

# Hartman Special Seminar on Harmonic Analysis

Wroclaw, May 10-11, 2019

Institute of Mathematics of University of Wroclaw, lecture room EM

## Friday, May 10

### 15:00-16:30 **Memoir session, part 1**

- Opening and welcome by Professor Marek Bożejko and by the Vice Dean of the Department of Mathematics and Computer Science, Professor Piotr Biler
- Shared memories by Piotr Biler, Władysław Narkiewicz, Ewa Damek, Krzysztof Stempak

### 16:30-17:00 **Coffee break**

### 17:00-18:30 **Memoir session, part 2**

- Shared memories by Marek Bożejko, Michael Leinert, Gero Fendler and other participants – everybody is welcome to join

### 19:30 **Dinner at Kuźnia Smaku**

- Address: Wrocław, ul. Kuźnicza 57/58, departure from the Institute at 19:00

## Saturday, May 11

### 10:00-10:30 **Victor Losert (University of Vienna)**

#### **Arens products for some convolution algebras of measures**

For a locally compact group  $G$  we had shown previously that  $L^1(G)$  and its measure algebra  $M(G)$  are always strongly Arens irregular. If  $K$  is a compact subgroup of  $G$ , there are subalgebras determined by the coset spaces  $G/K$  and the double coset spaces  $G//K$ . It turns out that for some groups  $G, K$  the corresponding topological centres are no longer of minimal size.  $G//K$  has the structure of a hypergroup and we discuss some properties of the measure algebra (and the convolution) for the relevant class of hypergroups (Chébli-Trimèche hypergroups).

### 10:35-11:05 **Roland Speicher (Universität des Saarlandes)**

#### **Regularity of non-commutative distributions and the free skew field**

I will report on recent joint work with Tobias Mai and Sheng Yin, when the division closure (within affiliated unbounded operators) of concrete operators in finite von Neumann algebras is isomorphic to an abstract algebraic object, the free skew field (aka the skew field of non-commutative rational functions).

### 11:10-11:40 **Ryszard Szwarc (Uniwersytet Wrocławski)**

#### **Norms of weak type convolution operators on free groups**

Let  $F_q$  be the free group on  $q$  generators,  $q \geq 2$ . Haagerup (1979) showed that the norm of convolution operator on  $\ell^2(F_q)$  with function  $f$  supported in the subset of elements of length  $n$  is bounded above by  $(n+1)\|f\|_2$ . The estimate is sharp, as for radial functions  $f$  the operator norm is equivalent to  $(n+1)\|f\|_2$ . We are going to calculate explicitly the weak type norm and restricted weak type norm on  $\ell^2(F_q)$  of such radial convolution operator. The estimates for these norms were given in Szwarc (1983) and in Pytlik, Szwarc (2008). We were unable to generalize the estimates for nonradial functions.

11:45-12:15 **Coffee break**

12:15-12:45 **Vincent Ngoc Mihn (Université Paris-Nord)**  
**Towards Picard-Vessiot theory for noncommutative differential equations**

12:50-13:20 **Marek Ptak (University of Agriculture in Krakow, Poland)**  
**Conjugations in  $L^2$  spaces and their invariants**

Conjugations, (antilinear isometric involutions), in the space  $L^2$  of the unit circle commuting with multiplication by  $z$  or intertwining multiplications by  $z$  and  $\bar{z}$  are characterized. We also study their behaviour with respect to the Hardy space, subspaces invariant for the unilateral shift and model spaces. We characterize all conjugations between two model spaces. Next, having in mind the importance of Nagy–Foiş theory, we move to conjugations in vector valued  $L^2$  spaces and vector valued model spaces. Joint work with C. Câmara, K. Kliś–Garlicka, B. Łanucha.

13:25-13:55 **Adam Paszkiewicz (Uniwersytet Łódzki)**  
**Some results and methods of investigation of orthogonal projections.**

We summarize some results on products and linear combinations of orthogonal projections in any von Neumann algebra. Such problems leads to many interesting applications of methods of Banach spaces and of spectral theory (sometimes unexpected). Some development of theory of perturbation of self-adjoint operators is also obtained.

14:00-15:00 **Lunch (at Kawiarnia Plastyczna)**

15:00-15:25 **Jacek Wesołowski (Politechnika Warszawska)**  
**Free and classical probability - a mysterious parallel in regression characterizations**

For either free noncommutative, or independent commutative, random variables  $X$  and  $Y$  and  $(U, V) = \Psi(X, Y)$  constancy of regressions conditions of the form  $E(U^i|V) = c_i$ , for two values of  $i$ , often allow to pin down the original distributions of  $X$  and  $Y$ . I will present a review of such results starting from Laha-Lukacs (1960) characterization of Meixner laws and its free analog of Bożejko-Bryc (2006) and finishing with recent results (obtained with Kamil Szpojankowski) on free analogs of classical dual Lukacs regressions for negative powers. All these results seem to point out to a "mysterious parallel" between probability laws playing the same roles in regression properties in free and classical probability.

15:30-15:55 **Kamil Szpojankowski (Politechnika Warszawska)**  
**On applications of Boolean cumulants in free probability**

We will present a result which relates boolean cumulants and free random variables. First we will present a characterization of freeness in terms of boolean cumulants. Our next goal will be to present that our formula is useful. We will show that for some natural problems in free probability combinatorics of Boolean cumulants of free random variables is easier than combinatorics of free cumulants. In particular we will discuss applications of Boolean cumulants approach to subordination results in free probability. Among applications of our approach we will describe the distribution of  $X + f(X)Yf(X)$  for free random variables  $X, Y$  as well as the distribution of anticommutator  $XY + YX$ . Talk is based on two joint projects: 1) with M. Fevrier (Paris), M. Mastnak (Halifax) and A. Nica (Waterloo), 2) with F. Lehner (Graz).

16:00-16:25 **Franz Lehner (TU Graz)**

**Combinatorics of free commutators, cotangents and the free Cantelli problem**

We report on recent progress in the study of polynomials of low degree in free random variables, more precisely, the Cantelli problem (joint work with K. Szpojankowski and V. Vasilchuk) and quadratic forms (joint work with W. Ejsmont). We discuss interesting combinatorial and trigonometric problems involved in the calculation of these distributions.

16:30-16:45 **przerwa kawowa**

16:45-17:05 **Michał Wojciechowski (IMPAN)**

**On the Hausdorff dimension of Riesz products**

We calculate the Hausdorff dimension of the Riesz products - historically the first example of a singular measure, defined 101 years ago by F. Riesz. Joint result with Rami Aouysh and Dima Stolyarov. The proof is an application of our results about vector valued martingales.

17:10-17:30 **Wojciech Młotkowski (Uniwersytet Wrocławski)**

**Some relatives of the Catalan sequence**

We will describe a family of sequences which are defined in a similar way as the Catalan numbers. We study the corresponding generating functions, positive definiteness and connections with free probability. This is joint work with Elżbieta Liszewska.