



Workshop on Stochastic Analysis

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A Stochastic Chemotaxis System in Two Dimensions

Abstract

Nonlinear partial differential equations arise naturally in many biological and chemical systems. An important class is given by cross-diffusion systems, in particular chemotaxis models. At the same time, random fluctuations are ubiquitous in real-world applications. Such randomness may lead to new phenomena and can have a non-trivial impact on the behaviour of solutions. The presence of stochastic perturbations in the model often produces qualitatively new dynamics, which may help to describe real processes more accurately. Due to the interplay between noise and nonlinearity, phenomena such as noise-induced transitions, stochastic resonance, metastability, or noise-induced chaos may occur.

In this talk, we introduce a chemotaxis system with proliferation as an example of a cross-diffusion system. We discuss the existence and uniqueness of solutions, based on fixed-point arguments, and present results on the long-time behaviour. We then consider a related stochastic chemotaxis system with a leading porous medium-type diffusion term. This is joint work with Debopriya Mukherjee and, in part, with Wei Wang.