AM06

Partial Differential Equations III: Mathematical Analysis and Applications

Ecuaciones en Derivadas Parciales III: Análisis Matemático y Aplicaciones

Organizers **Organizadores** **Antolatzaileak**

María Soria-Carro
(Rutgers University)

Claudia García
(Universidad de Granada)

Gissell Estrada-Rodriguez
(Universitat Politecnica de Catalunya)

Marta de León-Contreras
(Universidad de La Laguna)

Description **Descripción** **Deskribapena**

This session is dedicated to young researchers working in the field of Analysis, Partial Differential Equations, and their applications. The aim is to give visibility to junior analysts, especially women, and foster new connections that promote future collaborations. We want to highlight the innovative work of these researchers and create a space where they can share their advancements, exchange ideas, and establish mutual support networks.

Esta sesión está dedicada a jóvenes investigadores que trabajan en el campo de Análisis, Ecuaciones en Derivadas Parciales y sus aplicaciones. El objetivo es dar visibilidad a les analistas junior, especialmente mujeres, y fomentar nuevas conexiones que impulsen colaboraciones futuras. Queremos destacar su trabajo innovador y crear un espacio donde puedan compartir sus avances, intercambiar ideas y establecer redes de apoyo mutuo.

MSC Codes **Códigos MSC** **MSC Kodeak**

35-02

(primary)

42-02; 76-02; 92-02

(secondary)

Slots **Bloques** **Blokeak**

1.A (Aula 0.13); 1.B (Aula 0.13); 1.C (Aula 0.13)

QR Code **Código QR** **QR Kodea**

Session Schedule **Horario de la Sesión** **Saioaren Ordutegia**

L13 | 17:30-17:50 | 0.13
Boundary regularity for harmonic functions: from classical results to C^1 ***domains***
Clara Torres-Latorre (ICMAT)

L13 | 18:00-18:20 | 0.13
Prescribed local extrema of Laplace eigenfunctions of polygonal domains
Alba D. García Ruiz (ICMAT)

L13 | 18:30-18:50 | 0.13
On curved nonlinear waveguides
Laura Baldelli (IMAG & Universidad de Granada)

L13 | 19:00-19:20 | 0.13
Nonlinear systems of ODEs coupled to linear non-local boundary conditions
Lucía López Somoza (Universidade de Santiago de Compostela)

M14 | 15:00-15:20 | 0.13
Heat-flow methods in harmonic analysis
Jennifer Duncan (Universidad Autónoma de Madrid)

M14 | 15:30-15:50 | 0.13
Zero-dispersion limit for the Benjamin-Ono Equation
Louise Gassot (CNRS / Université de Rennes)

M14 | 16:00-16:20 | 0.13
Spectral stability via the method of multipliers.
Lucrezia Cossetti (UPV/EHU & Ikerbasque)

M14 | 16:30-16:50 | 0.13
Semilinear overdetermined free boundary problems
Pablo Hidalgo-Palencia (ICMAT)

M14 | 17:30-17:50 | 0.13
Existence of steady states in a Transport-Coagulation equation
Carmela Moschella (University of Vienna)

M14 | 18:00-18:20 | 0.13
Mean-field limit of particle systems over hypergraphs
Nastassia Pouradier Duteil (Inria Paris)

M14 | 18:30-18:50 | 0.13
Global existence vs. finite-time blow-up for the two-phase gravity Stokes system
Elena Salguero (MPI MiS Leipzig)

M14 | 19:00-19:20 | 0.13
A constructive proof of existence of traveling waves
Martina Magliocca (Universidad de Sevilla)

Monday 13	**Lunes 13**	**Astelehena 13**
17:30-17:50	**17:30-17:50**	**17:30-17:50**
[Room 0.13]	**[Aula 0.13]**	**[Gela 0.13]**

Boundary regularity for harmonic functions: from classical results to C^1 *domains*

Clara Torres-Latorre
(ICMAT)

The boundary regularity of harmonic functions is well established for domains with smooth or $C^{k,\alpha}$ boundaries. Conversely, the minimal requirements for continuous solutions to the Dirichlet problem are also well understood. In this talk, I will explore the nuanced regularity issues that arise in the intermediate case where the domain has C^1 boundaries.

Monday 13	**Lunes 13**	**Astelehena 13**
18:00-18:20	**18:00-18:20**	**18:00-18:20**
[Room 0.13]	**[Aula 0.13]**	**[Gela 0.13]**

Prescribed local extrema of Laplace eigenfunctions of polygonal domains

Alba D. García Ruiz
(ICMAT)

In this talk we will consider a polygonal domain drawn on a certain family of tilings of the plane and the Dirichlet or Neumann boundary problem associated to it for the Laplace operator. We will show that for any open set O and for any natural number N, one can find a big enough eigenvalue and an associated eigenfunction of the polygon that has at least N non-degenerate local extrema in the open set O.

Joint work with Alberto Enciso and Daniel Peralta.

Monday 13
18:30-18:50
[Room 0.13]

Lunes 13
18:30-18:50
[Aula 0.13]

Astelehena 13
18:30-18:50
[Gela 0.13]

On curved nonlinear waveguides

Laura Baldelli
(IMAG & Universidad de Granada)

Since there has been an increasing interest in the p-Laplacian operator, we will review recent developments concerning quantum waveguides modelled by the Dirichlet Laplacian in unbounded tubes of uniform cross-section in Euclidean spaces. Precisely, for bent and asymptotic straight tubes discrete eigenvalues appear below the essential spectrum, meaning that the particle in the waveguide gets trapped. While, twisted tubes give a Hardy-type inequality, preventing the particle from being trapped.

Joint work with David Krejcirik.

arXiv:2312.10357

Monday 13
19:00-19:20
[Room 0.13]

Lunes 13
19:00-19:20
[Aula 0.13]

Astelehena 13
19:00-19:20
[Gela 0.13]

Nonlinear systems of ODEs coupled to linear non-local boundary conditions

Lucía López Somoza
(Universidade de Santiago de Compostela)

We show how to obtain an explicit expression for the Green's function of a certain type of systems of differential equations subject to non-local linear boundary conditions. The novelty of our work is that the unknown functions do not appear separated neither in the equations nor in the boundary conditions in the system. We will show how the previous decomposition allows to improve some results for existence of solutions of nonlinear systems with linear non-local boundary conditions.

Joint work with Alberto Cabada and Mouhcine Yousfi.

Tuesday 14
15:00-15:20
[Room 0.13]

Martes 14
15:00-15:20
[Aula 0.13]

Asteartea 14
15:00-15:20
[Gela 0.13]

Heat-flow methods in harmonic analysis

Jennifer Duncan
(Universidad Autónoma de Madrid)

Heat-flow monotonicity, otherwise known as semigroup interpolation, is a classical analytic tool that falls under the broader category of 'proof-by-deformation', and has found a broad range of applications in geometry and analysis. In this talk, I will discuss applications of heat-flow methods to certain problems in harmonic analysis, with a particular focus on Brascamp–Lieb inequalities, a class of highly invariant multilinear inequalities that encompasses a number of classical examples.

arXiv:2101.07672

Tuesday 14
15:30-15:50
[Room 0.13]

Martes 14
15:30-15:50
[Aula 0.13]

Asteartea 14
15:30-15:50
[Gela 0.13]

Zero-dispersion limit for the Benjamin-Ono Equation

Louise Gassot
(CNRS / Université de Rennes)

We focus on the Benjamin-Ono equation on the line with a small dispersion parameter. The goal of this talk is to precisely describe the solution at all times when the dispersion parameter is small enough. This solution may exhibit locally rapid oscillations, which are a manifestation of a dispersive shock. The description involves the multivalued solution of the underlying inviscid Burgers equation, obtained by using the method of characteristics.

Joint work with Elliot Blackstone, Patrick Gérard and Peter D. Miller.

Tuesday 14
16:00-16:20
[Room 0.13]

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Asteartea 14
16:00-16:20
[Gela 0.13]

Spectral stability via the method of multipliers.

Lucrezia Cossetti
(UPV/EHU & Ikerbasque)

Originally arisen in a purely PDEs setting, in the last decades the method of multipliers has been recognized as a useful tool for proving absence of point spectrum for self-adjoint and non self-adjoint operators.
In this seminar we will see the developments of the method reviewing some recent results concerning self-adjoint and non self-adjoint Schrödinger operators in different settings and relativistic Pauli, Dirac and biharmonic operators.

Joint work with L. Fanelli and D. Krejcirik.

Tuesday 14
16:30-16:50
[Room 0.13]

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16:30-16:50
[Aula 0.13]

Asteartea 14
16:30-16:50
[Gela 0.13]

Semilinear overdetermined free boundary problems

Pablo Hidalgo-Palencia
(ICMAT)

In general, it is not possible to obtain solutions to PDE with more boundary conditions than needed (overdetermined problems). Indeed, Serrin ('71) showed that, at least for an easy Poisson equation, the only domains that admit solutions with constant Dirichlet and Neumann boundary conditions are balls. In this talk, we will show how to extend a well-known scheme (by Alt and Caffarelli) to obtain regular solutions to overdetermined PDE with general semilinear right hand sides.

Joint work with Alberto Enciso and Xavier Ros-Oton.

Tuesday 14	**Martes 14**	**Asteartea 14**
17:30-17:50	**17:30-17:50**	**17:30-17:50**
[Room 0.13]	**[Aula 0.13]**	**[Gela 0.13]**

Existence of steady states in a Transport-Coagulation equation

Carmela Moschella
(University of Vienna)

This talk is motivated by a biological phenomena known as autophagy, where cells recycle damaged cellular components, resulting in the spontaneous formation of aggregates. The model we consider involves an evolution equation for the distribution of aggregates of various sizes, denoted as f(x, t), where x is the aggregate's size. This leads to a transport-coagulation equation in which we seek to examine necessary and sufficient conditions for the existence of non-trivial steady states.

Tuesday 14	**Martes 14**	**Asteartea 14**
18:00-18:20	**18:00-18:20**	**18:00-18:20**
[Room 0.13]	**[Aula 0.13]**	**[Gela 0.13]**

Mean-field limit of particle systems over hypergraphs

Nastassia Pouradier Duteil
(Inria Paris)

We present a generalization of non-exchangeable particle systems with higher-order interactions. In such models, individuals interact by groups so that a full group jointly generates a non-linear force on any individual. This interaction is modeled by an underlying hypergraph. We show that the mean-field limit is determined by a Vlasov-type equation, where the hypergraph limit is given by an unbounded-rank hypergraphon, and the mean-field force admits infinitely-many orders of interactions.

Joint work with Nathalie Ayi and David Poyato.

arXiv:2406.04691

Tuesday 14	**Martes 14**	**Asteartea 14**
18:30-18:50	**18:30-18:50**	**18:30-18:50**
[Room 0.13]	**[Aula 0.13]**	**[Gela 0.13]**

Global existence vs. finite-time blow-up for the two-phase gravity Stokes system

Elena Salguero
(MPI MiS Leipzig)

We study the dynamics of two different fluids evolving in a 2D domain, governed by the Stokes-transport system, with particular emphasis on the evolution of the free interface between them. Using a contour dynamics approach, we analyze the global-in-time behavior of the nonlinear equation describing the free boundary. We find that this equation exhibits a subtle nonlinear structure that ensures global well-posedness, whereas simplified models show finite-time blow-up.

This work is in collaboration with F. Gancedo and R. Granero-Belinchón.

arXiv:2402.15593

Tuesday 14	**Martes 14**	**Asteartea 14**
19:00-19:20	**19:00-19:20**	**19:00-19:20**
[Room 0.13]	**[Aula 0.13]**	**[Gela 0.13]**

A constructive proof of existence of traveling waves

Martina Magliocca
(Universidad de Sevilla)

In this talk, we will give constructive proof of the existence of traveling wave solutions to a particular cell motility model. The model equations include a convection diffusion equation for the polarity marker concentration and the incompressible Darcy's equation.

Joint work with Thomas Alazard and Nicolas Meunier.