## TIMETABLE

<table>
<thead>
<tr>
<th>Mon 08 Sep</th>
<th>Tue 09 Sep</th>
<th>Wed 10 Sep</th>
<th>Thu 11 Sep</th>
<th>Fri 12 Sep</th>
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<tr>
<td><strong>09:00-12:15</strong></td>
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<td><strong>10:00-10:40</strong></td>
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<tr>
<td><strong>Arrival of participants</strong></td>
<td><strong>C1: J. Bastero</strong></td>
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<td><strong>M-C: J.Á. Peláez</strong></td>
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<td><strong>12:15 Welcoming</strong></td>
<td><strong>Pl: G. Garrigós</strong></td>
<td><strong>Pl: K. Grosse-Erdmann</strong></td>
<td><strong>Coffee Break</strong></td>
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<td><strong>12:30-13:10</strong></td>
<td><strong>10:45-11:15</strong></td>
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<td><strong>Coffee Break</strong></td>
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<td><strong>13:30-15:30</strong></td>
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<td><strong>16:00-16:40</strong></td>
<td><strong>Pl: M.C. Reguera</strong></td>
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<td><strong>Leisure Time</strong></td>
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<td><strong>M. Lorente</strong></td>
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<td><strong>M. Raja</strong></td>
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<td><strong>M. D. Acosta</strong></td>
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<td><strong>M. Mastyło</strong></td>
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<td><strong>17:30-18:00</strong></td>
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<td><strong>A. M. Cabrera</strong></td>
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<td><strong>Coffee Break</strong></td>
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<td><strong>Tourist Visit Meeting Point: City Hall</strong></td>
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<td><strong>18:00-18:25</strong></td>
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<td><strong>Gala Dinner</strong></td>
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The Course counts with the following **Scientific Organization** from different universities in Andalucía:

- **Univ. Almería**: El Amin KAIDI LHACHMI, and Juan Carlos NAVARRO PASCUAL.
- **Univ. Cádiz**: Fernando LEÓN SAAVEDRA, and Francisco Javier PÉREZ FERNÁNDEZ.
- **Univ. Granada**: Juan Francisco MENA JURADO, Rafael PAYÁ ALBERT, Ángel RODRÍGUEZ PALACIOS, and María Victoria VELASCO COLLADO.
- **Univ. Huelva**: Cándido PIÑEIRO GÓMEZ, and Ramón J. RODRÍGUEZ ÁLVAREZ.
- **Univ. Jaén**: Miguel MARANO CALZOLARI, José María QUESADA TERUEL, and Francisco ROCA RODRÍGUEZ.
- **Univ. Málaga**: Daniel GIRELA ÁLVAREZ, and Francisco Javier MARTÍN REYES.
- **Univ. Pablo Olavide**: Antonio VILAR NOTARIO.
- **Univ. Sevilla**: Tomás DOMÍNGUEZ BENAVIDES, Antonio FERNÁNDEZ CARRIÓN, Carlos PÉREZ MORENO, and Luis RODRÍGUEZ PIAZZA.

The **local organization** has been coordinated by Francisco Javier MARTÍN REYES (Univ. Málaga), with the aid of Venancio ÁLVAREZ GONZÁLEZ (Univ. Málaga), Daniel GIRELA ÁLVAREZ (Univ Málaga), Cristóbal GONZÁLEZ ENríQUEZ (Univ. Málaga), Antonio JIMÉNEZ MELADO (Univ. Málaga), María LORENTE DOMÍNGUEZ (Univ. Málaga), María Auxiliadora MÁRQUEZ FERNÁNDEZ (Univ. Málaga), Pedro ORTEGA SALVADOR (Univ. Málaga), Consuelo RAMíREZ TORREBLANCA (Univ. Córdoba), and Alberto DE LA TORRE RODRíQUEZ (Univ. Málaga).

The celebration of this Course has been possible thanks to the support given by many organizations and institutions. We express our gratitude to them: Universidad de Málaga - Campus de Excelencia internacional Andalucía Tech, Vicerrectorado de Investigación y Transferencia de la UMA, Departamento de Análisis Matemático de la UMA, Real Sociedad Matemática Española, Unicaja Banco, Ayuntamiento de Antequera, and, finally, PAIDI groups from the Junta de Andalucía through the universities of Almería, Cádiz, Granada, Huelva, Jaén, Málaga, Pablo Olavide, Sevilla.

The place chosen to celebrate the event has been the Hotel “Antequera Golf”. Antequera is a city in the province of Málaga, located almost at the geographical center of Andalucía, full of History and fine Monuments worthy to walk around and enjoy its many charming spots. Besides, it is easily accessible by car or train. September’s weather is usually quite nice in Antequera, although this year it seems that the temperatures are gone a little bit high.

Important dates have been set regarding registration to the VI CIDAMA. Registration was done online, by filling up a registration form at the web page of the Congress, www.uma.es/6cidama2014. The registration fee, before July 20th, 2014 was 150.00 EUR. After that, the fee increased to 200.00 EUR. The registration period ended on September 2nd 2014. The event has then gathered together about 50 participants:

1.- María Dolores ACOSTA VIGIL, dacosta@ugr.es, Universidad de Granada.
2.- Venancio ÁLVAREZ GONZÁLEZ, vag@uma.es, Universidad de Málaga.
3.- David ARIZA RUIZ, dariza@us.es, Universidad de Sevilla.
4.- Jesús BASTERO, bastero@unizar.es, Univ. Zaragoza, España.
5.- José Jorge BUENO CONTRERAS, jjbueno@us.es, Universidad de Sevilla.
6.- Ana María CABRERA SERRANO, anich7@correo.ugr.es, Universidad de Granada.
7.- María Jesús CARRO ROSSELL, carro@ub.edu, Universidad de Barcelona.
8.- Nadia CLAVERO, nadiaclavero@ub.edu, University of Barcelona.
9.- David CRUZ-URIBE, david.cruzuribe@trincoll.edu, Trinity College, Hartford, CT, USA.
10.- Estefanía Dafne DALMASSO, edalmas@cantafe-conicet.gov.ar, U. Nac. del Litoral - IMAL (CONICET-UNL).
11.- Wendolín DAMIÁN, wdamian@us.es, Universidad de Sevilla.
12.- Alberto DE LA TORRE, albertotorre@gmail.com, Universidad de Málaga.
13.- Tomás DOMÍNGUEZ BENAVIDES, tomas@us.es, Universidad de Sevilla.
14.- Luis ESPAÑOL, luis.espanol@unirioja.es, Univ. La Rioja, España.
15.- Antonio FERNÁNDEZ CARRIÓN, afcarrion@etsi.us.es, Universidad de Sevilla.
16.- Pedro FERNÁNDEZ MARTÍNEZ, pedrofdz@us.es, UNIVERSIDAD DE MURCIA.
17.- Víctor GARCíA GARCíA, victor.g2_malaga@hotmail.com, Universidad de Málaga.
Scientific Program

Recall that they are three the main objectives of these International Courses:

1. **Instruct** Andalusian researchers in the field of Mathematical Analysis through lectures, given by international experts, of most of the different, outstanding and up to date trends in the area.

2. **Encourage** the cooperation among the different research groups in Mathematical Analysis in Andalusia.

3. **Spread** in the international scientific community the contents generated by the Courses via appropriate publications.

In consequence, and after rescheduling certain parts of the program due to typical unexpected events, the VI CIDAMA 2014 consists of:

- **3 courses** of 3 hours each.

- **Jesús BASTERO**, Univ. Zaragoza, España  
  *Convex inequalities, isoperimetry and spectral gap*  
  **Scheduled**: Tue09Sep, Wed10Sep, Thu11Sep 9:00-9:55.

- **David CRUZ-URIBE**, Trinity College, Hartford, CT, USA  
  *Two weight norm inequalities for fractional integrals and commutators*  
  **Scheduled**: Tue09Sep, Wed10Sep, Fri12Sep 11:15-12:10.
PASCAL LEFÊVRE, Univ. Artois, Lens, France
Composition operators on Hardy spaces

1 Mini-Course of one hour and a half.

JOSÉ ÁNGEL PELÁEZ, Univ. Málaga, España
Decomposition norm theorem, $L^p$-behavior of reproducing kernels and two weight inequality for Bergman projection
SCHEDULED: THU11SEP, FRI12SEP 10:00-10:40.

6 plenary conferences, to reflect, in the most exhaustive way that can be, the different aspects and trend lines that are being developed now a days in the field of Mathematical Analysis.

LUIS ESPAÑOL, Univ. La Rioja, España
Meanings of “algebra” and “analysis” between two Encyclopedias: from the Enlightenment to the Great War
SCHEDULED: MON08SEP 16:45-17:25 (IN SPANISH).

GUSTAVO GARRIGÓS, Univ. Murcia, España
A weak 2-weight problem for the Poisson-Hermite semigroup
SCHEDULED: TUE09SEP 10:00-10:40.

KARL GROSSE-ERDMANN, Univ. Mons, Belgique
On frequently hypercyclic operators
SCHEDULED: WED10SEP 10:00-10:40.

MIECZYSŁAW MASTYLO, Adam Mickiewicz University, Poland
Multilinear interpolation theorems with applications

MARÍA DEL CARMEN REGUERA, Univ. Birmingham, England
Sarason Conjecture on the Bergman space
SCHEDULED: MON08SEP 16:00-16:40.

JOSÉ LUIS TORREA, Univ. Autónoma Madrid, España
Semigroups, a tool to develop Harmonic Analysis associated to general Laplacians

30 minutes Talks so that the participants that so requested it may share publicly their recent works. The date to communicate the wish to present a Talk expired on July 20th 2014.

MARÍA DOLORES ACOSTA VIGIL, Universidad de Granada
Bishop-Phelps-Bollobás property for operators
SCHEDULED: TUE09SEP(A) 16:30-16:55.

DAVID ARIZA RUIZ, Universidad de Sevilla
On the existence of solutions of differential equations using the coincidence theorems
SCHEDULED: TUE09SEP(A) 18:30-18:55 (IN SPANISH).

ANA MARÍA CABRERA SERRANO, Universidad de Granada
On extreme operators whose adjoints preserve extreme points
SCHEDULED: TUE09SEP(B) 17:00-17:20 (IN SPANISH).

NADIA CLAVERO, University of Barcelona
Sobolev type embeddings into mixed norm spaces
SCHEDULED: TUE09SEP(A) 16:30-16:55.

ESTEFANIA DAFNE DALMASSO, Universidad Nacional del Litoral - IMAL (CONICET-UNL)
Generalized maximal functions and the control of related operators on weighted Musielak-Orlicz spaces.
SCHEDULED: TUE09SEP(A) 17:00-17:25.

WENDOLÍN DAMIÁN, Universidad de Sevilla
Compact bilinear commutators: the weighted case
SCHEDULED: TUE09SEP(A) 18:00-18:25.

PEDRO FERNÁNDEZ MARTÍNEZ, UNIVERSIDAD DE MURCIA
Interpolation of the couple $(L \log L, L_{exp})$ and other examples
SCHEDULED: TUE09SEP(B) 18:00-18:25.

MARÍA DEL CARMEN LISTÁN GARCÍA, Universidad de Cádiz
Rough convergence and Chebyshev centers in Banach spaces
SCHEDULED: TUE09SEP(A) 19:00-19:20 (IN SPANISH).

MARÍA LORENTE DOMÍNGUEZ, Universidad de Málaga
Weighted inequalities for one-sided operators
SCHEDULED: TUE09SEP(A) 16:00-16:25 (IN SPANISH).
The topic is composition operators on Hardy spaces

PASCAL LEFÈVRE, pascal.levre@univ-artois.fr,
Univ. Artois, Lens, France
3 hours course: Tue09Sep Wed10Sep 12:15-13:10, Thu11Sep 11:15-12:10.

Abstract: The topic is composition operators \( f \mapsto f \circ \varphi \), where the symbol \( \varphi : \mathbb{D} \to \mathbb{D} \) is holomorphic. We shall give a (non-exhaustive) overview of -more or less recent- results when these operators are viewed on the classical Hardy spaces \( H^p \). The story involves some classical tools of complex analysis, as Nevanlinna counting function and Carleson measures. We will illustrate this presentation with miscellaneous examples and questions. Concerning the most recent results, we shall pay attention to their possible membership to the class of absolutely summing operators.
Abstract of the Mini-Course

Decomposition norm theorem, \( L^p \)-behavior of reproducing kernels and two weight inequality for Bergman projection

José Ángel Peláez, japelaez@um.es, 
Univ. Málaga, España

Abstract: Let \( D \) be the complex unit disc and let \( A^p_\omega \) denote the Bergman space in the unit disc induced by a radial weight \( \omega \) with the doubling property \( \sup_{0<\tau<1} \int_{D} \frac{1}{\tau^2} \omega(s) ds < \infty \). To begin with, we shall present a decomposition norm theorem for \( A^p_\omega \). This result will be used to obtain a description of the \( L^p \)-means and the \( L^p \)-behavior of \( B^p_\xi \), the reproducing kernels of \( A^p_\omega \).

Later, we shall consider the Bergman projection from \( L^2_\omega \) to \( A^p_\omega \),

\[ P_\omega(f)(z) = \int_{D} f(\zeta) B^p_\xi(z) \omega(\zeta) dA(\zeta), \]

and study the two weight problem

\[ \| P_\omega(f) \|_{L^p} \lesssim \| f \|_{L^p}, \quad f \in L^p_v. \]

Joint works with O. Constantin and J. Rättyä.


Abstracts of the 6 Plenary Conferences

Meanings of "algebra" and "analysis" between two Encyclopedias: from the Enlightenment to the Great War

Luis Español, luis.espanol@unirioja.es, 
Univ. La Rioja, España

Abstract: The meanings given to the terms "algebra" and "analysis", separately or jointly in expressions like "algebraic analysis" have changed over time, even simultaneously have been used with significant differentiating shades.

My presentation will focus on this issue during the period between the publication from 1751 of French Enlightenment’s encyclopedia, L’Encyclopédie ou Dictionnaire raisonné des sciences, des arts et des métiers, and the first phase of the publication from 1899, of the German mathematician encyclopedia, Enzyklopädie der Mathematischen Wissenschaften mit Einschluss ihrer Anwendungen, driven by F. Klein. The latter was translated into French with slight additions, under the direction of J. Molk, from 1904 until the Great War interrupted the process in 1915, when the period covered in my presentation ends.

Along the same, I will discuss some use cases of "algebra" and "analysis" with different meanings, and the different use of "algebraic analysis" in research and teaching.

A weak 2-weight problem for the Poisson-Hermite semigroup

Gustavo Garrigos, gustavo.garrigos@um.es, 
Univ. Murcia, España

Abstract: Consider the Poisson equation \( u_\Delta = u \) in \( \mathbb{R}^{d+1} \), with \( \Delta = -\Delta + |x|^2 \) the Hermite operator. We look for very general conditions on the initial datum \( f \), so that \( u(t,x) = e^{-t\Delta} f(x) \) converges a.e. to \( f(x) \).

When \( w(x) \) is a weight in \( A_p \), this is classically obtained from the \( L^p(w) \) boundedness of the associated maximal operators

\[ M f(x) = \sup_{t>0} \| u(t,x) \|, \]

However, such convergence also holds with less restrictive conditions, such as boundedness from \( L^p(w) \) to \( L^p(v) \), for some other weight \( v(x) \), of a local maximal operator \( M_a f = \sup_{0<t<a} \| u(t,x) \| \) for some \( a > 0 \). This produces a larger class of weights than classical \( A_p \) theory.

In this work we solve this version of the 2-weight problem, and as a consequence characterize the weights \( w(x) \) for which \( u(t,x) \rightarrow f(x) \) a.e. for all \( f \in L^p(w) \).

The proof requires sharp estimates on the decay of Hermite-Poisson kernels, together with classical factorization techniques of Rubio de Francia. Similar results are also valid in the Ornstein-Uhlenbeck setting. This is part of the joint work with Hartzstein, Signes, Torrea, Viviani.
On frequently hypercyclic operators
KARL GROSSE-ERDMANN, kg.grosse-erdmann@umons.ac.be,
Univ. Mons, Belgique

Abstract: An operator $T$ on a Fréchet space $X$ is called frequently hypercyclic if there is a vector $x \in X$ (also called frequently hypercyclic) such that, for any non-empty open set $U \subset X$, the set $\{n \geq 0 : T^n x \in U\}$ has positive lower density. We will discuss recent work on such operators. In particular, in joint work with A. Bonilla, we give a sufficient condition for the existence of a frequently hypercyclic subspace, that is, a closed infinite-dimensional subspace in which every non-zero vector is frequently hypercyclic. And Q. Menet has recently exhibited frequently hypercyclic operators that have a hypercyclic subspace but no frequently hypercyclic subspace.

Multilinear interpolation theorems with applications
MIECZYSŁAW MASTYŁO, mastylo@amu.edu.pl,
Adam Mickiewicz University, Poland

Abstract: We will discuss some recent results on abstract interpolation of linear as well as multilinear operators. In particular, we will present joint results with Loukas Grafakos on an abstract multilinear version of Stein's theorem for analytic families of multilinear operators defined on products of quasi-Banach spaces. We will show applications to the bilinear Hilbert transform and to the bilinear Bochner-Riesz operator.

Sarason Conjecture on the Bergman space
MARÍA DEL CARMEN REGUERA, m.reguera@bham.ac.uk,
Univ. Birmingham, England

Abstract: In the early 90's, D. Sarason posed conjectures on the characterization of the boundedness of Toeplitz products on Hardy and Bergman spaces [3]. The Hardy space case attracted much attention because of its close relation to the famous two-weight problem for the Hilbert transform in Real Analysis, pointed out by Cruz-Uribe in [1]. Unfortunately, the Sarason conjecture for Toeplitz products on Hardy space was shown to be false by F. Nazarov [2] around 2000.

In this talk we will show that Sarason conjecture is also false in the Bergman space. Some aspects of the Bergman space setting are easier, because cancellation plays much less of a role in this setting, unfortunately the opposite happens when we look for a counterexample. We will also provide a characterization of the boundedness of Toeplitz products in the Bergman space in terms of testing conditions. This is a joint work with A. Aleman and S. Pott from Lund University.


Semigroups, a tool to develop Harmonic Analysis associated to general Laplacians
JOSÉ LUIS TORREA, joseluis.torrea@uam.es,
Univ. Autónoma Madrid, España

Abstract: We shall discuss how to use semigroup theory in order to define the classical operators (Riesz transforms, square functions, Riesz potentials, ...) associated to a general Laplacian. Several examples will be given. We shall focus in the special case of the discrete Laplacian in the integers. In the talk, we shall follow the path sketched by E. Stein in his celebrated monograph (cf. [1]). (See also [2]).

Abstracts of the Short Talks

**Bishop-Phelps-Bollobás property for operators**

**MARÍA DOLORES ACOSTA VIGIL, dacosta@ugr.es, Universidad de Granada**

**Abstract:** Bishop-Phelps Theorem states the denseness of the subset of norm attaining functionals in the (topological) dual of a Banach space. Bollobás proved a quantitative version of this result, which has been useful for numerical ranges of operators. Roughly speaking, Bollobás proved that each pair of elements $(x_0, x_0')$ in $S_X 	imes S_{X'}$ such that $x_0' (x_0) = 1$ can be approximated by $(x, x')$ in $S_X 	imes S_{X'}$ satisfying $x'(x) = 1$. Recently the study of extensions of this result for operators was initiated. Since then some papers providing results for classical Banach spaces appeared. We will present recent results valid in case that the domain space of the operators is $C_0(L)$.

**On the existence of solutions of differential equations using the coincidence theorems**

**DAVID ARIZA RUIZ, dariza@us.es, Universidad de Sevilla**

**Abstract:** In this talk we will study the existence of a coincidence point for two mappings defined on a nonempty set and taking values on a Banach space using the fixed point theory for nonexpansive mappings. Using this type of results, we will obtain the existence of solutions for some classes of differential equations.

**On extreme operators whose adjoints preserve extreme points**

**ANA MARÍA CABRERA SERRANO, and e7@correo.ugr.es, Universidad de Granada**

**Abstract:** We say that a Banach space $X$ is nice whenever any extreme operator $T$ from a Banach space $Y$ to $X$ is a nice operator, that is, $T^*$, the adjoint of $T$, preserves extreme points. We get several necessary conditions for being nice. The main result is the characterization of nice finite-dimensional Banach spaces.

**Sobolev type embeddings into mixed norm spaces**

**NADIA CLAVERO, nadiaclavero@ub.edu, University of Barcelona**

**Abstract:** The Sobolev space $W^1 L^p(I^n), 1 \leq p \leq \infty$, consists of all functions in $L^p(I^n)$ whose first-order distributional derivatives also belong to $L^p(I^n)$. The classical Sobolev embedding theorem claims:

$$W^1 L^p(I^n) \hookrightarrow L^{pn/(n-p)}(I^n), \quad 1 \leq p < n.$$  

Sobolev proved this embedding for $p > 1$, but his method, based on integral representations, did not work when $p = 1$. That case was settled affirmatively by Gagliardo and Nirenberg, who first observed:

$$W^1 L^1(I^n) \hookrightarrow \mathcal{R}(L^1, L^\infty),$$  

where $\mathcal{R}(L^1, L^\infty)$ is a mixed norm space, and then, using an iterated form of Hölder’s inequality, completed the proof. Our main goal in this work is to study the embedding (1) for more general rearrangement invariant (r.i.) spaces. In particular we concentrate on seeking the optimal domains and the optimal ranges for these embeddings between r.i. spaces and mixed norm spaces. As a consequence, we prove that the classical estimate for the standard Sobolev space $W^1 L^p$ by Poornima and Peetre (1 $\leq p < n$), and by Hansson, Brézis, Wainger and Maz’ya ($p = n$) can be improved considering mixed norms as targets spaces.

This work is part of my PhD thesis, supervised by Javier Soria (University of Barcelona).

**Generalized maximal functions and the control of related operators on weighted Musielak-Orlicz spaces.**

**ESTEFANÍA DAFNE DALMASSO, edalmasso@santafe-conicet.gov.ar, Universidad Nacional del Litoral - IMAL (CONICET-UNL)**

**Abstract:** We characterize the class of weights related to the boundedness of maximal operators associated to Young functions of $L\log L$ type in the context of variable Lebesgue spaces and we give sufficient conditions for more general Young functions. Fractional versions of these results are also obtained by means of a weighted Hedberg type inequality in the variable context. These results are new even in the classical Lebesgue spaces. We also deal with Wiener’s type inequalities for the mentioned operators in the spirit of the corresponding result proved in [1] for the Hardy-Littlewood maximal operator. As applications of the strong type results for the maximal operators, we derive weighted boundedness properties for a large class of operators controlled by them, such as singular and fractional integrals with kernels satisfying certain Hörmander type condition and their commutators.

Compact bilinear commutators: the weighted case
Wendolín Damián, wdamian@us.es, Universidad de Sevilla

Abstract: In this talk we present the study of the compactness of commutators of bilinear Calderón-Zygmund operators and their iterates with CMO symbols determining the suitable classes of multiple weights in which this property holds. Joint work with A. Bényi, K. Moen and R.H. Torres.

Interpolation of the couple \((L \log L, L_{\exp})\) and other examples
Pedro Fernández Martínez, pedrofdz@um.es, Universidad de Murcia

Abstract: We will illustrate through examples the use of the reiteration theorems obtained in the joint papers with T. Signes [1], [2] and [3]. These results are proved for interpolation methods defined by means of slowly varying functions and symmetric spaces. We will derive interpolation formulas for the couple \((L \log L, L_{\exp})\) and other examples.


Rough convergence and Chebyshev centers in Banach spaces
María del Carmen Listán García, mariadelcarmen.listan@uca.es, Universidad de Cádiz

Abstract: By means of rough convergence, we study two geometric properties in Banach spaces and relate them to Chebyshev centers and some well-known classical properties, such as Kalton’s M property or Garkavi’s uniform rotundity in every direction.

Weighted inequalities for one-sided operators
María Lorente Domínguez, m.lorente@uma.es, Universidad de Málaga

Abstract: We present some examples of one-sided operators and focus our attention on the problem of characterizing the weak and strong type inequalities with weights for the one-sided Hardy-Littlewood maximal operator, in \(\mathbb{R}\) and \(\mathbb{R}^n\). In order to approach this problem we study several one-sided dyadic maximal operators.

The optimal modulus of convexity of a super-reflexive Banach space
Matías Raja, matias@um.es, Universidad de Murcia

Abstract: A super-reflexive Banach space admits many uniformly convex equivalent norms. We prove that the set of all the moduli of convexity of this set of norms admits a supremum, in a quite natural function ordering. The classical result of Pisier about the uniformly convex renorming with modulus of power type follows easily from the properties of such a supremum.

Ultrasymmetric sequence spaces
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Abstract: In this talk we study ultrasymmetric sequence spaces in the case in which the fundamental function belongs to a limit class of concave functions. In the process we present a simple analytical description of these spaces and we establish new \(J-K\) identities as well as a reiteration theorem for limit interpolation methods.

We also study ultrasymmetric approximation spaces and we give some applications to limit Lorentz-Zygmund operator ideals.

This is a joint work with Pedro Fernández-Martínez (Universidad de Murcia).