EARCO 2026

XXIII Encuentros de Análisis Real y Complejo

DEL 28 AL 30 DE MAYO 2026
Centro de la Cultura del Rioja (CCR)
C/ Mercaderes, 9. Logroño

Más información e inscripciones :
https://earco.unirioja.es

Imagen: Centro de Cultura del Rioja (CCR). Logroño

UNIVERSIDAD DE LA RIOJA

Logroño

Fundación San Millán de la Cogolla

XXIII Encuentros de Análisis Real y Complejo
Logroño, 28–30 de mayo de 2026

POINTWISE CONVERGENCE OF SCHRÖDINGER SOLUTIONS ALONG HIGHLY TANGENTIAL CURVES

JAVIER MINGUILLÓN, FERNANDO SORIA, AND ANA VARGAS

Abstract. Since the foundational work of Carleson in 1980, the problem of pointwise convergence of solutions to the Schrödinger equation to the initial datum has been a central topic in harmonic analysis. A natural generalization is to study this convergence as the initial point is approached not vertically in time, but along a prescribed curve $\gamma(t)$ with $t \to 0$. That is, we seek conditions on f such that

$$\lim_{t\to 0} e^{it\Delta} f(x+\gamma(t)) = f(x) \quad \text{a.e. } x \in \mathbb{R}^n.$$

Previous works by Cho, Lee, Vargas, and later by Cao, and Miao established sharp results for Hölder curves with index $\alpha \geq 1/2$. In this talk, we will discuss the more delicate regime $\alpha < 1/2$, where the curves become highly tangential. For the model family $\gamma(t) = (t^{\alpha_1}, \dots, t^{\alpha_n})$ with $\alpha = \min_j \alpha_j < 1/2$, we will show that the critical Sobolev regularity for almost everywhere convergence is

$$s = \max\left\{\frac{1-2\alpha}{2}, \frac{n}{2(n+1)}\right\}.$$

The proof relies on a decomposition of the maximal function, a refined L^2 estimate for the Schrödinger operator by Du and Zhang, and a density argument to control the contribution of the supremum along the curve for large times.

References

[1] Z. Cao and C. Miao, *Sharp pointwise convergence on the Schrödinger operator along one class of curves*, Bull. Sci. Math. **184** (2023), 103254.
[2] C. Cho, S. Lee, and A. Vargas, *Problems on pointwise convergence of solutions to the Schrödinger equation*, J. Fourier Anal. Appl. **18** (2012), no. 5, 972–994.
[3] X. Du and R. Zhang, *Sharp L^2 estimates of the Schrödinger maximal function in higher dimensions*, Ann. of Math. (2) **189** (2019), no. 3, 837–861.

Universidad Autónoma de Madrid
E-mail address: javier.minguillon@uam.es

Universidad Autónoma de Madrid
E-mail address: fernando.soria@uam.es

Universidad Autónoma de Madrid
E-mail address: ana.vargas@uam.es

XXIII Encuentros de Análisis Real y Complejo
Logroño, 28–30 de mayo de 2026

SELF-IMPROVING PROPERTIES OF POINCARÉ-TYPE INEQUALITIES

ALEJANDRO CLAROS

Abstract. In this talk, we will discuss recent results on self-improving properties of generalized Poincaré inequalities. More precisely, we consider a generalized Poincaré inequality of the form

$$\frac{1}{|Q|}\int_Q |f(x)-f_Q|\,dx \le a(Q),$$

for every cube Q, where f_Q is the average of f over Q and a is a functional defined on cubes. The main idea is that a summability condition for the functional a over families of pairwise disjoint subcubes, namely the $SD_p^s(w)$ condition, allows one to upgrade this estimate to stronger Poincaré–Sobolev type inequalities. We will present some new self-improving results in this direction and discuss several consequences, including applications to classical and fractional Poincaré–Sobolev inequalities with Lorentz norms on the left-hand side.

This is part of a joint work with Carlos Pérez and Linfei Zheng.

E-mail address: aclaros@bcamath.org

XXIII Encuentros de Análisis Real y Complejo
Logroño, 28–30 de mayo de 2026

DIFFUSION ON GRAPHS WITH OBSTACLES: LOCAL, FRACTIONAL AND d-PATH LAPLACIANS

JAIME ARTO AND ERNESTO ESTRADA

Abstract. In this talk, we study the effect of obstacles on diffusion processes on finite path graphs from a linear algebraic perspective. An obstacle can be modeled as a weighted self-loop on the graph [2, section 4.3], and diffusion is governed by local and nonlocal Laplacian operators.

We analyze the spectral perturbation induced by the obstacle for the standard path Laplacian and prove that, as the weight of the self-loop increases, the diffusive particle becomes effectively confined to a subregion of the graph.

Surprisingly, we show that the same trapping phenomenon occurs for a broad class of nonlocal operators given by matrix functions, including fractional powers of the Laplacian [3]. Although these operators are non-local, they inherit structural properties that prevent them from overcoming arbitrarialy strong obstacles.

In constrast, we prove that transformed d-path Laplacians [1] (particularly the Mellin transformed d-path Laplacian) overcome obstacles of arbitrary weight. This distinction is explained through spectral decomposition and block diagonalization techniques. This results establish a sharp structural difference between matrix functions and transformed d-path Laplacians and provide a general framework for modeling nonlocal diffusion on graphs with barriers.

References

[1] E. Estrada, E. Hameed, N. Hatano and M. Langer. Path Laplacian operators and superdiffusive processes on graphs. I. One-dimensional case. *Linear Algebra Appl.*, 523: 307–334 (2017),

[2] E. Estrada. Path Laplacians versus fractional Laplacians as nonlocal operators on networks. *New. J. Phys.*, 23: 073049 (2021),

[3] A. P. Riascos, T. M. Michelitsch, A. B. Collet, A. F. Nowakowski and F. C. G. A. Nicolleau. Random walks with long-range steps generated by functions of Laplacian matrices. *J. Stat. Mech.*, 043404 (2018).

Departamento de Matemáticas, Universidad de Zaragoza
E-mail address: jarto@unizar.es

IFISC (UIB-CSIC)
E-mail address: estrada@ifisc.uib-csic.es

XXIII Encuentros de Análisis Real y Complejo
Logroño, 28–30 de mayo de 2026

MAXIMAL THEOREMS FOR WEIGHTED ANALYTIC TENT SPACES

JOSÉ ÁNGEL PELÁEZ

Abstract. Let $\mathcal{H}(\mathbb{D})$ denote the space of analytic functions on the unit disc $\mathbb{D}$ of the complex plane, and for $\xi \in \partial\mathbb{D}$ let us consider the non-tangential region

$$\Gamma(\xi) = \{z \in \mathbb{D} : |\arg z - \arg \xi| < (|\xi| - |z|)\}.$$

The Calderón's area formula for Hardy spaces

$$\|f\|_{H^p}^p \asymp \int_{\partial\mathbb{D}} \left(\int_{\Gamma(\xi)} |f'(z)|^2 \, dA(z) \right)^{\frac{p}{2}} |d\xi|, \quad 0 < p < \infty,$$

together with the seminal results by Coifman, Meyer and Stein [3] constitute two of the main cornerstones that have driven the development of the theory of classical (and analytic) tent spaces over the last decades [1, 4, 5]. However, it seems that very little is known about the theory of weighted tent spaces $T_p^q(\omega)$, $0 < p, q < \infty$, of those f for which

$$\|f\|_{T_p^q(\omega)}^q = \frac{1}{2\pi} \int_{\partial\mathbb{D}} \left(\int_{\Gamma(\xi)} |f(z)|^p \omega(z) \frac{dA(z)}{1-|z|} \right)^{\frac{q}{p}} |d\xi| < \infty$$

and the corresponding analytic tent spaces $AT_p^q(\omega) = T_p^q(\omega) \cap \mathcal{H}(\mathbb{D})$.

In this talk, we present several basic results, including the density of polynomials on $AT_p^q(\omega)$, when ω is radial weight. In order to obtain them, we previously prove that the non-tangential maximal operator

$$f \mapsto N(f)(\xi) = \sup_{z \in \Gamma(\xi)} |f(z)|, \quad \xi \in \mathbb{D},$$

is bounded fro $AT_p^q(\omega)$ to $T_p^q(\omega)$.

If time permits, we will also discuss further applications of this maximal theorem to the theory of Littlewood−Paley inequalities on $AT_p^q(\omega)$.

These results are part of a joint work together with T. Aguilar-Hernández, A. Mas and J. Rättyä [2].

References

[1] T. Aguilar-Hernández, M. D. Contreras and Luis Rodríguez-Piazza, Average radial integrability spaces of analytic functions, J. Funct. Anal. 282 (2022), no. 1, Paper No. 109262, 34 pp.

[2] T. Aguilar-Hernández, A. Mas and J. Rättyä, Maximal theorems for weighted analytic tent and mixed norm spaces, preprint (submitted), https://arxiv.org/abs/2407.08387

[3] R. R. Coifman, Y. Meyer and E. M. Stein, Some new functions spaces and their applications to Harmonic Analysis, J. Funct. Anal. 62 (1985), no. 3, 304–335.

[4] W. S. Cohn and I. E. Verbitsky, Factorization of tent spaces and Hankel operators, J. Funct. Anal. 175 (2000), no. 2, 308–329.

[5] J. Ortega and J. Fábrega, Holomorphic Triebel-Lizorkin spaces, J. Funct. Anal. 151 (1997), no. 1, 177–212.

E-mail address: japelaez@uma.es

XXIII Encuentros de Análisis Real y Complejo
Logroño, 28–30 de mayo de 2026

MULTIPLIERS AND CYCLIC SINGULAR INNER FUNCTIONS FOR COEFFICIENT SPACES

ALBERTO DAYAN

Abstract. The seminal work of Beurling says that no singular inner function can be cyclic for the Hardy space on the unit disc. On the other hand, Korenblum showed that some singular inner functions are cyclic in Bergman-type spaces.

In this talk, we show the existence of singular inner functions that are cyclic in Besov-type spaces. As a corollary, we will see how such singular inner functions are cyclic also for the space of those analytic functions with p-summable Taylor coefficient, for $p > 2$. Our condition relies only on the second modulus of continuity of the underlying singular measure, and hence is far more treatable than the one provided by Anderson, Fernández and Shields in the setting of the small Bloch space. Time permitting, we will also discuss whether such cyclic singular inner function are multipliers of the Besov and the coefficient spaces that we consider.

This talk is based on a joint work with Daniel Seco.

E-mail address: alberto.dayan@uab.cat

XXIII Encuentros de Análisis Real y Complejo
Logroño, 28–30 de mayo de 2026

LIPSCHITZ FREE BOUNDARIES IN ALT-CAFFARELLI TYPE PROBLEMS

JOAN DOMINGO-PASARIN AND XAVIER ROS-OTON

Abstract. In this talk we study weak solutions of the generalised Alt-Caffarelli problem $-\Delta u = f$ in Ω, $u = 0$ on $\partial\Omega$, $\partial_\nu u = Q$ on $\partial\Omega$. We show that if Ω is a bounded Lipschitz domain, then it is actually C^∞ (provided that f and Q are smooth). We also apply this result to obtain an alternative prove of Serrin's problem for Lipschitz domains, and in the context of characterising the regularity of Lipschitz domains in terms of their Poisson kernel.

References

[1] J. Domingo-Pasarin, X. Ros-Oton, *Regularity of Lipschitz free boundaries for weak solutions of Alt-Caffarelli type problems*, preprint arXiv (2026).

E-mail address: jdomingopasarin@ub.edu

E-mail address: xros@icrea.cat

XXIII Encuentros de Análisis Real y Complejo
Logroño, 28–30 de mayo de 2026

MATRIX WEIGHTED L^p ESTIMATES FOR HAAR SHIFTS WITH NON-DOUBLING MEASURES

FERNANDO BENITO F. DE LA CIGOÑA

ABSTRACT. The measures μ in $\mathbb{R}^n$ for which Haar shift operators are bounded in $L^p(\mu)$ were characterized by López-Sánchez, Martell and Parcet and later termed balanced. In that setting, when both the source and the target space are one-dimensional, a sparse domination was developed by Conde-Alonso, Pipher and Wagner that yields weighted estimates dependent on the complexity of the shift. In this talk we will discuss how to extend that domination to arbitrary dimension on both the source and the target space using the convex body domination framework of Nazarov, Petermichl, Treil and Volberg. Furthermore, we will see how a generalization of the Carleson embedding theorem allows us to get matrix-weighted L^p-estimates for $1 < p < \infty$.

This is joint work with Tainara Borges, Francesco D'Emilio, Marcus Pasquariello and Nathan A. Wagner.

E-mail address: fbf_delacigona@brown.edu

XXIII Encuentros de Análisis Real y Complejo
Logroño, 28–30 de mayo de 2026

EXTENSION THEOREMS FOR LOGARITHMIC SCHRÖDINGER AND DISCRETE LAPLACIAN OPERATORS

MARTA DE LEÓN CONTRERAS

Abstract. The celebrated Caffarelli-Silvestre extension theorem in [2] opened numerous new lines of research, one of which focused on identifying which operators admit a representation through an extension problem. In this direction, many authors have considered a variety of differential operators in different settings that can be obtained from an extension problem. Very recently, Chen, Hauer and Weth [3] have proved and extension problem associated with the logarithmic Laplacian, $\log(-\Delta)$, on $\mathbb{R}^d$. This logarithmic Laplacian operator was previously studied in [4], where a pointwise representation was obtained.

In this talk we consider logarithmic operators in two different contexts: the adapted to (continuous) Schrödinger operators, $\mathcal{L}_V = -\Delta + V$ on $\mathbb{R}^d$ where $V \geq 0$ and satisfies a reverse Hölder inequality, and the classical discrete setting, that is, the one adapted to the discrete Laplacian on $\mathbb{Z}$, $(\Delta_d f)(n) = f(n+1) - 2f(n) + f(n-1)$, $n \in \mathbb{Z}$. Both logarithmic operators $\log \mathcal{L}_V$ and $\log(-\Delta_d)$ are of nonlocal nature and we will define them through suitable extension problems. Although our extension problems are inspired by the one developed by Caffarelli and Silvestre for the fractional Laplacian, the logarithmic operators appear as the boundary values of the solution to the extension problem in a more involved way.

The content of this talk is based on a joint work with J.J. Betancor and L. Rodríguez-Mesa, [1].

References

[1] Betancor, J.J., De León-Contreras, M., and Rodríguez-Mesa, L. Extension theorems for logarithmic Schrödinger and discrete Laplacian operators. Preprint 2026.

[2] Caffarelli, L., and Silvestre, L. An extension problem related to the fractional Laplacian. *Comm. Partial Differential Equations 32*, 7-9 (2007), 1245–1260.

[3] Chen, H., Hauer, H., and Weth, T. An extension problem for the logarithm Laplacian. Preprint 2023 http://arxiv.org/abs/2312.15689(arXiv:2312.15689).

[4] Chen, H., and Weth, T. The Dirichlet problem for the logarithmic Laplacian. *Comm. Partial Differential Equations 44*, 11 (2019), 1100–1139.

E-mail address: mleoncon@ull.edu.es

XXIII Encuentros de Análisis Real y Complejo
Logronño, 28–30 de mayo de 2026

λ-FORMAN-RICCI CURVATURE ON GRAPHS

ROSALIO REYES GUILLERMO

Abstract. In the context of graphs, several discrete versions of Ricci curvature have been proposed since the geometrical properties of a network are used to understand important information associated with it. In this work we study the properties of the λ-Forman-Ricci curvature, a concept that generalizes and integrates the Forman-Ricci curvature and the augmented Forman-Ricci curvature. We show that this definition captures the essence of Ricci curvature in Riemannian manifolds, by proving discrete analogues of important results in geometry. We also obtain optimal bounds of this curvature in terms of some main graph parameters, as the size and the isoperimetric constant.

E-mail address: rreyes@math.uc3m.es

XXIII Encuentros de Análisis Real y Complejo
Logroño, 28–30 de mayo de 2026

OPERATORS IN $\mathcal{L}(c_0, Y)$ AND THE BPBp: THE LONG ROAD TOWARDS THE (c_0, ℓ_1) CASE

JOSÉ LUIS DÁVILA

Abstract. A problem in the geometry of Banach spaces consists in determining the abundance of norm-attaining operators. This line of research originates from the celebrated Bishop-Phelps theorem [2], which guarantees the density of norm-attaining functionals in the dual space. Subsequently, B. Bollobás [3] obtained a quantitative extension of this result, allowing for the simultaneous approximation of the functional and the vector where it nearly attains its norm.
Inspired by these ideas, Acosta, Aron, García, and Maestre introduced in 2008 [1] the Bishop-Phelps-Bollobás property (BPBp) for operators. Since its formulation, this property has generated intense activity, confirming its validity for a wide range of pairs of spaces. However, the situation becomes remarkably complex when the domain of the operator is the sequence space c_0.

In this seminar, we will explore the evolution of the BPBp by focusing on operators defined on c_0. We will analyze the current state of the open problem regarding the validity of this property for the pair (c_0, ℓ_1) in the real case, reviewing the partial results obtained to date and the intrinsic geometric difficulties — such as the absence of extreme points in the unit ball of c_0 — that currently prevent the resolution of this chapter in functional analysis.

References

[1] M.D. Acosta, R.M. Aron, D. García and M. Maestre, *The Bishop-Phelps-Bollobás theorem for operators*, J. Funct. Anal. **254** (2008), 2780–2799.
[2] E. Bishop and R.R. Phelps, *A proof that every Banach space is subreflexive*, Bull. Amer. Math. Soc. **67** (1961), 97–98.
[3] B. Bollobás, *An extension to the theorem of Bishop and Phelps*, Bull. Lond. Math. Soc. **2** (1970), 181–182.

E-mail address: jdavila@unizar.es

XXIII Encuentros de Análisis Real y Complejo
Logroño, 28–30 de mayo de 2026

A FRACTAL LOCAL SMOOTHING CONJECTURE FOR THE WAVE EQUATION

DAVID BELTRAN

Abstract. The local smoothing phenomenon for the wave equation consists in obtaining a regularity gain over the known fixed-time L^p estimates for the half-wave propagator if one takes an L^p-integration in time over the interval $[1, 2]$. This phenomenon was first observed by Sogge, who conjectured the sharp regularity gain depending on the Lebesgue exponent. Obtaining the conjectured bounds has become a central problem in Harmonic Analysis. It continues open in dimensions 3 and higher, but there has been lots of partial progress in recent years. In this talk we present a fractal version of that conjecture, in which the integration is now taken over an arbitrary subset E of $[1, 2]$. This new family of conjectured inequalities "interpolates" between the fixed-time estimates and the standard local smoothing estimates. The conjectured regularity gain for each Lebesgue exponent depends on a quantity involving the Assouad spectrum of E and the Legendre transform. We provide positive evidence for this conjecture, verifying it for radial functions and any Lebesgue exponent, and for arbitrary functions in the off-diagonal Strichartz regime.

This is joint work with Joris Roos, Alex Rutar and Andreas Seeger.

E-mail address: david.beltran@uv.es

XXIII Encuentros de Análisis Real y Complejo
Logronño, 28–30 de mayo de 2026

FROM THE QUASI-GEOSTROPHIC SHALLOW-WATER MODEL TO THE 2D EULER EQUATIONS: TWO CONVERGENCE RESULTS

MARC MAGAÑA CENTELLES

Abstract. The quasi-geostrophic shallow-water (QGSW) equations,

$$\partial_t \omega_\lambda + u_\lambda \cdot \nabla \omega_\lambda = 0, \qquad u_\lambda = \nabla^\perp (\lambda - \Delta)^{-1} \omega_\lambda,$$

describe large-scale atmospheric and oceanic circulations. Formally, as the inverse Rossby radius $\lambda^{1/2}$ tends to zero, the operator $(\lambda - \Delta)^{-1}$ reverts to $(-\Delta)^{-1}$ and the QGSW model reduces to the vorticity formulation of the 2D Euler equations,

$$\partial_t \Omega + v \cdot \nabla \Omega = 0, \qquad v = \nabla^\perp (-\Delta)^{-1} \Omega.$$

This talk presents two complementary results that rigorously justify this singular limit.

First, joint work with Joan Mateu and Joan Orobitg, for initial data in the little Hölder space c^γ_c, we prove that solutions of QGSW converge to the corresponding Euler solution in the C^γ norm, uniformly on finite time intervals. The proof relies on a careful analysis of the associated flow maps and their continuity with respect to the parameter λ.

Second, joint work with Haroune Houamed, for the more general Yudovich class ($L^1 \cap L^\infty$), we establish strong convergence of vorticities in L^p for any finite p. This is achieved through the Extrapolation Compactness method. The endpoint case $p = \infty$ is also discussed.

E-mail address: marc.magana@uab.cat

XXIII Encuentros de Análisis Real y Complejo
Logroño, 28–30 de mayo de 2026

SOME RESULTS ON VECTOR-VALUED FOCK SPACES

MARC VENTURA

ABSTRACT. For $p \geq 1$ and $\alpha > 0$, the classical Fock space F^p_α consists of entire functions f such that $|f(z)|e^{-\frac{\alpha}{2}|z|^2} \in L^p(dA)$. Given a complex Banach space X, we denote by $F^p_\alpha(X)$ and $F^{w,p}_\alpha(X)$ the X-valued Fock spaces of entire functions f such that $\|f(z)\|e^{-\frac{\alpha}{2}|z|^2} \in L^p(dA)$ and $x^* \circ f \in F^p_\alpha$ for every $x^* \in X^*$, respectively. For Hilbert space-valued functions, we show that $F^2_\alpha(H) = F^{w,2}_\alpha(H)$ if and only if H is finite-dimensional, and that $F^2_\alpha(H)$ can be identified with the space of Hilbert–Schmidt operators from H into F^2_α. We also prove the density of polynomials in $F^p_\alpha(X)$ for $p < \infty$, as well as the expected duality $(F^p_\alpha(X))^* = F^q_\alpha(X^*)$, where $1/p + 1/q = 1$.

REFERENCES

[1] O. Blasco and M. Ventura, *Some results on vector-valued Fock spaces*, J. Math. Sci. (2026), online first. https://doi.org/10.1007/s10958-026-08265-x

E-mail address: marc.ventura@uv.es

XXIII Encuentros de Análisis Real y Complejo
Logroño, 28–30 de mayo de 2026

BOUNDARY VALUE PROBLEMS VIA WEIGHTS

FERNANDO BALLESTA-YAGÜE

Abstract. In this talk, we will consider boundary value problems for the Laplacian in graph Lipschitz domains in the plane with boundary data satisfying different integrability conditions, like L^p or $L^{p,1}$. We will impose different boundary conditions and estimates, like Dirichlet, Neumann, Regularity and (time permitting) Oblique Derivative.

The technique, introduced by Carlos Kenig in the 80's, will involve the use of a conformal mapping to transfer the problem to the upper half-plane. There, the use of Harmonic Analysis, and more specifically Muckenhoupt's theory of weights, is handy. We will emphasise the different weighted theory problems that are motivated by this approach.

This is joint work with María J. Carro.

References

[1] F. Ballesta-Yagüe and M. J. Carro, *Boundary Value Problems in graph Lipschitz domains in the plane with A_∞-measures on the boundary*, Advances in Mathematics, Volume 486.
[2] F. Ballesta-Yagüe and M. J. Carro, *The Oblique Derivative problem in graph Lipschitz domains in the plane*, in preparation.
[3] C. Kenig, *Weighted H^p-spaces on Lipschitz Domains*, American Journal of Mathematics **102** (1980),
[4] M. J. Carro, V. Naibo and C. Ortiz-Caraballo, *The Neumann Problem in graph Lipschitz domains in the plane*, Mathematische Annalen **385** (2023),

E-mail address: ferballe@ucm.es

XXIII Encuentros de Análisis Real y Complejo
Logroño, 28–30 de mayo de 2026

MATRIX-VALUED BISPECTRALITY: FROM THE MATRIX BOCHNER PROBLEM TO MATRIX EXCEPTIONAL POLYNOMIALS

IGNACIO BONO PARISI

Abstract. In this talk, we present recent results on the matrix-valued extension of the Bochner problem, which concerns the classification of all matrix weights whose associated sequence of matrix-valued orthogonal polynomials are eigenfunctions of a second-order differential operator. We also discuss matrix extensions of exceptional orthogonal polynomials, including recent results and new examples.

Email address: ignacio.bono@unc.edu.ar

XXIII Encuentros de Análisis Real y Complejo
Logroño, 28–30 de mayo de 2026

HEAT SMOOTHING FOR THE WASSERSTEIN DISTANCE AND RANDOM NORMAL MATRICES

PABLO GARCÍA ARIAS

Abstract. The Random Normal Matrix model is a probability measure on the space of normal matrices. By considering their eigenvalues one obtains a random set of points on the complex plane. This is an example of a Determinantal Point Process, a class of point processes characterized by a built-in repulsion among the points. Such point processes are used by physicists to model fermionic systems, and to produce uniformly distributed points.

As the number of points in the spectrum increases, they tend to accumulate in a certain compact subset called the droplet. More precisely, the empirical measure converges weakly to the associated equilibrium measure. This convergence and its properties are classical topics in the field of study. This talk will focus on quantifying the equidistribution using the expected 2-Wasserstein distance, a metric over the space of finite measures defined using optimal transport. The empirical measure will be regularized using the heat equation with Neumann boundary conditions on a suitable subset of the droplet.

E-mail address: pablo.garcia.arias@ub.edu

XXIII Encuentros de Análisis Real y Complejo
Logroño, 28–30 de mayo de 2026

BREAKING OF BREATHERS BY A POINT DEFECT IN THE SINE–GORDON EQUATION

SERGIO MORONI

Abstract. We study the nonlinear wave equation

$$\partial_{tt}u - \partial_{xx}u + \sin u + q\delta_0 \sin u = 0,$$

where δ_0 denotes the Dirac delta distribution and $q \in \mathbb{R}$.
In the unperturbed case ($q = 0$), this reduces to integrable sine–Gordon equation. Among other interesting dynamics, the model supports arbitrarily small periodic breather solutions. We prove that, in the presence of the point defect with q in a specific range, the zero solution is asymptotically stable. In particular, small breather solutions do not persist under this perturbation, showing that this delicate feature of the integrable structure is destroyed.

Email address: smoroni@bcamath.org

XXIII Encuentros de Análisis Real y Complejo
Logroño, 28–30 de mayo de 2026

SYMMETRY-TYPE CONDITIONS ON CONDITIONAL BASES OF BANACH SPACES

ALEJANDRO MARCOS

Abstract. Symmetric and spreading properties of bases have been mainly studied assuming that these bases are unconditional. In fact, symmetric Schauder bases are unconditional and spreading (that is, equivalent to all its sequences). However, instances of conditional symmetric and spreading fundamental systems appear naturally in Functional Analysis and Approximation Theory. In this talk, we discuss the existence of isometric renormings of Banach and quasi-Banach spaces with symmetric or spreading fundamental systems. These results extend and unify classical isometric renorming theorems for subsymmetric (that is, unconditional and spreading) and symmetric Schauder bases to the conditional setting. We also explore the connections between symmetric and spreading systems and certain properties that emerge in the study of the Thresholding Greedy Algorithm.

The results we present are part of a joint work with José L. Ansorena and Miguel Berasategui.

Email address: alejandro.marcos@unirioja.es