Propagation in non homogeneous media and applications

Abstract:

I will start by describing reaction-diffusion phenomena and reviewing the classical theory for homogeneous Fisher and Kolmogorov-Petrovsky-Piskunov (KPP) equations. It derives the spreading properties in a homogeneous setting. A well known invasion speed governs the asymptotic speed of propagation. This equation plays an important role in a variety of contexts in ecology, biology and physics.

In applications, it is particularly important to understand the effects of heterogeneity and I will present some motivation. In this lecture, I will focus on the effect of inclusion of a line (a “road”) with fast diffusion on biological invasions in the plane (the “field”), otherwise homogeneous. I will describe in detail the effect of the road on the speed of invasion as well as the effects of other factors. The results shed light on oriented diffusion in an excitable medium. I report here on results from a series of joint works with Jean-Michel Roquejoffre and Luca Rossi.