COLLOQUIUM

DEPARTAMENTO DE MATEMÁTICAS
UNIVERSIDAD CARLOS III DE MADRID

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Diffusion equations, minimal surfaces, and front propagation

Abstract:

The Laplacian is the main operator describing the diffusion not only of heat and other physical substances, but also the diffusion in financial markets. We will start showing with very simple arguments the relation between random walks in Probability and the Laplace operator. This will lead us to understand the fruitful connection between the fundamental solution of the heat equation (the Gaussian) and the Central Limit Theorem for the propagation of random errors. Similar arguments apply for long-range or anomalous diffusions, such as the Lévy processes generated by the fractional powers of the Laplacian. They attract lately great interest in Physics, Biology, and Finance.

We will then turn to some reaction-diffusion equations, involving the Laplacian or fractional Laplacians, and modeling phase transition problems. We will present recent developments that are strongly related to some classical results in the theory of minimal surfaces. Phase transitions or interfaces modeled by reaction-diffusion equations appear when two different states coexist and there is a balance between two opposite tendencies: a diffusive effect that tends to mix the materials and a reaction mechanism that drives them into their pure state. Due to surface tension, interfaces tend to minimize their area as the reaction becomes stronger.

Hora: 10:45

Lugar: Seminario del Departamento de Matemáticas

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