

ABSTRACTS

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Diagonal operators between vector-valued sequence spaces and measure of compactness

Abstract: In the literature, vector valued sequence spaces $\lambda(X)$, defined with the help of a Banach space X and a scalar valued sequence space λ , have been studied quite extensively. This paper deals with the study of the diagonal operator D between these spaces, defined with the help of a sequence $\{T_i\}$ of bounded linear operators acting between the underlying Banach spaces. The relationships of the measures of compactness of D with those of T_i 's, in terms of entropy numbers, approximation numbers and Kolmogorov numbers have been obtained. Using these results the compactness of D in terms of compactness of T_i 's has been characterized.

Joint work with Manjul Gupta.

Saturday, 2:00-2:20, Rm 215

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María D. Acosta *Universidad de Granada, Granada, Spain*

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An “isomorphic” version of James’s theorem

Abstract: James’s theorem states that every Banach space is reflexive if every functional on it attains its norm. There are (even classical) non-reflexive Banach spaces for which the set of norm attaining functionals has non-empty interior. Namioka posed the question if reflexivity holds anytime that for every equivalent norm, the above condition is satisfied. We present a quite general partial answer to the above question obtained in a joint work with V. Montesinos.

Monday, 2:40-3:00, Rm 10

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Yakov Alber *Technion-Israel Institute of Technology, Haifa, Israel*

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Generalized projection operators in Banach spaces

Abstract: In the paper [1], we have introduced generalized projection operators in Banach spaces and studied their properties in uniformly convex and uniformly smooth ones. In [2], these properties have been extended to reflexive Banach spaces. In this talk we present the main results of [1] and [2] as well as examples and applications.

[1] Ya. I. Alber, Metric and generalized projection operators in Banach spaces: properties and applications, In “Theory and Applications of Nonlinear Operators of Accretive and Monotone Type” (A. Kartsatos, ed.). Marcel Dekker, New York (1996), 15-50.

[2] Jinlu Li, The generalized projection operator on reflexive Banach spaces and its applications, JMAA, 306, No. 1 (2005), 55-71.

Joint work with Jinlu Li.

Thursday, 2:40-3:00, Rm 215

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Fernando Albiac *University of Missouri, Columbia, MO*

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Lipschitz maps between quasi-Banach spaces

Abstract: Let X and Y be quasi-Banach spaces. A Lipschitz map $f : X \rightarrow Y$ is a possibly nonlinear map satisfying an estimate

$$\|f(x_1) - f(x_2)\| \leq C\|x_1 - x_2\|, \quad x_1, x_2 \in X.$$

X and Y are Lipschitz isomorphic if there exists a Lipschitz bijection $f : X \rightarrow Y$ such that f^{-1} is also Lipschitz. It is a well-known open problem whether two separable Lipschitz isomorphic Banach spaces are necessarily linearly isomorphic. Counterexamples are known for nonseparable Banach spaces.

Using the notion of the Arens-Eells p -space over a metric space for $0 < p \leq 1$, we show the existence of a number of examples of separable quasi-Banach spaces which are Lipschitz isomorphic but not linearly isomorphic.

Joint work with Nigel Kalton.

Monday, 3:10-3:30, Rm 115

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Dale Alspach *Oklahoma State University, Stillwater, OK*

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Partition and weight spaces with the KP property

Abstract: We introduce a property of unconditional bases we call KP. By results of Kadets and Pelczynski every unconditional basic sequence in L_p has this property. The motivation for introducing the property is the problem of determining conditions on a space with partition and weight norm which will imply that the space is isomorphic to a subspace of L_p . In this talk we will discuss this problem and the KP property.

Wednesday, 2:40-3:00, Rm 215

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George Androulakis *University of South Carolina, Columbia, SC*

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The invariant subspace problems for Banach spaces

Abstract: The invariant subspace problem has its origin in the work of J. von Neumann around 1935, it remains open and it asks whether every (bounded linear) operator on a complex separable Hilbert space has a non-trivial invariant subspace. The following two open questions are called invariant subspace problems for Banach spaces: Does any operator on a separable reflexive Banach space has a non-trivial invariant subspace? (This question is motivated by work of P. Enflo and C. Read who constructed in the 70's and 80's non separable Banach spaces and operators on them without any non-trivial invariant subspace). Does there exist an infinite dimensional Banach space such that any operator on it has a non-trivial invariant subspace? We will discuss these two invariant subspace problems for Banach spaces.

Monday, 3:40-4:00, Rm 229

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Razvan Anisca *Lakehead University, Thunder Bay, Canada*

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Theorem of Komorowski and Tomczak-Jaegermann, revisited

Abstract: We discuss properties related to unconditionality in Banach spaces which admit a UFDD (unconditional finite-dimensional decomposition), in the same context as the work of Komorowski and Tomczak-Jaegermann. As a consequence we obtain that if a Banach space X contains an unconditional basic sequence then we have one of the following “regular-irregular” alternatives: either X contains a subspace isomorphic to ℓ_2 or X contains a subspace which has a UFDD but does not admit a UFDD with a uniform bound for the dimensions of the decomposition. This result can be also viewed in the context of Gowers’ dichotomy theorem.

Monday, 3:10-3:30, Rm 10

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Antonio Avilés *University of Murcia, Murcia, Spain*

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Renormings of the duals of James tree spaces

Abstract: It is a result of Fabian and Godefroy that the dual of every Asplund Banach space admits an equivalent LUR norm. We show that this result does not extend to Banach spaces not containing ℓ_1 by studying when the dual of James tree spaces JT for different trees T admit equivalent Kadec, strictly convex or LUR norms. A complete picture is given in the case when JT is weakly compactly generated, showing that there are such T 's with JT^* non Kadec renormable, and we also construct a weakly countably determined JT such that JT^* has neither Kadec nor strictly convex equivalent norm. It is an open problem whether the dual of every separable Banach space not containing ℓ_1 has an equivalent LUR norm.

Monday, 4:20-4:40, Rm 10

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Pradipta Bandyopadhyay *Indian Statistical Institute, Kolkata, India*

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Almost constrained subspaces of $C(K)$ -II

Abstract: A subspace Y of a Banach space X is called 1-complemented or constrained if Y is the range of a norm 1 projection on X . A subspace Y of X is an *almost constrained (AC) subspace* if for any $x_0 \in X$, there exists $y_0 \in Y$ such that

$$\|y_0 - y\| \leq \|x_0 - y\| \quad \text{for all } y \in Y.$$

Clearly, any 1-complemented subspace is an AC-subspace. In the talk at SIUE, we showed that the converse holds for a finite codimensional subspaces in $C(K)$, the Banach space of all complex valued continuous functions on a compact Hausdorff space K with the sup norm.

Our proof also leads to an explicit description of 1-complemented subspaces of finite codimension in $C(K)$ in terms of the measures defining it.

In this talk, we present the proof of this last statement. But we will make it largely self-contained.

Joint work with Sudipta Dutta.

Monday, 4:50-5:10, Rm 10

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Sudeshna Basu *Morgan State University, Baltimore, MD*

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Ball intersection properties in Banach spaces

Abstract: In this talk, we survey a large class of ball intersection properties which have played a very important role in the study of geometry of Banach spaces. We look at two different classes one hereditary, and the other non hereditary. We show that many of these properties are separably determined and some of them are preserved by taking c_0 and ℓ_p direct sums. We investigate the stability under “three space property”. We also study these properties in operator spaces and examine their stability.

Wednesday, 3:10-3:30, Rm 10

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Elizabeth Bator *University of North Texas, Denton, TX*

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c_0 , ℓ^∞ , and complemented subspaces of $L(X, Y)$

Abstract: In a recent paper, Paul Lewis showed that whenever c_0 embeds in $L(X, Y)$, then it must be the case that ℓ^∞ embeds in $L(X, Y)$. We show that if c_0 embeds in the operator ideal $\mathcal{O}(X, Y)$ and $\mathcal{O}(X, Y)$ is complemented in $L(X, Y)$, then ℓ^∞ embeds in $\mathcal{O}(X, Y)$ too. We also investigate conditions for which $\mathcal{O}(X, Y)$ is not complemented in $L(X, Y)$.

Joint work with Manijeh.

Thursday, 4:50-5:10, Rm 10

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Kevin Beanland *University of South Carolina, Columbia, SC*

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A hereditarily indecomposable asymptotic ℓ_2 Banach space

Abstract: A Hereditarily Indecomposable asymptotic ℓ_2 Banach space is constructed. The existence of such a space solves a problem of B. Maurey and verifies a conjecture of W.T. Gowers. Additionally, it is shown that for every $C > 0$, a Banach space with an asymptotic biorthogonal system can be renormed to be C -Hereditarily Indecomposable.

Joint work with George Androulakis.

Saturday, 1:30-1:50, Rm 115

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Oscar Blasco *University of Valencia, Burjasot, Spain*

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A Coiffman-Weiss transference method for bilinear and maximal bisublinear operators and applications

Abstract: We present a bilinear version of the transference method of Coifman and Weiss which allows to obtain the boundedness of the periodic, discrete and Ergodic bilinear Hilbert

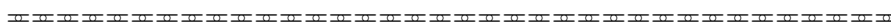
transform (proved in the real line by M. Lacey and C. Thiele), maximal bisublinear Hardy Littlewood (proved in the real line by M. Lacey and C. Thiele) or bilinear fractional integrals (proved in the real line by C. Kenig and E. Stein, and L. Grafakos and N. Kalton).

This talk is based on papers :

1.- Blasco, O., Carro, M., Gillespie, T. A., Bilinear Hilbert transform on measure spaces. *J. Fourier Anal. Appl.* **11** (4) (2005) , pp. 459–470.

2.- Berkson, E., Blasco, O., Carro, M., Gillespie, T. A., Discretization and transference for bisublinear maximal operators. *J. Fourier Anal. Appl.* (To appear).

Monday, 2:40-3:00, Rm 215



Sarita Bondre *The M.S. University of Baroda, Vadodara, India*

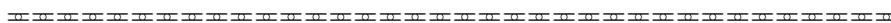
e-mail: rs_bondre@yahoo.com

Structural properties of spaces of fuzzy number valued functions

Abstract: To model uncertainties in the real world situation, probability and fuzzy sets are used. While probability deals with uncertainty associated with the occurrence of the event, fuzziness deals with the uncertainty due to unclear perception of the concept, which does not allow crisp modelling of the concept. A crisp set can be represented by its characteristic function $\chi_A : X \rightarrow \{0, 1\}$, whereas a fuzzy set A is represented by a membership function $\mu_A : X \rightarrow [0, 1]$ representing membership grade to every element of X . Fuzzy numbers are fuzzy sets on \mathbb{R} which are normal, fuzzy convex, have compact level sets and are upper semi-continuous. Let \mathcal{E}^1 be the set of all fuzzy numbers and \mathcal{E}^n be the collection of fuzzy sets defined on \mathbb{R}^n having similar properties. Fuzzy numbers are used to deal with measurement uncertainties. Structural properties of \mathcal{E}^n have been studied quite rigorously. For example, there are several ways of defining a metric on \mathcal{E}^n and under some metrics \mathcal{E}^n becomes a complete metric space. Also, the properties of \mathcal{E}^n -valued functions have been studied in the literature. A little work has been done to study the structural properties of spaces of \mathcal{E}^n -valued functions.

Unlike the spaces of real valued functions, the spaces of fuzzy number valued functions do not have a linear structure. In this paper we have discussed algebraic and topological structures of the spaces of continuous fuzzy number valued functions and differentiable fuzzy number valued functions. Joint work with Prof. V. D. Pathak.

Friday, 5:20-5:40, Rm 215



Olga Brezhneva *Miami University, Oxford, OH*

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Implicit function theorems for nonregular mappings in Banach spaces

Abstract: We consider the equation $F(x, y) = 0$, where $F : X \times Y \rightarrow Z$ is a smooth mapping, and X, Y and Z are Banach spaces. In the case when $F(x_0, y_0) = 0$ and the mapping F is regular at (x_0, y_0) , i.e., when $D_2F(x_0, y_0)$ is invertible, the classical implicit function theorem guarantees the existence of a smooth mapping ϕ defined on a neighborhood of x_0 such that $F(x, \phi(x)) = 0$ and $\phi(x_0) = y_0$. We are interested in the case when the mapping F is nonregular and the classical implicit function theorem is not applicable. We present generalizations of the implicit function theorem for this case. The results are illustrated by some examples.

Joint work with A.Tret'yakov.

Thursday, 4:50-5:10, Rm 115

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Bo Brinkman *Miami University, Oxford, OH*

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A technique for bounding the dimensionality of ℓ_1 spaces

Abstract: In this talk I will give a brief introduction to Charikar and Sahai's technique of "stretch-limited" embeddings for ℓ_1 spaces. By comparing properties of the whole metric space to properties of individual dimensions they are able to derive trade-offs between dimensionality and bi-Lipschitz distortion. Stretch-limited embeddings lead naturally to both upper and lower bounds on dimensionality, and in many situations can lead to efficient algorithms for generating low-dimensional embeddings into ℓ_1 . I will also summarize several results that used this approach.

Monday, 3:40-4:00, Rm 115

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Yuri Brudnyi *Technion - Israel Institute of Technology, Haifa, Israel*

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Multivariate functions of bounded variation

Abstract: The talk is devoted to basic properties of V-spaces introduced by the lecturer in the framework of local polynomial approximation theory. This family include such classical spaces as BV, Sobolev, Morrey and their natural generalizations. We discuss the following topics

- a) relations to classical function spaces
- b) imbeddings
- c) interpolation of couples of V-spaces
- d) duality
- e) N-term approximation of functions from these spaces.

Thursday,10:30-11:20, Rm 115

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Qingying Bu *University of Mississippi, University, MS*

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Radon-Nikodym property for Fremlin projective tensor product of Banach lattices

Abstract: We will use the Schauder decomposition and semi-embedding theory to show that the Fremlin projective tensor product of an atomic Banach lattice with any Banach lattice has the Radon-Nikodym property whenever both Banach lattices have the Radon-Nikodym property.

Joint work with Gerard Buskes.

Saturday, 1:30-1:50, Rm 215

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Félix Cabello Sánchez *Universidad de Extremadura, Badajoz, Spain*

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Some weak forms of injectivity for Banach spaces, with applications to ultraproducts

Abstract: A Banach space E is said to be injective if every operator $T : Y \rightarrow E$ from a subspace Y of a Banach space X can be extended to an operator $\tilde{T} : X \rightarrow E$.

We deal in this talk with some weak forms of injectivity obtained by restricting the ‘size’ of X . Accordingly, given a cardinal number κ , we say that E is κ -injective if the above definition holds for all Banach spaces X with $\text{dens}(X) < \kappa$. (Recall that $\text{dens}(X)$ is the least cardinal that a dense subset of X can have.) When $\kappa = \omega_1$ is the first uncountable cardinal we speak of separably injective spaces. We will focus on the following points:

- Spaces of $C(K)$ type
- Ultraproducts, mainly of Lindenstrauss spaces
- Examples
- Applications of homological flavor
- Applications to topology

We will use only basic properties of ultraproducts (this is forced by my limited knowledge of the topic).

Friday, 4:20-4:40, Rm 10

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Jesús M. F. Castillo *University of Extremadura, Badajoz, Spain*

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Limit Banach spaces and the extension of operators

Abstract: We take as starting point a result of Lindenstrauss and Pełczyński asserting that every operator from a subspace of c_0 with values in an "isometric L_1 -predual", later called Lindenstrauss spaces in the literature, can be extended to the whole c_0 . Having this in mind, we will review classical and recent results about the extension of operators having range in $C(K)$, Lindenstrauss and arbitrary \mathcal{L}_∞ -spaces.

Then, a twill will be woven with three lines of though:

- The construction of inductive limits of Banach spaces with certain universal properties. To give a typical result in this direction: Every separable Banach space X can be embedded into a Lindenstrauss space $\mathcal{L}^1(X)$ with the property that very operator from X into a Lindenstrauss space can be extended to $\mathcal{L}^1(X)$.
- The existence of weak* continuous selectors with particular properties. This continues Zippin's "global approach" to the problem of the extension of $C(K)$ -valued operators, and allows the obtention of some results for nonseparable spaces.
- The observation of the class of those \mathcal{L}_∞ -spaces that can play the role of $C(K)$ in the Lindenstrauss-Pełczyński theorem.

If such garment can dress topics such as the classification of \mathcal{L}_∞ -spaces or the problem of the automorphic space will be considered.

Friday, 1:30-2:20, Rm 115

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Marianna Csörnyei *University College, London, UK*

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Structure of null sets, differentiability of Lipschitz functions, and other problems

Abstract: We describe a decomposition result for Lebesgue negligible sets, and outline some applications to real analysis and geometric measure theory. In particular, we characterise the set of points of non-differentiability of Lipschitz mappings on \mathbb{R}^n . This is a joint work with G. Alberi and D. Preiss.

Thursday, 1:30-2:20, Rm 115

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Michael Cwikel *Technion, Israel Institute of Technology, Haifa, Israel*

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K-divisibility constants for some special Banach and Hilbert couples

Abstract: The Brudnyi-Krugljak K -divisibility theorem is a powerful tool in the theory of real interpolation spaces, and also, potentially, well beyond.

In this talk we present joint work with Yacin Ameer about new estimates for the constant, the so-called K -divisibility constant, which appears in that theorem, and which is sometimes denoted by $\gamma(X_0, X_1)$. In particular we consider some cases where the ambient Banach couple (X_0, X_1) consists of finite dimensional spaces. Our results include the rather surprising fact that $\gamma(X_0, X_1)$ is strictly larger than 1, in fact at least $2/\sqrt{3}$, in many cases where (X_0, X_1) is a couple of Hilbert spaces. This contrasts with an earlier result of Ameer, that the Calderón constant for every couple of Hilbert spaces is always 1. Joint work with Yacin Ameer.

This talk can also be considered as a prelude to the talk to be given by Sten Kaijser, which will be scheduled immediately after it.

Wednesday, 3:10-3:30, Rm 115

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Stefan Czerwik *Silesian University of Technology, Gliwice, Poland*

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On the Ulam-Hyers stability of the functional equations in Banach spaces

Abstract: In my talk the problem of Ulam-Hyers stability of functional equations will be presented. In particular, we shall consider this problem for the equation of quadratic functionals in L_p -spaces and in more general setting, in topological spaces. Also some general Baker superstability criterium for the D'Alembert functional equation will be discussed. Moreover, some results for stability and superstability of the generalized quadratic functional equation will be presented.

Reference:

[1] S. Czerwik, *Functional Equations and Inequalities in Several Variables*, World Scientific, New Jersey, London, 2002, 410pp.

Monday, 5:20-5:40, Rm 115

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Jerry Day *University of Pittsburgh, Pittsburgh, PA*

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Minimal invariant sets of Alspach's map

Abstract: In 1981, Dale Alspach introduced the baker transform as an example of a non-expansive map on a weakly compact convex set that is fixed point free. The minimal invariant sets for this mapping have been of particular interest. Recent work of C. Lennard and the presenter has shed some light on this topic. Specifically, a method for finding all minimal invariant sets of Alspach's Map will be presented, and a constructive definition of these sets will be given.

Joint work with C. Lennard.

Wednesday, 3:40-4:00, Rm 10

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Geoff Diestel *University of Missouri, Columbia, MO*

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Sobolev spaces with only trivial isometries

Abstract: Certain Sobolev spaces defined on bounded Lipschitz domains are shown to have only trivial isometries corresponding to a finite set of composition operators. Partial results will be given and questions related to imbedding theorems and isometric approximation will be posed.

Joint work with A. Koldobsky.

Tuesday, 2:40-3:00, Rm 215

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Stephen Dilworth *University of South Carolina, Columbia, SC*

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Coefficient quantization in Banach spaces

Abstract: The problem which motivates this paper is the following. Let $(X, \|\cdot\|)$ be a separable infinite-dimensional Banach space and let (e_i) be a semi-normalized dictionary for X (i.e. (e_i) has dense linear span in X). For a given choice of $N \in \mathbb{N}$, consider the problem of approximating an element $x \in X$ by an element of the 'lattice'

$$\mathcal{D}^N((e_i)) = \left\{ \sum_{i \in E} \frac{k_i}{2^N} e_i : k_i \in \mathbb{Z}, E \subset \mathbb{N} \text{ finite} \right\}.$$

In many situations (e.g. when (e_i) is a Schauder basis for X) each coefficient $k_i/2^N$ of an approximant from $\mathcal{D}^N((e_i))$ will be bounded by a constant that depends only on (e_i) and $\|x\|$. In this case the approximant will be chosen from a collection of vectors in $\mathcal{D}^N((e_i))$ whose coefficients are quantized by a 'finite alphabet'.

The main property which we consider is the *Coefficient Quantization Property* (abbr. CQP), defined roughly as follows: for every prescribed tolerance there exists a quantization such that every vector $x = \sum_{i \in E} a_i e_i$ in X that can be expressed as a finite linear combination of dictionary elements can be approximated by a quantized vector $y = \sum_{i \in E} d_i e_i$ with the

same (or possibly smaller) support E . Thus, for each $\varepsilon > 0$, there exists N such for every x with finite support E there exists $y \in \mathcal{D}^N((e_i))$ supported in E such that $\|x - y\| \leq \varepsilon$.

Main theorem. *Let X be a separable Banach space. Then X has a fundamental and total normalized minimal system with the CQP if and only if c_0 is isomorphic to a subspace of X . Moreover, if X has a basis then X has a normalized weakly null basis with the CQP if and only if X contains an isomorph of c_0 .*

This is joint work with E. Odell, Th. Schlumprecht and A. Zsák.

Tuesday, 1:30-2:20, Rm 115

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Paweł Domański *Adam Mickiewicz University, Poznań, Poland*

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Interpolation inequalities between norms in spaces of distributions and real analytic functions

Abstract: The interpolation inequalities of the form

$$\|\cdot\|_2 \leq C \|\cdot\|_1^\theta \|\cdot\|_3^{1-\theta}, \quad \theta \in]0, 1[,$$

where $\|\cdot\|_j$ are (semi-)norms and $\theta \in (0, 1)$, play a profound role in the theory of non-Banach function (locally convex) spaces and their applications to classical analysis. We survey implications of that type of inequalities to the following problems:

- splitting of short exact sequences of non-Banach spaces (like spaces of distributions or spaces of real analytic functions)

$$0 \rightarrow X \rightarrow Y \rightarrow Z \rightarrow 0;$$

- parameter dependence of distributional solutions of linear partial differential equations with constant coefficients $P(D)u = f$;
- structure (subspaces, quotient spaces) of the space of real analytic functions $A(\Omega)$.

The talk is based on a joint work with J. Bonet (Valencia).

Wednesday, 2:40-3:00, Rm 115

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Ian Doust *University of New South Wales, Sydney, Australia*

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Norm bounds for families of projections

Abstract: In the technical depths of the spectral theory of Banach space operators, one usually requires both boundedness and topological/continuity properties for the families of projections that arise as ‘spectral decompositions’. The topological properties make the theory neater, but in practice, what one is usually looking for is just the boundedness of certain operators. In this talk we shall examine some of the results from the past few years

concerning questions of when certain operations give rise to bounded projections, and what can be said about the norms of these projections.

Tuesday, 5:20-5:40, Rm 10

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Jakub Duda *Weizmann Institute of Science, Rehovot, Israel*

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Metric derived numbers and continuous metric differentiability via homeomorphisms

Abstract: Let $f : [a, b] \rightarrow X$, where (X, ρ) is a metric space, and

$$md(f, x) := \lim_{t \rightarrow 0} \frac{\rho(f(x+t), f(x))}{|t|}$$

for $x \in [a, b]$. Then $md(f, \cdot)$ is a metric analogue of the usual derivative. We define the notions of unilateral metric derivatives and “metric derived numbers” in analogy with Dini derivatives (also referred to as “derived numbers”) and establish their basic properties. If $md(f, \cdot)$ is continuous, we show that the set of points $x \in [a, b]$, where f is not metrically differentiable, i.e. where

$$\rho(f(y), f(z)) - md(f, x)|y - z| = o(|x - y| + |x - z|), \quad \text{when } (y, z) \rightarrow (x, x)$$

fails, is σ -symmetrically porous, and provide an example in which this set is uncountable. We also study the continuous metric differentiability via change of variable.

This is a joint work with Olga Maleva.

Thursday, 2:40-3:00, Rm 115

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Yves Dutrieux *Université de Franche-Comté, Besançon, France*

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Lipschitz free space of $C(\mathbf{K})$ -spaces

Abstract: The Lipschitz free Banach space of a pointed metric space is the canonical predual of the space of all real-valued Lipschitz functions which vanish at the base point. G. Godefroy and N. Kalton have studied it in order to linearize nonlinear isometric embeddings between separable Banach spaces. In this work, we prove that this Lipschitz invariant is not complete, that is to say that there exist Banach spaces which are not Lipschitz homeomorphic but have the same Lipschitz free space. More precisely, we prove that all separable spaces of continuous functions on compact spaces have the same Lipschitz free space.

Joint work with V. Ferenczi.

Thursday, 5:20-5:40, Rm 115

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Sudipta Dutta *Ben-Gurion University of the Negev, Beer-Sheva, Israel*

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On tree characterizations of some Banach spaces

Abstract: Consider the following properties for a separable infinite dimensional Banach space E .

(s) Any weak-null sequence in S_E has a BCBS.

(t) any weak-null tree in S_E has a branch which is a BCBS.

Similarly for a dual Banach space E^* , consider the following.

(s*) Any weak*-null sequence in S_{E^*} has a boundedly complete basic subsequence (BCBS).

(t*) any weak*-null tree in S_{E^*} has a branch which is a BCBS.

The main results which we are going to present in this talk are the following.

Theorem 1. Let E be a separable Banach space. The dual space E^* is separable if and only if E^* has property (t*). There is a separable Banach space B with non-separable B^* such that B^* has property (s*).

Theorem 2. Let X be a Banach space with separable dual X^* . The space X has *point of continuity property* if and only if it has property (t). There is a Banach space Y with separable dual Y^* such that Y has property (s) but fails to have *point of continuity property*.

In this talk we show the converse. Namely, if X contains an infinite dimensional reflexive subspace, we construct a Banach space Z and a hereditary semi-embedding $T : X \rightarrow Z$ which is not an isomorphic embedding.

Joint work with V. P. Fonf.

Saturday, 2:30-2:50, Rm 215

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Mahmoud Mohammed Mostafa El-Borai *Alexandria University, Alexandria, Egypt*

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On some stochastic fractional integrodifferential equations

Abstract: The purpose of this paper is to study the integro-partial differential equation of fractional order:

$$\frac{\partial^\alpha u(x, t)}{\partial t^\alpha} - \sum_{|q| \leq 2m} a_q(x) D^q u(x, t) = f_1(u(x, t)) + \int_0^t f_2(u(x, s)) dW(s),$$

with the nonlocal condition

$$u(x, 0) = \varphi(x) + \sum_{k=1}^p c_k u(x, t_k),$$

where $0 \leq t_1 < t_2 < \dots < t_p$, x is an element of the n -dimensional Euclidean space \mathbb{R}^n and $D^q = D_1^{q_1} \dots D_n^{q_n}$,

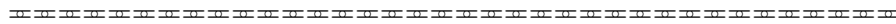
$$D_j = \frac{\partial}{\partial x_j}, 0 < \alpha \leq 1,$$

$q = (q_1, \dots, q_n)$ is an n dimensional multi-index, $|q| = q_1 + \dots + q_n$ and $W(t)$ is standard Wiener process over the filtered probability space Ω, F, F_t, P .

It is supposed that $\sum_{|q|=2m} a_q(x) D^q$ is uniformly elliptic on \mathbb{R}^n . The existence of solutions of the considered Cauchy problem and some properties are studied under suitable conditions on φ , the constants c_1, \dots, c_p , the functions a_q, f_1 and f_2 .

Keywords: Nonlocal initial condition, stochastic integro-partial differential equations, fractional order.

Monday, 4:50-5:10, Rm 215



Marián Fabian *Czech Academy of Sciences, Prague, Czech Republic*

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Weakly compactly generated spaces and their relatives

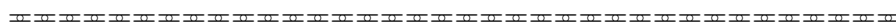
Abstract: A Banach space is called weakly compactly generated (WCG) if it contains a weakly compact set whose linear hull is dense in it. Originating from now standard results on WCG spaces obtained by Amir and Lindenstrauss in late sixties, we characterize several relatives of the class of WCG spaces.

Theorem 1. A Banach space X is a subspace of a WCG space, if and only if for every $\varepsilon > 0$ its unit ball B_X can be split into countably many pieces, each piece being ε -weakly compact, if and only if X is weakly Lindelöf determined and moreover for every $\varepsilon > 0$ the ball B_X can be split into countably many pieces, each piece being an ε -Asplund set, if and only if the dual unit ball B_{X^} is an Eberlein compact.*

Theorem 2. X is a subspace of a Hilbert generated space, if and only if it admits an equivalent uniformly Gâteaux differentiable norm, if and only if B_{X^} is uniform Eberlein compact.*

As consequences, we get functional analytic proofs of several topological results: *A continuous image of a (uniform) Eberlein compact is (uniform) Eberlein* [Benyamini et al.]. *A compact space is Eberlein if and only if it is both Corson and quasi-Radon-Nikodým* [Arvanitakis]. We also get a criterion of Talagrand-Argyros-Farmaki for recognizing Eberlein compacta sitting in the Σ -product of real lines. The presented results have been obtained by a group of collaborators: G. Godefroy, P. Hájek, V. Montesinos, V. Zizler and the lecturer.

Wednesday, 3:40-4:00, Rm 215



Vasiliki Farmaki *Athens University, Athens, Greece*

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Schreier families of variable located words

Abstract: The recursive system of Schreier families, which arose gradually in the theory of Banach spaces (Schreier 1930, Tsirelson 1974), is a purely combinatorial entity that has proved to be the suitable vehicle for the extension of the Ramsey and Nash-Williams theory, an extension that is proving fruitful in Banach space theory. In our present work, jointly with S. Negrepontis, we extend, in the setting of Schreier families, a partition theorem, established by Bergelson-Blass-Hindman (1994), on located words (i.e. words with a support in the set of natural numbers) over a finite alphabet. As a consequence we obtain a Nash-Williams type (and Ellentuck type) partition theorem on Schreier sequences of infinite sequences of variable located words which is a strengthening of various Nash-Williams type theorems (including those by Milliken-Taylor and by Carlson). We note that the Gowers partition theorem, used in the proof of his c_0 -theorem (1992), is somewhat related to the Bergelson-Blass-Hindman result; and, that the Hindman-Milliken-Taylor results have been employed for a theory of asymptotic models in Banach spaces, by Halbeisen and Odell (2004). It is possible that our main result, suitably extended to an infinite alphabet, can provide an abstract combinatorial version of Gowers Banach space partition theorem (2002).

Joint work with Stelios Negrepontis.

Tuesday, 4:20-4:40, Rm 115

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Valentin Ferenczi *Université Paris VI, Paris, France*

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Uniqueness of complex structure and real hereditarily indecomposable Banach spaces

Abstract: There exists a real hereditarily indecomposable Banach space $X = X(\mathbb{C})$ (resp. $X = X(\mathbb{H})$) such that the algebra $\mathcal{L}(X)/\mathcal{S}(X)$ is isomorphic to \mathbb{C} (resp. to the quaternionic division algebra \mathbb{H}).

Up to isomorphism, $X(\mathbb{C})$ has exactly two complex structures, which are conjugate, totally incomparable, and both hereditarily indecomposable. So there exist two Banach spaces which are isometric as real spaces but totally incomparable as complex spaces. This extends results of J. Bourgain and S. Szarek, and shows that a theorem of G. Godefroy and N.J. Kalton about isometric embeddings of separable real Banach spaces does not extend to the complex case.

The quaternionic example $X(\mathbb{H})$, on the other hand, has unique complex structure up to isomorphism; other examples with a unique complex structure are produced, including a

space with an unconditional basis and non-isomorphic to l_2 . This answers a question of S. Szarek.

Monday, 1:30-2:20, Rm 115

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Richard J. Fleming *Central Michigan University, Mt. Pleasant, MI*

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Bohnenblust's Theorem and norm-equivalent coordinates

Abstract: In 1940, F. Bohnenblust gave a set of conditions on a function $f(s, t)$ for which $f(s, t) = (|s^p| + |t^p|)^{1/p}$ for some p , $1 \leq p < \infty$, or $f(s, t) = \max\{|s|, |t|\}$. We will give an improvement of this theorem due to B. Randrianantoanina, and show how to use it to decompose certain sequence spaces into direct sums of ℓ^p -spaces.

Tuesday, 4:50-5:10, Rm 215

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Julio Flores *Universidad Rey Juan Carlos, Madrid, Spain*

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Domination by positive Banach-Saks operators

Abstract: Given a positive Banach-Saks operator T between two Banach lattices E and F , we give sufficient conditions on E and F in order to ensure that every positive operator dominated by T is Banach-Saks. A counterexample is also given when these conditions are dropped. Moreover, we deduce a characterization of the Banach-Saks property in Banach lattices in terms of disjointness.

Joint work with César Ruiz.

Friday, 4:50-5:10, Rm 10

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Jan Fourie *North-West University, Potchefstroom, South Africa*

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On operator valued sequences of multipliers and R -boundedness

Abstract: The concept of (p, q) -summing multiplier was considered in several recent papers, where it was shown that some geometric properties of Banach spaces and some classical theorems can be described using spaces of (p, q) -summing multipliers. We discuss results from a recently submitted joint paper (of the above mentioned authors), whereby multiplier spaces for some classical Banach spaces are considered. Generally spoken, a sequence of bounded linear operators $(u_n) \subset \mathcal{L}(X, Y)$ is called a *multiplier sequence* from

$E(X)$ to $F(Y)$ if $(u_n x_n) \in F(Y)$ for all $(x_i) \in E(X)$, whereby $E(X)$ and $F(Y)$ are two Banach spaces whose elements are sequences of vectors in X and Y , respectively. Several cases where $E(X)$ and $F(Y)$ are different (classical) spaces of sequences, including for instance the space $Rad(X)$ of almost unconditionally summable sequences in X , are considered. Several examples, properties and relations among spaces of summing multipliers are discussed. Important concepts like R-bounded, semi-R-bounded and weak-R-bounded from recent papers are also considered in this context.

Joint work with Oscar Blasco and Ilse Schoeman.

Tuesday, 2:40-3:00, Rm 10

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Maria Fragoulopoulou *University of Athens, Athens, Greece*

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When an enveloping pro- C^* -algebra is a genuine C^* -algebra?

Abstract: The enveloping pro- C^* -algebra (inverse limit of C^* -algebras) of an m^* -convex algebra is defined by using bounded $*$ -representations. It often happens that highly non-normed m^* -convex algebras have their enveloping pro- C^* -algebra to be just a C^* -algebra. For instance, take an arbitrary C^* -algebra A , a compact smooth manifold X and the Fréchet $*$ -algebra $C^\infty(X, A)$ of all A -valued smooth functions on X . Then, the enveloping pro- C^* -algebra of $C^\infty(X, A)$ is the C^* -algebra $C(X, A)$ of all A -valued continuous functions on X . Answers of S. J. Bhatt and D. J. Karia to the question in the title put by the speaker will be mentioned and some new results from a joint work with S. J. Bhatt, A. Inoue and D. J. Karia will be discussed

Friday, 3:40-4:00, Rm 10

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Onno van Gaans *Leiden University, Leiden, The Netherlands*

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One-complemented subspaces of finite dimensional vector spaces with smooth lattice norms

Abstract: Which norms on a finite dimensional real vector space have the property that every one-complemented subspace admits a basis of vectors with mutually disjoint supports? We consider a class of strictly convex smooth lattice norms with this property. The conditions defining the class are in terms of the second order partial derivatives of the norm. The class is closed under addition and multiplication by positive scalars and it contains the duals of norms belonging to it. The class contains, for example, positive linear combinations of p -norms, provided the smallest p is not equal to 2.

Joint work with Bas Lemmens.

Friday, 4:50-5:10, Rm 215

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Nadia J. Gal *The University of Memphis, Memphis, TN*

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Isometries and isometric equivalence of Hermitian operators on $A^{1,p}(X)$

Abstract: Let $1 \leq p < \infty$, $p \neq 2$ and X be a Banach space. Barbu and Precupanu defined the space $A^{1,p}(X)$ of all absolutely continuous functions $f : [0, 1] \rightarrow X$ such that df/dx exist a.e. on $(0, 1)$ and belongs to $L^p([0, 1], X)$. We show that whenever X is smooth and reflexive, a surjective isometry T of $A^{1,p}$ is given by

$$Tf(x) = T_0[f(0)] + \int_0^x U(f')(t) dt,$$

where T_0 is a surjective isometry of X and U is a surjective isometry of $L^p([0, 1], X)$. We also give the form of a Hermitian operators on $A^{1,p}(X)$ and the condition of isometric equivalence of two Hermitian operators on $A^{1,p}(X)$.

Joint work with James Jamison

Tuesday, 5:20-5:40, Rm 215

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Pando Georgiev *University of Cincinnati, Cincinnati, OH*

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Variational principles in Banach spaces - parametric versions

Abstract: We combine variational principles in Banach spaces with selection theorems resulting in statements in which the minimum point in a parametrized minimization problem depends in a good way on parameters. Applications in analysis, statistical learning theory, optimal control, etc. are considered.

Thursday, 5:20-5:40, Rm 215

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Ioana Ghenciu *University of Wisconsin, River Falls, WI*

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Complemented spaces of operators

Abstract: Classical results of Kalton are used to study the complementation of the space $W(X, Y)$ of weakly compact operators and the space $K(X, Y)$ of compact operators in the space $L(X, Y)$ of bounded linear operators.

Thursday, 5:20-5:40, Rm 10

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Gilles Godefroy *Université Paris VI, Paris, France*

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Non-linear isomorphisms between Banach spaces

Abstract: Sometimes, but not always, it can be shown that two Banach spaces which are Lipschitz-isomorphic are linearly isomorphic. We will survey part of this theory, and approach the quite different setting of quasi-Banach spaces, which has been investigated and understood by Nigel Kalton.

Saturday, 3:15-4:05, Rm 115

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Stanisław Goldstein *University of Łódź, Łódź, Poland*

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Twisting noncommutative L^p -spaces

Abstract: Let M be a semifinite von Neumann algebra. We show that for any p strictly between 1 and ∞ there exists a nontrivial twisted sum of $L^p(M)$ with itself, by demonstrating that the twisted sum does not have the required type/cotype to be a product. Our method provides an explicit description of the quasi-linear map involved.

Joint work with Jesús Castillo and Jesús Suarez.

Friday, 3:10-3:30, Rm 10

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Manuel González *Universidad de Cantabria, Santander, Spain*

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Local duality for Banach spaces: examples and characterizations

Abstract: A closed subspace Z of the dual X^* of a Banach space X is a *local dual* of X if X^* is finitely dual representable in Z by means of local representation maps that fix the points of Z . For example, the principle of local reflexivity can be stated by saying that X is a local dual of X^* . Here we present several characterizations of the local dual spaces of a Banach space and apply them to show some new examples.

Joint work with Antonio Martínez-Abejón.

Monday, 3:40-4:00, Rm 10

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Karl Grosse-Erdmann *Fachbereich Mathematik, Hagen, Germany*

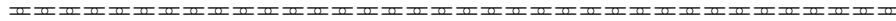
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Frequently hypercyclic operators

Abstract: F. Bayart and S. Grivaux have recently introduced an interesting new concept in hypercyclicity, that of frequently hypercyclic operators. Recall that an operator T on a Banach space X is called hypercyclic if the orbit $\{x, Tx, T^2x, \dots\}$ of some vector x is dense in X , that is, if the orbit meets every non-empty open subset U of X . Now, Bayart and Grivaux call T *frequently hypercyclic* if the orbit of some $x \in X$ meets every non-empty open subset U of X 'often' in the sense that each set $\{n \in \mathbb{N} : T^n x \in U\}$ has positive lower density.

In the talk we present joint work with A. Bonilla and with A. Peris in which we solve some problems posed by Bayart and Grivaux.

Monday, 2:40-3:00, Rm 229



Manjul Gupta *Indian Institute of Technology, Kanpur, India*

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Banach spaces of entire sequences and their Köthe duals

Abstract: Let M and N be complementary Orlicz function and $\gamma = \{\gamma_0, \gamma_1, \dots, \gamma_n, \dots\}$ be a fixed sequence of positive reals such that $\frac{\gamma_{n+1}}{\gamma_n} \downarrow 0$ and $\gamma_n^{1/n} \rightarrow 0$ as $n \rightarrow \infty$. Denoting by ω , the space of all scalar sequences, let us write

$$\ell_M = \{x \in \omega : \sum_{i \geq 1} M\left(\frac{|x_i|}{k}\right) < \infty \text{ for some } k > 0\}$$

and ℓ_N being defined analogously. We now introduce the sequence spaces

$$\lambda_{\gamma, M} = \{ \{\alpha_n\} \in \omega : \{\frac{\alpha_n}{\gamma_n}\} \in \ell_M \}$$

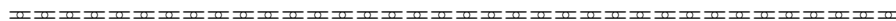
and

$$\mu_N^\gamma = \{ \{\beta_n\} \in \omega : \{\beta_n \gamma_n\} \in \ell_N \}.$$

One can easily check that $\lambda_{\gamma, M}$ and μ_N^γ are vector subspaces of ω , containing φ (the class of finitely non-zero sequences). If M and N satisfy Δ_2 -condition, they are perfect sequence spaces. By equipping $\lambda_{\gamma, M}$ and μ_N^γ with suitable norms, we show that these spaces are AK-BK spaces and so each is the topological dual of the other. This study has relevance in finding the duals of subspaces of the space of entire functions.

Joint work with Shesadev Pradhan.

Thursday, 3:40-4:00, Rm 229



Alexander Ya. Helemskii *Moscow State University, Moscow, Russia*

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Highlights of homology theory in classical and quantum functional analysis

Abstract: We shall discuss the following topics:

1. A characterization of amenable Banach algebras within the class of measure algebras of locally compact groups.
2. Wedderburn operator algebras and the spatial projectivity.

The Wedderburn operator algebras, alias type I von Neumann algebras with discrete center, are, speaking informally, operator algebras with the best matrix presentation. We shall show that these algebras are exactly spatially projective von Neumann algebras in the framework of the homology theory of quantized Banach algebras. At the same time, “classically” spatially projective von Neumann algebras form only part of Wedderburn algebras

Friday, 2:40-3:00, Rm 10

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Francisco L. Hernandez *Universidad Complutense de Madrid, Madrid, Spain*

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Strict singularity and disjoint strict singularity in rearrangement invariant spaces

Abstract: The strict singularity and the disjoint strict singularity of inclusions between rearrangement invariant (or symmetric) spaces has received some attention. A pioneering result in this direction was Kalton characterization of strict singularity for inclusions between separable Orlicz sequence spaces and the application to the existence of singular ℓ^p -complemented copies.

In this talk some recent results for function spaces will be reviewed. We discuss the strict singularity and the disjoint strict singularity of the canonical inclusions $L^1 \cap L^\infty \hookrightarrow E \hookrightarrow L^1 + L^\infty$. It will be shown that the scale of order continuous weak L^p -spaces $L_0^{p,\infty}$, $1 < p < \infty$, are the “boundary” for the disjoint strict singularity of the right inclusions $E \hookrightarrow L^1 + L^\infty$.

Joint work with E. M. Semenov and V. M. Sanchez.

Friday, 5:20-5:40, Rm 10

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Tuomas Hytönen *University of Turku, Turku, Finland*

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Probabilistic Littlewood-Paley theory in Banach spaces

Abstract: Using the novel framework for Banach space-valued “square-function” estimates due to N. Kalton and L. Weis, and the related theory of stochastic integration of Banach-valued processes recently developed by J. van Neerven, M. Veraar and Weis, we present an extension to UMD-spaces of results from the probabilistic Littlewood-Paley theory of N. Varopoulos (JFA 1980). It turns out that the proofs become very natural in this

general setting. As an application of this theory, we obtain a dimension-free upper bound for the norm of the imaginary powers of the Euclidean Laplacian on a UMD space, which differs from the known lower bound (in terms of the UMD constant) due to S. Guerre-Delabrière (IJM 1991) only by a numerical factor 4.

Friday, 3:10-3:30, Rm 115

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Mar Jimenez-Sevilla *Universidad Complutense de Madrid, Madrid, Spain*
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Approximation by smooth functions with no critical points in separable Banach spaces

Abstract: In this talk we will present an approximate Morse-Sard theorem for a general infinite-dimensional separable Banach space, namely that every continuous function $f : X \rightarrow \mathbb{R}$, where X is an infinite-dimensional Banach space X with separable dual X^* , can be uniformly approximated by a C^1 smooth function $g : X \rightarrow \mathbb{R}$ which does not have any critical point. In some cases where more information about the structure of the Banach space X is known, we will extend our result to higher order of differentiability, C^p ($p > 1$). This is the case for $\ell_p(\mathbb{N})$ and $L_p(\mathbb{R}^n)$.

This result provides two interesting corollaries. The first one is the existence of a *non-linear Hahn-Banach theorem* which shows that two disjoint closed subsets in X can be separated by a 1-codimensional C^p smooth manifold of X (which is the set of zeros of a C^p smooth function with no critical points on X). The second one states that every closed subset of X can be approximated by C^p smooth open subsets of X . This is a joint work with D. Azagra.

Thursday, 3:40-4:00, Rm 115

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William B. Johnson *Texas A&M University, College Station, TX*
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Non linear factorization of linear operators

Abstract: The following is a recurring problem in the non linear theory of Banach spaces: Suppose that a linear operator $T : X \rightarrow Y$ has a Lipschitz factorization through a Banach space Z . What additional conditions guarantee that T has a linear factorization through Z ?

We will survey some recent progress on this problem by Godefroy-Kalton, by J-Maurey-Schechtman, and by Farmer-J. As an application of [JMS] we show that if X is uniformly equivalent to a \mathcal{L}_1 space, then X is a \mathcal{L}_1 space. This answers a question in the 1982 paper of Heinrich and Mankiewicz.

Joint work with B. Maurey and G. Schechtman.

Monday, 9:30-10:20, Rm 115

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Sten Kaijser *Uppsala University, Uppsala, Sweden*

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More on K-divisibility

Abstract: In this talk I shall present an “optimal” approach to K-divisibility. I have for a few years worked on the problem of finding the “absolute” K-divisibility constant. My setting is that I have “the extreme couples”. These couples depend on a given K-functional, and as a result, the problem of finding best possible bounds is mainly a matter of finding the “extreme function”, and of course, to understand these extremal couples better. It should be added that these couples are related to interpolation of subcouples.

Joint work with Peter Sunehag.

This talk will be scheduled immediately after Michael Cwikel’s talk.

Wednesday, 3:40-4:00, Rm 115

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Anna Kamińska *The University of Memphis, Memphis, TN*

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On the extensions of homogeneous polynomials

Abstract: We investigate the problem of uniqueness of extension of n -homogeneous polynomials in Banach spaces. We show in particular that in a nonreflexive Banach space X that admits a finite rank contractive projection, for every $n \geq 3$ there exists an n -homogeneous polynomial on X that has infinite many extensions to X^{**} . We also prove that under some geometric conditions imposed on the norm of a complex Banach lattice E , for instance when E satisfies an upper p -estimate with constant one for some $p > 2$, any 2-homogeneous polynomial on E attaining its norm at some element with finite support has a unique extension to its bidual E^{**} . We apply these results in a class of Orlicz sequence spaces. These are joint results with Pei-Kee Lin.

Tuesday, 2:40-3:00, Rm 229

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Mubariz T. Karaev *Suleyman Demirel University, Isparta, Turkey*

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On some problems in the Banach spaces with basis

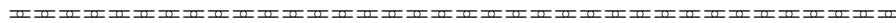
Abstract: Let X be a Banach space with basis $\{e_n\}_{n \geq 0}$, and let $T, Te_n = \lambda_n e_{n+1}, \lambda_n \neq 0, n \geq 0$, be a weighted shift operator acting in X . By considering some special product in X we investigate the unicellularity for an operator T . We describe the so-called extended eigenvectors of the operators $T | E_n$, where $E_n = span \{e_k : k \geq n\}, n \geq 0$, are the invariant

subspaces of the weighted shift operator T . We study the spectral multiplicity for the direct sum of Banach space operators. Moreover, we introduce the notion of strong splitting operator on a Banach space with complete system, and we prove the structure theorem for this operator. We also obtain some sufficient condition under which the Banach space of analytic functions on the unit disc $\mathbb{D} = \{z \in \mathbb{C} : |z| < 1\}$ is a Banach algebra with respect to the Duhamel product

$$(f \otimes g)(z) = \frac{d}{dz} \int_0^z f(z-t)g(t)dt.$$

This result generalizes, in particular, a result of Wigley for the Hardy space $H^p(\mathbb{D})$, $1 \leq p \leq \infty$.

Friday, 3:40-4:00, Rm 229



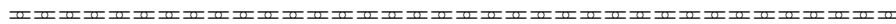
Liaqat Ali Khan *King Abdul Aziz University, Jeddah, Saudi Arabia*

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Topological modules of continuous multipliers

Abstract: In this talk, we consider the notions of left multiplier, right multiplier, multiplier, and double multiplier in the topological module setting and establish their continuity and linearity applying the factorization theorem and closed graph theorem. We also introduce the uniform and strict topologies on the modules of continuous multipliers and study their various properties.

Saturday, 2:30-2:50, Rm 10



Tamara Kucherenko *University of California Los Angeles, Los Angeles, CA*

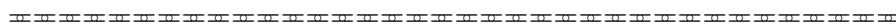
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Absolute functional calculus for sectorial operators

Abstract: We introduce absolute functional calculus for sectorial operators, which is stronger than H^∞ -calculus. Using this technique, we prove a theorem of Dore-Venni type for sums of closed operators. There, we are able to remove any assumptions such as R-boundedness or BIP on one of the operators given that the second operator has absolute calculus. Moreover, we show that any sectorial operator has absolute calculus on the real interpolation spaces between the domains of its fractional powers. As an application we obtain results regarding the well-posedness and existence of mild solutions to the Cauchy problem on Hölder and Besov spaces.

Joint work with N. Kalton.

Friday, 4:20-4:40, Rm 115



Denka Kutzarova *University of Illinois, Urbana-Champaign, IL*

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On strongly asymptotic ℓ_p spaces and minimality

Abstract: If a Banach space X has a primarily minimal, strongly asymptotic ℓ_p basis, then X embeds into ℓ_p . We also study asymptotic ℓ_p sequences in L_p .

Joint work with S.J. Dilworth, V. Ferenczi and E. Odell.

Saturday, 11:00-11:20, Rm 115

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Florence Lancien *Université de Franche-Comté, Besançon, France*

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Square functions and H^∞ functional calculus for sectorial operators on subspaces of L^p

Abstract: For a sectorial operator A on an L^p -space, it is well known that having a bounded H^∞ functional calculus is related to square functions of the form $\|(\int_0^\infty |F(tA)x|^2 \frac{dt}{t})^{1/2}\|_{L^p}$. We present these notions for operators on subspaces of L^p -spaces, in particular on the Hardy space $H^1(\mathbb{R}^n)$. This is connected to results of Kalton and Weis.

Joint work with C. Le Merdy.

Friday, 4:50-5:10, Rm 115

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Gilles Lancien *Université de Franche-Comté, Besançon, France*

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Spectral theory for linear operators on L^1 or $C(K)$ spaces

Abstract: A classical question in spectral theory is to look for a good spectral decomposition of the sum or product of two commuting operators on a Banach having themselves nice spectral decompositions. We will consider operators that are scalar type spectral (roughly speaking, unconditionally decomposable) or well bounded (with a conditional decomposition). It is known that on a Hilbert space, the sum of a real scalar-type operator and a commuting well-bounded operator is well-bounded. This conjecture has been proved to be false on L^p spaces, for $1 < p \neq 2 < \infty$. We show that it is true on L^1 or $C(K)$ spaces. This theory bares a lot of resemblance with the questions about the sum of two commuting unbounded operators that either have an H^∞ functional calculus or are sectorial. Our talk is clearly inspired by the fundamental work of Kalton and Weis on this subject. We will also try to give an overview of the analogies and differences

Joint work with Ian Doust and Florence Lancien.

Friday, 3:40-4:00, Rm 115

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Christian Le Merdy *Université de Franche-Comté, Besançon, France*

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HP-Maximal regularity and operator valued multipliers on Hardy spaces

Abstract: I will present some joint work with Shangquan Bu, in which we consider maximal regularity in the H^p sense for the Cauchy problem $u'(t) + Au(t) = f(t)$ ($t \in \mathbb{R}$). Here A is a closed operator on a Banach space X and f is an X -valued function defined on \mathbb{R} . We obtain that if X is an AUMD Banach space, then A satisfies H^p -maximal regularity if and only if A is Rademacher sectorial of type $< \frac{\pi}{2}$. Moreover we have found an operator A with H^p -maximal regularity that does not have the classical L^p -maximal regularity. I will present a related Mikhlin type theorem for operator valued Fourier multipliers on Hardy spaces $H^p(\mathbb{R}; X)$, in the case when X is an AUMD Banach space.

Tuesday, 3:10-3:30, Rm 10

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Bas Lemmens *University of Warwick, Coventry, UK*

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Dynamics of 1-Lipschitz maps

Abstract: Let X be a finite dimensional Banach space whose unit ball is a polyhedron. If $f: X \rightarrow X$ is a 1-Lipschitz (or non-expansive) map, then it is known that every bounded orbit, $x, f(x), f^2(x), f^3(x), \dots$, converges to a periodic orbit of f . Moreover, there exists an a priori upper bound for the lengths of the period of periodic orbits of f in terms of the number of facets of the unit ball in X .

Particularly important examples of polyhedrally normed spaces are ℓ_1^n and ℓ_∞^n , and it is an interesting combinatorial geometric problem to determine the optimal estimate for the lengths of periodic orbits of 1-Lipschitz maps on these spaces. In this talk I will discuss some recent results concerning this problem, which were obtained in collaboration with Michael Scheutzow. Among others we shall see that for ℓ_∞^n the lengths of the periodic orbits do not exceed $\max_k 2^k \binom{n}{k}$.

Monday, 2:40-3:00, Rm 115

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Chris Lennard *University of Pittsburgh, Pittsburgh, PA*

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L_+^p is uniformly concave for $0 < p < 1$

Abstract: We prove the uniform concavity of the positive cone of the quasi-normed Lebesgue function space $L^p(\mu)$, $0 < p < 1$.

Saturday, 11:00-11:20, Rm 215

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Camino Leránoz *Universidad Pública de Navarra, Pamplona, Spain*

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Geometric properties of quasi-Banach spaces

Abstract: If X is a quasi-Banach space, $0 < p < 1$, C is a closed, p -convex subset of X , and $x \in X \setminus C$, the p -convex hull of $\{x\} \cup C$ is called p -drop. We study geometric properties of the space X related to p -drops such as p -Drop Property, p - (β) Property, and Uniform p -Convexity; and prove that they are not equivalent.

Saturday, 10:30-10:50, Rm 215

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Denny H. Leung *National University of Singapore, Singapore*

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Comparing mixed Tsirelson spaces and their modified versions

Abstract: Let \mathcal{S}_n , $n \in \mathbb{N}$ be the Schreier families and let (θ_n) be a regular sequence: $0 < \theta_n < 1$, $\theta_n \downarrow 0$ and $\theta_{m+n} \geq \theta_m \theta_n$. It is shown that for a large class of parameters (θ_n) , the mixed Tsirelson space $T[(\mathcal{S}_n, \theta_n)_{n=1}^\infty]$ is not isomorphic to its modified version $T_M[(\mathcal{S}_n, \theta_n)_{n=1}^\infty]$. The result holds in particular if $0 < \inf \theta_n / \theta^n \leq \sup \theta_n / \theta^n < 1$, where $\theta = \sup_n \theta_n^{1/n}$.

Joint work with Wee Kee Tang.

Saturday, 2:00-2:20, Rm 115

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Grzegorz Lewicki *Jagiellonian University, Kraków, Poland*

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Minimal multi-convex projections

Abstract: We say that a function from $X = C^L[a, b]$ is k -convex (for $k \leq L$) if the k -th derivative of the function is nonnegative. Let P denote a projection from X onto $V = \Pi_n \subset X$, where Π_n denotes the space of algebraic polynomials of degree less than equal to n . If we want P to leave invariant the cone of k -convex functions ($k \leq n$), we find

that such a demand is impossible to fulfill for nearly every k . Indeed only for $k = n - 1$ and $k = n$ does such a projection exist. So let us consider instead a more general 'shape' to preserve. Let $\sigma = (\sigma_0, \sigma_1, \dots, \sigma_n)$ be an $(n + 1)$ -tuple with $\sigma_i \in \{0, 1\}$; we say $f \in X$ is *multi-convex* if $f^{(i)} \geq 0$ for i such that $\sigma_i = 1$. In this talk we characterize those σ for which there exists a projection onto V preserving the multi-convex shape. For those shapes able to be preserved via a projection, we construct a minimal norm multi-convex preserving projection. The above mentioned results can be found in [1] and [2].

1. G. Lewicki, M. Prophet, *Minimal multi-convex projections*, IMUJ Preprint 2005/08.
2. G. Lewicki, M. Prophet, *Minimal shape-preserving projections* IMUJ Preprint 2005/10.

Joint work with Michael Prophet.

Friday, 2:40-3:00, Rm 215

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Chong Li *Zhejiang University, Hangzhou, China*

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Existence and well-posedness in approximation theory in Banach spaces

Abstract: This survey reports some well-known generic results on the existence and well-posedness of nonlinear approximation problems in connection with some geometric properties of Banach spaces.

Joint work with Lihui Peng.

Monday, 4:20-4:40, Rm 215

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Jinlu Li *Shawnee State University, Portsmouth, OH*

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Relationship between metric and generalized projections in Banach spaces

Abstract: We study the connection between the metric projection operator $P_K :: B \rightarrow K$ and generalized projection operators $\Pi_K : B \rightarrow K$ and $\pi_K : B^* \rightarrow K$, where B is a reflexive Banach space with dual space B^* and K is a non-empty closed convex subset of B . We also present some results in non-reflexive Banach space [1].

[1] Yakov Alber and Jinlu Li, The connection between the metric and generalized projection operators in reflexive Banach spaces, *Acta Mathematica Sinica* (to appear).

Joint work with Yakov Alber.

Thursday, 3:10-3:30, Rm 215

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Vegard Lima *Agder University College, Kristiansand, Norway*

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Ideals of operators and the weak metric approximation property

Abstract: The notion of an ideal was introduced and studied by Godefroy, Kalton and Saphar in 1993. A subspace E of a Banach space F is said to be an *ideal* in F if there is a norm one linear operator (an *extension operator*) $\phi : E^* \rightarrow F^*$ with $\phi(e^*)(e) = e^*(e)$ for all $e \in E$ and $e^* \in E$.

It is known that a Banach space X has the approximation property (AP) if and only if $\mathcal{F}(Y, X)$ (the *finite rank* operators) is an ideal in $\mathcal{W}(Y, X)$ (the *weakly compact* operators) for all Banach spaces Y and that X has the metric AP (MAP) if and only if $\mathcal{F}(Y, X)$ is an ideal in $\mathcal{L}(Y, X^{**})$ (the *bounded* operators) for all Banach spaces Y .

We show that X has the weak MAP, introduced by . Lima and E. Oja, if and only if $\mathcal{F}(Y, X)$ is an ideal in $\mathcal{W}(Y, X^{**})$ for all Banach spaces Y . We also relate the weak MAP to norm one extension operators $\phi : X^* \rightarrow X^{***}$ and Grothendieck's classical characterization of the approximation property.

Saturday, 10:30-10:50, Rm 10

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Pei-Kee Lin *The University of Memphis, Memphis, TN*

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There is an equivalent norm of ℓ_1 that has the fixed point property

Abstract: Let $\gamma_n = 1 - 8^{-n}$ for all $n \in \mathbb{N}$, and let $\|\cdot\|$ be the equivalent norm on ℓ_1 defined by

$$\|(a_k)\| = \sup \sum_{k=n}^{\infty} \gamma_n |a_k| \quad \text{for all } x = (a_k) \in \ell_1.$$

We prove that $(\ell_1, \|\cdot\|)$ has the fixed point property for nonexpansive self-mappings.

Wednesday, 3:10-3:30, Rm 10

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Joram Lindenstrauss *Hebrew University, Jerusalem, Israel*

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Porous sets, Fréchet differentiability and Γ_n null sets

Abstract: I will discuss some recent joint work with David Preiss and J. Tiser concerning the notions in the title and related notions. Non standard notions will be defined in the talk. Here is just one result. Assume X is a Banach space whose modulus of asymptotic uniform smoothness $\bar{\rho}_X(t)$ is $o(t^n)$ as $t \rightarrow 0$ for every n . Then any Lipschitz map f from X to a

space Y with the Radon Nikodym property and with $B(X, Y)$ separable has many points of Fréchet differentiability (i.e. outside a Γ null set).

Tuesday, 9:15-10:05, Rm 115

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Alexander Litvak *University of Alberta, Edmonton, Canada*

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A covering lemma and its applications

Abstract: An entropy lemma states that if we control the diameter of a body on a subspace then we control the covering of the body. More precisely, given two centrally-symmetric bodies K and L , satisfying $K \subset AL$ and $K \cap E \subset aL$ for a k -codimensional subspace E , one has $N(K, 2rL) \leq (4A/(r - a))^k$ for every $r > a$. That means that, surprisingly, the covering numbers of K behave in the same way as the covering numbers of a cylinder with the base $aL \cap E$. We prove this lemma and discuss its applications to the Gelfand numbers and to the Sudakov inequality. This talk is based on joint works with A. Pajor and N. Tomczak-Jaegermann and with V. Milman, A. Pajor and N. Tomczak-Jaegermann.

Wednesday, 9:15-10:05, Rm 115

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Olga Maleva *University of Cambridge, Cambridge, UK*

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Unavoidable sigma-porous sets

Abstract: In this talk we are concerned with the question whether porous sets in a metric space X are small on Lipschitz curves. When X is a Banach space, this question is related to the existence of points of differentiability of Lipschitz functions defined on X .

We first show that when X is a special metric space called ℓ_1 -tree, there is a sigma-porous subset S of X such that for every Lipschitz curve γ in X , the length of $\gamma \setminus S$ is zero. We then extend this result to metric spaces which admit a nice surjective map onto an ℓ_1 -tree. (This map has to be a so-called Lipschitz quotient map.) This applies, in particular, to any separable Banach space containing ℓ_1 .

As a corollary, we obtain an infinite-dimensional counterexample to the Fubini theorem for the σ -ideal of σ -porous sets.

Thursday, 3:10-3:30, Rm 115

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Kristel Mikkor *Tartu University, Tartu, Estonia*

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Uniform factorization for compact sets of operators acting from a Banach space to its dual space

Abstract: Let X be a Banach space. We prove a uniform factorization result that describes the factorization of compact sets of compact and weakly compact operators acting from X to X^* via Hölder continuous homeomorphisms having Lipschitz continuous inverses. This yields a similar factorization result for compact sets of 2-homogeneous polynomials. This is a joint work with Eve Oja.

Thursday, 4:20-4:50, Rm 115

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Luiza A. Moraes *Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil*

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On the extension of polynomials on Banach spaces

Abstract: The problem of extending a continuous n -homogeneous polynomial $P : E \rightarrow \mathbb{C}$ to an n -homogeneous polynomial $\bar{P} : E'' \rightarrow \mathbb{C}$ was solved by Aron and Berner in 1978. In 1989, Davie and Gamelin showed that the Aron Berner extension of polynomials is a norm preserving extension.

If $E = F'$ for some Banach space F , we have $E'' = E \oplus F^\perp$ and in this case $\bar{P} = P \circ \pi_1$ is a norm preserving extension of every continuous n -homogeneous polynomial $P : E \rightarrow \mathbb{C}$ to a continuous n -homogeneous polynomial $\bar{P} : E'' \rightarrow \mathbb{C}$ (where $\pi_1 : E'' \rightarrow E$ is the projection). It is natural to ask under what conditions does $\bar{P} = P \circ \pi_1$ coincide with the Aron Berner extension of P . This question is connected to the problem of determining spaces where the Aron Berner extension is the unique norm-preserving extension of an n -homogeneous polynomial in E to a n -homogeneous polynomial in E'' .

This problem was studied by Llavona and myself and I am going to present some of the results obtained by us. I will establish necessary and sufficient conditions under which $\bar{P} = P \circ \pi_1$ coincides with the Aron Berner extension of P . As a consequence, I will obtain that if E is a non-reflexive dual Banach space, then for every $n > 1$ there exists always a continuous n -homogeneous polynomial P from E into \mathbb{C} such that $\bar{P} = P \circ \pi_1$ is different of the Aron Berner extension of P and so the norm-preserving extension is not always unique in such spaces. Some related problems will be studied.

Tuesday, 3:10-3:30, Rm 229

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Douglas Mupasiri *University of Northern Iowa, Cedar Falls, IA*

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On the difficulty of preserving monotonicity via projections and related results

Abstract: A subspace V of a Banach space X is said to be *complemented* if there exists a (bounded) projection mapping X onto V . Obviously all subspaces of finite-dimension are complemented. When $X = (C[a, b], \|\cdot\|_\infty)$, we say a subspace V is *monotonically complemented* if there exists a projection $P : X \rightarrow V$ such that Pf is monotone (increasing) whenever f is. The goal of this talk is to show that X possess (relatively) few monotonically complemented subspaces of finite-dimension.

Friday, 4:20-4:40, Rm 215

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Assaf Naor *Microsoft Research, Redmond, WA*

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Dvoretzky's theorem in metric spaces

Abstract: For every $\varepsilon > 0$, any n -point metric space has a subset of size $n^{1-\varepsilon}$ which embeds into Hilbert space with distortion $O(1/\varepsilon)$. This result is optimal up to constant factors, and it thus completes the work on the non-linear Dvoretzky problem which was posed by Bourgain, Figiel and Milman in 1986. Much like the proof of the classical Dvoretzky theorem from convex geometry, the proof of this theorem is probabilistic. I will present a self contained proof of this result, and I will also mention the history of this problem and some of its algorithmic applications. No prerequisites will be assumed.

Based on joint work with Manor Mendel.

Thursday, 10:30-11:20, Rm 115

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Jan van Neerven *Technical University Delft, Delft, The Netherlands*

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Uniformly γ -radonifying families of operators

Abstract: We introduce the notion of uniformly γ -radonifying families of operators from a given Hilbert space H into a given Banach space E and discuss some their properties. The results are applied to obtain a necessary condition for the existence of solutions of the stochastic Cauchy problem

$$dU(t) = AU(t) dt + B dW_H(t),$$

where A generates a strongly continuous semigroup of operators on E , in terms of the decay of $(\lambda - A)^{-1}B$ along vertical lines in the complex plane.

Friday, 2:40-3:00, Rm 115

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Ren Xing Ni *Shaoxing College of Arts and Sciences, Shaoxing, China*

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The convergence of an implicit iteration scheme for a finite family of asymptotically quasi-nonexpansive mappings

Abstract: The purpose of this paper is to study the convergence of implicit iteration process to a common fixed point for a finite family of asymptotically quasi-nonexpansive mappings in the intermediate sense with error numbers in Banach space. Some sufficient and necessary conditions for this scheme without any assumptions on convexity of the Banach space and continuity of mappings are obtained. The results presented in this paper improve and extend the corresponding results of previous known results.

Wednesday, 2:40-3:00, Rm 10

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Piotr Nowak *Vanderbilt University, Nashville, TN*

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Coarse embeddings into Banach spaces and the Novikov conjecture

Abstract: Coarse geometry became recently a very active research area mainly because of spectacular applications to the Novikov conjecture due to Guoliang Yu, and more recently due to Kasparov and Yu. In the talk we'll briefly survey these motivations and present relevant results on coarse embeddability of finitely generated groups and locally finite metric spaces into Banach spaces.

Monday, 4:50-5:10, Rm 115

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Edward Odell *University of Texas, Austin, TX*

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On the structure of asymptotic ℓ_p spaces

Abstract: We prove that if X is a separable, reflexive space which is asymptotic ℓ_p for some $1 \leq p \leq \infty$, then X embeds into a reflexive space Z having an asymptotic ℓ_p finite-dimensional decomposition. This result leads to an intrinsic characterization of subspaces of spaces with an asymptotic ℓ_p FDD. More general results of this type are also obtained.

This is joint work with Th. Schlumpercht and A. Zsák.

Saturday, 9:15-10:05, Rm 115

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Timur Oikhberg *University of California-Irvine, Irvine, CA*
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Hyperreflexivity with respect to operator ideals

Abstract: Suppose the symmetric sequence space E is mononormalizing (in the terminology of Gohberg and Krein; the space l_p have this property). A subspace A of $B(H, K)$ (H, K are Hilbert spaces) is called S_E -hyperreflexive if there exists a constant C such that, for every $T \in B(H, K)$,

$$\inf_{S \in A} \|T - S\|_E \leq C \sup \|P_{A(X)}T|_X\|_E,$$

where the supremum on the right is taken over all subspaces of H , and $P_{A(X)}$ is the orthogonal projection onto the orthogonal complement of $A(X)$ (both the left and the right hand side can be infinite; we use the convention $\infty \leq \infty$). Note that the centered equation yields the usual definition of hyperreflexivity if used for the operator norm, instead of $\|\cdot\|_E$.

It turns out that S_E -hyperreflexivity is different from the classical hyperreflexivity. For instance, while every 1-dimensional space of operators is hyperreflexive, there are 1-dimensional spaces which are not S_p -hyperreflexive. On the other hand, any von Neumann algebra is S_E -hyperreflexive.

Time permitting, we will discuss the Banach space analogues of S_E -hyperreflexivity, and applications to the theory of operator spaces.

Saturday, 2:00-2:20, Rm 10

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Eve Oja *Tartu University, Tartu, Estonia*
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Grothendieck's theorem on nuclear operators revisited

Abstract: Let X and Y be Banach spaces. Let $T \in \mathcal{L}(X, Y)$, the Banach space of bounded linear operators from X to Y . Denote by $\mathcal{N}(X, Y)$ the space of nuclear operators from X to Y .

The operator T may be viewed as an operator from X to Y^{**} . Assume that $T \in \mathcal{N}(X, Y^{**})$. Grothendieck proved in *Memoir* that $T \in \mathcal{N}(X, Y)$ whenever X^* has the approximation property. He also affirmed that the same was true whenever Y^{**} has the approximation property. A counterexample to the affirmation of Grothendieck was given in [1].

We extend Grothendieck's theorem as follows, and discuss applications. Let Y be a subspace of a Banach space Z . Assume that there is an extension operator $\Phi \in \mathcal{L}(Y^*, Z^*)$. If X^* or Z^* has the approximation property and $T \in \mathcal{N}(X, Z)$, then $T \in \mathcal{N}(X, Y)$.

Recall that $\Phi \in \mathcal{L}(Y^*, Z^*)$ is an extension operator if $(\Phi y^*)(y) = y^*(y)$ for all $y^* \in Y^*$ and $y \in Y$. Kalton (1984) proved that Φ exists if and only if Y is locally complemented in Z . The existence of Φ with $\|\Phi\| = 1$ means, according to Godefroy, Kalton, and Saphar (1993), that Y is an ideal in Z .

1. *Oja, E., Reinov, O.*, Un contre-exemple à une affirmation de A. Grothendieck, C. R. Acad. Sci. Paris, Sér. I, **305** (1987) 121–122.

Saturday, 11:00-11:20, Rm 10

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Mikhail I. Ostrovskii *St.-John's University, New York, NY*

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Compositions of projections in Banach spaces and relations between approximation properties

Abstract: The problem of existence of Banach spaces with the π -property but without a finite dimensional decomposition is one of the well-known open problems in Banach space theory. It was first studied by W. B. Johnson (1970). P. G. Casazza and N. J. Kalton (1990) found important connections of this problem with other problems of Banach space theory. The purpose of the talk is to present a necessary and sufficient condition for existence of a Banach space with a finite dimensional decomposition but without the π -property in terms of norms of compositions of projections. In the second part of the talk we discuss related problems on compositions of projections.

Thursday, 3:40-4:00, Rm 215

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Elena Ournycheva *Kent State University, Kent, OH*

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Composite Cosine Transforms on Stiefel Manifolds

Abstract: We introduce new higher rank integral transforms that generalize the classical cosine transform, arising in convex geometry, the Banach space theory, and other areas, for functions on the Stiefel and Grassmann manifolds. We call them the composite cosine transforms, by taking into account that their kernel agrees with the composite power function of the cone of positive definite symmetric matrices. We show that injectivity of the composite cosine transforms can be studied using standard tools of the Fourier analysis on matrix spaces and obtain an explicit representation of the corresponding Fourier multiplier.

Joint work with B. Rubin.

Wednesday, 2:00-2:20, Rm 229

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Imre Patyi *Georgia State University, Atlanta, GA*,

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Lifting and right invertibility of holomorphic operator functions

Abstract: Let Z be a Banach space with an unconditional basis, $\Omega \subset Z$ a (pseudo)convex open, and $\pi(z) : X \rightarrow Y$ an epimorphism of Banach spaces that depends holomorphically on $z \in \Omega$. We show that if $\pi(z)$ is right invertible for all z , then there is a right inverse $R(z) : Y \rightarrow X$ with $\pi(z)R(z)$ equal to the identity on Y that depends holomorphically on $z \in \Omega$. As for lifting, we show that if $Z = \ell_1$, and $\pi(z)$ is an epimorphism but not necessarily right invertible, then for any holomorphic $\eta : \Omega \rightarrow Y$ there is a holomorphic $\xi : \Omega \rightarrow X$ with $\pi(z)\xi(z) = \eta(z)$ for all $z \in \Omega$. If $\pi(z)$ is independent of z , and Z is a Banach space with an unconditional basis, then we show that the above type of lifting holds if $\text{Ker}(\pi)$ is an M-ideal in X .

Joint work with S. Dineen and M. Venkova.

Thursday, 4:20-4:40, Rm 215

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Anna Pelczar *Jagiellonian University, Kraków, Poland*

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Stabilization of Tsirelson-type norms on ℓ_p spaces

Abstract: We consider classical Tsirelson-type norms of $T[\mathcal{A}_n, \theta]$ and their modified versions on ℓ_p spaces, $1 < p < \infty$. We show that the modified Tsirelson-type norms do not distort any of subspaces of ℓ_p spaces. We prove that Tsirelson-type norms, being equivalent to their modified versions, may at most 2-distort ℓ_p spaces.

Saturday, 2:30-2:50, Rm 115

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Henrik Petersson *Chalmers, Goteborg, Sweden*

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Hypercyclic operators with hypercyclic adjoints

Abstract: A continuous linear operator T on a Banach space X is said to be hypercyclic if, for some vector $x \in X$, the orbit $\{T^n x\}_{n \geq 0}$ is dense. Every infinite dimensional separable Banach space supports a hypercyclic operator. In 1991 H. Salas constructed a hypercyclic operator on a (separable) Hilbert space whose adjoint is also hypercyclic, thus, every infinite dimensional separable Hilbert space supports such a, let us call it, dual hypercyclic operator. We are lead to the question: What other Banach spaces X admits a dual hypercyclic operator? A necessary condition is that X and X' are separable so, in particular, there is no dual hypercyclic operator on ℓ_1 . However, we have proved that every infinite dimensional Banach space with a shrinking symmetric basis (such as c_0 and ℓ_p where $1 < p < \infty$) supports such an operator. We sketch the proof and discuss our posed problem.

Monday, 3:10-3:30, Rm 229

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Pierre Portal *Australian National University, Canberra, Australia*

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Sectorial operators and H^∞ -functional calculus in a discrete setting

Abstract: Using ideas from the geometry of Banach spaces, Nigel Kalton has recently made deep contributions to the theory of sectorial operators. While this theory is concerned with continuous time semigroups and is motivated by questions concerning parabolic PDE, a discrete analogue can be considered and applied to difference equations in Banach spaces. This leads to the study of power-bounded operators satisfying the Ritt resolvent condition. In this talk we will present some of the results that can be proven in this setting, including maximal regularity of difference equations and an unconditional version of Ritt condition which provides a discrete analogue of the square functions estimates characterizing the H^∞ functional calculus. This includes joint work with Nigel Kalton.

Friday, 5:20-5:40, Rm 115

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Daniel P. Radelet *University of Pittsburgh, Pittsburgh, PA*

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Reconstruction using Markushevich and Cesàro bases

Abstract: There are examples of Banach frames which are not usual Hilbert frames, and for which the reconstruction property does not hold. However, certain M-bases with these properties can still be used for a type of reconstruction when they are shown to be Cesàro bases.

Monday, 3:10-3:30, Rm 215

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Nirina Lova Randrianarivony *University of Missouri, Columbia, MO*

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L_p is not uniformly homeomorphic to $\ell_p + \ell_2$ when $p < 2$

Abstract: We show that L_p is not uniformly homeomorphic to $\ell_p + \ell_2$ when $p < 2$.
Joint work with Nigel Kalton.

Monday, 4:20-4:40, Rm 115

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Yves Raynaud *Institut de Mathématiques de Jussieu, Paris, France*

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Positive contractive projections in $L_p(L_q)$, with applications to axiomatizability theory

Abstract: We give a description of the range of a positive contractive projection in a space $L_p(L_q)$, in the most general setting. As a consequence we obtain that the class \mathcal{B}_{pq} of bands in $L_p(L_q)$ spaces is closed under ultraroots. Since it is also known to be closed under ultraproducts, it follows by a general theorem in logics that it is axiomatizable. We give an intrinsic characterization of this class in the category of Banach lattices from which a set of axioms can be deduced.

Joint work with C. W. Henson.

Tuesday, 3:40-4:00, Rm 115

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Christian Rosendal *University of Illinois, Urbana-Champaign, IL*

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Infinite asymptotic games

Abstract: We study determinacy of infinite asymptotic games on analytic sets and their applications.

Tuesday, 2:40-3:00, Rm 115

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Héctor Salas *University of Puerto Rico, Mayagüez, Puerto Rico*

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Pathological hypercyclic operators

Abstract: Let T be a bounded linear operator defined in a separable Banach space X . S. Ansari showed in a 1995 paper that if $x \in X$ is hypercyclic for T , then so is x for any power of T . (In other words, if $\text{Orb}(x, T) = \{T^n(x) : n = 0, 1, 2, \dots\}$ is dense in the space and m is a positive integer, then $\text{Orb}(x, T^m)$ is also dense.)

We exhibit a hypercyclic operator whose square is not. Such operator is necessarily unbounded in view of Ansari's result. Moreover, minus the operator and the direct sum with itself are also not hypercyclic. Using the idea of a cone, we refine the above example in the sense that the square of the operator is not even supercyclic. These two results have other additional features which are also in stark contrast with other properties, discovered by several mathematicians, of hypercyclic bounded operators .

We also exhibit an unbounded Hilbert space operator whose non-zero vectors are hypercyclic. This improves a result of A. Shields in which he showed a Hilbert space operator, most probably unbounded, without non-trivial invariant subspaces. Shields's construction, as well as ours, uses the Axiom of Choice.

Friday, 3:10-3:30, Rm 229

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Frank Sanacory *University of South Carolina, Columbia, SC*

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On the compact plus multiple of the inclusion problem

Abstract: We present some partial answers to the question given a Banach space, X , does there exist some infinite dimensional subspace Y and an operator T from Y to X such that T is strictly singular and noncompact. Our method is to compare the $R_X(\cdot)$, sup of the spreading model norms to some element of the spreading model. If $R_X(\cdot)$ strongly dominates some spreading model of X then there does exist such an operator.

Joint work with G. Androulakis.

Tuesday, 3:40-4:00, Rm 229

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Bünyamin Sarı *University of North Texas, Denton, TX*

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Lattice structures and spreading models

Abstract: The set of spreading models of a Banach space generated by weakly null normalized sequences is a semi-lattice with respect to domination ordering. We construct examples of Banach spaces showing that the possible structure of these sets include a certain class of finite semi-lattices (including all finite lattices) and countable lattices. The constructions involve Orlicz and Lorentz sequence spaces. We also give some partial answers to the ℓ_p spreading model problem.

Joint work with S. Dilworth and E. Odell.

Tuesday, 5:20-5:40, Rm 115

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Gideon Schechtman *Weizmann Institute of Science, Rehovot, Israel*

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Fine estimates in Dvoretzky's theorem

Abstract: The celebrated theorem of Dvoretzky states that any n -dimensional symmetric convex body has a central section “close” to a k -dimensional Euclidean ball where k grows to infinity with n . The estimate of k as a function of n and the degree of “closeness” was, and to a certain degree still is, a subject of intense research. I'll report on some progress on this subject.

Wednesday, 10:30-11:20, Rm 115

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Thomas Schlumprecht *Texas A&M University, College Station, TX*
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Embeddings into Banach spaces with finite dimensional decompositions

Abstract: We consider the following general problem: Given a class \mathcal{C} of Banach spaces, is there an element of \mathcal{C} , or in a class, closely related to \mathcal{C} , which is universal for the class \mathcal{C} , meaning that every member of \mathcal{C} is isomorphically a subspace of X ? In many cases these type questions can be easily solved in the category of spaces having a basis, or more generally, a finite dimensional decomposition (FDD). Then, the aforementioned problem becomes a problem of the following type: Can a Banach space X in certain class \mathcal{C} be embedded into a space Z of that class, or to a class closely related to \mathcal{C} , with Z having a basis or an FDD?

In our talk we will present a general combinatorial argument leading to the solutions of these type of problems. Secondly, we present the solution some concrete problems using our machinery

The work presented is joint work with E. Odell.

Thursday, 9:15-10:05, Rm 115

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Morteza Seddighin *Indiana University East, Richmond, IN*
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Algorithms for computation of antieigenvalues

Abstract: We will discuss the computation and application of operator/matrix antieigenvalues. Given a bounded or unbounded Banach space operator T on a Banach space \mathcal{B} , the first antieigenvalue of T is defined by $\inf \left\{ \frac{(Tx, x)}{\|Tx\|\|x\|}, x \in \mathcal{D}(T), \|Tx\| \neq 0 \right\}$, where (x, y) is a semi-inner product on \mathcal{B} . Higher antieigenvalues are defined inductively. Antieigenvalues have important applications in Numerical Optimization, Quantum Scattering Theory, Statistics, and Operator/Matrix Theory. We will also show how similar techniques can be used to find stationary values of the product of two Raleigh Quotients.

Friday, 2:40-3:00, Rm 229

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Veli B. Shakhmurov *Istanbul University, Istanbul, Turkey*
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Operator-valued multipliers in weighted L_p -spaces and applications

Abstract: Say that the Banach space E has property $h_{p,\gamma}$ if the Hilbert operator is bounded in $L_{p,\gamma}(R^n; E)$ for $p \in (1, \infty)$. Let γ such that $S(R^n; E_1)$ is dense in $L_{p,\gamma}(R^n; E_1)$.

Under some assumptions on weighted function $\gamma \in A_p$, $p \in (1, \infty)$ we show that for two Banach spaces E_1, E_2 with local unconditional structure and properties $h_{p,\gamma}$, and for $\Psi \in C^{(n)}(R^n/0; B(E_1, E_2))$ if the set

$$\left\{ \xi^\beta D_\xi^\beta \Psi(\xi) : \xi \in R^n / \{0\}, \beta = (\beta_1, \beta_2, \dots, \beta_n), \beta_j \in \{0, 1\} \right\} \leq K_\beta < \infty$$

is R -bounded then $\Psi(\xi)$ is a multiplier in $M_{p,\gamma}^{p,\gamma}(E_1, E_2)$.

Then by applying this multipliers theorem we established that the degenerate differential operator generated by equation

$$\begin{aligned} Lu &= -u^{[2]}(x) + Au(x) + B_1(x)u^{[1]}(x) + B_2(x)u(x) \\ &= f(x), x \in (0, 1), \end{aligned}$$

in $L_p(0, 1; E)$, where E is a Banach space, $A, B_k(x)$ for $x \in [0, 1]$ are possible unbounded operators in E , $u^{[i]} = \left(\gamma(x) \frac{d}{dx}\right)^i u(x)$, is separable in $L_p(0, 1; E)$. These results are also applied to the nonlocal boundary value problems for degenerate elliptic partial differential equations with the parameters on cylindrical domain to obtain the algebraic conditions that ensure the same properties.

Wednesday, 3:10-3:30, Rm 229

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Boris Shekhtman *University of South Florida, Tampa, FL*

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Perturbation of ideal complements

Abstract: Let Y and Z be subspaces of a finite-dimensional space X such that $\dim Y = \text{codim} Z$. While this does not imply that Z complements Y , it does imply that there exists a small perturbation Z' of Z such that

$$X = Y \oplus Z'.$$

An additional requirement for Z and Z' to be ideals in a normed algebra, makes this problem much more challenging. In the talk I will show that the above statement is true for the ideals in the algebra of polynomials of one or two variables and fails for the polynomials of three or more variables. These results have connections to some questions in Approximation Theory, Algebraic Geometry and PDEs.

Friday, 3:40-4:00, Rm 215

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Leslaw Skrzypek *University of South Florida, Tampa, FL*

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Minimal projections in L_p spaces

Abstract: We will talk about the minimal projections in L_p spaces. A projection from X to V is called minimal if it has the smallest possible norm. Some recent (and some old too) theorems concerning uniqueness of minimal projections will be presented. Several examples will be given to demonstrate the difference between L_2 , L_1 and L_p ($1 < p < \infty$, $p \neq 2$) spaces.

Joint work with G. Lewicki and B. Shekhtman.

Friday, 3:10-3:30, Rm 215

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Scott Simon *Purdue University, West Lafayette, IN*

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Inhomogeneous Cauchy-Riemann equations in Banach spaces

Abstract: Existence results for global solutions to the inhomogeneous Cauchy-Riemann equations play a central role in several complex variables. We prove such a result for real analytic functions on open subsets of complex Banach spaces with an unconditional basis.

Thursday, 4:50-5:10, Rm 215

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Gieri Simonett *Vanderbilt University, Nashville, TN*

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Operator-valued symbols for elliptic and parabolic problems on wedges

Abstract: We investigate certain operator-valued symbols that arise from elliptic or parabolic equations on wedge domains, and from free boundary problems with moving contact lines in the context of phase transitions and fluid flows. We show that the associated symbols lead to well-posed evolution problems. The tools involve recent results of Kalton and Weis on R -boundedness and maximal regularity, as well as extensions thereof for non-commuting operators.

Joint work with Jan Prüss.

Tuesday, 4:50-5:10, Rm 10

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Emily H. Sprague *University of Wisconsin, Richland, WI*

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An application of uniform integrability to the characterization of Walsh Fourier series

Abstract: A characterization, due to C. J. de la Vallée Poussin, of Fourier series generated by functions in the Orlicz class $L_\Phi[-\pi, \pi]$ is presented in Chapter IV of *Trigonometric Series* by A. Zygmund. The proof hinges upon the uniform absolute continuity of the family of indefinite integrals of the first Cesàro means of the sequence of partial sums of a trigonometric series. A related technique relying on uniform integrability of a subsequence of partial sums allows us to find the Walsh-Fourier series of functions in $L_\Phi[0, 1]$. We review these ideas and consider the case of series built on other orthonormal bases.

Monday, 3:40-4:00, Rm 215

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Lian Sun *Beijing Guojing Pengrun Science & Trade Co., Ltd., Beijing, China*

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Trying to capture dynamic behavior

Abstract: This article presents a set of real-life industrial applications of mathematical programming that go from LP and 0-1 programming to combinatorics, network optimization, nonlinear optimization and stochastic programming in the broad area of supplying, production, allocation, distribution, scheduling and dynamic planning. The application cases belong to the strategic, tactical and operational domains.

Joint work with Xiaodong Xie.

Monday, 5:20-5:40, Rm 215

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Abebaw Tadesse *University of Pittsburgh, Pittsburgh, PA*

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Compact composition operators on the Hardy and Bergman spaces

Abstract: In the first part of my talk, We formulate B. Lotto's (1998) conjecture on the weighted Bergman spaces setting and based on D. Luecking and K. Zhu's (1992) characterization of composition operators which belongs to Schatten ideals, we extend Y. Zhu's (2001) results on the weighted Bergman spaces, A_α^2 , $0 < \alpha < \infty$.

In the second part, we investigate further compact composition operators which are not Hilbert-Schmidt. As to this end, We re-consider the class of examples of composition operators C_ϕ whose symbol ϕ is a Riemann map from the unit disk D onto the half disk with center $(1/2, 0)$ and radius $1/2$ and ,in general, onto a "crescent" shaped regions constructed based on

the half-disk. We use the R. Riedel (1994), characterization of β -boundedness/compactness on H^2 to determine the range of values of $\beta \in \mathbb{R}$ for which C_ϕ is β -bounded/compact. In particular, we show that the class of examples under consideration gives examples of β -bounded composition operators C_ϕ which fails to be β -compact, which was an open question raised by H. Hunziker and H. Jarchaw (1991). At last, we prove a necessary condition for C_ϕ to be Hilbert-Schmidt in terms of β -boundedness.

Thursday, 3:10-3:30, Rm 229

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Jarno Talponen *University of Helsinki, Helsinki, Finland*
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On the Banach-Mazur rotation problem

Abstract: Some results related to the Banach-Mazur problem are described in my talk. Suppose \mathbf{X} is a Banach space and denote $\mathcal{G}_{\mathbf{X}}(x) = \{T(x) \mid T \in L(\mathbf{X}) \text{ isometry onto}\}$, $x \in \mathbf{S}_{\mathbf{X}}$. Recall that \mathbf{X} is *transitive*, *almost transitive* or *convex-transitive* if respectively $\mathcal{G}_{\mathbf{X}}(x) = \mathbf{S}_{\mathbf{X}}$, $\overline{\mathcal{G}_{\mathbf{X}}(x)} = \mathbf{S}_{\mathbf{X}}$ or $\overline{\text{conv}(\mathcal{G}_{\mathbf{X}}(x))} = \mathbf{B}_{\mathbf{X}}$ for all $x \in \mathbf{S}_{\mathbf{X}}$. The Banach-Mazur problem, which appears in Banach's book, asks if each *transitive separable* space is in fact isometrically a Hilbert space (Clearly any Hilbert space is transitive). A recent rotational characterization in [R] says that each real almost transitive space, which contains a 1-complemented, 1-codimensional subspace is in fact isometrically Hilbert. An almost isometric generalization of this result is given. The result from [R] is also generalized to the convex-transitive setting in the following sense. Suppose \mathbf{X} is a real convex-transitive space, which admits a 1-dimensional linear projection $P: \mathbf{X} \rightarrow L$ such that $\|P\| = \|I - P\| = 1$. In this class of spaces I characterize the Hilbert spaces under various mild additional assumptions on the weak geometry of the norm (these are, roughly speaking, suitable properties of $(\mathbf{S}_{\mathbf{X}}, \omega)$).

[R] B. Randrianantoanina, A Note on the Banach-Mazur Problem, Glasgow J. Math. 44, (2002), 159-165.

Tuesday, 3:10-3:30, Rm 215

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Wee-Kee Tang *Nanyang Technological University, National Inst. of Education, Singapore*
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Extension of functions with small oscillation

Abstract: A classical theorem of Kuratowski says that every Baire one function on a G_δ subspace of a Polish (= separable completely metrizable) space X can be extended to a Baire one function on X . Kechris and Louveau introduced a finer gradation of Baire one functions into small Baire classes. A Baire one function f is assigned into a class in this hierarchy depending on its oscillation index $\beta(f)$. We prove a refinement of Kuratowski's

theorem: if Y is a subspace of a metric space X and f is a real-valued function on Y such that $\beta_Y(f) < \omega^\alpha$, $\alpha < \omega_1$, then f has an extension F onto X so that $\beta_X(F) \leq \omega^\alpha$. We also show that if f is a continuous real valued function on Y , then f has an extension F onto X so that $\beta_X(F) \leq 3$. An example is constructed to show that this result is optimal.

Joint work with Denny H. Leung.

Tuesday, 3:10-3:30, Rm 115

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Adi Tcaciuc *University of Alberta, Edmonton, Canada*

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On the existence of asymptotic- l_p structures in Banach spaces

Abstract: The asymptotic theory of infinite dimensional Banach spaces, developed by Maurey, Milman and Tomczak-Jaegermann, is concerned with the structure of infinite dimensional Banach spaces manifested in the finite-dimensional subspaces that appear everywhere far away in the space. The class of spaces that have a simple asymptotic structure, in the sense that we can find a $1 \leq p \leq \infty$ such that all such finite-dimensional subspaces as before are essentially l_p^n 's, are of special interest and they are called asymptotic- l_p spaces.

We prove that if a Banach space is saturated with infinite dimensional subspaces in which all special n -tuples of vectors are equivalent, uniformly in n , then the space contains asymptotic- l_p subspaces, for some $1 \leq p \leq \infty$. The proof reflects a technique used by Maurey in the context of unconditional basic sequence problem and extends a result by Figiel, Frankiewicz, Komorowski and Ryll-Nardzewski.

Saturday, 10:30-10:50, Rm 115

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Eduardo V. Teixeira *Rutgers University, Piscataway, NJ*

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Regularity theory for differential equations in abstract spaces and applications to nonlinear PDEs

Abstract: We shall present recent advances on the solvability and regularity results for the initial value problem $u_t = f(t, u(t))$, $u(0) = u_0$ in locally convex spaces. This theory is developed towards the study of regularity results for certain classes of nonlinear differential equations in the euclidean space. Among the applications we shall present are the optimal regularity for a nonlinear differential equation involving the Hardy-Littlewood maximal operator, the solvability of partial differential evolution equations of infinite order: $u_t(t, x) \sum_{\alpha \in \mathbb{N}^d} a_\alpha(t, x) D^\alpha u(t, x) + \Phi(t, x)$ and fully nonlinear equations: $u_t(t, x) = H(t, u, Du, D^2u, D^3u, \dots, D^n u)$.

Tuesday, 3:40-4:00, Rm 10

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Vladimir Temlyakov *University of South Carolina, Columbia, SC*

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Greedy approximations in Banach spaces

Abstract: In nonlinear approximation we seek ways to approximate complicated functions by simpler functions using methods that depend nonlinearly on the function being approximated. Recently, a particular kind of nonlinear approximation, namely greedy approximation has attracted a lot of attention in both theoretical and applied settings. Greedy type algorithms have proven to be very useful in various applications such as image compression, signal processing, design of neural networks, and the numerical solution of nonlinear partial differential equations. A theory of greedy approximation is now emerging. Some fundamental convergence results have already been established and many fundamental problems remain unsolved. In this talk I will place emphasis on the study of the efficiency of greedy algorithms with regards to redundant systems (dictionaries). Redundancy, on the one hand, offers much promise for greater efficiency in terms of the rate of approximation. On the other hand, it gives rise to highly nontrivial theoretical and practical problems.

We note that there is solid justification for the importance of redundant systems in both theoretical questions and practical applications.

Tuesday, 10:30-11:20, Rm 115

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Nicole Tomczak-Jaegermann *University of Alberta, Edmonton, Canada*

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Saturating normed spaces

Abstract: This talk is based on a series of joint results with Stanislaw Szarek.

We discuss a new understanding of the structure of high-dimensional normed spaces and convex bodies brought by the discovery of the following phenomenon: passing to large subspaces or quotients of a finite-dimensional normed space *can not*, in general, erase k -dimensional features of a space if k is below certain threshold value depending on the dimension of the initial space and the exact meaning of “large”.

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Vladimir Troitsky *University of Alberta, Edmonton, Canada*

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Norm closed ideals in $\mathcal{L}(\ell_p \oplus \ell_q)$

Abstract: It is well known that the only proper non-trivial norm-closed ideal in the algebra $\mathcal{L}(X)$ for $X = \ell_p$ ($1 \leq p < \infty$) or $X = c_0$ is the ideal of compact operators. The

next natural question is to describe all closed ideals of $\mathcal{L}(\ell_p \oplus \ell_q)$ for $1 \leq p, q < \infty$, $p \neq q$, or, equivalently, the closed ideals in $\mathcal{L}(\ell_p, \ell_q)$ for $p < q$. We show that for $1 < p < 2 < q < \infty$ there are at least four distinct proper closed ideals in $\mathcal{L}(\ell_p, \ell_q)$, including one that has not been studied before.

Joint work with B. Sari, Th. Schlumprecht, and N. Tomczak-Jaegermann.

Saturday, 1:30-1:50, Rm 10

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Stanimir Troyanski *University of Murcia, Murcia, Spain*

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Banach spaces with modulus of convexity of power type 2

Abstract: An upper bounded $q(c)$ for the best, under equivalent renorming, possible power type of the modulus of smoothness of a Banach space with modulus of convexity satisfying:

$$\delta_X(\varepsilon) \geq c\varepsilon^2$$

is found. The estimate is asymptotically sharp and is expressed in terms of linear fractional function $q(c)$.

Joint work with M. Ivanov.

Monday, 5:20-5:40, Rm 10

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Hans-Olav Tylli *University of Helsinki, Helsinki, Finland*

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Composition operators on vector-valued harmonic functions and Cauchy transforms

Abstract: The talk describes joint work [1] with J. Laitila (Helsinki), which characterizes the weak compactness of the composition operators $f \mapsto f \circ \varphi$ on the X -valued spaces $h^p(X)$ of harmonic functions and $CT(X)$ of Cauchy transforms. Here φ is an analytic self-map of the unit disk and X is a reflexive complex Banach space. This extends earlier results of Sarason (1990), respectively Cima and Matheson (1998), from the scalar-valued setting $X = \mathbf{C}$. The study of composition operators on vector-valued spaces of analytic functions was initiated by (among others) Liu, Saksman and the speaker (1998). There are at least two competing approaches, which apply to spaces of strong respectively weak type. Examples demonstrate that such vector-valued spaces differ very much from each other.

Reference:

[1] J. Laitila and H.-O. Tylli: *Composition operators on vector-valued harmonic functions and Cauchy transforms*, Indiana Univ. Math. J. (to appear, 2006).

Thursday, 2:40-3:00, Rm 229

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Roman Vershynin *University of California-Davis, Davis, CA*

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Functional analysis approach to linear programming?

Abstract: The Simplex Method is the oldest and easiest algorithm in Linear Programming. Nevertheless, it puts the theory of computing in an awkward position. It is not a polynomial time algorithm (counterexamples are known), but in practice it runs in polynomial time. To theoretically explain the strange behavior, Spielman and Teng introduced the notion of the Smoothed Analysis of Algorithms. There, one “smooths” an input by a small random perturbation, in hope that this models “most” practice problems. The heart of Spielman-Teng’s argument are geometric problems, for which methods of geometric functional analysis should work. I will survey a correspondence between Functional Analysis and Linear Programming, recent work on the simplex method, and open problems.

Friday, 9:15-10:05, Rm 115

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M. D. Voisei *The University of Texas-Pan American, Edinburg, TX*

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Monotonicity representability and maximality via the Fitzpatrick function

Abstract: The problem concerning the maximality of the sum $A + B$ of two maximal monotone operators in a non-reflexive Banach space under qualification constraints involving their domains is an old open problem.

In reflexive Banach spaces this was solved first by Rockafellar under a condition of the type $\text{co } D(A) - \text{co } D(B)$ is absorbing. Here “co” stands for the convex hull. In general Banach spaces the same result holds if A, B are subdifferentials or linear maximal monotone.

One of our main results is:

Theorem. If X is a Banach space, A, B are maximal monotone in X with $D(A), D(B)$ closed convex and $0 \in^{\text{ri}} (D(A) - D(B))$ then $A + B$ is maximal monotone.

Here $^{\text{ri}}(D(A) - D(B))$ stands for the relative algebraic interior of $D(A) - D(B)$ when the affine hull of $D(A) - D(B)$ is closed and is considered empty otherwise.

This result gives a positive answer to the open problem under the additional assumption that $D(A), D(B)$ are closed and convex. Several other simpler proofs of previous results and calculus rules for maximal monotone operators are presented.

Tuesday, 4:20-4:40, Rm 10

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Lutz Weis *Universität Karlsruhe, Karlsruhe, Germany*

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R-bounded sets of operators in analysis

Abstract: In recent years, the notion of R-boundedness has been very useful in extending Hilbert space results to the Banach space setting in a number of areas: e.g. it allows to formulate Mihlin multiplier theorems for operator-valued multiplier functions in UMD spaces, characterize maximal regularity of parabolic evolution equations, develop a theory of the holomorphic functional calculus for sectorial operators on Banach spaces and give criteria for the stochastic integrability of Banach space valued functions. Many of these results are already of interest and non-trivial for L_p spaces. We will first survey some of these results and explain the connection between them, with a view towards the deep contributions that Nigel Kalton has made to this area. In the last part of the talk, we present some new results in this line of research.

Wednesday, 1:30-2:20, Rm 115

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Przemysław Wojtaszczyk *Warsaw University, Warsaw, Poland*

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Results and problems on wavelet greedy approximation of functions of bounded variation

Abstract: Let $BV(\mathbb{R}^d)$ be the space of functions of bounded variation on \mathbb{R}^d , $d \geq 1$. From the Sobolev embedding theorem we infer that $BV(\mathbb{R}^d) \subset L_p(\mathbb{R}^d)$ for $p = d/(d-1)$. Given a nice wavelet basis $\{\Psi_\lambda\}_{\lambda \in \Lambda}$ normalized in L_p we are interested in approximating $f \in BV$ in the L_p norm by functions of the form $\sum_{\lambda \in A} a_\lambda \Psi_\lambda$ where $A \subset \Lambda$ is an arbitrary subset of a fixed cardinality. It is known that almost optimal approximation is achieved by the greedy operator i.e. for a function $f = \sum_{\lambda \in \Lambda} b_\lambda \Psi_\lambda$ we take the approximant $\Gamma_m(f)$ to be the sum of m terms with biggest coefficients $|b_\lambda|$. We give the optimal estimate for the error of approximation and prove the stability of the operator Γ_m . I will also discuss relevant open problems.

For various wavelets and in various generality these questions have been discussed in the following papers:

- [1.] A. Cohen, R. DeVore, P. Petrushev, H. Xu, *Nonlinear approximation and the space $BV(\mathbb{R}^2)$* , Amer. J. Math. 121 (1999) 587-628.
- [2.] P. Wojtaszczyk *Projections and non-linear approximation in the space $BV(\mathbb{R}^d)$* , Proc. London. Math. Soc. (3) 87 (2003) 471-97.
- [3.] P. Bechler, A. Kamont, G. Petrova, R. DeVore, P. Wojtaszczyk *Greedy wavelet projections are bounded in BV* , Trans. Amer. Math. Soc. (in print).

Monday, 10:30-11:20, Rm 115

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Marek Wójtcowicz *Casimir the Great University, Bydgoszcz, Poland*

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An isometric form of the theorem of Lindenstrauss and Rosenthal on quotients of $\ell_1(\Gamma)$

Abstract: Let X denote an infinite dimensional Banach space. In 1969 Lindenstrauss and Rosenthal showed that if X is separable then the set of quotient mappings $\ell_1 \rightarrow X$ is determined uniquely, up to automorphisms of ℓ_1 : *for every pair T_1, T_2 of mappings from ℓ_1 onto X there is an automorphism τ of ℓ_1 such that $T_1 = T_2\tau$.*

We apply Banach's decomposition theorem (a version of the Cantor-Bernstein theorem) to prove an isometric form of the Lindenstrauss-Rosenthal result.

Let $\mathcal{Q}(X, \Gamma)$ denote the set all natural quotient mappings Q_A acting from $\ell_1(\Gamma)$ onto X defined by the formula

$$Q_A((\xi_\gamma)_{\gamma \in \Gamma}) = \sum_{\gamma \in \Gamma} \xi_\gamma a_\gamma, \quad (\xi_\gamma)_{\gamma \in \Gamma} \in \ell_1(\Gamma),$$

where the set $A = \{a_\gamma : \gamma \in \Gamma\}$ is dense in the unit ball of X , and $\text{card}(\Gamma) = \text{card}(A)\chi(X)$ (the density character of X).

Theorem. *For every pair Q_A, Q_B in $\mathcal{Q}(X, \Gamma)$ there is a sequence (π_j) of autoisometries of $\ell_1(\Gamma)$ with $\lim_{j \rightarrow \infty} \|Q_A - Q_B\pi_j\| = 0$.*

A similar approximation property holds for a class of operators from $\text{Lip}(V)$ into ℓ_∞ , where V is an infinite compact metric space without isolating points, and $\text{Lip}(V)$ denotes the space of all numerical functions on V fulfilling the Lipschitz condition.

Joint work with Marcos González.

Tuesday, 3:40-4:00, Rm 215

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Geoffrey Wood *University of Wales, Swansea, UK*

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Transitive norms and unitary Banach algebras

Abstract: For a unital Banach algebra A , an element u in A is said to be *unitary* if u is invertible in A and satisfies $\|u\| = \|u^{-1}\| = 1$. The Banach algebra A is called *unitary* if the convex hull of the set of its unitary elements is norm-dense in the closed unit ball of A . If X is a complex Hilbert space, then the algebra $B(X)$ of all bounded linear operators on X is unitary (by the Russo-Dye theorem). Whether $B(X)$ is unitary *only* when X is a Hilbert space is an open problem. Progress on this problem will be discussed.

Tuesday, 4:20-4:40, Rm 215

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Vladyslav Yaskin *University of Missouri, Columbia, MO*

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The geometry of L_0

Abstract: Suppose that we have the unit Euclidean ball in \mathbb{R}^n and construct new bodies using three operations - linear transformations, closure in the radial metric and multiplicative summation defined by $\|x\|_{K+oL} \sqrt{\|x\|_K \|x\|_L}$. We prove that in dimension 3 this procedure gives all origin symmetric convex bodies, while this is no longer true in dimensions 4 and higher. We introduce the concept of embedding of a normed space in L_0 that naturally extends the corresponding properties of L_p -spaces with $p \neq 0$, and show that the procedure described above gives exactly the unit balls of subspaces of L_0 in every dimension. We provide Fourier analytic and geometric characterizations of spaces embedding in L_0 , and prove several facts confirming the place of L_0 in the scale of L_p -spaces. This is joint work with N.J. Kalton, A. Koldobsky, and M. Yaskina.

Thursday, 4:20-4:40, Rm 10

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Maryna Yaskina *University of Missouri, Columbia, MO*

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Centroid bodies and comparison of volumes

Abstract: For $-1 < p < 1$ we introduce the concept of a polar p -centroid body Γ_p^*K of a star body K . We consider the question of whether $\Gamma_p^*K \subset \Gamma_p^*L$ implies $\text{vol}(L) \leq \text{vol}(K)$. Our results extend the studies by Lutwak in the case $p = 1$ and Grinberg, Zhang in the case $p > 1$. This is joint work with V. Yaskin.

Tuesday, 2:40-3:00, Rm 10

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Jindrich Zapletal *University of Florida, Gainesville, FL*

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Ramsey capacities

Abstract: Motivated by forcing considerations, I will introduce a natural Ramsey property of capacities, with a number of applications, examples, non-examples, and open questions.

Tuesday, 4:50-5:10, Rm 115

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Artem Zvavitch *Kent State University, Kent, OH*

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On Gaussian measure of sections of dilations and shifts of convex bodies

Abstract: In this talk we give a solution for the Gaussian version of the Busemann-Petty problem with additional inequalities on dilations or shifts of the bodies.

Thursday, 3:10-3:30, Rm 10

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