

PIMS GRADUATE WORKSHOP, EDMONTON, MARCH 3-4 2007

The talks will be in CAB 235, coffee breaks in CAB 229.

Saturday, March 3

9:00 *Coffee.*

9:25 *Opening remarks.*

9:30 *Shawn Desaulniers.* Generalized function spaces in Banach algebras.

10:00 *Chad Hogan.* Pseudodifferential Operator Theory in Seismic Imaging.

10:30 *Faruk Uygul.* A representation theorem for completely contractive dual Banach algebras.

11:00 *Coffee.*

11:30 *Márton Naszódi.* Touching Homothetic Bodies in Euclidean d -space.

12:00 *Peter Pivovarov.* Volume thresholds for Gaussian and spherical random polytopes.

12:30 *Lunch break.*

2:00 *Carlos Jimenez.* On the extremal distance between convex bodies.

2:30 *Zsolt Lángi.* Seven points in a plane convex body in large relative distances.

3:00 *Benjamin Willson.* Folner conditions and semidirect products related to amenability of groups and semigroups.

3:30 *Coffee.*

4:00 *Peter Papez.* Isoperimetric Inequalities for Circle-Polygons.

4:30 *Wes Maciejewski.* On Zonotopes.

6:00 *Banquet.* (Faculty Club)

Sunday, March 3

9:00 *Coffee.*

9:30 *Yin-hei Cheng.* Some characterizations of compact groups and discrete groups.

10:00 *Alexey Popov.* Schreier singular operators.

10:30 *Coffee.*

11:00 *Zhuang Niu.* Extended Rotation Algebras.

11:30 *Danny Chan.* Ordinals, Cardinals and Their Applications to Amenable Locally Compact Groups.

ABSTRACTS

Yin-hei Cheng. *Some characterizations of compact groups and discrete groups.*

Abstract: Many properties of a locally compact group and those of various Banach algebras associated to it are closely related. In this talk, we will see that the compactness and discreteness of a given group can be characterized by the existence of finite dimensional ideals of its Banach algebras.

Danny Chan. *Ordinals, Cardinals and Their Applications to Amenable Locally Compact Groups.*

Abstract: In this seminar, we will firstly have a brief introduction to the notions of ordinals and cardinals. Then we will investigate the cardinality of the set of all topologically left invariant means on various von-Neumann algebras associated to a locally compact group.

Shawn Desaulniers. *Generalized function spaces in Banach algebras.*

Abstract: In abstract harmonic analysis we study the interplay between algebraic and topological properties of locally compact groups and their associated algebras of functions and measures.

In this talk, we will first discuss some of the “classical function spaces” associated to \mathbb{R} . By examining their properties from an algebraic point of view, we will find very natural generalizations to any locally compact group.

Once this is done, we will use Banach space techniques to define these spaces in the setting of Banach algebras. Special focus will be given to the Fourier algebra of a locally compact group. To conclude we will introduce the notion of a Dunford-Pettis operator and use it to define a new Banach space associated to a locally compact group.

Chad Hogan. *Pseudodifferential Operator Theory in Seismic Imaging.*

Abstract: Our work focuses on the understanding, application, and development of PSDO and related theories in the context of imaging seismic reflection data. In a mathematical context, this amounts to the solution of a scalar Helmholtz equation with nonconstant coefficients given partial boundary data. We will introduce the problem, and describe some of the challenges involved, including both analytic and computational approaches.

Carlos Jimenez. *On the extremal distance between convex bodies.*

Abstract: Let K and L be two convex bodies in \mathbb{R}^n with non-empty interiors. Define the following (multiplicative) distance between them as follows

$$d(K, L) = \inf \{ |\lambda| \mid \lambda \in \mathbb{R}, K - a \subset T(L - b) \subset \lambda(K - a) \},$$

where the infimum is taken over all $a, b \in \mathbb{R}^n$ and all linear bijections T from \mathbb{R}^n into \mathbb{R}^n . It was recently proved, using John's decomposition of the identity ($I_n = \sum_{i=1}^m a_i u_i \otimes v_i$), that for any two convex bodies K and L the distance between them $d(K, L) \leq n$. It was also observed that if L is a non-degenerate simplex and K is centrally symmetric then we have $d(K, L) = n$. This gives rise to a natural question about the extremal case when $d(K, L) = n$ and none of these additional assumptions are made on K and L . In this talk we investigate this question.

Zsolt Lángi. *Seven points in a plane convex body in large relative distances.*

Abstract: Packing points into a Euclidean unit disk in large pairwise distances is a long-standing problem of geometry. In this talk, we present a generalization of this problem for convex bodies in general. In particular, we define the relative distance of two points with respect to a convex body C as the normed distance of the points in the norm with unit disk $1/2(C - C)$. We examine what is the smallest number d such that, among seven points in any plane convex body C , there is a pair at relative distance at most d . We use our result to prove a conjecture of Brass and Swanepoel.

Wes Maciejewski. *On Zonotopes.*

Abstract: In this talk I will present a special class of convex polytopes, known as zonotopes, and discuss some of their interesting properties.

Márton Naszódi. *Touching Homothetic Bodies in Euclidean d -space.*

Abstract: According to a conjecture of Károly Bezdek and János Pach from 1986, the maximum number of pairwise touching positive homothetic copies of any convex body in Euclidean d -space is 2^d . This bound, if it holds, is sharp as it is attained by cubes. The previously known bound was 3^d , I improved it to $2^{d+1} - 1$. I will present the proof of this result and possible directions of further improvement.

Zhuang Niu. *Extended Rotation Algebras.*

Abstract: The C^* -algebra generated by the irrational rotation algebra and certain spectral projections of the canonical unitary generators is studied. It is shown that this C^* -algebra has a unique tracial state. Moreover, if the spectral projections are those (one for each generator) concentrated on certain half-open intervals, the extended rotation algebra is simple and unclear. This is a joint work with George Elliott.

Peter Pivovarov. *Volume thresholds for Gaussian and spherical random polytopes.*

Abstract: Let g be a Gaussian random vector in \mathbb{R}^n . Let $N = N(n)$ be a positive integer and denote by K_N the convex hull of N independent copies of g . Fix $R > 0$ and consider the ratio of volumes $V_N := \mathbb{E} \text{vol}(K_N \cap RB_2^n) / \text{vol}(RB_2^n)$. For a large range of $R = R(n)$, I will establish a sharp threshold for N , above which $V_N \rightarrow 1$ as

$n \rightarrow \infty$, and below which $V_N \rightarrow 0$ as $n \rightarrow \infty$. I shall also discuss the case when K_N is generated by independent random vectors distributed uniformly on the Euclidean sphere. Analogous threshold results for both $R \in (0, 1)$ and $R = 1$ will be presented. This work was motivated by recent results of Gatzouras and Giannopoulos and uses the method developed by Dyer, Füredi and McDiarmid.

Peter Papez. *Isoperimetric Inequalities for Circle-Polygons.*

Abstract: Let C be a circle of radius strictly less than one. If a sequence of n points lying on C are labeled from 1 to n in the clockwise direction, say, and the points are joined in the given order by arcs of a unit circle then we call the resulting object an n -sided circle-polygon inscribed in C . In this talk, we characterize such circle polygons of largest area and perimeter. The isoperimetric inequalities developed are inspired by the work of Dowker in the 1930s and follow the techniques of Fejes Tóth.

Part of a joint work with K. Bezdek, M. Naszódi and Z. Lángi.

Alexey Popov. *Schreier singular operators.*

Abstract: The talk will be about recently introduced class of Schreier singular operators. It will be shown that this class is stable under left and right multiplication by bounded operators. I am going to describe a characterization of these operators in terms of spreading models. Also, compactness of finite products of such operators under certain conditions will be discussed. Finally, it will be shown that these conditions cannot be dropped by giving a counterexample of finitely strictly singular operator which is not polynomially compact.

Faruk Uygul. *A representation theorem for completely contractive dual Banach algebras.*

Abstract: The theory of operator spaces is a very powerful tool in the study of abstract harmonic analysis. In 2001, Zhong-Jin Ruan proved an abstract characterization of operator spaces: Every abstract operator space is indeed a closed subspace of $B(H)$, for some Hilbert space H . As a special class of operator spaces, completely contractive dual Banach algebras are found abundantly in abstract harmonic analysis, such as the measure algebra and the Fourier-Stieltjes algebra with their natural operator space structures. Moreover, any dual Banach algebra can be equipped with a natural operator space structure turning it into a completely contractive dual Banach algebra. Recently, Matthew Daws proved that every dual Banach algebra can be isometrically embedded into the space of bounded linear operators on some reflexive Banach space. In this talk, we will prove that: *If \mathfrak{A} is a completely contractive dual Banach algebra,*

then \mathfrak{A} is completely isometric to a weak-closed subalgebra of $CB(E)$, for some reflexive operator space E . The construction of such a reflexive operator space heavily relies on the theory of real and complex interpolation of operator spaces defined by Quanhua Xu and Gilles Pisier respectively.

Benjamin Willson. *Folner conditions and semidirect products related to amenability of groups and semigroups.*

Abstract: Let G be a locally compact group. A Folner net is a net of subsets of G such that the elements of the net eventually satisfy the Folner condition for each compact set and positive epsilon. The existence of a Folner net on G is equivalent to G being amenable, but constructing these nets can be difficult. I will present two methods for combining two Folner nets for two groups into a Folner net for the semidirect product of the groups.

Additionally I will discuss similar concepts defined on discrete semigroups, and present a necessary condition for a semidirect product of semigroups to be amenable.

HUB Mall restaurants that are open on Saturday:

New York Fries (*Fries, hot dogs*).

Bar Teca (*Sandwiches, frozen yogurt, coffee*).

Motherly (*Freshly made sandwiches, soup and pastries*).

Edo Japan (*Japanese foods*).

A& W (*Hamburgers, chicken burgers*).

Pita Pazzaz (*Pitas*).

Academy Pizza (*Pizza*).

Ho Ho Chinese (*Chinese food*).

Subway (*Sub sandwiches*).

Restaurants in SUB that are open on Saturday:

Subway (*Sandwiches*).

Edo Japan (*Japanese foods*).

Funky Pickle (*Pizza*).

Marco's Famous Donair (*Donair*).

L'Express (*deli, hot meals*).