

53rd Kanazawa Analysis Seminar

April 8 (Sat.), 2017

Kanazawa University Satellite Plaza

13:30 – 14:20 Yihong Du (University of New England)

Logarithmic shifting in spreading governed by the Fisher-KPP porous medium equation

14:30 – 15:20 Yoshitaro Tanaka (Hokkaido University)

Reaction-diffusion approximation to nonlocal evolution equations

15:40 – 16:30 Norihisa Ikoma (Kanazawa University)

Existence of nontrivial solutions for equations with fractional operator

16:40 – 17:30 Hiroshi Matano (University of Tokyo)

Front propagation in predator-prey models

Abstracts

Yihong Du, Logarithmic shifting in spreading governed by the Fisher–KPP porous medium equation

We consider the large time behaviour of solutions to the porous medium equation with a Fisher-KPP type reaction term and bounded, nonnegative, and compactly supported initial function in \mathbb{R}^N .

Such a problem may be used to model the spreading of an invasive species. Through a detailed analysis of the radially symmetric case, we show that, in space dimension $N \geq 2$, the spreading profile is largely determined by the one-dimensional traveling wave solution (with minimal speed) with a logarithmic shift. We note that in one space dimension, it has been known that no such logarithmic shift happens. Comparison with related results on spreading will be discussed. The talk is based on recent joint work with Fernando Quiros (UAM, Spain) and Maolin Zhou (Univ of New England).

Yoshitaro Tanaka, Reaction–diffusion approximation to nonlocal evolution equations

In recent years, nonlocal evolution equations with convolution kernels have attracted attentions in various fields. In this talk, we show that there exists a reaction-diffusion system (RDS) that approximates the nonlocal evolutionary equation with any continuous even kernels. Moreover, we propose a method that can determine the parameters in the RDS for the given kernel shape.

This is joint work with Hiroko Yamamoto (Meiji University) and Hirokazu Ninomiya (Meiji University).

Norihisa Ikoma, Existence of nontrivial solutions for equations with fractional operator

This talk is concerned with the existence of nontrivial solutions for equations involving fractional operator. We discuss the existence of infinitely many nontrivial solutions and their characterization by minimax values. If time permits, then I shall also present the applications of the characterization by minimax values, the nonexistence of nontrivial solutions and an existence result for other equations.

Hiroshi Matano, Front propagation in predator–prey models

In this talk I will discuss the spreading properties of solutions of predator-prey type reaction-diffusion systems. Here, by a spreading property, we mean the way the solution front propagates to infinity when starting from compactly supported initial data. Among other things we show that both the prey and the predator spread to infinity with definite spreading speeds. The spreading speeds could be different between the two species. This means that two separate fronts may appear, and they divide the space into three regions; the leading edge, the intermediate zone and the final zone. The final zone is where the two species are both uniformly positive and interact with each other most intensively.

The dynamics in the final zone is still largely unknown, but we can prove the convergence of the solution to a positive steady state if the corresponding ODE system has a special type of Lyapunov function and if the diffusion coefficients of the two species are equal.

If I have time, I will also mention briefly the extension of the above work to the case of spatially periodic environments;

This is joint work with Arnaud Ducrot and Thomas Giletti.