**May 20-24, 2013**
**University of Granada**

**Organizing Committee**
J. Alaminos
J. Extremera
E. Kaniuth
A. Lau
A. Ülger
A. R. Villena

# 7th International Conference on
# Abstract Harmonic Analysis

# Welcome

It is our great pleasure to welcome you to 7th International Conference on Abstract Harmonic Analysis 2013 in Granada, Spain. This booklet has been put together to help you find your way through the conference and make the most of your stay in Granada.

In addition to this program booklet, you can find most of the information online at `http://www.ugr.es/local/aha2013`.

We hope you find them useful – feel free to email `aha2013@ugr.es` with your feedback.

# Acknowledgements

We would like to thank the support and cooperation of the following institutions

- Universidad de Granada,
- Facultad de Ciencias,
- Departamento de Análisis Matemático,
- Research Project MTM2012–31755 from the Ministerio de Economía y Competitividad,
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- FisyMat (Máster/Programa de doctorado),

Jerónimo Alaminos
José Extremera
Eberhard Kaniuth
Antony To-Ming Lau
Ali Ülger
Armando R. Villena

The organizers,
`http://www.ugr.es/local/aha2013/`
`aha2013@ugr.es`

# Contents

# Instructions for Participants

For general enquiries or projector/computer/internet problems please contact the local organizers (Jerónimo Alaminos, José Extremera, Armando Villena).

## Instructions for Speakers

- The lecture room will have a digital projector, overhead projector, a computer and pointers. There is also a blackboard that can be used simultaneously with the projector.
- Speakers can bring their own laptop.
- Please arrive some minutes before the session starts to check the equipment works, and, if you will not be using your own laptop, to upload your slides from your USB drive. Even better, please send a copy of the talk by e-mail to the organizers in advance.
- The time allocated to each speaker is 40 minutes plus 5 for questions.

## Instructions for Session Chairs

- Please arrive 5 minutes before the session starts to check the equipment works.
- Please stick to the schedule.
- Please moderate questions.
- Please do not start sessions or talks early.

## Internet access

- There are several wifi nets available in the university (cviugr, cviugr-v2, eduroam). Please, select **cviugr**. When you point the browser to a webpage, use the provided username and password.
- Your badge has a login name, password.
- The classroom 0.7 has several computers connected to internet at the disposal of the participants.
- You can use the Eduroam facilities for those who have a working account on their own university.

# Where

- All the lectures will be at *"Sala de Conferencias"*.
- Lunch and coffee will be served at the cafeteria of Facultad de Ciencias. You can find the tickets for lunch in your badge.
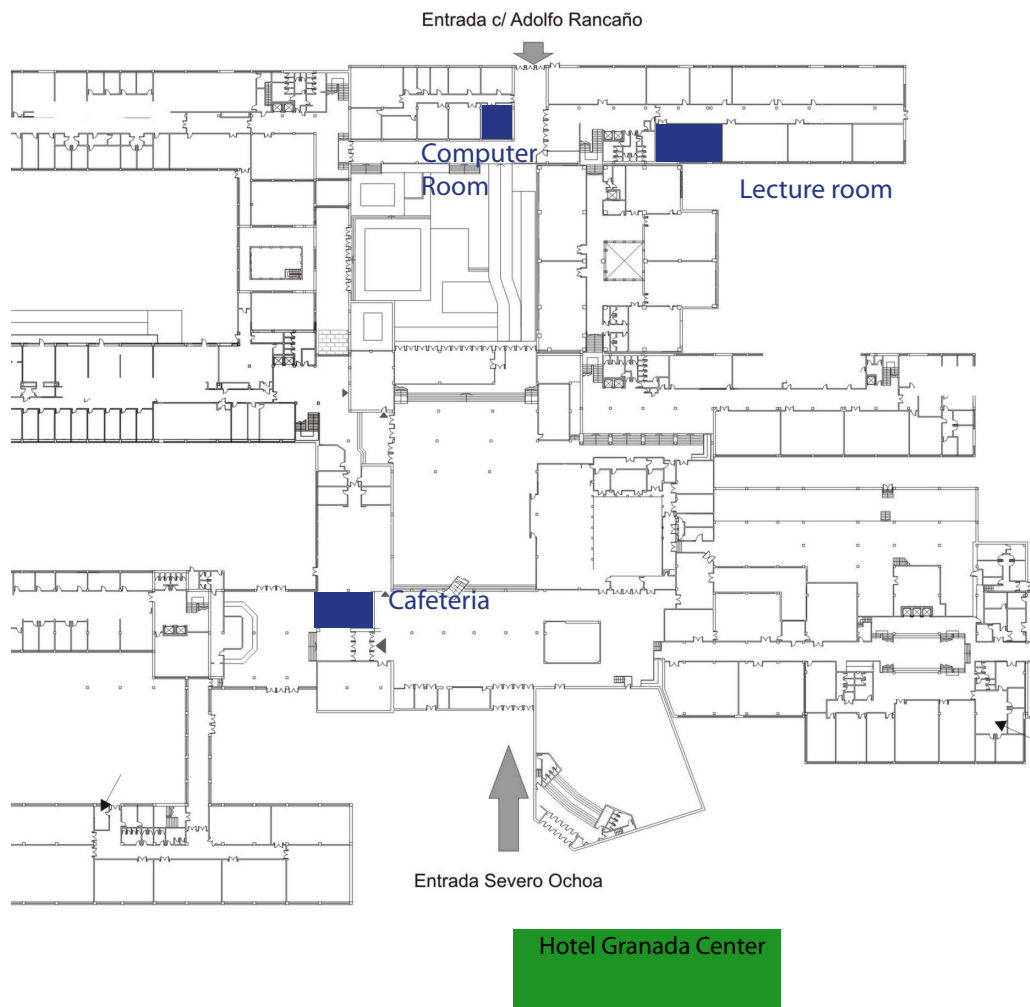- In room 0.7 there will be computers available to the participants.

Entrada c/ Adolfo Rancaño

Computer Room

Lecture room

Cafetería

Entrada Severo Ochoa

Hotel Granada Center

Figure 1: Ground floor of Facultad de Ciencias

## Conference dinner and visit to the Alhambra

On the afternoon of Wednesday, 22 we plan to visit the Alhambra and celebrate the conference dinner.

- We meet at 16:00 at the entrance/hall of the Granada Center Hotel.

- At 16:15 the bus will leave to the Alhambra.

- The visit will start at 17:00 and will last for approximately 3 hours.

- The conference dinner will take place just after the visit. A bus will pick us up at the Alhambra and will leave us at Mirador de San Cristóbal. There is a short walk from there to Restaurante San Nicolás where we are going to celebrate the conference dinner.

- After the dinner, the bus will pick us up again at Mirador de San Cristóbal and take us back to the hotel.

## Dinning out

There are plenty of places to eat ranging from small bars to restaurants all over the city. The highlighted areas in the following map are some of the most popular. All of them are at walking distance (10–20 minutes) from the hotel. You can not go wrong if you go around the cathedral, Paseo de los tristes, Plaza Nueva or the town hall.
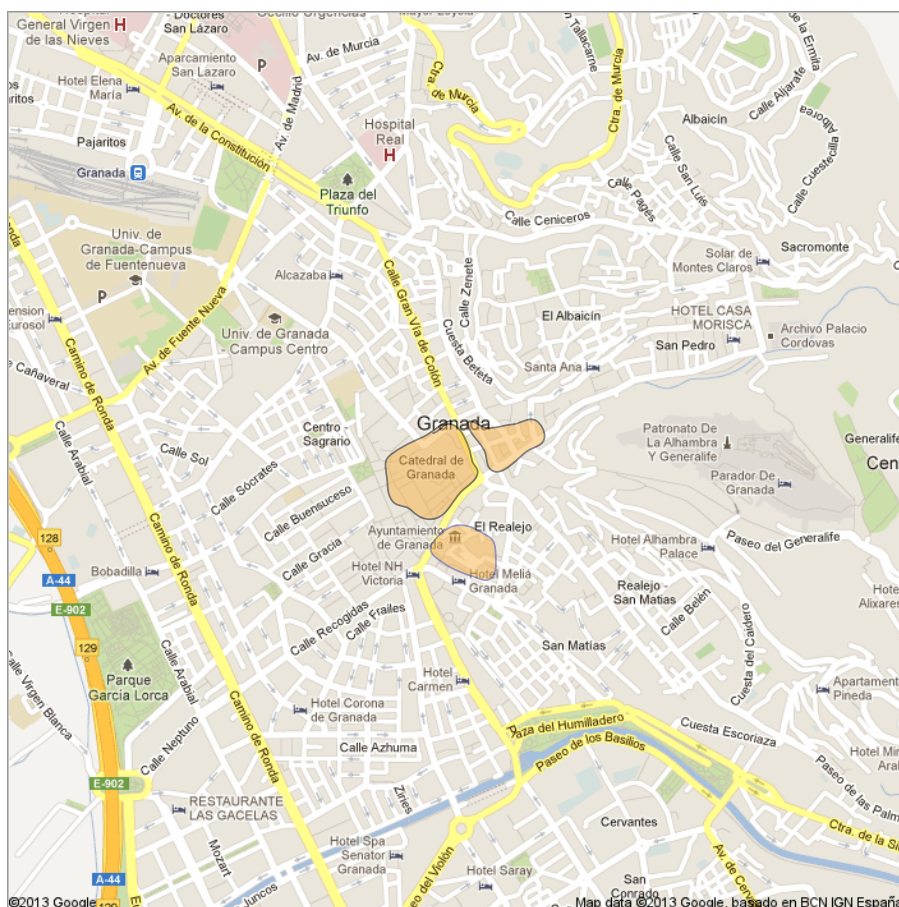


Figure 2: Granada downtown

# Program

## Monday, May 20

08:30–09:10     **Registration and opening**

**Chair**
*Armando Villena*

09:20–10:00     **Spectral synthesis in Fourier algebras of double coset hypergroups**
*Eberhard Kaniuth*

10:10–10:50     **Strongly invariant means on commutative hypergroups**
*Rupert Lasser*

11:00–11:30     **Coffee Break** ☕

**Chair**
*Garth Dales*

11:30–12:10     **Amenability properties for various classes of polynomial hypergroups**
*Stefan Alexander Kahler*

12:20–13:00     **Transferring convolution operators from locally compact groups to closed subgroup**
*Antoine Derighetti*

13:00–15:30     **Lunch** 🍴

**Chair**
*José E. Galé*

15:30-16:10     **Interpolation sets and quotients of function spaces on a locally compact group I**
*Mahmoud Filali*

16:20–17:00     **Interpolation sets and quotients of function spaces on a locally compact group II**
*Jorge Galindo*

# Tuesday, May 21

**Chair**
*Anthony To-Ming Lau*

08:30–09:10 **Completely bounded $\Lambda_p$ sets in compact groups**
*Parasar Mohanty*

09:20–10:00 **When is the quotient algebra $A/I$ isomorphic to a subalgebra of $A^{**}$?**
*Ali Ülger*

10:10–10:50 **Compact operator synthesis and spectral synthesis in harmonic analysis**
*Lyudmila Turowska*

11.00–11:30 **Coffee Break** ☕

**Chair**
*Nico Spronk*

11:30–12:10 **Operator synthesis: unions and products**
*Ivan Todorov*

12:20–13:00 **Spectral synthesis for absolutely continuous functions of higher order**
*José E. Galé*

13:00–15:30 **Lunch** 🍴

**Chair**
*José Extremera*

15:30-16:10 **On weighted Orlicz algebras**
*Serap Öztop*

16:20–17:00 **$N$-hyperreflexivity of the space of bounded $N$-cocycle from Banach algebras**
*Ebrahim Samei*

# Wednesday, May 22

| | **Chair** |
| | *Antoine Derighetti* |

08:30–09:10 **Separable $C^*$-algebras and weak$^*$-fixed point property of their Banach space dual**
*Gero Fendler*

09:20–10:00 **Fixed point and related geometric properties on the Fourier and Fourier-Stieltjes algebras of locally compact groups**
*Anthony To-Ming Lau*

10:10–10:50 **Kirillov theory without polarizations**
*Detlev Poguntke*

11:00–11:30 **Coffee Break** ☕

**Chair**
*Jorge Galindo*

11:30–12:10 **On the $L^p$-Fourier transform norm of some locally compact groups**
*Ali Baklouti*

12:20–13:00 **TBA**
*Jean Ludwig*

13:00–15:30 **Lunch** 🍴

16:00– **Visit to the Alhambra and Conference Dinner**

# Thursday, May 23

|  | **Chair** |
|---|---|
|  | *Lyudmila Turowska* |

**09:20–10:00**  **Left identities for measure algebras with an application to the Connes-amenability of dual Banach algebras**
*Voker Runde*

**10:10–10:50**  **On the algebra of functions generated by pure positive definite functions**
*Nico Spronk*

**11:00–11:30**  **Coffee Break** ☕

**Chair**
*Jerónimo Alaminos*

**11:30–12:10**  **New results on semigroups of analytic functions**
*Óscar Blasco*

**12:20–13:00**  **Directly finite algebras of pseudomeasures and pseudofunctions**
*Yemon Choi*

**13:00–15:30**  **Lunch** 🍴

**Chair**
*Ali Ülger*

**15:30–16:10**  **Rough Cayley graphs of compactly generated groups**
*Pekka Salmi*

**16:20–17:00**  **The dual space of precompact groups**
*Salvador Hernández*

# Friday, May 24

**Chair**
*Óscar Blasco*

08:30–09:10 **Wavelet coorbit theory in higher dimensions**
*Hartmut Führ*

09:20–10:00 **Images of wavelet transforms**
*Keith Taylor*

10:10–10:50 **Algebras of multilinear forms on hypergroups**
*Bert Schreiber*

11:00–11:30 **Coffee Break** ☕

**Chair**
*Eberhard Kaniuth*

11:30–12:10 **Weak amenability of the Fourier algebra of $ax + b$ group**
*Mahya Ghandehari*

12:20–13:00 **Radicals of some semigroup algebras**
*Garth Dales*

13:00–15:30 **Lunch** 🍴

# Timetable

|  | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| **08:30–09:10** | Registration and opening | Mohanty | Fendler |  | Führ |
| **09:20–10:00** | Kaniuth | Ülger | Lau | Runde | Taylor |
| **10:10–10:50** | Lasser | Turowska | Poguntke | Spronk | Schreiber |
| **11:00–11:30** | *Coffee Break* | *Coffee Break* | *Coffee Break* | *Coffee Break* | *Coffee Break* |
| **11:30–12:10** | Kahler | Todorov | Baklouti | Blasco | Ghandehari |
| **12:20–13:00** | Derighetti | Galé | Ludwig | Choi | Dales |
| **13:00–15:30** | *Lunch* | *Lunch* | *Lunch* | *Lunch* | *Lunch* |
| **15:30–16:10** | Filali | Öztop |  | Salmi |  |
| **16:20–17:00** | Galindo | Samei |  | Hernández |  |

# Abstracts

**Ali Baklouti** – Wednesday, 11:30–12:10
*On the $L^p$-Fourier transform norm of some locally compact groups*

Let $G$ be a separable locally compact unimodular group of type I, and $\widehat{G}$ the unitary dual of $G$ endowed with the Mackey Borel structure. We regard the Fourier transform $\mathcal{F}$ as a mapping of $L^1(G)$ to a space of $\mu$-measurable field of bounded operators on $\widehat{G}$ defined for $\pi \in \widehat{G}$ by

$$L^1(G) \ni f \mapsto \mathcal{F}f : \mathcal{F}f(\pi) = \pi(f),$$

where $\mu$ denotes the Plancherel measure of $G$. For $1 < p \leq 2$ and $q = p/(p-1)$, we have the inequality

$$\|\mathcal{F}f\|_q \leq \|f\|_p, \quad f \in L^p(G) \cap L^1(G)$$

and the mapping $f \mapsto \mathcal{F}f$ extends to a continuous operator $\mathcal{F}^p \colon L^p(G) \to L^q(\widehat{G})$. We are concerned in this talk with the norm $\|\mathcal{F}^p(G)\|$ of the $L^p$-Fourier transform:

$$\|\mathcal{F}^p(G)\| := \sup_{\|f\|_p \leq 1} \|\mathcal{F}^p f\|_q.$$

We give an estimate of this norm for some classes of solvable Lie groups and we discuss the sharpness problem. For compact extensions of $\mathbb{R}^n$, an extremal function is given by an extension of a gaussian function. Besides, as an example of non-compact extension, the universal covering group of the Euclidean motion group of the plane is also treated and an estimate of the norm is obtained.

**Óscar Blasco** – Thursday, 11:30–12:10
*New results on semigroups of analytic functions*

We study the maximal spaces of strong continuity on $BMOA$ and the Bloch space $\mathcal{B}$ for semigroups of composition operators. Characterizations are given for the cases when these maximal spaces are $VMOA$ or the little Bloch $\mathcal{B}_0$. These characterizations are in terms of the weak compactness of the resolvent function or in terms of a specially chosen symbol $g$ of an integral operator $T_g$.

**Yemon Choi** – Thursday, 12:20–13:00
*Directly finite algebras of pseudomeasures and pseudofunctions*

An algebra with identity is said to be directly finite or Dedekind finite if all left-invertible elements are in fact invertible. By an old observation of Kaplansky, this is true for the $\ell^1$-group algebra of a discrete group; the proof goes through properties of the group von Neumann algebra. I will present an extension of this result to the corresponding algebras of $p$-pseudomeasures.

There is a natural way to define direct finiteness for algebras without identity, and it turns out that the result above continues to hold for $L^1(G)$ when $G$ is unimodular; here we have to work in the reduced group $C*$-algebra rather than the von Neumann algebra. I will give an outline of the proof and give some partial extensions for algebras of $p$-pseudofunctions. I will also present an example of a locally compact group $G$ where $L^1(G)$ is not directly finite, and suggest some questions for future work.

**Garth Dales** – Friday, 12:20–13:00
*Radicals of some semigroup algebras*

It is well known that group algebras are semisimple. I shall recall the definition of a semigroup algebra $\ell^1(S)$ for a semigroup $S$, and think when these algebras are semisimple.

In particular I shall describe the semigroup compactification of a semigroup, concentrating on the definition of the semigroup $(\beta\mathbb{N}, \square)$. The definitions involve commutative $C^*$-algebras and the theory of ultrafilters on $\mathbb{N}$.

Then I shall try to work out the(Jacobson) radical of the algebra $\ell^1(\beta\mathbb{N}, \square)$ and some related algebras. The theory involves compact, right topological semigroups.

The talk is based on joint work with Dona Strauss, Yuliya and Yevhen Zelenyuk, Semigroup Forum, to appear.

**Antoine Derighetti** – Monday, 12:20–13:00
*Transferring convolution operators from locally compact groups to closed subgroups*

Let $G$ be a locally compact group and $H$ a closed subgroup. We define and study natural maps of $CV_p(G)$ into $CV_p(H)$. Applications to the discretization problem for $p$-convolution operators and to the Herz-Figà-Talamanca will be derived.

**Gero Fendler** – Wednesday, 08:30–09:10
*Separable $C^*$-algebras and weak*-fixed point property of their Banach space dual*

It is show that the dual $\widehat{A}$ of a separable $C^*$-algebra $A$ is discrete if and only if its Banach space dual has the weak*-fixed point property. We discuss further the equivalence of properties to the uniform weak* Kadec-Klee property of $A^*$ and to the coincidence of the weak* topology with the norm topology on the pure states of $A$.

The lecture is based on joint work with Prof. Michael Leinert, Institut für angewandte Mathematik, Universität Heidelberg.

**Mahmoud Filali** – Monday, 15:30–16:10
*Interpolation sets and quotients of function spaces on a locally compact group I*

Using interpolation sets, we devise a fairly general method for estimating the size of quotients of function spaces on a locally compact group. This unifies approaches followed by many other authors (including us) to obtain particular cases.

This is joint work with Jorge Galindo, University of Jaume I, Spain.

**Hartmut Führ** – Friday, 08:30–09:10
*Wavelet coorbit theory in higher dimensions*

Coorbit theory provides a functional-analytic framework for the construction and study of Banach frames arising from the action of an integrable representation. This talk is concerned with existence and basic properties of coorbit spaces associated to wavelet transforms arising from an irreducible, square-integrable representation of a semidirect product of the type $G = \mathbb{R}^d \rtimes H$ acting naturally on $L^2(\mathbb{R}^d)$. Here $H$ is a suitably chosen, closed matrix group.

The talk provides a unified and rather general approach to a setting that so far has only been studied for very special choices of affine group actions (such as the similitude group, or the shearlet group). It establishes the well-definedness of a scale of Besov-type coorbit spaces, and provides the existence of atomic decompositions for these spaces in terms of suitably chosen band-limited Schwartz functions.

Under suitable assumptions on the dual action of $H$ I establish easily verified concrete conditions for frame atoms, in terms of vanishing moments, smoothness and decay. In particular, these results imply the existence of compactly supported smooth atoms.

**José E. Galé** – Tuesday, 12:20–13:00
*Spectral synthesis for absolutely continuous functions of higher order*

Let $AC^{(n)}$ be the convolution Banach algebra on $\mathbb{R}^n$ formed by functions $f \in C^{(n-1)}(\mathbb{R})$ such that $f^{(n-1)}$ is absolutely continuous on $\mathbb{R}$ and $t^n f^{(n)} \in L^1(\mathbb{R})$, endowed with the corresponding natural norm. In the talk, a characterization of functions f of spectral synthesis in $AC^{(n)}$ is given, as well as some applications to the study of stability or ergodicity of orbits of operator semigroups.

   This is part of a joint work, still in progress, with María Martínez and Pedro J. Miana.

**Jorge Galindo** – Monday, 16:20–17:00
*Interpolation sets and quotients of function spaces on a locally compact group II*

We will describe how the method proposed in the previous talk can be applied to obtain linearly isometric copies of $\ell_\infty(\kappa)$, with $\kappa$ as large as possible, in the following quotient spaces: $WAP(G)/(C_0(G) \oplus AP(G))$, $WAP(G)/B(G)$, $CB(G)/LUC(G)$. We will also see how this method can be adapted to show that $L_1(M \times H)$ is extremely non-Arens regular when $M$ is metrizable and nondiscrete. This fact ultimately leads to the extreme non-Arens regularity of $L_1(G)$ for any locally compact group.

   This is joint work with Mahmoud Filali, University of Oulu, Finland.

**Mahya Ghandehari** – Friday, 11:30–12:10
*Weak amenability of the Fourier algebra of $ax + b$ group*

In his paper published in 1992, Johnson constructed a non-zero bounded derivation from the Fourier algebra of the rotation group in 3 dimensions into its dual. At the time, this result was surprising as it was natural, due to the duality between the $L^1$-algebra and the Fourier algebra of a group, to suspect that the Fourier algebra of an amenable group is amenable as a Banach algebra. Johnson's derivation showed that the Fourier algebra of $SO_3(\mathbb{R})$ is not even weakly amenable.

   In this talk, we use properties of square-integrable representations to construct explicit, non-zero derivations on the Fourier algebra of the $ax + b$ group, proving in particular that this algebra is not weakly amenable. This result extends to semisimple Lie groups using the structure theory of Lie groups.

   This talk is based on a joint work with Y. Choi.

**Salvador Hernández** – Thursday, 16:20–17:00
*The dual space of precompact groups*

For a topological group $G$ the dual object $\widehat{G}$ is defined as the set of equivalence classes of irreducible unitary representations of $G$ equipped with the Fell topology. It is well known that if $G$ is compact, $\widehat{G}$ is discrete. In this paper, we investigate to what extent this remains true for precompact groups, that is, dense subgroups of compact groups. We show that: (a) if $G$ is an almost-metrizable precompact group, then $\widehat{G}$ is discrete; (b) if $G$ is a countable non-metrizable precompact group, then $\widehat{G}$ is not discrete; (c) every non-metrizable compact group contains a dense subgroup $G$ for which $\widehat{G}$ is not discrete. This extends to the non-Abelian case what was known for Abelian groups. We also prove that if $G$ is a countable Abelian precompact group, then $G$ does not have Kazhdan's property (T), although $\widehat{G}$ is discrete if G is metrizable.

**Stefan Alexander Kahler** – Monday, 11:30–12:10
*Amenability properties for various classes of polynomial hypergroups*

In contrast to the special case of a locally compact group, the $L^1$-algebra of a general hypergroup need not be weakly amenable; restricting to commutative hypergroups, the situation does not improve, whereas this restriction would guarantee even amenability in the group case. Concerning polynomial hypergroups, which are very different from groups but possess a rich and highly developed harmonic analysis, even 'point-amenability' of the $\ell^1$-algebra (i.e. the non- existence of non-zero bounded point derivations w.r.t. symmetric characters, considered as a global property) is surprisingly rare. At 'AHA2011', we presented a solution to the problem whether amenability and weak amenability of the $\ell^1$-algebra necessarily coincide or may differ for this class of (commutative and discrete) hypergroups; to this end, we first developed some general results and then considered the example of ultraspherical polynomials as a first and rather easy application.

In this talk, we study the three probably most important one-parameter generalizations of the ultraspherical polynomials, which are the classes of Jacobi, symmetric Pollaczek and associated ultraspherical polynomials. We give full characterizations for amenability, weak amenability and point-amenability by precisely specifying the corresponding parameter regions. Since – in contrast to the common subclass of ultraspherical polynomials – explicit computations are difficult or even impossible for these larger classes, our strategy requires combining methods from harmonic and functional analysis with suitable ingredients from the theory of orthogonal polynomials and their asymptotics, and from the theory of special functions. We also give some new general results concerning point-amenability.

**Eberhard Kaniuth** – Monday, 09:20–10:00
*Spectral synthesis in Fourier algebras of double coset hypergroups*

Let $G$ be a locally compact group, $K$ a compact subgroup of $G$ and $G//K$ the associated double coset hypergroup. The talk will report on recent spectral synthesis results for the Fourier algebra $A(G//K)$ of $G//K$ and, more generally, the Fourier algebra of so-called ultraspherical hypergroups. Special emphasis is placed on the question of when spectral synthesis holds for $A(G//K)$, i.e. when every closed subset of the spectrum $G//K$ of $A(G//K)$ is a set of synthesis.

This is joint work with Sina Degenfeld-Schonburg and Rupert Lasser, Technical University of Munich

**Rupert Lasser** – Monday, 10:10–10:50
*Strongly invariant means on commutative hypergroups*

Each commutative hypergroup K possesses an invariant mean. For groups many conditions are known, which are equivalent to the existence of an invariant mean. This is not the case for hypergroups. We present several results connecting amenability of K with related properties, e.g. summing sequences, Reiter condition, Følner condition. We give also examples showing that these conditions are not equivalent for hypergroups. Moreover we introduce the notion of strongly invariant means and investigate the relation to a strong Reiter condition. Finally we characterize those polynomial hypergroups having a strongly invariant mean.

**Anthony To-Ming Lau** – Wednesday, 09:20–10:00
*Fixed point and related geometric properties on the Fourier and Fourier-Stieltjes algebras of locally compact groups*

In this talk I shall discuss some recent results concerning various geometric properties including fixed point properties, and Radon-Nikodym property on the Fourier and Fourier-Stieltjes algebras of a locally compact group.

**Jean Ludwig** – Wednesday, 12:20–13:00
*TBA*


**Parasar Mohanty** – Tuesday, 08:30–09:10
*Completely bounded $\Lambda_p$ sets in compact groups*

Sidon sets and $\Lambda_p$-sets has many applications in various topics of mathematics.

In the last decade completely bounded $\Lambda_p$-sets ($\Lambda_p^{cb}$-sets), for compact abelian groups, are studied in the frame work of Pisier's canonical operator space structure on $L^p$. In this talk we will see the existence of non-Sidon $\Lambda_p^{cb}$-sets, $2 < p < \infty$, in the dual of any infinite compact abelian group $G$. Also, we will extend the definition of $\Lambda_p^{cb}$ to non-abelian compact groups and discuss certain properties analogue to the classical settings.

This talk is based on joint work with Kathryn E. Hare.


**Serap Öztop** – Tuesday, 15:30–16:10
*On weighted Orlicz algebras*

Let $G$ be a locally compact group and $\Phi$ be a Young function. We study weighted Orlicz spaces $L^\Phi(G)$, denoted by $L_w^\Phi(G)$, which are weighted $L^p(G)$ spaces for a special Young function $|x|^p$, $1 \leq p < \infty$. We show that weighted Orlicz spaces are Banach algebras with respect to convolution and natural norm under certain conditions on weight. Among other things, the maximal ideal spaces of the algebra $L_w^\Phi(G)$ on an abelian group $G$ is also described.

This talk is based on joint work with A. Osancliol.


**Detlev Poguntke** – Wednesday, 10:10–10:50
*Kirillov theory without polarizations*

In his seminal doctoral dissertation Kirillov constructed a bijection between the unitary dual $\hat{N}$ of a simply connected nilpotent Lie group $N$ and the orbit space $\mathfrak{n}^*/N$ (orbit method). Later, Bernat extended this result to exponential groups $G$.

Traditionally one constructs a map $\mathfrak{g}^*/G \to \hat{G}$ using (Pukanszky) polarizations. It requires some work to see the independence of the chosen polarizations.

Here we construct a family of bijections $\kappa_G : \hat{G} \to \mathfrak{g}^*/G$, $G$ an exponential Lie group, in the opposite direction. This construction depends on the choice of an abelian ideal, which in a way is a milder arbitrariness. But still the independence has to be established.

Furthermore, the family $(\kappa_G)$ is canonical in the sense that it can be (uniquely) characterized in terms of a short list of plausible properties. If one restricts to nilpotent groups one has, with some extra work, an even nicer characterization of this family $(\kappa_N)$.


**Volker Runde** – Thursday, 09:20–10:00
*Left identities for measure algebras with an application to the Connes-amenability of dual Banach algebras*

A few years ago, we claimed that a [SIN]-group $G$ such that $\mathcal{WAP}(G)^*$ has a normal, virtual diagonal must be compact. As it turns out, there is a gap in the proof. We will close this gap and in the process characterize those locally compact, semitopological semigroups $S$ for which the measure algebra $M(S)$ has a left identity.

**Pekka Salmi** – Thursday, 15:30–16:10
*Rough Cayley graphs of compactly generated groups*

What should be the analogue of Cayley graph in the case of compactly generated locally compact groups? This talk tries to answer the question by introducing the notion of rough Cayley graph. Given a compactly generated group, there is a natural construction for a graph – the rough Cayley graph – that encodes the coarse structure of the group. The natural action of a group on its Cayley graph has its analogue in the quasi-action of the compactly generated group on its rough Cayley graph. If the compactly generated group has a cocompact lattice, then the Cayley graph of the lattice is the rough Cayley graph of the ambient group. The general definition encompasses also the recent notion, introduced by Krön and Möller, of rough Cayley graph (also called relative Cayley graph) of a totally disconnected locally compact group. Time permitting, we shall also discuss some applications to growth and amenability.

**Ebrahim Samei** – Tuesday, 16:20–17:00
*$N$-hyperreflexivity of the space of bounded $N$-cocycle from Banach algebras*

The concept of hyperreflexivity has already been defined for subspaces of $B(X,Y)$, where $X$ and $Y$ are Banach spaces. We extend this concept to the subspaces of $B^n(X,Y)$ for any $n \in \mathbb{N}$, taking into account the $n$-linear structure of $B^n(X,Y)$. We call the new concept $n-$hyperreflexivity. If $A$ is a Banach algebra and $X$ a Banach $A$-bimodule, we give sufficient conditions under which $\mathcal{Z}^n(A,X)$, the space of all bounded $n$-cocycles from $A$ into $X$, is $n$-hyperreflexive. To do so, we define two notions related to a Banach algebra: The strong property $(B)$ and bounded local units. The hereditary properties of both notions are studied. We apply our approach and show that the bounded $n$-cocycle spaces related to certain C*-algebras and group algebras are $n$-hyperreflexive.
   This is a joint work with Jafar Soltani Farsani.

**Bert Schreiber** – Friday, 10:10–10:50
*Algebras of multilinear forms on hypergroups*

For locally compact hypergroups $H_i$, $i = 1, 2, \dots, n$, let $CB(H_1, \dots, H_n)$ denote the Banach space of completely bounded multilinear forms on $C_0(H_1) \times \cdots \times C_0(H_n)$, in the completely bounded norm. $CB(H_1, \dots, H_n)$ can be given the structure of a Banach $*$-algebra under a multiplication and adjoint operation which agree with the convolution structure on the measure algebra $M(H_1 \times \cdots \times H_n)$. If the $H_i$ are all abelian, $CB(H_1, \dots, H_n)$ carries a naturally defined Fourier transform as functions on the space of semicharacters which generalizes the Fourier transform on hypergroup measure algebras. The construction of these Banach algebras will be outlined, and various other aspects of $CB(G_1, \dots, G_n)$ will be described as time permits. This is joint work with Rupert Lasser.

**Nico Spronk** – Thursday, 10:10–10:50
*On the algebra of functions generated by pure positive definite functions*

Let $G$ be a locally compact group and $A(G)$ and $B(G)$ denote its Fourier and Fourier-Stieltjes algebras, respectively. In his doctoral thesis (completed at U. Alberta), Y.-H. Cheng considered the subspace $a_0(G)$ in $B(G)$ generated by pure positive definite functions and the smallest closed algebra $a(G)$ in $B(G)$ containing $a_0(G)$. If $G$ is abelian with dual group $\hat{G}$, then $a_0(G) = a(G) \cong \ell^1(\hat{G})$; whereas $A(G) \cong L^1(G)$. Thus we think of $a(G)$ as the dual analogue of $\ell^1(G)$. Chen further demonstrated many cases in which $a_0(G) = a(G)$.
   In joint work, recently published in *Monatsh. Math.*, Chen, B.E. Forrest and I investigated the structure of $a(G)$ for Heisenberg groups $\mathbb{H}_n$, and for $SL_2(\mathbb{R})$. In both cases $a_0(G) \subsetneq a(G)$. For the Heisenberg groups, $a(\mathbb{H}_n)$ contains the Fourier algebra of a special "compactification along the centre" of the group, and is a subalgebra of the spine, $A^*(\mathbb{H}_n)$ (as defined by M. Ilie and the speaker). In both cases I comment on the Banach algebra structure of $a(G)$, namely operator amenability properties.

**Keith Taylor** – Friday, 09:20–10:00
*Images of wavelet transforms*

Any square-integrable representation of a locally compact group $G$ admits an abstract wavelet transform, the image of which is a subspace of the Fourier algebra $A(G)$. We will explore how this image varies as the generating wavelet varies.

**Ivan G. Todorov** – Tuesday, 11:30–12:10
*Operator synthesis: unions and products*

The present talk, based on joint work with G. Eleftherakis, will be centred around the notion of operator synthesis, introduced by W. B. Arveson in 1974. A more general version of the problem about the operator synthesis of the union of two operator synthetic sets will be formulated. Several results in this direction will be discussed and consequences for spectral synthesis in locally compact groups will be given. Fubini products and J. Kraus' property $S_\sigma$ will be related to the problem about the operator synthesis of the product of operator synthetic sets, and a general result about unions of products will be discussed. At the centre of our approach lie idempotent Schur multipliers and intersection formulas for weak* closed spans of spaces of operators.

**Lyudmila Turowska** – Tuesday, 10:10–10:50
*Compact operator synthesis and spectral synthesis in harmonic analysis*

W. Arveson in his fundamental paper (Ann. Math. 1974) discovered an interplay between invariant subspaces and operator algebras theory and spectral synthesis in harmonic analysis. The notion of operator synthesis was proposed. It provided a powerful tool to study different questions in harmonic analysis, operator theory, theory of multipliers and so on. In this talk we will discuss sets that are operator synthetic "modulo compact operators" or "modulo Schatten ideals". Analogs of such sets in harmonic analysis are subsets $E \subset \mathbb{T}$ ($\mathbb{T}$ the circle group) such that any pseudofunction supported in $E$ (any pseudomeasure whose Fourier transform is in $\ell^p$ and supported in $E$ annihilates functions in $A(\mathbb{T})$ vanishing on $E$. We will give different examples of such sets and discuss applications to operator equations.

**Ali Ülger** – Tuesday, 09:20–10:00
*When is the quotient algebra $A/I$ isomorphic to a subalgebra of $A^{**}$?*

Let $A$ be an arbitrary Banach algebra with a bounded approximate identity. We consider $A^{**}$ as a Banach algebra under one of the Arens multiplications. The main result of this talk says that, for any closed left ideal $I$ of $A$ with a bounded right approximate identity, the quotient algebra $A/I$ is isomorphic to a closed subalgebra of the form $Au$ of $A^{**}$ for some idempotent $u$ in $A^{**}$.

This result is a part of a joint work with Prof. A. To-Ming Lau.