Alejandro Chávez Domínguez (University of Oklahoma, USA)

Thursday, June 28, 10.00-11.00

Title: Frame potential for finite-dimensional Banach spaces

Abstract: Frames for Hilbert spaces, as overcomplete versions of bases, are quite useful in applications because they provide decompositions that are more robust. Those frames that consist of vectors of norm one and are additionally tight have even more computational advantages, e.g. they provide fast convergence for said decompositions.

Benedetto and Fickus have defined a *frame potential*, a numerical quantity that can be assigned to a collection of finitely many vectors in a Hilbert space, which characterizes unit norm tight frames: a sequence of k norm-one vectors in an n-dimensional Hilbert space (where $k \geq n$) has frame potential at least k^2/n, with equality if and only if the sequence forms a tight frame (and there always exist frames achieving this bound).

The main result of this paper is a generalization of the aforementioned result to the context of finite-dimensional Banach spaces. We use the 2-summing norm to define a frame potential for a sequence of k norm-one vectors in an n-dimensional Banach space (where $k \geq n$), which generalizes the Hilbert-space notion. This generalized potential is also bounded below by k^2/n, with equality if and only if the sequence is a tight frame. The arguments rely on the geometry of the space of 2-summing maps from a finite-dimensional Banach space to itself. For a wide class of spaces, in particular complex n-dimensional Banach spaces with a 1-unconditional basis, we show that the equality case does occur.

This is joint work with Dan Freeman and Keri Kornelson.

Gilles Godefroy (University Paris VI, France)

Monday, June 25, 11.30-12.30

Title: The Borel complexity of some isomorphism classes

Abstract: Using a universal space and the Effros-Borel structure, a proper frame exists for estimating the descriptive complexity of classes of separable Banach spaces which are stable under isomorphisms, and thus in particular of isomorphism classes. In a joint work with Jean Saint-Raymond, we show that the isomorphism classes of reflexive l_p spaces are Borel sets of order at most $\omega + 1$ (unless $p = 2$, in which case the order is 2), and that some asymptotically Hilbertian spaces have classes which are Borel of order 4. This leads to a number of open problems.

Sophie Grivaux (University of Lille, France)

Tuesday, June 26, 10.00-11.00

Title: Baire Category methods in linear dynamics

Abstract: Given a separable Hilbert space of infinite dimension H, one can consider on the space $\mathcal{B}(H)$ of bounded linear operators on H several natural topologies which turn the closed balls $\mathcal{B}_M(H) = \{T \in \mathcal{B}(H)\ ;\ ||T|| \leq M\}$ into Polish spaces.
I will present some results concerning typical properties in the Baire Category sense of operators of $\mathcal{B}_M(H)$ for these topologies, as well as some applications of these typicality results to Hilbertian linear dynamics, i.e. to the study of dynamical systems given by the action of an operator $T \in \mathcal{B}(H)$ on H.
This is joint work with Etienne Matheron and Quentin Menet.

David Preiss (University of Warwick, UK)

Tuesday, June 26, 11.30-12.30

Title: An "absolute" counterexample to Density Theorem in Hilbert spaces.

Abstract: The talk will discuss some of the valid or invalid infinite-dimensional analogues of basic finite-dimensional results of geometric measure theory: Density Theorem and Differentiation of Integrals. The most recent result, proved jointly with Elena Riss and Jaroslav Tišer, says that even for a Gaussian measure in a Hilbert space the Density Theorem may fail uniformly, i.e., there is a set Q of positive measure such that

$$\text{measure}(Q \cap B(x,r)) \,/\, \text{measure}(B(x,r))$$

tends to zero as r tends to zero uniformly for x in the whole Hilbert space.

Gideon Schechtman (The Weizmann Institute of Science, Israel)

Wednesday, June 27, 10.00-11.00

Title: Pisier's cotype dichotomy problem revisited

Abstract: In an effort to renew interest in the dichotomy problem, I'll survey what is known and in particular tell you about an old/new result of Nicole Tomczak-Jaegermann and myself along the lines of a result of Bourgain but with some improvement. This gives the best known estimate concerning the dichotomy problem. I'll also try to suggest what should be done next.

Antonio Aviles (University of Murcia, Spain)

Tuesday, June 26, 14.30-15.30

Title: Free Banach lattices

Abstract: We consider the free Banach lattice generated by a Banach space E. We will describe the general properties of this construction and the particular cases of ℓ_p and c_0, both in the separable and nonseparable settings.

Kevin Beanland (Washington and Lee University, USA)

Thursday, June 28, 14.30-15.00

Title: Universal Operators and Descriptive Set Theory

Abstract: A bounded linear operator U between Banach spaces is universal for the complement of some operator ideal $\mathfrak{J}$ if it is a member of the complement and it factors through every element of the complement of $\mathfrak{J}$. In this talk, we discuss some new results for universal operators for the complements of several ideals and give examples of ideals whose complements do not admit such operators. We will also describe how to use Descriptive Set Theory to study operator ideals and give a sufficient condition, based on the complexity of the ideal, for when the complement does not admit a universal operator. In particular, we use this machinery to give a new proof of a theorem of M. Girardi and W.B. Johnson which states that there is no universal operator for the complement of the ideal of completely continuous operators.

Claudia Correa (Universidade Federal do ABC, Brazil)

Thursday, June 28, 15.00-15.30

Title: Twisted sums of c_0 and $C(K)$

Abstract: The purpose of this talk is to discuss a problem I have been working on for the last couple of years. This problem deals with the existence of nontrivial twisted sums of Banach spaces. It is an easy corollary of Sobczyk's Theorem that if X is a separable Banach space, then every twisted sum of c_0 and X is trivial. This naturally raises the question about the converse of this last implication, i.e., if X is a Banach space such that

every twisted sum of c_0 and X is trivial, then X must be separable? This question is easily answered negatively. However it becomes quite interesting when we restrict ourselves to the subclass of Banach spaces of the form $C(K)$, i.e., the space of continuous real-valued functions defined on a compact Hausdorff space K, endowed with the supremum norm. Recall that a space $C(K)$ is separable if and only if K is metrizable. Therefore the question in this context can be rephrased as: Is there a nonmetrizable compact Hausdorff space K such that every twisted sum of c_0 and $C(K)$ is trivial? This question was proposed originally by Cabello, Castillo, Kalton and Yost in 2003 and it has not been solved yet. In this talk I will present the progress we have made towards the general solution of this problem as well as possible future developments.

Marian Fabian (Czech Academy of Sceinces, Czech Republic)

Wednesday, June 27, 14.30-15.30

Title: On Nash-Moser-Ekeland hard inverse mapping theorem

Abstract: We present a criterion for local surjectivity of mappings between Fréchet spaces in the spirit of a well known criterion in Banach spaces formulated by M. Fabian and D. Preiss in 1987. As an application, we prove a hard inverse mapping theorem, of Nash-Moser type, between Fréchet spaces. The technology of our proofs was strongly influenced by a recent paper of I. Ekeland from 2011. The speech is based on a forthcoming joint paper by Radek Cibulka and the lecturer.

Tomasz Kania (Czech Academy of Sciences, Czech Republic)

Wednesday, June 27, 11.30-12.00

Title: (1+)-separation in the unit sphere of a Banach space

Abstract: We shall delve into the question of whether the unit sphere of a non-separable Banach space contains an uncountable (1+)-separated subset, that stubbornly remains open. A sharp result for the classes of reflexive and super-reflexive spaces will be discussed together with some new, quantitative results concerning separation in separable cases. Certain positive results concerning the said problem that make use of extra structural assumptions will be presented. This talk is based on two joint papers with P. Hájek and T. Russo.

Richard Lechner (J. Kepler University Linz, Austria)

Thursday, June 28, 11.30-12.30

Title: Dimension dependence of factorization problems in one- and two-parameter dyadic Hardy spaces

Abstract: For each $n \in \mathbb{N}$, let $(e_j)_{j=1}^n$ denote a normalized 1-unconditional basis for the n-dimensional Banach space X_n. We consider the following question: What is the smallest possible dimension $N = N(n)$ such that the identity operator on X_n factors through any operator having large diagonal on X_N ? For one- and two-parameter dyadic Hardy spaces we improve the best previously known *super-exponential* estimates for $N = N(n)$ to *polynomial* estimates.

References:

R. Lechner. Dimension dependence of factorization problems: Hardy spaces and SL_n^∞. ArXiv e-prints https://arxiv.org/abs/1802.02857, Feb. 2018.

R. Lechner. Dimension dependence of factorization problems: bi-parameter Hardy spaces. ArXiv e-prints https://arxiv.org/abs/1802.05994, Feb. 2018.

Frank Oertel (The London School of Economics and Political Science, UK)

Wednesday, June 27, 16.00-17.00

Title: A statistical interpretation of Grothendieck's inequality: towards an approximation of the real Grothendieck constant

Abstract: In 1953 A. Grothendieck proved a theorem that he called *le théorème fondamental de la théorie metrique des produits tensoriels*. This result is known today as *Grothendieck's inequality* or *Grothendieck's theorem*. Originally, it is recognised as one of the major results of Banach space theory.

Grothendieck formulated his deep result in the language of tensor norms on tensor products of Banach spaces. To this end he described how to generate new tensor norms from known ones and unfolded a powerful duality theory between tensor norms. Only in 1968, thanks to J. Lindenstrauss and A. Pelczyński, Grothendieck's inequality was decoded and equivalently rewritten - in matrix form - which lead to its global breakthrough.

However, since the appearance of Grothendieck's paper in 1953 there exists the (still) open problem to determine the smallest possible constant - called *the Grothendieck constant* - which can be used in Grothendieck's inequality.

In addition to its multifaceted representations in functional analysis the Grothendieck inequality admits further equivalent formulations - each one of them reflecting deep and surprising links with different scientific branches, such as semidefinite programming in convex optimisation, NP-hard combinatorial optimisation, graph theory, communication

complexity, private data analysis, geomathematics and - due to the pioneering work of B. S. Tsirelson in 1985 - even foundations and philosophy of quantum mechanics.
Based on some block matrix analysis and a few techniques from multivariate statistics we will present a further equivalent representation of Grothendieck's inequality (over the reals) which reveals also its deep underlying complexity nature. Using this representation, built on non-linear mappings between sets of correlation matrices - such as $[-1, 1] \ni x \mapsto \frac{2}{\pi}\arcsin(x) \in [-1, 1]$ - and the crucial Schur multiplication of matrices, we are able to reproduce Krivine's result very quickly. Moreover, this approach allows us to continue to analyse Krivine rounding schemes in depth - leading us to surprising links with Gaussian harmonic analysis including Gaussian dependence modelling, Gaussian copulas and the Ornstein-Uhlenbeck semigroup.

Tanmoy Paul (Indian Institute of Technology Hyderabad, India)

Monday, June 25, 16.00-16.30

Title: Some geometric properties of relative Chebyshev centers in Banach spaces

Abstract: Given a normed linear space X, a family $\mathcal{V}$ of nonempty closed subsets of X and $\mathcal{F}$ family of nonempty closed and bounded subsets of X we identify three properties viz. Property-(P_1), Property-(P_2) and Property-(R_1) related to the triplet $(X, V, \mathcal{F})$, where $V \in \mathcal{V}$. All these properties are originated for studying the (Relative) *Chebyshev center* of a set $F \in \mathcal{F}$ w.r.t. $V \in \mathcal{V}$. We discuss some characterizations of these properties in terms of the structures of the spaces. We introduce the notion of *modulus of Restricted Chebyshev Center* for $V \in \mathcal{V}$ and $F \in \mathcal{F}$. Property-(P_1), Property-(P_2) and Property-(R_1) are charecterized by this modulus. The continuity of Restricted Chebyshev Center map is also chrecterized using this modulus.

Katriin Pirk (University of Tartu, Estonia)

Tuesday, June 26, 16.30-17.00

Title: Daugavet points and Δ-points

Abstract: The well-known Daugavet property has the following geometrical characterization: a Banach space X has the Daugavet property, i.e. $\|I + T\| = 1 + \|T\|$ holds for compact operators T on X, if and only if

$$B_X = \overline{conv}\Delta_\varepsilon(x) \quad \text{for all } x \in S_X \text{ and } \varepsilon > 0, \text{ where}$$

$$\Delta_\varepsilon(x) = \{y \in B_X : \|x - y\| \geq 2 - \varepsilon\}$$

(see D. Werner, Recent progress on the Daugavet property, Irish Math. Soc. Bulletin 46, 2001). We say that $x \in S_X$ is a

- *Daugavet point* if $B_X = \overline{\text{conv}}\Delta_\varepsilon(x)$ for all $\varepsilon > 0$;
- Δ*-point* if $x \in \overline{\text{conv}}\Delta_\varepsilon(x)$ for all $\varepsilon > 0$.

If X has the Daugavet property then every $x \in S_X$ is a Daugavet point. However, Daugavet points may exist in Banach spaces without the Daugavet property.
Every Daugavet point is clearly a Δ-point. In general, these notions are different. This appears by studying the existence of these points in direct sums. In $C(K)$ and in Lindenstrauss spaces, for example, Daugavet points are exactly Δ-points.
We also consider the property

$$B_X = \overline{\text{conv}}\Delta, \tag{1}$$

where Δ is the set of all Δ-points of X. This new property is a kind of diameter-2 property. In fact, in X with (1), every slice of B_X has diameter 2. On the other hand, every slice of B_{c_0} is of diameter 2, but in c_0 we have $\Delta = \emptyset$. We show that every Müntz space has (1).
This talk is based on the joint work with T. A. Abrahamsen, R. Haller, and V. Lima.
The research was supported, in part, by institutional research funding IUT20-57 of the Estonian Ministry of Education and Research.

Martin Rmoutil (Charles University, Prague, Czech Republic)

Monday, June 25, 15.00-15.30

Title: c-Removable Sets: Old and New Results

Abstract: This is a joint work with Dušan Pokorný, and is still in progress. We study subsets of Euclidean spaces that are negligible from the point of view of convexity of functions (the "c" in c-removability comes from "convexity"). More precisely, a closed set $F \in \mathbb{R}^d$ is said to be *c-removable* if the following is satisfied: Whenever a continuous function $f : \mathbb{R}^d \to \mathbb{R}$ is locally convex on the complement of F, it is convex on the whole $\mathbb{R}^d$.
About five years ago Dušan Pokorný and I were able to disprove a conjecture by Jacek Tabor and Józef Tabor that c-removability is characterized by *interval thinness*, a notion that they introduced, which means that the set is essentially transparent in all directions: We found examples of sets which are c-removable, yet not intervally thin (one such example we call the *Holey Devil's Staircase*). We also found many examples of non-c-removable compact discontinua—disproving an incorrect but published result by L. Pasqualini from 1938.

However, the question remained open of the existence of a nontrivial c-removable *continuum*. We now have such examples along with other new results, providing a better understanding of the notion of c-removability.

José David Rodríguez Abellán (University of Murcia, Spain)

Tuesday, June 26, 16.00-16.30

Title: Some properties of free Banach lattices

Abstract: We will talk about some general aspects of free Banach lattices. In particular, we will focus on some chain conditions in free Banach lattices over Banach spaces and linearly ordered sets.

Tommaso Russo (Università degli Studi di Milano, Italy)

Wednesday, June 27, 12.00-12.30

Title: On Auerbach systems in Banach spaces

Abstract: In this talk, based on a joint work with Petr Hájek and Tomasz Kania, we shall present some results concerning the existence of uncountable Auerbach systems in some classes of non-separable Banach spaces.
