

# I ENCUENTRO IMAG

20 y 21 de Marzo, 2024





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# About

## I ENCUENTRO IMAG

¡Bienvenidos a la primera edición del **Encuentro IMAG**! Este evento marca el inicio de unas jornadas diseñadas para promover la comunicación directa entre los estudiantes predoctorales y postdoctorales del Instituto de Matemáticas de la Universidad de Granada (IMAG), con el objetivo de fomentar una convivencia armoniosa y una comunicación científica efectiva. El I Encuentro IMAG tendrá lugar en el IMAG (por supuesto) los días **20 y 21 de Marzo de 2024**.

En estas jornadas se propone un reto: explicar nuestro tema de investigación a los demás investigadores del Instituto (de nuestra rama y de otras ramas). Para lograr este objetivo, los **investigadores postdoctorales** tendrán la oportunidad de impresionar con charlas de 20 minutos, mientras que los **investigadores predoctorales** tendrán 3 minutos para sorprender y cautivar, ya sea con una sola diapositiva, con la pizarra o ¡sin ninguna herramienta! Todo con el fin de motivar al resto de asistentes a acercarse a su póster durante el tiempo establecido para ello. Y como todo reto logrado... ¡será recompensado! Y es que hemos establecido 4 categorías de premios que serán entregados al finalizar estas jornadas.

Gracias a todos vosotros por hacer posible la realización de esta actividad. ¡Nos vemos en futuras ediciones!

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Welcome to the first edition of **Encuentro IMAG**! This event is the beginning of a series of conferences designed to promote direct communication between predoctoral and postdoctoral students of the Institute of Mathematics of University of Granada (IMAG), with the aim to promote harmonious coexistence and effective scientific communication. I Encuentro IMAG will take place at the IMAG (of course) on March 20 and 21, 2024.

The challenge of this conference is to explain our research topic to the other researchers of the Institute (from our field and other fields). To achieve this challenge, **postdoctoral researchers** will have the opportunity to impress with 20-minute talks, while **predoctoral researchers** will have 3 minutes to amaze, either with a single slide, with the blackboard or without any tool at all! All in order to motivate the other participants to approach their poster during the time established for this purpose. And as every challenge achieved... it will be rewarded! We have set up 4 categories awards that will be handed out at the end of the conference.

Thanks to all of you for making this activity possible, see you in future editions!

## Organizing committee

Lourdes M<sup>a</sup> Navarrete Pérez    Universidad de Granada

## Scientific committee

Patricio Almirón-Cuadros	Universidad de Granada
David Moya Hinojosa	Universidad de Granada
María Alonso Pena	Universidad de Granada

# Timetable

	Wednesday, 20	Thursday, 21
9:30 - 9:50	WELCOME	
9:50 - 10:10	PATRICIO ALMIRÓN	PRASANTA BARIK
10:10 - 11:00	POSTER SESSION	
11:00 - 11:30	Coffee BREAK 	
11:30-11:50	LILIA MEHIDI	MARLON JOSUÉ
11:50-12:10	LAURA BALDELLI	FRANCISCO J MARTÍNEZ
12:10-12:30	AUDREY FOVELLE	ALEJANDRO GÁRRIZ
12:30-12:50	MARÍA ALONSO	FILIPE KELMER
13:00-13:30	MONÓLOGO 	AWARD CEREMONY 
16:00-16:20	DAVID MOYA	
16:20-16:40	NICOLÁS TORRES	
16:40-17:30	POSTER SESSION	
17:30	SNACK 	

# List of Abstracts – Talks

## Wednesday 20

### A Dive into Curve and Hypersurface Singularities

*Patricio Almirón*

T

D10, IMAG

Singularity theory acts as a convergence zone, where differential and symplectic geometry, topology, analysis, dynamical systems, and commutative algebra coalesce, fostering intricate interactions that occasionally unveil unexpected connections.

This talk will provide a condensed exploration of curve and hypersurface singularities. Drawing from algebraic geometry, commutative algebra, topology, and numerical semigroups, we'll delve into key aspects of singularities' topological and algebraic properties. In particular, the talk spotlights the study of analytic invariants of isolated hypersurface singularities and the combinatorics of numerical semigroups in geometric contexts, such as complete intersection monomial curves. Expect insights into the deformations of these curves and the associated semigroups, expanding our understanding of their intrinsic properties.

### Questions in Lorentzian geometry : focus on Brinkmann spacetimes

*Lilia Mehidi*

T

D11, IMAG

Lately I have been studying compact Brinkmann spacetimes. They are Lorentzian manifolds with special holonomy, namely, the action of the holonomy group preserves an isotropic vector. Even though compact spacetimes may not be relevant from the physical point of view (because of bad causal behaviour), they lead to interesting mathematical questions. I will give an overview of the main questions that interest me on this subject, and some results.

## Shades of Liouville-type theorems

Laura Baldelli

T

D12, IMAG

In 1844, in a short note in the Comptes Rendus de l'Académie des Sciences, Paris, Augustin Cauchy published the first statement of what is now known as the Liouville Theorem for bounded analytic functions. In this talk, we will discuss some developments in Liouville-type theorems and their connection with universal pointwise a priori estimates of solutions to elliptic problems. The main tools involved are the celebrated blow-up technique due to Gidas and Spruck and the geometric "Doubling Lemma".

Finally, we will focus our attention on elliptic equations in bounded domains with a diffusion term which destroys, in general, the variational structure. Thus, in order to prove existence results, Liouville-type theorems together with a fixed point argument and a priori estimates, will play crucial roles.

These results are contained in papers written jointly with Roberta Filippucci (University of Perugia, Italy).

## A short introduction to nonlinear geometry of Banach spaces

Audrey Fovelle

T

Facultad de Ciencias

Classical theory of Banach spaces usually consists in studying the properties of those spaces which are stable under linear isomorphisms (or isometries). The modern era of the geometry of Banach spaces started in the 1960s with the foundational works of Lindenstrauss and Pełczyński. For most of the 1960s, 1970s, and 1980s, *nonlinear* aspects of functional analysis were slowly developing on the sidelines of mainstream Banach space theory. Nonlinear geometry of Banach spaces is now a topic of investigation in itself. Its principal motivation is to understand how the linear structure of a space is, or is not, determined by its nonlinear structure. In other words, we are looking for the linear properties that are stable under nonlinear maps, that can be of different kinds.

In this talk, we will give examples of typical results of nonlinear geometry of Banach spaces. We will pay special attention to Ribe's Theorem.



## Nonparametric inference for directional variables

*María Alonso*



D7, IMAG

In this talk, we will introduce the concept of directional random variables. We will argue why this kind of variables cannot be analyzed with classical statistical techniques. In addition, we will introduce the notion of nonparametric estimation and show examples of nonparametric estimation with directional data. Subsequently, we will discuss how to derive asymptotic properties of directional nonparametric estimators and will finish by giving some real-world examples.

## Minimal surfaces in homogeneous 3-manifolds

*David Moya*



B8, IMAG

In this talk, we will provide an introduction to simply-connected homogeneous 3-manifolds. In particular, we will discuss their classification in terms of the dimension of their isometry group and some interesting results that can be used as a tool for the study of minimal and constant mean curvature surfaces within them. The problem of the study of minimal surfaces that are invariant by certain uniparametric groups of isometries will be introduced for the case of unimodular metric Lie groups.

## The elapsed time model for neural assemblies with discrete and distributed delays.

*Nicolás Torres*



D8, IMAG

The elapsed time equation is an age-structured model that describes dynamics of interconnected spiking neurons through the elapsed time since the last discharge, leading to many interesting questions on the evolution of the system from a mathematical and biological point of view. In this talk, we deal with the case when the transmission after a spike is instantaneous and the case of distributed and discrete delays, which take into account the previous history. We study the asymptotic behavior and the convergence of a numerical scheme. We show some numerical simulations to compare the behavior of the system under different parameters, leading to solutions with different asymptotic profiles.

## Thursday 21

### Some mathematical results on coagulation-fragmentation type models

*Prasanta Kumar Barik*

T

D3, IMAG

In this talk, we discuss some mathematical results related to coagulation-fragmentation type models. More precisely, we discuss the existence and uniqueness of solutions of these models. Additionally, we examine essential physical properties such as mass conservation, gelation, and instantaneous gelation. Finally, we analyze the metastability behavior of the Becker-Döring models.

### Advances in approximation on the unit disk

*Marlon J. Recarte*

T

D5, IMAG

Our research focuses on approximating functions within the unit ball using two primary methods: least-squares approximation and uniform approximation.

In the first method, we approximate functions within the  $d$ -dimensional ball by adjusting the classical inner product using multivariate differential operators such as gradients or Laplacians. These adjustments are referred to as Sobolev inner products.

In the second method, we develop sequences of Bernstein-type operators to operate on bivariate functions within the unit disk. This involves examining Bernstein-type operators under domain transformations, studying bivariate Bernstein-Stancu operators, and introducing Bernstein-type operators on disk quadrants through continuous differentiable transformations of the function.

### The car-parking problem and Contact Topology

*Javier Martínez-Aguinaga*

T

D2, IMAG

We will motivate Contact Topology through the car-parking problem. We will then show how Knot Theory is related to this branch of Mathematics, giving rise to the Theory of Legendrian knots. The talk will not require any pre-requisites and everything will be motivated through pictures.

## Entropy techniques in diffusion equations. Old & new results

Alejandro Gárriz



D9, IMAG

We will show how techniques based on physical quantities like mass, moment or entropy are used to study large-time uniform asymptotic estimates for the solutions of the Heat Equation, both in  $\mathbb{R}^n$  and in domains  $\Omega$  with holes. The later case refers to new (and sharp) results obtained by the authors, while the former will serve as an introduction to the subject. Finally, we will discuss some open questions regarding non-linear diffusion problems.

## Superposition Formulae for the Geometric Bäcklund Transformations of the Hyperbolic and Elliptic Sine-Gordon and Sinh-Gordon Equations

Filipe Kelmer



D13, IMAG

We provide superposition formulae for the six cases of Bäcklund transformations corresponding to space-like and time-like surfaces in the 3-dimensional pseudo-Euclidean space. In each case, the surfaces have constant negative or positive Gaussian curvature and they correspond to solutions of one of the following equations: the sine-Gordon, the sinh-Gordon, the elliptic sine-Gordon and the elliptic sinh-Gordon equation. The superposition formulae provide infinitely many solutions algebraically after the first integration of the Bäcklund transformation. Such transformations and the corresponding superposition formulae provide solutions of the same hyperbolic equation, while they show an unusual property for the elliptic equations. The Bäcklund transformation alternates solutions of the elliptic sinh-Gordon equation with those of the elliptic sine-Gordon equation and the superposition formulae provide solutions of the same elliptic equation. Explicit examples and illustrations are given.

# Poster Sessions

## T1

### Minimal surfaces with free boundaries and an overdetermined problem in the 2-sphere

*Diego Alfonso Marín*

3' + P

B8, IMAG

### Proper Bryant Cantor Ends

*Jorge Hidalgo*

3' + P

B7, IMAG

### The Mittag-Leffler theorem for proper minimal surfaces and directed meromorphic curves

*Tjaša Vrhovnik*

3' + P

B7, IMAG

### Network flow based approaches for the pipelines routing problem in naval design

*Gabriel González*

3' + P

B7, IMAG

### Multifractionally Integrated Functional Time Series on $L^2(\mathbb{M}_d, d\nu)$ with LRD in time

*Diana Paola Ovalle*

3' + P

B6, IMAG

### Asymptotic behavior of solutions to the linear Becker-Döring equations

*Inmaculada Benítez*

3' + P

B3, IMAG

## Prescribing Curvatures in the disk

*Francisco Javier Reyes*

3' + P

Facultad de Ciencias

## T2

## Translators of the Mean Curvature Flow in the Hyperbolic Einstein Space-time

*Buse Yalçın*

3' + P

B8, IMAG

## Palatini Formalism and Quadratic Gravity

*Lorens Niehof*

3' + P

B6, IMAG

## Norm attaining functionals on Banach spaces

*Helena del Río*

3' + P

Facultad de Ciencias

## Orthogonal Polynomials Applications and Bivariate Multiple Orthogonality

*Juan Antonio Villegas*

3' + P

B4, IMAG

## Descriptive Complexity of some geometric classes

*Esteban Martínez*

3' + P

Facultad de Ciencias

## T3

### Metric-affine Finslerian gravity

*Fidel Fernández*

3' + P

B8, IMAG

### Intra-specific competition enhances periodic model for biotic interactions

*Ruth I. Oliva*

3' + P

B4, IMAG

### Preserver enjoyer

*Gerardo Martín*

3' + P

Facultad de Ciencias

### On minimal extended representations of generalized power cones

*Miguel Martínez*

3' + P

B7, IMAG

### Control Theory and Real-Life Challenges

*Amine Sbai*

3' + P

B8, IMAG

### The trendiest trends in (global) Lorentzian geometry (that I know of)

*Saúl Burgos*

3' + P

B6, IMAG

### Hypothesis Testing for Mean Comparison of Two Paired Functional Samples

*Cristhian Leonardo Urbano*

3' + P

B5, IMAG

## TIPS PARA CUIDAR EL MEDIO AMBIENTE DESDE EL **IMAG**

**01. CAMINA O PEDALEA**

Al evitar el uso de vehículos motorizados, estás contribuyendo directamente a la reducción de emisiones de carbono, ayudando a mitigar el cambio climático.



**02. AHORRA ENERGÍA Y AGUA**

Apaga la luz, el ordenador o la calefacción cuando no sea necesario que estén encendidos. No dejes ningún grifo abierto.



**03. RECICLA**

En el **IMAG** disponemos de contenedores especiales para papel y plástico.



**04. APROVECHA EL PAPEL**

Dale otra vida al papel: utiliza papel reciclado o que ha tenido otro uso, escribe por las dos caras y recíclalo después.



**05. UTILIZA LAS ESCALERAS**

Elige subir por las escaleras en vez de utilizar el ascensor.



