

International Workshop on “Fundamental Problems in Mathematical and Theoretical Physics”

Date: July 24 – July 28, 2017

Venue: Conference Room No. 2, 1st Floor, 55N Bldg., Nishi-Waseda Campus, Waseda University
早稲田大学 西早稲田キャンパス 55 号館 N 棟 1 階 第 2 会議室

Part II. Mathematical Physics

◆Tai-Chia Lin (National Taiwan University)◆

◆Mini Course I	July 26, Wednesday	13:30 – 15:00
◆Mini Course II	July 27, Thursday	10:30 – 12:00
◆Mini Course III	July 28, Friday	10:30 – 12:00

Analysis of nonlinear Schrödinger equations and its applications

In this course, I'll introduce the mathematical analysis of nonlinear Schrödinger equations and its applications on Bose-Einstein condensation and photorefractive medium. Firstly, the problems of ground and bound states will be formulated from physical point of views. Then I'll introduce the idea of big ball approximation and the energy method to prove the existence of ground state when the concentration compactness method fails. Besides, I'll introduce a virial theorem and eigenvalue estimate of nonlinear Schrödinger (NLS) equations in \mathbb{R}^2 with square root and saturable nonlinearity, respectively. Furthermore, the eigenvalue estimate can be used to prove the 2nd order term (which is of order $\ln \Gamma$) of the lower bound of the ground state energy as the coefficient Γ of the nonlinear term tends to infinity.

References

1. T.C. Lin, M.R. Belic, M.S. Petrovic, H. Hajaiej and G. Chen, The virial theorem and ground state energy estimate of nonlinear Schrödinger equations in \mathbb{R}^2 with square root and saturable nonlinearities in nonlinear optics, submitted.
2. T.C. Lin, X. Wang and Z.Q. Wang, Orbital stability and energy estimate of ground states of saturable nonlinear Schrödinger equations with intensity functions in \mathbb{R}^2 , to appear in J. Diff. Eqn.
3. T.C. Lin, Milivoj R. Belić, Milan S. Petrović and Goong Chen, Ground states of nonlinear Schrödinger systems with saturable nonlinearity in \mathbb{R}^2 for two counterpropagating beams, Journal of Mathematical Physics, 55, 011505(1-13), 2014.
4. T. C. Lin, Milivoj R. Belić, Milan S. Petrović, Najdan B. Aleksić and Goong Chen, Ground-state counterpropagating solitons in photorefractive media with saturable nonlinearity, J. Opt. Soc. Am. B / Vol. 30, No. 4 / April 2013.

◆Yoshihiro Tonegawa (Tokyo Institute of Technology)◆

◆Mini Course I	July 26, Wednesday	15:30 – 17:00
◆Mini Course II	July 27, Thursday	15:30 – 17:00
◆Mini Course III	July 28, Friday	13:30 – 15:00

A short course on Brakke's mean curvature flow

A time-parametrized family of surfaces is called the mean curvature flow if the velocity of motion is equal to the mean curvature. For a given smooth initial surface, there exists a unique mean curvature flow until some singularities such as vanishing or pinching occur. There are various weak notion of mean curvature flow past singularities, and one of them is called Brakke flow which was introduced by Brakke in 1978.

In this mini course, after giving a quick introduction and explaining some preliminary materials from geometric measure theory, I plan to present the existence and regularity theorems which were obtained quite recently jointly with Lami Kim, Kota Kasai and others.