FRANCE-TAIWAN JOINT CONFERENCE ON NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS

WORKSHOPS

CASTS

理論科學研究中心

Center for Advanced Study in Theoretical Sciences

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Forward Discretely Self-Similar Solutions of the 3D Incompressible Navier-Stokes Equations

Prof. Tai-Peng Tsai

For the abstract of this talk, please click here.

For material related to this talk, click here.

Semilinear elliptic equations in convex domains and convex rings

Prof. François Hamel

In this talk, I will discuss some geometrical properties of positive solutions of some semilinear elliptic equations in bounded convex domains or convex rings, with Dirichlet-type boundary conditions. A solution is called quasiconcave if its superlevel sets are convex. I will present two counterexamples, that is two cases of semilinear elliptic equations for which the solutions are not quasiconcave. This talk is based on a joint work with N. Nadirashvili and Y. Sire.

For material related to this talk, click here.

Liouville type theorems and classification of solutions for elliptic and parabolic systems

Prof. Philippe Souplet

We survey a number of recent results on Liouville type nonexistence theorems and classification of solutions, for various classes of superlinear elliptic and parabolic problems. This includes in particular some elliptic systems arising in models of Bose-Einstein condensates, in Lotka-Volterra type systems from population dynamics and in models of chemical reactions. We also discuss related methods and applications.

Recent development of random matrix theory

Prof. Petru Mironescu

In this seminar, we will discuss the recent work on the eigenvalue and eigenvector distributions of random matrices. We will discuss a dynamical approach to these problems and related open questions. We will discuss both Wigner type matrix ensembles and invariant ensembles.

For material related to this talk, click here.

Asymptotic analysis of solutions of the Chern-Simons CP(1) model on a torus

Prof. Youngae Lee

For the abstract of this talk, please click here.

For material related to this talk, click here.

Weak solutions for compressible fluid models

Prof. Benoît Desjardins

Recent progress about the construction of weak solutions for compressible fluid models such as the Navier Stokes equations for barotropic flows and for the full Navier Stokes equations for heat conducting fluids are presented, as well as more recent extensions to two phase flow models. This work was intiated ten years ago from fruitful collaborations with Chi-Kun Lin (at NCKU).

For material related to this talk, click here.

Boundary layer solutions of PNP systems

Prof. Tai-Chia Lin

The Poisson-Nernst-Planck （PNP) system is an important model to describe ion transport in ionic liquids having many applications in biology, chemistry and physics. From the steady state PNP systems, we may derive a new Poisson-Boltzmann type equation called "Charge Conservation Poisson-Boltzmann (CCPB)" equation with a small parameter from the ratio of length scale and dielectric constant. The CCPB equations with Robin boundary conditions may have solutions with boundary layers as the small parameter tends to zero. The profile of boundary layer solutions may represent Debye layers which should have stability observed by physical experiments. Here we provide mathematical results for the stability by studying the linearized problem of PNP systems and proving the linear and nonlinear stability.

Infinitely many sign-changing and semi-nodal solutions for a nonlinear Schrodinger system

Prof. Zhijie Chen

We study a nonlinear Schrodinger system which has appeared as several models from mathematical physics. For the repulsive case, we show that this system has infinitely many sign-changing solutions. We also obtain infinitely many semi-nodal solutions in the following sense: one component changes sign and the other one is positive. This is a joint work with Prof. Chang-Shou Lin and Wenming Zou.

For material related to this talk, click here.

On area-preserving and length-preserving nonlocal flows of convex closed plane curves

Prof. Dong-Ho Tsai

For the abstract of this talk, please click here.

The effect of a line with fast diffusion on biological invasions

Prof. Henri Berestycki

I will present a system of equations describing the effect of inclusion of a line (the "road") with fast diffusion on biological invasions in the plane. A classical Fisher-KPP propagation is assumed outside of the road. It is found that past a certain threshold for the ratio of diffusivity coefficients, the presence of the road enhances the global propagation. I will discuss several other effects such as transport or reaction on the "road". I will also derive the asymptotic behavior of the invasion speed depending on the various parameters. These results are from a series of joint works with Jean-Michel Roquejoffre and Luca Rossi.

On the derivation of multicomponent flows systems

Prof. Didier Bresch

I will present several models which are frequently used for applications. Where they come from? That is the question.... Partial answers will be given.

For material related to this talk, click here.

Co-existence and traveling wave solutions of the diffusive Lotka-Volterra system of three competing species

Prof. Chiun-Chuan Chen

We study the coexistence problem when a third species w invades an eco-system consisting of two species u and v, where u, v and w compete with one another. Even if the influence of w on u and v is quite small under suitable conditions, we show that the three species can co-existence as a traveling wave on the real line R. Our approach uses the results by Berestycki et al.(2009) and provides a method to construct 3-species non-monotone traveling wave solutions. This is a joint work with Chueh-Hsin Chang, Li-Chang Hung, Masayasu Mimura and Toshiyuki Ogawa.

A Hamilton-Jacobi approach for a model of population structured by space and trait

Prof. Sepideh Mirrahimi

We study a non-local parabolic Lotka-Volterra type equation describing a population structured by a space variable and a phenotypical trait. Considering diffusion, mutations and competition between the individuals, we analyze the asymptotic (long–time/long–range in the space variable) behavior of the solutions. Using some kind of real phase WKB ansatz, we prove that the propagation of the population in space can be described by a Hamilton-Jacobi equation with obstacle which is independent of the trait variable. The effective Hamiltonian is derived from an eigenvalue problem which has a similar role as the cell problem in homogenization. Moreover, the eigenfunction corresponding to the latter eigenvalue problem provides a candidate for the phenotypical distribution of the population. This is a joint work with Emeric Bouin.

For material related to this talk, click here.

On a free boundary problem for the curvature flow with driving force

Prof. Jong-Shenq Guo

For the abstract of this talk, please click here.

For material related to this talk, click here.

Models of tumor growth and therapy

Prof. Benoît Perthame

The growth of solid tumors can be described at a number of different scales from cell to the organ scale. For a large number of cells, the 'fluid mechanical' approach has been advocated recently by many authors in mathematics or biophysics. Several levels of mathematical descriptions are commonly used, inluding only elastic effects, or nutrients, or active movement and the solutions exhibit different qualitative behaviours.

Another, more macroscopic, description is based on a free boundary problem close to the Hele-Shaw equation. Asymptotic analysis is a tool to derive these Hele-Shaw free boundary problems from cell density systems in the stiff pressure limit. This modeling also opens other questions as circumstances in which instabilities develop.

This work is a collaboration with F. Quiros and J.-L. Vazquez (Universidad Autonoma Madrid), M. Tang (SJTU) and N. Vauchelet (LJLL).

For material related to this talk, click here.

Uniform holder bounds for strongly competing systems involving standard and anomalous diffusions

Prof. Susanna Terracini

For the abstract of this talk, please click here.

For material related to this talk, click here.

Classification of the entire radial self-dual solutions to non-Abelian Chern-Simons systems

Prof. Hsin-Yuan Huang

For the abstract of this talk, please click here.

For material related to this talk, click here.

Circulant Matrices, Intermediate Liapunov-Schmidt Reduction Method and Nonlinear Elliptic Equations

Prof. Juncheng Wei

For the abstract of this talk, please click here.

For material related to this talk, click here.

Estimates of the mean field equations with integral singular sources

Dr. Ting-Jung Kuo

For the abstract of this talk, please click here.

For material related to this talk, click here.

On the Lane-Emden equation

Prof. Louis Dupaigne

We review Liouville-type results for the Lane-Emden equation and their application to elliptic regularity. Special attention is paid to the understanding of solutions of finite Morse index in the supercritical case. Variants of the equation will be presented, such as the nonlocal and the fourth order settings.

For material related to this talk, click here.

Bubbling Solutions for Chern-Simons Model in a Torus

Prof. Shusen Yan

In this talk, I will present some results on the existence and the exact number of bubbling solutions for Chern-Simons model in torus. Necessary conditions for the blow up points of multi-bubbling solutions has been derived to obtain such results. (This is joint work with C.-S. Lin in NTU.)

For material related to this talk, click here.

Refined finite-dimensional reduction method and applications to nonlinear elliptic equations

Dr. Weiwei Ao

For the abstract of this talk, please click here.

For material related to this talk, click here.

Noncompact variational problems involving complex unimodular maps

Prof. Petru Mironescu

Among the complex-valued harmonic maps in the unit disc which are unimodular on the unit circle and vanish somewhere, Moebius transforms have minimal Dirichlet energy. This simple fact extends to more general energies and to multiply connected domains. The corresponding result is an essential tool in the analysis of several noncompact problems: uniqueness of vortexless minimizers for the Ginzburg-Landau equation, existence of degree one maps which are minimal in critical function spaces, existence of critical points of the Ginzburg-Landau energy with prescribed degree in simply connected domains. In a related direction, I will present a strategy for obtaining critical points of the Ginzburg-Landau energy with semi-stiff boundary conditions starting from Dirichlet boundary conditions. Based on joint works with L.V. Berlyand, A. Farina, X. Lamy, E. Sandier and V. Rybalko.

For material related to this talk, click here.

The geometry of critical points of Green functions on a torus

Prof. Chang-Shou Lin

The location of blowup points of a sequence of solutions to semilinear equations (say, mean field equation) usually satisfies some equation related to Green functions. Indeed, the equation could be viewed as an equation for critical points of Green function in a product space of original underlying space (say a torus). In this lecture, we will discuss the nature (minimum points, saddle points, degeneracy or non-degeneracy etc.) of critical points and its relation to the mean field equations.