LA REAL ACADEMIA DE CIENCIAS EXACTAS, FÍSICAS Y NATURALES DE ESPAÑA

se complace en invitarle al acto de celebración de la

Segunda reunión Académie des Sciences – Real Academia de Ciencias

Viernes, 6 de junio de 2025 - 16.00 horas

Ponencias:

16.00 – 17.30 h - Parte I

"From nonlinear and nonlocal PDEs, and applications"
Prof. Juan Luis Vázquez, *Universidad Autónoma de Madrid y Real Academia de Ciencias*

"Radiative Transfer for Climate: Some Mathematical and Numerical Results"
Prof. Olivier Pironneau, *LJLL, Sorbonne-Université y Académie des Sciences, France*

17.30 – 18.00 h - Intermedio

18.00 – 19.30 h - Parte II

"From cancer screening to safe flying: AI meets the complex real world"
Prof. David Ríos, *ICMAT y Real Academia de Ciencias*

"Crowd motion models of the gradient flow type"
Prof. Bertrand Maury , *Université Paris-Saclay y Académie des Sciences, France*

Sesión presencial. Entrada hasta completar aforo.

Calle Valverde, 22
28004 Madrid - España

Retransmisión en directo en YouTubeRAC

Resumen de las conferencias

From nonlinear and nonlocal PDEs, and applications, Prof. Juan Luis Vázquez

The theories of nonlinear PDEs received a strong impetus in Spain since the decade 1970-80 due to the connections established with France, in particular Paris, with the collaboration of the French Embassy in Madrid. Since then the influence of masters like J.-L. Lions, H Brezis, Y. Meyer and many others allowed for the developing of groups like the ones working on Nonlinear Partial Differential Equations with close attention to applications. As a student of Brezis I could follow the development of topics that had a strong influence in the past and present state of the analysis of PDEs, like the equations of nonlinear diffusion, the generation of nonlinear semigroups, the asympotic behaviour of evolution problems, the existence and role of exact selfsimilar solutions, the theory of singularities, the theory of free boundaries, functional inequalities, and nonlocal operators. I will present in some detail notable results obtained in some of these topics.

Radiative Transfer for Climate: Some Mathematical and Numerical Results, Prof. Olivier Pironneau

Light is converted into heat by Planck's law for black bodies. The Radiative Transfer Equations (RTE) coupled with the heat equations for the atmosphere is a system of 7 dimensions with very large time and length scale differences. Nevertheless, existence and uniqueness can be established, even in the case of refractive media (water and clouds). Numerically, it is better to convert RTE into an integral equation and apply sparse matrix approximations like H-matrices. We shall review these results and see if they can explain the Greenhouse Effect.

From cancer screening to safe flying: AI meets the complex real world, Prof. David Ríos

I shall describe a few very complex real world problems developed at our lab in the last years including: designing new strategies for colorectal cancer screening, discovering new drugs for AD, designing social emotional robots for treating autism, and enabling safer flying. The talk will reflect the complexities of such problems, some of the new mathematical concepts involved and the actual solutions developed, making a brief reflection on the risks and benefits that AI brings in and the role of math within them.

Crowd motion models of the gradient flow type, Prof. Bertrand Maury

The modeling of crowd motions has motivated a huge activity in the last 3 decades, an activity which now mobilizes social scientists, physicists, computer scientists, and mathematicians. Most models are based on principles which pertain to classical mechanics: individuals are considered as particles or grains, and those virtual entities are submitted to forces which encode individual and collective tendencies. We shall detail a model of the granular type, dedicated to highly congested crowds at the microscopic and macroscopic scales, and present some related mathematical issues. We will explore in particular to which extend they fit in the general framework of Gradients Flows, and whether this very framework is suited to the modeling of social phenomena.