{C}^n$: the essential numerical range $W_e(T)$ and the k-th numerical range $W_k(T), k \in \mathbb{N} \cup \{\infty\}$.

The talk is based on joint work with Yu. Tomilov.

Models for subhomogeneous C^*-algebras

Piotr Niemiec

A C^*-algebra is said to be *subhomogeneous* if all its irreducible representations act on finite-dimensional Hilbert spaces whose dimension does not exceed n for some integer n. The aim of this talk is to introduce a category of certain *quantum spaces*, called *solid towers*, and corresponding to them C^*-algebras of functions defined on these quantum spaces; and to establish a one-to-one **functorial** correspondence between subhomogeneous C^*-algebras and solid towers of finite height. This correspondence is contravariant (that is, it reverses the arrows). In this way one obtains a generalisation of both Gelfand-Naimark's theorem for commutative C^*-algebras and Fell's on homogeneous C^*-algebras.

The talk is based on a recent paper, available at `arXiv:1310.5595`.

Extremal functions in weighted Bergman spaces

Maria Nowak

Let $\mathbb{D}$ denote the unit disk in the complex plane. For $-1 < \alpha < \infty$, the weighted Bergman space A^2_α is the space of functions f that are holomorphic in $\mathbb{D}$ and such that

$$\|f\|^2_\alpha = \int_{\mathbb{D}} |f(z)|^2 dA_\alpha(z) < \infty,$$

where $dA_\alpha(z) = (\alpha + 1)\left(1 - |z|^2\right)^\alpha \frac{dxdy}{\pi} = (\alpha + 1)\left(1 - |z|^2\right)^\alpha dA(z)$.

A sequence of points $\{a_n\}$ in the unit disk is called an A^2_α zero-set if there is a function in A^2_α which vanishes precisely on the set $\{a_n\}$. A closed subspace I of A^2_α is called invariant if $zf \in I$ whenever $f \in I$. Clearly, the subspace of A^2_α consisting of functions vanishing on a given A^2_α zero-set is an invariant subspace, the so-called zero based invariant subspace. H. Hedelman, P. Duren, D. Khavison, S. Shimorin and others considered the following extremal problem

$$\sup\left\{\mathrm{Re} f(0) \,:\, f \in I, \|f\|_\alpha \leq 1\right\}. \tag{1}$$

It is known that for $-1 < \alpha < \infty$ the extremal problem has a unique solution.

We find the formula for the solution of extremal problem (1) in the case of the invariant subspace I consisting of functions with a zero at $z = a \neq 0$ of multiplicity at least k, k=2, 3,.... A consequence of this formula is the failure of the Bergman-type theeorem for $\alpha = 4$

The talk is based on joint work with R. Rososzczuk and M. Wołoszkiewicz-Cyll.

On barrelledness in locally convex algebras

Lourdes Palacios

Besides the very classical barrelledness in locally convex algebras, as locally convex spaces, several notions of a specific kind of barrelledness pertaining to the algebra structure, have been introduced, according to the context someone is working in. The aim of this talk is to give an idea of all of them. Characterizations of them will be given in terms of (algebra) seminorms, which are the respective ones of vector space seminorms in locally convex spaces. This approach reveals a new notion of barrelledness. The latter shows to be what is needed to have meaningful statements in locally uniformly convex algebras. Comparisons between them will be established. Some relevant examples will be given.

The talk is based on joint work with Marina Haralampidou, University of Athens, Greece; Mohamed Oudadess, École Normale Supérieure, Morocco; Carlos Signoret, Universidad Autónoma Metropolitana - Iztapalapa, México.

Semigroups of Bergman and Dirichlet shifts

Jonathan R. Partington

The theme of this talk is C_0-semigroups of 2-isometries and 2-hypercontractions in the sense of Agler. By a result of Richter [4], 2-isometries may be regarded as shifts on generalized Dirichlet spaces, while Agler [1] showed that 2-hypercontractions are equivalent to restrictions of backward shifts on weighted Bergman spaces.

We present some characterizations of 2-isometric and 2-hypercontractive semigroups, as well as applications to invariant subspaces and Hankel operators.

The talk is based on material from the preprints [2] and [3].

[1] J. Agler: Hypercontractions and subnormality, *J. Operator Theory*, 13 (1985), 203–217.

[2] E. A. Gallardo-Gutiérrez and J. R. Partington: C_0-semigroups of 2-isometries and Dirichlet spaces, preprint, 2016.

[3] B. Jacob, J. R. Partington, S. Pott and A. Wynn: β-admissibility of observation and control operators for hypercontractive semigroups, preprint, 2015.

[4] S. Richter: A representation theorem for cyclic analytic 2-isometries, *Trans. Amer. Math. Soc.*, 328 (1991), 325–349.

On certain characterizations of quasinormal operators

Paweł Pietrzycki

In 1953 A. Brown introduced the class of bounded quasinormal operators. In the case of unbounded operators, two different definitions of unbounded quasinormal operators appeared independently. The first one was given in 1983 by Kaufman, and a few years later, the second one by Stochel and Szafraniec.

The talk will be devoted to the new characterisation of quasinormality and normality of unbounded operators.

[1] P.Pietrzycki: The single equality $A^{*n}A^n = (A^*A)^n$ does not imply the quasinormality of weighted shifts on rootless directed trees, *JMAA*, vol. 435 (2016), 338-348

Unbounded composition operators via inductive limits: cosubnormal operators with matrical symbols

Artur Płaneta

The aim of this talk is to present recent results concerning cosubnormality of unbounded composition operators induced by finite and infinite matrix symbols. There is no effective general criterion for subnormality of unbounded operators. As a consequence, the methods of verifying the subnormality of an operator depends on its properties. In the context of the aforementioned class of operators, inductive limit method can be applied. In finite-dimensional case this method enables us to give a criterion for cosubnormality of unbounded composition operators induced by finite invertible matrix symbol.

If the matrix is infinite, then the question of cosubnormality of corresponding composition operator is far more complicated. We introduce classes $\mathcal{S}^*_{n,r}$ of unbounded operators closely related to cosubnormal operators and investigate under what conditions composition operators with infinite matrix symbols belong to the classes. Using inductive limits we go from finite-dimensional case to infinite-dimensional case and get three criteria for cosubnormality.

The talk is based on the joint work with P. Budzyński and P. Dymek.

[1] P. Budzyński, P. Dymek, A. Płaneta, Unbounded composition operators via inductive limits: cosubnormal operators with matrix symbols, *Filomat*, (to appear), http://arxiv.org/abs/1502.01638.

[2] P. Budzyński, P. Dymek, A. Płaneta, Unbounded composition operators via inductive limits: Cosubnormal operators with matrix symbols, II BJMA (accepted)

Subadditive maps, group representations and addition theorems

Ekaterina Shulman

Let G be a group, Ω an arbitrary set. We call a map $f : G \to 2^\Omega$ *subadditive* if

$$f(gh) \subset f(g) \cup f(h) \qquad \text{for all } \; g, h \in G.$$

It will be shown that

$$\left| \bigcup_{g\in G} F(g) \right| \leq 4 \sup_{g\in G} |F(g)|,$$

where by $|M|$ we denote the number of elements of a subset $M \subset \Omega$.

We will discuss the extensions of this inequality to maps with values in subspaces of a linear space. Then we apply the result on non-commutative subadditivity to the study of "almost invariant" subspaces in a Banach G-space where a bounded representation of finite multiplicity of a group G is given.

This gives us the possibility to obtain a description of functions admitting an addition theorem of the form

$$f(g_1 g_2 \cdots g_n) = \sum_E \sum_{j=1}^{N_E} u_j^E v_j^E \tag{1}$$

where E runs through all proper non-empty subsets of $\{1, 2, ..., n\}$, $N_E \in \mathbb{N}$ and for each E, the functions u_j^E only depend on variables g_i with $i \in E$, while the v_j^E only depend on g_i with $i \notin E$. In particular, for $G = R$ and $n = 3$ the relation has the form

$$f(x+y+z) = \sum_{i=1}^{n} a_i(x) A_i(y,z) + \sum_{i=1}^{m} b_i(y) B_i(x,z) + \sum_{i=1}^{k} c_i(z) C_i(x,y)$$

We prove that any bounded continuous function f on a topological group G satisfying (1), for some $n \geq 2$, is a matrix element of a continuous finite-dimensional representation of G.

Continuous maps on triangular matrices that preserve commutativity

Roksana Słowik

During the talk we will consider the maps defined on some matrix algebras that preserve commutativity. We will present the most significant results in this field, mainly concerning full matrix algebras. Then we will focus on the continuous maps defined on the space of upper triangular matrices that preserve commutativity in both directions. We will give a description of such maps. Namely, we will roughly prove that every such map is a composition of either an inner automorphism and a locally polynomial map or the two latter and one more automorphism of upper triangular matrices.

[1] G. Dolinar, A. Guterman, B. Kuzma, P. Oblak: Extremal matrix centralizers, *Linear Algebra Appl.*, 438 (2013), 2904–2910.

[2] A. Fošner: Commutativity preserving maps on $M_n(\mathbb{R})$, *Glas. Mat. Ser. III*, 44 (64) (2009), 127–140.

[3] P. Šemrl: Non-linear commutativity preserving maps, *Acta Sci. Math. (Szeged)*, 71 (2005), 781–819.

[4] R. Słowik: Continuous maps on triangular matrices that preserve commutativity, to appear in *Linear Multilinear Algebra*.

Weighted p-Laplacian problems on a half-line

Bruce Watson

We study the weighted half-line eigenvalue problem

$$-(|y'(x)|^{p-1}\mathrm{sgn}y'(x))' = (p-1)(\lambda r(x) - q(x))|y(x)|^{p-1}\mathrm{sgn}y(x), \quad 0 \le x < \infty,$$

for $1 < p < \infty$, with initial condition $y'(0)\sin\alpha = y(0)\cos\alpha$, $\alpha \in [0,\pi)$, using a modified Prüfer angle $\phi(\lambda, x)$. The eigenvalues λ_k, $k \ge 0$, with $\lambda_k \to \infty$ as $k \to \infty$, are characterized by $\phi(\lambda_k, x) \to (k+1)\pi_p-$, and $\phi(\lambda, x) \to (k+1)\pi_p+$ if $\lambda_k < \lambda < \lambda_{k+1}$, as $x \to \infty$. We allow the weight r to be locally integrable and definite, semidefinite or indefinite. In the first two cases, the sequence of eigenvalues accumulates at one of $\pm\infty$, and in the third, the sequence accumulates at both $\pm\infty$. In all cases, solutions y are nonoscillatory on $(0,\infty)$ for all λ.

This talk is based on joint work with Paul Binding and Patrick Browne.

The Sobolev moment problem and Jordan dilations

Michał Wojtylak

We consider the following problem. Given a bisequence$(s(m,n))_{m,n=0}^{\infty}$ of numbers, we ask under which conditions there is a 2×2 positive definite matrix $\boldsymbol{\mu} = (\mu_{i,j})_{i,j=0}^{1}$ of measures on $\mathbb{R}$ such that

$$s(m,n) = \sum_{i,j=0}^{1} \int_{\mathbb{R}} t^{m^{(i)}} t^{n^{(j)}} \mu_{i,j}(dt), \quad m,n = 0,1,\ldots.$$

The superscript $^{(i)}$ designates the i-th derivative and positive definiteness of the 2×2 matrix valued function $(\mu_{i,j}(\,\cdot\,))_{i,j=0}^{1}$ defined on Borel subsets of $\mathbb{R}$ means that for every Borel ρ the 2×2 complex matrix $(\mu_{i,j}(\rho))_{i,j=0}^{1}$ is positive definite.

The necessary and sufficient condition we present is a combination of the Helton condition (see [1])

$$s(m+3,n) - 3s(m+2,n+1) + 3s(m+1,n+2) - s(m,n+3) = 0, \quad m,n \ge 0,$$

and positive definitness of some specific quadratic form. Our main tool is the dilation theory, developed here in the context of Jordan operators.

The talk is based on joint work with Franciszek Hugon Szafraniec.

[1] J. W. Helton, Infinite dimensional Jordan operators and Sturm–Liouville conjugate point theory, *Trans. Amer. Math. Soc.*, 170 (1972), 305–331.

[2] F.H. Szafraniec, M. Wojtylak, The Sobolev moment problem and Jordan dilations, arXiv:1603.00269.

Orthogonality of compact operators

Paweł Wójcik

In this paper we characterize the Birkhoff–James orthogonality for elements of $\mathcal{K}(X;Y)$. In this way we extend the Bhatia–Šemrl theorem. As an application, we consider the approximate orthogonality preserving property. Moreover, we give a new characterization of inner product spaces.

[1] R. Bhatia, P. Šemrl, *Orthogonality of matrices and some distance problems*, Linear Algebra Appl. **287** (1999), no. 1-3, 77–85.

[2] T. Bhattacharyya, P. Grover, *Characterization of Birkhoff–James orthogonality*, J. Math. Anal. Appl. **407** (2013), 350–358.

[3] P. Wójcik, *Orthogonality of compact operators*, Expositiones Mathematicae (2016), http://dx.doi.org/10.1016/j.exmath.2016.06.003

Range-kernel complementarity of linear operators

Nikos Yannakakis

We present some sufficient conditions for range-kernel complementarity of a bounded linear operator on a Banach space, with closed range.

The talk is based on joint work with D. Drivaliaris.

On the structure of the set of algebraic elements in a Banach algebra

Jaroslav Zemánek

We study the set of elements satisfying a given polynomial equation, with simple roots. In particular, we show that this set is a union of its isolated points (central elements of the algebra) and of complex lines (consisting of noncentral elements).

The talk is based on joint work with Endre Makai, Jr.

Application of inverse scattering transform method to study solutions of the short pulse equation

Lech Zielinski

The non-linear Schrödinger (NLS) equation is one of the universal integrable models describing the slow modulation of the amplitude of a weakly nonlinear wave packet in a moving medium. However in the case of ultra-short pulses in high-speed fiber-optic communication, the NLS model should be replaced by a short pulse (SP) model. The SP model can be formulated as the Cauchy problem of finding $u : \mathbf{R}^2 \to \mathbf{R}$ such that

$$\frac{\partial^2}{\partial x \partial t} u(x,t) = u(x,t) + \frac{1}{6} \frac{\partial^2}{\partial x^2} \left(u(x,t)^3 \right), \qquad u(x,0) = u_0(x),$$

where $u_0(x)$ is rapidly decaying as $|x| \to \infty$, and $u(x,t)$ is also rapidly decaying as $|x| \to \infty$, for any fixed t.

The purpose of this talk is to describe the behaviour of $u(x,t)$ for large time t using an adaptation of the inverse scattering transform method, in the form of a Riemann–Hilbert factorization problem.

The talk is based on joint work with Dmitry Shepelsky (Institute of Low Temperatures, Kharkiv, Ukraine).

Hilbert Space Geometry problems occurring in the Tomita-Takesaki Theory

László Zsidó

Each normal weight on a von Neumann algebra is (by a result of U. Haagerup) the pointwise least upper bound of the majorized bounded linear functionals. This is a basic ingredient in the treatment of the fundamental facts of the Tomita-Takesaki Theory, but is not enough to reduce the case of general faithful, semi-finite, normal weights to the case of (everywhere defined) faithful normal linear functionals.

In the talk we propose a "spatial" approximation of an arbitrary faithful, semi-finite, normal weight φ on a von Neumann algebra M with bounded normal functionals. Essentially we approximate φ with its (bounded) restrictions φ_e to the reduced von Neumann algebras eMe, where $e \in M$ are projections with $\varphi(e) < +\infty$. Difficulties arise because in general we don't have $\varphi(eae) \leq \varphi(a)$ for every $a \in M^+$, and because the family of all projections of finite weight is not upward directed. We are approximating appropriately the identity operator on the Hilbert space H_φ of the GNS representation of φ with the orthogonal projections onto the Hilbert spaces of the GNS representations of the functionals φ_e (considered subspaces of H_φ) and succeed to reduce the fundamentals of the Tomita-Takesaki Theory for general faithful, semi-finite, normal weights to the case of bounded functionals.

Maximal abelian subalgebras

Wiesław Żelazko

I want to address two results.

1. Let X be a Banach space, $\dim X > 1$. Then every maximal abelian subalgebra (m.a.s) $\mathcal{A}$ of $L(X)$ occurs there uncountably many times, i.e. there are uncountably many m.a.s in $L(X)$ which are isomorphic with $\mathcal{A}$ (see [1]).

2. Let $\mathcal{A}$ be the two-dimensional unital algebra generated by a square zero element ξ. Then there are exactly two algebras, one of dimension 3 and another of dimension 4 in which $\mathcal{A}$ is a m.a.s (see [2]).

[1] W. Żelazko, *All maximal commutative subalgebras occur in $L(X)$ uncountably many times*, Funct. Approx. Comment. Math. 53.2 (2015), 189-192.

[2] W. Żelazko, *An algebra which is a maximal commutative subalgebra in very few algebras*, submitted.