Department of Mathematics 數學系
The Chinese University of Hong Kong 香港中文大學

The Croucher Foundation Advanced Study Institute
Recent Development in Nonlinear Partial Differential Equations: Part I

Date: 2 March 2011
Venue: Rm. 501a, Academic Building 1, IMS, CUHK

Time / Date	2 March 2011 (Wednesday)
09:00am – 10:15am	**Professor Manuel del Pino** *University of Chile* Title: New Entire Solutions of Semilinear Elliptic Equations (Part I)
10:15am – 10:45am	**Tea Break**
10:45am – 12:00pm	**Professor Manuel del Pino** *University of Chile* Title: New Entire Solutions of Semilinear Elliptic Equations (Part II)
12:00pm – 02:00pm	**Working Lunch#**
02:00pm – 02:45pm	**Professor Juan Dávila** *University of Chile* Title: Concentrating solutions of an elliptic equation with singular nonlinearity
02:45pm – 03:30pm	**Professor Zhaoli Liu** *Capital Normal University* Title: Ground states and bound states of a nonlinear Schrödinger system
03:30pm – 04:00pm	**Tea Break**
04:00pm – 04:45pm	**Professor Dong Ye** *University Paul Verlaine of Metz* Title: A Hardy-Moser-Trudinger inequality
04:45pm – 05:30pm	**Professor Daomin Cao** *Chinese Academy of Sciences* Title: Infinitely many solutions for p-Laplacian equation
06:00pm – 08:00pm	**Free**

 # For invited speakers and invited guests only.

New Entire Solutions of Semilinear Elliptic Equations

Professor Manuel del Pino
Departamento de Ingenieria Matemática, Universidad de Chile

Abstract

We will survey some recent results on construction of entire solutions of semilinear elliptic equations. We will mostly focus on the construction of families of solutions to the Allen-Cahn equation of phase transitions, whose level sets suitable scaled concentrate around a given minimal surface. To do so, we shall introduce an infinite-dimensional form of Lyapunov-Schmidt reduction suitable for this and various related questions.

Concentrating solutions of an elliptic equation with singular nonlinearity

Professor Juan Dávila
Departamento de Ingenieria Matemática, Universidad de Chile

Abstract

We are interested in non-negative non-trivial solutions of the equation

$$-\Delta u + \chi_{[u>0]} u^{-\beta} = \lambda u^p$$

on a bounded smooth domain of $\mathbb{R}^N$, with Dirichlet boundary condition. Here β is in (0,1), $p > 1$ is subcritical and λ is positive. We prove existence of nontrivial solutions for every $\lambda > 0$. As $\lambda \to +\infty$ we find that the least energy solutions concentrate around a point that maximizes the distance to the boundary.

This is joint work with Marcelo Montenegro (UNICAMP).

Ground states and bound states of a nonlinear Schrödinger system

Professor Zhaoli Liu
School of Mathematical Sciences, Capital Normal University

Abstract

In this talk, we will discuss existence of ground states, multiplicity of bound states, uniqueness of positive solutions of a system of N-coupled time-independent Schrödinger equations from nonlinear optics and Bose-Einstein condensates.

A Hardy-Moser-Trudinger inequality

Professor Dong Ye
LMAM, University Paul Verlaine of Metz

Abstract

We show a two dimensional analog of the Hardy-Sobolev-Maz'ya inequality in higher dimensions, that is an inequality which combines the classical Moser-Trudinger inequality and the classical Hardy inequality. Indeed, there exists a constant $C_0 > 0$ such that

$$\int_B e^{\frac{4\pi u^2}{H(u)}} dx \leq C_0, \quad \forall\, u \in C_0^\infty(B),$$

where B is the unit disc in $\mathbb{R}^2$ and

$$H(u) := \int_B |\nabla u|^2 dx - \int_B \frac{u^2}{(1-|x|^2)^2} dx.$$

We also prove that the supremum is achieved in a suitable function space, which is an analog of the celebrated result of Carleson-Chang for the classical Moser-Trudinger inequality.

Infinitely many solutions for p-Laplacian equation

Professor Daomin Cao
Institute of Applied Mathematics, Chinese Academy of Science

Abstract

In this talk, I will talk about the existence of infinitely many solutions for the following elliptic problem with critical Sobolev growth:

$$-\Delta_p u = |u|^{p^*-2}u + a|u|^{p-2}u \text{ in } \Omega, \qquad u = 0 \text{ on } \partial\Omega,$$

where Δ_p is the p-Laplacian operator, $p^* = \frac{pN}{N-p}$, $1 < p < N$, $a > 0$ and Ω is an open bounded domain in $\mathbb{R}^N$.

This is a joint work with Shuangjie Peng and Shusen Yan.