

Singular phenomena in reaction diffusion equations and in conservation laws

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The aim in this project is to study nonlinear reaction diffusion equations of parabolic type and conservation laws with singularities. By singularities, we mean the non-smoothness of the coefficients that appear in the equations. For example, nonlinearities blow up at the boundary for the heat equation or the discontinuous flux at the interface appears in the coupled parabolic/hyperbolic equations. Significant progress has been made, by the collaborators of this project, related to the existence and uniqueness of solutions of stationary problems, which is the starting point to study long time behaviour of solutions of the corresponding parabolic equation. In this project, for different types of diffusion operators, we would like to study the local existence, the global behaviour of the solutions of the associated parabolic/hyperbolic equations and the link with the existence of stationary solutions.

Nonlinear reaction diffusion equations and coupled parabolic-hyperbolic equations with singularities arise in wide variety of physical systems in engineering and science. Here, by singularities we mean the non-smooth coefficients. Consequently, the analytical study of solutions of these equations plays an important role in understanding these physical processes. The main objective of this project is to investigate the existence, uniqueness, regularity and the long time behaviour of solutions of reaction diffusion problems and coupled parabolic-hyperbolic equations having the singular phenomena.

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