Plenary Talks

Stability of planar waves in a bidomain Allen-Cahn equation

Hiroshi Matano

June 27, 2016

University of Tokyo
E-mail : **matano@ms.u-tokyo.ac.jp**

Abstract

This talk is concerned with the stability of planar fronts in the "bidomain Allen-Cahn equation"

The bidomain model is the standard model describing electrical activity of the heart. Despite its importance in applications, not much is understood about the qualitative properties of this model. In this talk, as a first attempt to shed light on the nature of the bidomain model, I shall focus on a relatively simplified version of this model called the bidomain Allen-Cahn equation, which is given in the following form:

$$u_t = -\Lambda u + f(u) \quad (x \in \mathbb{R}^2,\ t > 0).$$

Here f is a bistable nonlinearity, while Λ is the so-called "bidomain operator", which is a pseudo-differential operator expressed in terms of a Fourier multiplier. This operator bears certain similarity with the Laplacian, but there are also significant differences. For example, the maximum principle does not hold for this operator. Moreover, it is highly anisotropic. Consequently, the stability of planar fronts may depend on the direction of propagation.

We present several criteria for stability and instability of planar fronts. The first result is concerned with the stability with respect to long-wavelength perturbations. Remarkably, the stability with respect to long-wavelength perturbations does not depend on the choice of the bistable nonlinearity f; it is fully determined by the convexity properties of the Frank diagram associated with the bidomain operator Λ. More precisely, the planar wave in the direction θ is linearly stable (resp. linearly unstabel) if and only if the Frank diagram is convex (resp. concave) in the direction θ. This, in particular, implies that planar waves can be unstable in some parameter ranges, which is in marked contrast to the case of classical Allen-Cahn equation

$$u_t = \Delta u + f(u),$$

whose planar waves are always stable. We also discuss the stability under intermediate-wavelength perturbations. This type of stability does depend on the choice of the nonlinearity. Intriguingly, there are examples of f and the choice of parameters in Λ that make the planar wave unstable in all directions.

This is joint work with Yoichiro Mori of the University of Minnesota.

Optimal transportation between unequal dimensions

Robert McCann

June 27, 2016

University of Toronto
E-mail : **mccann@math.toronto.edu**

Abstract

In this talk, we describe some recent developments concerning the Monge-Kantorovich problem of optimal transportation between probability densities on manifolds with arbitrary topology and dimensions. For smooth costs and densities on compact manifolds, the only known examples for which the optimal solution is always unique require at least one of the two underlying spaces to be homeomorphic to a sphere. With Rifford, we introduce a (multivalued) dynamics which the transportation cost induces between the target and source space, for which the presence or absence of a sufficiently large set of periodic trajectories plays a role in determining whether or not optimal transport is necessarily unique. This insight allows us to construct smooth costs on a pair of compact manifolds with arbitrary topology, so that the optimal transportation between any pair of probability densities is unique. With Chiappori and Pass, we give conditions under which the solution to this problem can be reduced to the solution of a partial differential equation. However, in contrast to the case where the source and target have equal dimensions, this equation presents new challenges, being generally nonlocal.

Witten's Morse theory, revisited

Naichung Conan Leung

June 28, 2016

Chinese University of Hong Kong
E-mail : **leung@math.cuhk.edu.hk**

Abstract

Witten interpreted Morse theory as a limit of twisted Hodge theory. This idea leads to the developments of Chern-Simons-Floer theory for three manifolds and Lagrangian-Floer theory for symplectic manifolds. We study the limit of algebra structure on the twisted deRham complex and show that its limit is the A_∞ structure on the Morse category. If time permits, I will explain applications to mirror symmetry. This research is supported by a RGC grant of the Hong Kong Government.

Symmetries of varieties

James McKernan

June 28, 2016

UCSD
E-mail : **jmckernan@math.ucsd.edu**

Abstract

It is a natural question to ask what are the most symmetric varieties. We review some old and new results on this topic and how these results relate to the birational classification of varieties.

Mathematical and computational modeling of graphene growth

John Lowengrub

June 29, 2016

UC Irvine
E-mail : **lowengrb@math.uci.edu**

Abstract

The epitaxial growth of graphene on copper foils is a complex process, influenced by thermodynamic, kinetic, and growth parameters, often leading to diverse island shapes including dendrites, squares, stars, hexagons, butterflies, and lobes. We introduce a phase-field model that provides a unified description of these diverse growth morphologies and compare the model results with experiments. We develop a minimal microkinetic model in order to relate the deposition rate with the partial pressures, to assess the importance of the different chemical species that might attach to the graphene edge. We also build a model for the kinetic coefficient, in this multiple species context. Our model explicitly accounts for the anisotropies in the energies of growing graphene edges, kinetics of attachment of carbon at the edges, and the crystallinity of the underlying copper substrate (through anisotropy in surface diffusion). We show that anisotropic diffusion has a very important, counterintuitive role in the determination of the shape of islands, and we present a "phase diagram" of growth shapes as a function of growth rate for different copper facets. Our results are shown to be in excellent agreement with growth shapes observed in experiments.

Asynchronous sparse sampling for classification and reconstruction of spatio-temporal dynamics in PDEs

J. Nathan Kutz

June 29, 2016

University of Washington
E-mail : **kutz@uw.edu**

Abstract

We present a method for the classification and reconstruction of time dependent, high-dimensional data using sparse measurements, and apply it to the flow around a cylinder. Assuming the data lies near a low dimensional manifold (low-rank dynamics) in space and has periodic time dependency with a sparse number of Fourier modes, we employ compressive sensing for accurately classifying the dynamical regime. We further show that we can reconstruct the full spatio-temporal behavior with these limited measurements, extending previous results of compressive sensing that apply for only a single snapshot of data. The method can be used for building improved reduced-order models and designing sampling/measurement strategies that leverage time asynchrony.

Removable and non-removable singularities in some parabolic equations

Eiji Yanagida

June 29, 2016

Tokyo Institute of Technology
E-mail : **yanagida@math.titech.ac.jp**

Abstract

For parabolic partial differential equations, there may exist solutions with time-dependent singularities. In this talk we give a sufficient condition for the removability of such singularities. We also show the existence of solutions with non-removable singularities, and study the asymptotic profile of solutions near singular points.

Random planar metrics for discrete Gaussian free fields

Jian Ding

June 29, 2016

University of Chicago
E-mail : **jianding@galton.uchicago.edu**

Abstract

I will discuss some recent progress on random planar metrics that arise from two-dimensional discrete Gaussian free fields. I will also draw some connections to simple and non-simple random walks on two-dimensional lattice.

Calculus on symplectic manifolds

Michael Eastwood

June 30, 2016

University of Adelaide
E-mail : **meastwoo@member.ams.org**

Abstract

One can use the symplectic form to construct an elliptic complex replacing the de Rham complex. Then, under suitable curvature conditions, one can form coupled versions of this complex. Finally, on complex projective space, these constructions give rise to a series of elliptic complexes with geometric consequences for the Fubini-Study metric and its X-ray transform. This talk, which will start from scratch, is based on the work of many authors but, especially, current joint work with Jan Slovak.

New a priori estimate of the 3D Navier-Stokes equations and its application to the Liouville-type theorem

Hideo Kozono

June 30, 2016

Waseda University
E-mail : **kozono@waseda.jp**

Abstract

Consider the 3D homogeneous stationary Navier-Stokes equations in the whole space. We deal with solutions vanishing at infinity in the class of the finite Dirichlet integral. By means of quantities on the vorticity and the velocity itself with the same scaling properties as the Dirichlet integral, we establish new a priori estimates. As an application, we prove the Liouville theorem in the marginal case of scaling invariant class. This is a joint work with Profs. Yutaka Terasawa and Yuta Wakasugi at Nagoya University.

Classification of simple amnebale C^*-algebras

Huaxin Lin

July 1, 2016

University of Oregon/East China Normal University
E-mail : **hlin@uoregon.edu**

Abstract

Given two unital separable C^*-algebras A and B. We study the problem when they are isomorphic. In the commutative cases, $A = C(X)$ and $B = C(Y)$ the algebras of continuous functions on compact metric spaces X and Y, respectively. We study non-commutative topology. In fact, we will only consider the cases that both A and B are simple C^*-algebras. We will briefly introduce the Elliott invariant and an equally brief discussion of history. We will present the most recent results in the cases that C^*-algebras are finite and provide a glance of some technical development. Some applications to minimal dynamical systems may be presented.

Global solvability of some complex kinetic equations near Maxwellians in the perturbative framework

Huijiang Zhao

July 1, 2016

Wuhan Univ.
E-mail : **hhjjzhao@whu.edu.cn**

Abstract

This talk is concerned with the construction of global smooth solutions to some complex kinetic equations near Maxwellians in the perturbative framework.

Invited Talks

(June 27th - June 28th)

Session : Algebraic Geometry

Birational geometry through complex dymanics

Keiji Oguiso

June 27-28, 2016

University of Tokyo
E-mail : **oguiso@ms.u-tokyo.ac.jp**

Abstract

Birational algebraic geometry and complex dymanics are rich subjects having interactions with many branches of mathematics. On the other hand, though these two subjects share many common interests hidden especially when one considers group symmetry of manifolds, it seems rather recent that their rich interations are really notified, perhaps after breaking through works for surfaces by Cantat and McMullen early in this century. In this talk, I would like to discuss the above mentioned phenomena, their higher dimensional analogues together with some unexpected applications, through their interactions: (1) Liftability problem of automorphisms of manifolds of positive characteristic to chacateristic 0 via number theoretic property of entropy; (2) Existence results of primitive automorphisms of projective manifolds, through (relative) dynamical degrees due to Dinh-Sibony, Dinh-Nguyen-Troung.

Commuting nilpotents modulo simultaneous conjugation and Hilbert scheme

Donghoon Hyeon

June 27-28, 2016

Seoul National University
E-mail : **dhhyeon@gmail.com**

Abstract

Pairs of commuting nilpotent matrices have been extensively studied, especially from the view point of quivers. But the space of commuting nilpotents modulo simultaneous conjugation has not received any attention at all although it has a definite moduli theory flavor. Unlike the case of commuting nilpotents paired with a cyclic vector, the GIT is not well behaved in this case. I will explain how a 'moduli space' can be constructed as a homogeneous space, and show that it is isomorphic to an open subscheme of a punctual Hilbert scheme. Over the field of complex numbers, thus constructed space is diffeomorphic to a direct sum of twisted tangent bundles over a projective space. Time permitting, I will also explain how the new development in GIT (of affine spaces modulo solvable groups) might possibly treat this case and produce a moduil space as a GIT quotient. This is a joint work with W. Haboush.

Recursion of quintic's FJRW invariants via mixed-spin-P fields

Huailiang Chang

June 27-28, 2016

Hong Kong University of Science and Technology
E-mail : **mahlchang@ust.hk**

Abstract

Mixed-Spin-P field originates from quantizing complexified Kaehler parameter in A model; it adds a field called ν to the ordinary P fields in both Calabi Yau and Landau Ginzburg setting. We have used MSP moduli to reduce quintic's all-genus GW invariants to FJRW invariants of quintic singularity. A new result we obtain recently is that this infinite set of all FJRW invariants can be further reduced to finitely many initial ones, via a recursion provided by moduli of MSP fields which "levitate". This is a joint work with Jun Li, Weiping Li, and Chiu-Chu Melissa Liu.

Hyperk$\ddot{a}$hler fourfolds and Kummer surfaces

Atanas Iliev

June 27-28, 2016

Seoul National University
E-mail : **ailiev2001@yahoo.com**

Abstract

(common with G.Kapustka, M.Kapustka and K.Ranestad; e-print arxiv:1603.00403): By using the geometry of the general quadratic section of the cone K over the Segre 4-fold $\mathbb{P}^2 \times \mathbb{P}^2$, we construct a hyperkahler (HK) fourfold $Y = Y(X)$, deformation equivalent to the Hilbert square of a K3 surface. The general Y is a $2:1$ cover of a singular quartic section $Y(o)$ of the cone K with two Kummer surface fibrations $p_i : Y(o) \to \mathbb{P}^2$, $i = 1, 2$, which involve two abelian fibrations on Y. We call these Y Verra HK fourfolds, after A.Verra who had studied the Prym map for double covers of plane sextics from the geometry of the quadratic sections of $\mathbb{P}^2 \times \mathbb{P}^2$. Although our construction describes a non-complete family (of dimension 19) of HK fourfolds Y in a polarization of Beauville degree 4, the general Y is not birational to a Hilbert square of a K3 surface or to a 4-dimensional moduli space over a K3 surface.

Injectivity theorem for pseudo-effective line bundles and its applications

Osamu Fujino

June 27-28, 2016

Osaka university
E-mail : **fujino@math.sci.osaka-u.ac.jp**

Abstract

We will explain a new generalization of Kollár's injectivity theorem for adjoint bundles twisted by a suitable multiplier ideal sheaf. As applications, we can generalize Kollár's vanishing theorem, Kollár's torsion-freeness, generic vanishing theorem, and so on, for pseudo-effective line bundles. Our approach is not Hodge theoretic but is analytic since we treat singular hermitian metrics with arbitrary singularities. For the proof of the main injectivity theorem, we use the theory of harmonic integrals on noncompact Kähler manifolds. This is a joint work with Shin-ichi Matsumura.

Automorphisms of the complement of a smooth del Pezzo hypersurface

Jihun Park

June 27-28, 2016

IBS / POSTECH
E-mail : **wlog@postech.ac.kr**

Abstract

We consider a smooth del Pezzo surface in a 3-dimensional weighted projective space. The group of birational automorphisms of the 3-dimensional weighted projective space is huge. In this talk, we will discuss birational automorphisms of the 3-dimensional weighted projective space that induce biregular automorphisms outside of the given smooth del Pezzo surface.

Session : Applications of Information Science to PDEs

Solve geometric PDEs on manifolds represented as point clouds and applications

Rongjie Lai

June 27-28, 2016

Rensselaer Polytechnic Institute
E-mail : **lair@rpi.edu**

Abstract

In this talk, I will discuss our recent work of solving geometric PDEs on manifolds sampled as point clouds. These methods can achieve high order accuracy and enjoy flexibility of solving different types of equations on manifolds with possible high co-dimesion. We use the proposed methods to consider special designed geometric PDEs on point clouds, which provides us a bridge to link local and global information. Based on this method, I will discuss a few applications to geometric understanding for point clouds, including computation of LB eigen-systems for point clouds, extraction of global skeletons structure from point clouds, extraction of conformal structures from point clouds, and intrinsic comparisons among point clouds etc. In addition, our methods can also be extended to solve PDEs on manifolds only represented as incomplete distance information. I will also discuss our results of this method for reconstructing and understanding distance data based on solutions of Laplace-Beltrame equations.

Finding eigenvectors via unconstrained difference of convex functions

Yunho Kim

June 27-28, 2016

UNIST
E-mail : **yunhokim@unist.ac.kr**

Abstract

Unconstrained difference of convex functions drew some attention in image processing to impose sparsity on the solution. In this talk, we will propose another unconstrained difference of convex functions to find an eigenvector of a symmetric postitive definite matrix corresponding to the smallest eigenvalue and show that the gradient descent method finds such an eigenvector with probability 1 and the norm of the eigenvector determines the corresponding eigenvalue. We will also talk about finding singular value decompositions of a matrix. In addition, finding eigenfunctions of symmetric elliptic operators as steady states of corresponding parabolic equations will be discussed.

Compressed modes for differential equations

Russel Caflisch

June 27-28, 2016

UCLA
E-mail : **rcaflisch@ipam.ucla.edu**

Abstract

This talk is on the use of ideas from information science in differential equations and physics. The focus is on variational principles and differential equations whose solutions are sparse; i.e. they have compact support. Analytic results will be presented on the size of the support and the completeness of these "compressed modes". Applications of compressed modes as Wannier modes for density functional theory and for signal fragmentation in radio transmission will be described.

A generalized multiscale model reduction technique for heterogeneous problems

Yalchin Efendiev

June 27-28, 2016

Texas A&M University
E-mail : **efendiev@math.tamu.edu**

Abstract

In this talk, I will discuss multiscale model reduction techniques for problems in heterogeneous media. I will describe a framework for constructing local (space-time) reduced order models for problems with multiple scales and high contrast. I will focus on a recently proposed method, Generalized Multiscale Finite Element Method, that systematically constructs local multiscale finite element basis functions on a coarse grid, which is much larger than the underlying resolved fine grid. The multiscale basis functions take into account the fine-scale information of the resolved solution space via careful choices of local snapshot spaces and local spectral decompositions. I will discuss the issues related to the construction of multiscale basis functions, main ingredients of the method, and a number of applications. These methods are intended for multiscale problems without scale separation and high contrast.

Variational image segmentation models with L^1 data-fitting terms

Miyoun Jung

June 27-28, 2016

Hankuk University of Foreign Studies
E-mail : **mjung@hufs.ac.kr**

Abstract

In this talk, I will introduce a class of variational image segmentation models that involves L^1 norms as data fidelity measures. The L^1 norms enable to segment images with low contrast or outliers such as impulsive noise. The regions to be segmented are represented as smooth functions, almost binary functions, instead of the Heaviside expression of level set functions as in the level set method. To handle both non-smooth data-fitting and regularization terms, we use the variable splitting scheme to obtain constrained optimization problems, and apply an augmented Lagrangian method to solve the problems. This results in fast and efficient iterative algorithms for solving our models. Numerical results will be shown to demonstrate the effectiveness of our models.

Low dimensional manifold model for image processing

Zuoqiang Shi

June 27-28, 2016

Tsinghua University
E-mail : **zqshi@math.tsinghua.edu.cn**

Abstract

In this talk, I will present a novel low dimensional manifold model for some image processing problem. This model is based on the observation that for many natural images, the patch manifold usually has low dimension structure. Then, we use the dimension of the patch manifold as a regularization to recover the original image. Using some formula in differential geometry, this problem is reduced to solve Laplace-Beltrami equation on manifold. The Laplace-Beltrami equation is solved by the point integral method. Numerical tests show that this method gives very good results in image inpainting, denoising and super-resolution problem.

Session : Computational Aspects of Interface Problems with Applications

Multiphase flow simulation using a level set method and its applications

Myungjoo Kang

June 27-28, 2016

Seoul National University
E-mail : **mkang@snu.ac.kr**

Abstract

The multiphase flow simulation is important for many industrial application, including computer graphics, computational physics and engineering. In spite of numerous needs on this simulation, it is still difficult to achieve accuracy and efficiency simultaneously. When we attempt to describe the motion of multiphase flow, two things must be considered: To obtain the information of properties of fluid itself, such as velocity of fluid, and to express motion of interface. In this talk, mathematical formulation for multiphase incompressible flow motion including governing equation and level set method is given. Various numerical methods for solving the incompressible Navier-Stokes equations and level set advection are given. Finally, computational results of multiphase flow simulation is illustrated by core-annular flow example and interesting problem will be given.

Mechanisms of elastic enhancement and hindrance for swimmers in viscoelastic fluids

Robert Guy

June 27-28, 2016

University of California Davis
E-mail : **guy@math.ucdavis.edu**

Abstract

Low Reynolds number swimming of microorganisms in Newtonian fluids is an extensively studied classical problem. However, many biological fluids such as mucus are mixtures of water and polymers and are more appropriately described as viscoelastic fluids. Recently, there have been many studies on locomotion in complex fluids. Both experiments and theory have exhibited that viscoelasticity can lead to either an enhancement or retardation of swimming, but a complete understanding of this problem is lacking. A computational model of finite-length undulatory swimmers is used to examine the physical origin of the effect of elasticity on swimming speed. We reproduce conflicting results from the literature simply by changing relevant physical parameters.Additionally, we examine an oscillatory bending beam in a viscoelastic fluid to provide a mechanistic understanding of how elasticity affects swimming and to identify a threshold in amplitude related to the development of large elastic stresses. We relate this transition to previously studied bifurcations in steady extensional flows of complex fluids. This reduced model sheds light on properties of swimmer gaits and body mechanics that lead to either elastic enhancement or hindrance.

On a vector field embedding of multiphase geometries

Elliott Ginder

June 27-28, 2016

Hokkaido University
E-mail : **eginder@gmail.com**

Abstract

Tracking the evolution of multiphase geometries represents a fundamental problem that arises in a variety of scientific simulations. The phenomena under consideration can exhibit additional challenges to its numerical simulation, including the occurrence of topological changes, volume constraints, and inertial effects. We will introduce a method for treating these issues and investigate its application in the simulation of 2D and 3D multiphase parabolic and hyperbolic curvature flows. Volume constrained motions will also be investigated through the use of minimizing movements, and we will remark about aspects related to our method's numerical realization.

An efficient threshold dynamics method for wetting on rough surfaces

Xiao-Ping Wang

June 27-28, 2016

Hong Kong University of Science and Technology
E-mail : **mawang@ust.hk**

Abstract

The threshold dynamics method developed by Merriman, Bence and Osher(MBO) is an efficient method for simulating the motion by mean curvature flow when the interface is away from the solid boundary. Direct generalization of the MBO type method to the wetting problems with interface intersecting the solid boundary is not easy because solving heat equation on general domain with wetting boundary condition is not as efficient as that for the original MBO method. The dynamics of the contact point also follows a different dynamic law compared to interface dynamics away from the boundary. In this paper, we develop an efficient volume preserving threshold dynamics method for wetting on rough surfaces, which is based on minimization of the weighted surface area functional over a extended domain that includes the solid phase. The method is simple, stable with the complexity $O(N \log N)$ per time step and it is not sensitive to the inhomogeneity or roughness of the solid boundary.

An efficient parallel immersed boundary algorithm for simulating flexible particle suspensions

John Stockie

June 27-28, 2016

Simon Fraser University
E-mail : **stockie@math.sfu.ca**

Abstract

We study the hydrodynamic interactions in a semi-dilute suspension of hundreds or even thousands of particles that deform in response to a surrounding incompressible fluid. Simulating such suspension flows is a computationally demanding task that is really only practical with the use of parallel algorithms. We develop an immersed boundary approach for simulating the fluid-structure interaction that makes use of a pseudo-compressible fluid solver proposed by Guermon and Minev. The resulting method has excellent parallel scaling properties. We illustrate the accuracy and efficiency of our approach using two examples: a 2D active suspension consisting of swimming jellyfish, and 3D simulations of flexible fiber suspensions. This is joint work with Jeffrey Wiens.

Electrohydrodynamic simulations: droplet and vesicle

Ming-Chih Lai

June 27-28, 2016

National Chiao Tung University, Taiwan
E-mail : **mclai@math.nctu.edu.tw**

Abstract

In this talk, we will introduce a hybrid immersed boundary and immersed interface method to simulate the deformation dynamics of a droplet or vesicle in leaky dielectric fluids under a DC electric field. We treat the Maxwell stress jump across the interface as a singular delta function force term that can be formulated in the immersed boundary method. Meanwhile, the elliptic potential function with jumps across the interface can be solved by the immersed interface method so that the electric field can be computed accurately. A series of numerical tests will be shown to validate the present numerical algorithms.

Session : Monge-Ampere type equations in geometry, optics and optimal transportation

Free boundary problems in curvature flows

Ki-Ahm Lee

June 27-28, 2016

Seoul National University
E-mail : **kiahm@snu.ac.kr**

Abstract

In this talk, we are going to consider Free Boundary Problems in Curvature Flows. Gauss Curvature Flows describe the evolution of hypersurfaces in inward normal direction with a speed proportional to Gauss Curvature of the hypersurface. Free boundary problems occur at various case with different characters. First, we will discuss obstacle problems for Curvature flows designed to block the development of singularities. Existence of solutions, optimal regularity, and the regularity of the interface separating the coincident set and non-coincident set between the obstacle and the solution. In addition, we will consider the evolution of convex hypersurfaces with a flat spot where the boundary of the flat spot evolves along the time. We will discuss the optimal regularity, and the regularity of the moving free boundary, and the development of solitons with flat spots.

Global smoothness of the Monge-Ampere eigenfunctions

Nam Quang Le

June 27-28, 2016

Indiana University, Bloomington
E-mail : **nqle@indiana.edu**

Abstract

The question of global higher derivative estimates up to the boundary of the eigenfunctions of the Monge-Ampere operator is a well known open problem. In this talk, I will discuss the proof of global smoothness of the eigenfunctions of the Monge-Ampere operator on smooth, bounded and uniformly convex domains in all dimensions. A key ingredient in our analysis is boundary Schauder estimates for certain degenerate Monge-Ampere equations. This is joint work with Ovidiu Savin.

From optimal transportation to conformal geometry.

Neil Trudinger

June 27-28, 2016

Australian National University
E-mail : **neil.trudinger@anu.edu.au**

Abstract

In this talk we will show the connection between boundary value problems in optimal transportation and geometric optics with the prescribed boundary mean curvature problem in conformal geometry.

Wasserstein/Information geometry and its applications

Asuka Takatsu

June 27-28, 2016

Tokyo Metropolitan University
E-mail : **asuka@tmu.ac.jp**

Abstract

Wasserstein/Information geometry is a geometry on the space of probability measures, however both geometries are completely different from each other: On the one hand, the Wasserstein geometry is a distance geometry and relates with the geometry of its underlying space. On the other hand, the Information geometry is a geometry of a metric with a pair of orthogonal connections and does not reflect the geometry of its underlying space. However the two geometries are related to each other. In this talk, I explain that the combination of two geometries is useful to investigate functional inequalities, partial differential equations and so on.

Dynamics of optimal partial transport

Young-Heon Kim

June 27-28, 2016

University of British Columbia / Korea Institute for Advanced Study
E-mail : **yhkim@math.ubc.ca**

Abstract

Optimal partial transport is a variant of optimal transport theory, where only a portion of mass is to be transported in an efficient way. It was initially studied by Caffarelli and McCann. I will explain a joint work with Gonzalo Davila, on the change of the free boundary arising from the optimal partial transport problem, as the portion of mass to be transported changes.

The existence of the classical solution for the Hessian equations with Neumann boundary value problem

Xinan Ma

June 27-28, 2016

Univ. Sci. Tech. China, Hefei, CHINA
E-mail : **xinan@ustc.edu.cn**

Abstract

We prove the existence of a classical admissible solution to a class of Neumann boundary value problems for the standard k Hessian equations in uniformly convex domain in $\mathbb{R}^n$, so it give an affirmative answer to a conjecture of N. Trudinger in 1987. The methods depend upon the establishment of a priori derivative estimates up to second order. This is a joint work with Guohuan Qiu.

Session : Mathematics in Biology and Medicine

A simplified tumor growth model of contact inhibition

Masayasu Mimura

June 27-28, 2016

MIMS/Meiji University
E-mail : **mimura.masayasu@gmail.com**

Abstract

It is observed in vitro and in vivo that when two populations of different types of cells come near to each other, the rate of proliferation of most cells decreases. This phenomenon is called contact inhibition of growth between two cells. We consider a simplified 1-dimensional PDE model for normal and abnormal cells. We discuss the qualitative properties of contact inhibition arising in this model.

A new maximum principle for diffusive Lotka-Volterra systems of two competing species

Chiun-Chuan Chen

June 27-28, 2016

National Taiwan University
E-mail : **chchchen@math.ntu.edu.tw**

Abstract

Using an elementary approach, we establish a new maximum principle for the diffusive Lotka-Volterra system of two competing species. This maximum principle gives apriori estimates for the total mass of the two species. Moreover, applying it to the system of three competing species leads to a nonexistence theorem of traveling wave solutions.

Drift bifurcation of traveling wave in reaction-diffusion system with 3 competing species

Toshiyuki Ogawa

June 27-28, 2016

Meiji University
E-mail : **togw@meiji.ac.jp**

Abstract

There have been a lot of studies on the traveling wave solutions to a reaction-diffusion system with 2 competing species. Leu us consider, here, the situation where we have third competing species adding to the original two competing species. Since this system has a trivial traveling solution which consists of the traveling wave solution of 2 species, the question is the stability of this solution in the full 3 component system. It turns out there is one critical point by taking the birth rate of the third species as a bifurcation parameter and we study the bifurcation structure around this critical point.

Spreading in a shifting environment modeled by a free boundary problem

Yihong Du

June 27-28, 2016

University of New England, Australia
E-mail : **ydu@une.edu.au**

Abstract

We investigate the influence of a shifting environment on the spreading of an invasive species through a model given by the diffusive logistic equation with a free boundary. Here we consider the situation that part of the environment becomes unfavourable, and the unfavourable range of the environment moves into the favourable part with speed $c > 0$. We prove that there exists $c_0 > 0$ such that when $c > c_0$, the species always dies out in the long-run, but when $0 < c < c_0$, the long-time behavior of the species is determined by a trichotomy described by (a)vanishing, (b)borderline spreading, or (c)spreading.

How does an organism configure its dynamical networks ?

Alejandro Maass

June 27-28, 2016

University of Chile
E-mail : **amaass@dim.uchile.cl**

Abstract

A living organism or a community of living organisms configure different dynamical networks to live. Among them one distinguishes regulatory and metabolic networks. Much of these networks emerge from the consolidation of a series of interactions that occur at a local level. Of course the environment plays a key role in this process. Many questions remains open about the way such networks are produced, in particular, does it exists some optimisation process leading to them? In this talk we explore different mathematical directions to understand this question in communities of bacteria.

Modeling and analysis in immunology

Hyung Ju Hwang

June 27-28, 2016

Postech
E-mail : **hyungjuege@gmail.com**

Abstract

We discuss the chemotactic mechanism arising in immunology by modeling and analyzing the interaction between immune cells and antigens.

Session : Low-dimensional Topology and Sympletic Geometry

On orbifold Jacobian algebras

Atsushi Takahashi

June 27-28, 2016

OSAKA University
E-mail : **takahashi@math.sci.osaka-u.ac.jp**

Abstract

To a polynomial with an isolated singularity at the origin, one can associate the Jacobian algebra, which is a finite dimensional commutative Frobenius algebra. We propose axioms for "orbifold Jacobian algebras" which generalize the Jacobian algebras to those for polynomials with a group action. We shall prove the existence and the uniqueness for invertible polynomials in three variables with a group action and show a compatibility with the geometry of vanishing cycles. This is a joint work with Alexey Basalaev and Elisabeth Werner.

TBA

Jae-suk Park

June 27-28, 2016

IBS CGP & Postech
E-mail : **jaesuk@postech.ac.kr**

Abstract

TBA

4-manifold invariants from Seiberg-Witten and Heegaard Floer theories

Yi-Jen Lee

June 27-28, 2016

CUHK
E-mail : **yjlee@math,cuhk.edu.hk**

Abstract

We discuss the relations between various 4-manifold invariants from Seiberg-Witten and Heegaard Floer theory.

Floer theory and covering spaces

Kaoru Ono

June 27-28, 2016

RIMS, Kyoto University
E-mail : **ono@kurims.kyoto-u.ac.jp**

Abstract

I will use the construction of Floer complex associated with a covering space of the symplectic manifold to obtain an estimate for the number of fixed points of a Hamiltonian diffeomorphism on a non-simply connected closed symplectic manifold. This is based on a joint work with Andrei Pajitnov. If time allows, I will mention some related topics.

Gopakumar-Vafa type structure for real symplectic manifolds

Eleny Ionel

June 27-28, 2016

Stanford University
E-mail : **ionele@stanford.edu**

Abstract

In the late nineties physicists Gopakumar and Vafa conjectured that the Gromov-Witten invariants of Calabi-Yau 3-folds have a hidden structure: they are obtained, by a specific transform, from a set of more fundamental “BPS numbers”, which are integers. In joint work with Tom Parker, we proved this conjecture by a decomposing the Gromov-Witten invariants into contributions of “clusters” of curves, deforming the almost complex structure and reducing it to a local calculation. In this talk, I will discuss recent progress, joint with Penka Georgieva, towards proving that a similar structure theorem holds for the real Gromov-Witten invariants of symplectic Calabi-Yau 3-folds in the presence of an anti-symplectic involution.

Non-commutative homological mirror functors

Cheolhyun Cho

June 27-28, 2016

Seoul National University
E-mail : **chocheol@snu.ac.kr**

Abstract

We give a constructive homological mirror formalism using formal Lagrangian Floer deformation theory. Given a symplectic manifold X and a choice of a reference Lagrangian submanifold L, our formalism provides a possibly non-commutative algebra A, together with a central element W, which provides a non-commutative Landau-Ginzburg model (A, W). The construction comes with a natural A-infinity functor from the Fukaya category to the category of matrix factorizations of the constructed Landau-Ginzburg model. In particular it recovers and strengthens several interesting results of Seidel, Etingof-Ginzburg, Bocklandt and Smith, and gives a unified understanding of their results in terms of mirror symmetry and symplectic geometry. Applying the mirror construction to an elliptic curve quotient, we also obtain a deformation quantization of an affine del Pezzo surface. This is based on joint works with Hansol Hong and Siu-Cheong Lau.

Session : Qualitative properties of Solutions of nonlinear PDEs

Constant solutions, ground-state solutions and radial terrace solutions

Yihong Du

June 27-28, 2016

University of New England, Australia
E-mail : **ydu@turing.une.edu.au**

Abstract

We consider the long-time behavior of positive solutions to a general Cauchy problem of the form $u_t - \Delta u = f(u)$, with $f(0) = 0$ and $u(0, x)$ nonnegative with compact support. If f is C^2 and all its zeros are nondegenerate, we show that, as t goes to infinity, in the space $L^\infty_{loc}(\mathbb{R}^n)$, a globally bounded solution $u(t, x)$ must converge to a constant solution or a ground-state solution (based on a constant solution) of the corresponding elliptic problem on $\mathbb{R}^n$. Moreover, we show that, in the space $L^\infty(\mathbb{R}^n)$, the limit of such a solution $u(t, x)$ is determined by a radial terrace solution. This talk is based on joint works with Peter Polacik and with Hiroshi Matano.

A remark on the compactness of the Sobolev type embedding with variable exponent

Michinori Ishiwata

June 27-28, 2016

Osaka university
E-mail : **ishiwata@sigmath.es.osaka-u.ac.jp**

Abstract

In this talk, we are concerned with the compactness of the embedding of the usual Sobolev space into the Lebesgue space with a variable exponent which touches the critical exponent at a point. The touching rate of the exponent function with the critical exponent decides the compactness of the embedding. We will extend the former results of Kurata-Shioji and Mizuta-Ohno-Shimomura-Shioji and discuss the relation between the log-Holder continuity of the exponent function and the scaling properties of norms, which is one of the crucial aspect of our result.

Uniqueness of positive solution to some coupled cooperative variational elliptic systems on an interval

Jann-Long Chern

June 27-28, 2016

National Central University
E-mail : **chern@math.ncu.edu.tw**

Abstract

Oscillatory behavior of solutions of linearized equations for cooperative semilinear elliptic systems of two equations on one-dimensional domains are proved, and it is shown that the stability of the positive solutions for such semilinear system is closely related to the oscillatory behavior. These properties are used to prove the uniqueness of positive solutions to some semilinear elliptic systems with nonlinearities satisfying certain variational structure and growth conditions. This is a joint work with Profs. Yulian An and Junping Shi.

Blowing up solutions for the harmonic map flow

Juan Diego Davila

June 27-28, 2016

Universidad de Chile
E-mail : **jdavila@dim.uchile.cl**

Abstract

We study singularity formation for the harmonic map flow from a two dimensional domain into the sphere. We show that for suitable initial conditions the flow develops a type 2 singularity at some point in finite time, and that this is stable under small perturbations of the initial condition. This phenomenon and the rate of blow up were studied formally by van den Berg, Hulshof and King (2003) and proved by Raphael and Schweyer (2013) in the class of radial and 1-corrotationally symmetric maps. Our results hold without any symmetry assumptions.

Besov spaces defined via the spectral theorem for the Dirichlet Laplacian

Tsukasa Iwabuchi

June 27-28, 2016

Osaka City University
E-mail : **iwabuchi@sci.osaka-cu.ac.jp**

Abstract

Let Ω be an arbitrary open set of $\mathbb{R}^n$ with $n \geq 1$. It is well known that the Besov spaces on $\mathbb{R}^n$ are defined by the dyadic decomposition of frequency component via the Fourier transform. The aim of this talk is to introduce the Besov spaces on Ω by the dyadic decomposition of spectrum for the Dirichlet Laplacian via the spectral theorem.

Linear inviscid damping for a class of monotone shear flow in Sobolev spaces

Zhifei Zhang

June 27-28, 2016

Peking university
E-mail : **zfzhang@math.pku.edu.cn**

Abstract

I will talk about the decay estimates of the velocity and H^1 scattering for the 2D linearized Euler equations around a class of monotone shear flow in a finite channel.

Decaying properties of the total and local energies for the wave equations with dissipations

Mishio Kawashita

June 27-28, 2016

Hiroshima University
E-mail : **kawasita@math.sci.hiroshima-u.ac.jp**

Abstract

In this talk, the dissipative wave equations in an outside of compact regions with smooth boundary are treated. Assume that the dissipation coefficient depends only on the space variable. First, in this setting, a sufficient condition showing uniformly decaying estimates of the local energy is given. As an application of it, a decaying estimate of the local energy near the boundary is obtained if the dissipation coefficient is positive near concave part of the boundary. Second, the cases that the dissipation coefficient is not small in far region are considered. In this case, an optimal decay of the total energy corresponding to the decay rate for high frequency waves is discussed.

Invited Talks
(June 30th - July 1st)

Session : Differential Geometry

How to construct minimal hypersurfaces in $\mathbb{R}^n$

Jaigyoung Choe

June 30-July 1, 2016

KIAS
E-mail : **choe@kias.re.kr**

Abstract

We will show how to construct higher dimensional generalizations of Enneper's surface, helicoid, Schwarz's P-surface, D-surface, Scherk's first and second surfaces.

The ambient obstruction tensor and conformal holonomy

Thomas Leistner

June 30-July 1, 2016

University of Adelaide
E-mail : **thomas.leistner@adelaide.edu.au**

Abstract

The obstruction tensor is a conformally covariant tensor that obstructs the existence of an analytic Ricci flat ambient metric in the sense of Fefferman and Graham. In the talk, I will describe a new relation between the obstruction tensor and the holonomy of the normal conformal Cartan connection. This relation implies several results on the vanishing and the rank of the obstruction tensor, for example for conformal structures with twistor spinors. As the main tool we introduce the notion of a conformal holonomy distribution whose integrability is closely related to the exceptional conformal structures in dimensions five and six that were found by Nurowski and Bryant. This is joint work with Andree Lischewski from the Humboldt-University Berlin.

Universal curvature identities and their applications

JeongHyeong Park

June 30-July 1, 2016

Sungkyunkwan University
E-mail : **parkj@skku.edu**

Abstract

We will review some results in the theory of harmonic manifolds. A new proof of the Lichnerowicz conjecture in dimensions 4 and 5 will be presented which relies on the theory of universal curvature identities. This is joint work with Y. Euh and K. Sekigawa.

Total Q-prime curvature in view of scattering theory

Kengo Hirachi

June 30-July 1, 2016

University of Tokyo
E-mail : **hirachi@ms.u-tokyo.ac.jp**

Abstract

Total Q-prime curvature is a generalization of Burns-Epstein invariant of 3-dimensional CR manifolds to higher dimensions. We study the geometric properties of total Q-curvature by using the scattering theory of Cheng-Yau metric on strictly pseudoconvex domains. This is a report based on the masterś thesis by Yuja Takeuchi at University of Tokyo.

Higher dimensional analogues of the Willmore energy and invariant by a singular Yamabe problem

Rod Gover

June 30-July 1, 2016

University of Auckland
E-mail : **r.gover@auckland.ac.nz**

Abstract

The Willmore energy of a surface is a conformal measure of its failure to be conformally spherical. In physics the energy is variously called the bending energy, or rigid string action. In both physics and geometric analysis it has been the subject of great recent interest. We explain that its Euler-Lagrange equation is an extremely interesting equation in conformal geometry: the energy gradient is a fundamental curvature that is a scalar-valued hypersurface analogue of the Bach tensor (of dimension 4) of intrinsic conformal geometry. Then we show that that these surface conformal invariants, i.e. the Willmore energy and its gradient, are the lowest dimensional examples in a family of similar invariants in higher dimensions. They arise in the asymptotics associated with a singular Yamabe problem on conformally compact manifolds. This is joint work with Andrew Waldron arXiv:1506.02723

Renormalized Volume

Andrew Waldron

June 30-July 1, 2016

University of California, Davis
E-mail : **wally@math.ucdavis.edu**

Abstract

We define a canonical renormalized volume functional for any conformally compact manifold and give an explicit holographic formula for its anomaly. We also give explicit holographic formulae for the divergences of the volume functional valid for any regulating hypersurface. The anomaly gives an extrinsic analog of Branson's Q-curvature. In every dimension, this gives an energy integral generalizing the Willmore/rigid string functional. The variation of these functionals obstruct smooth solutions to the singular Yamabe problem. The approach is based on a conformal boundary calculus that utilizes the bulk conformal structure.

Session : Kinetic and Related Models

The Vlasov-Poisson-Boltzmann system for a binary mixture

Renjun Duan

June 30-July 1, 2016

The Chinese University of Hong Kong
E-mail : **rjduan@math.cuhk.edu.hk**

Abstract

In the talk we are concerned with the Vlasov-Poisson-Boltzmann system modelling the motion of plasmas of electrons and ions with disparate masses. We present the construction of rarefaction waves through the quasineutral two-fluid Euler system and further show the time asymptotic stability of the nontrivial profile under small perturbations. The main analytical tool is the macro-micro decomposition around local bi-Maxwellians in the context of binary mixtures with disparate masses.

Fluid limits of the Boltzmann equation and boundary layers

Ning Jiang

June 30-July 1, 2016

Wuhan University
E-mail : **njiang@whu.edu.cn**

Abstract

In this talk, we review the recent progress on the fluid limits from the Boltzmann equation in the domain with boundary. The Boltzmann equation has Maxwell reflection or incoming boundary conditions. We consider both incompressible Navier-Stokes and acoustic limits. The key role played is the kinetic-fluid coupled boundary layers. These are joint work with Nader Masmoudi and Francois Golse respectively.

Global well-posedness to the MHD equations with partial viscosity

Quansen Jiu

June 30-July 1, 2016

Capital Normal University
E-mail : **jiuqs@mail.cnu.edu.cn**

Abstract

In this talk, we will present some recent results on the global wel-posedness to the two-dimensional and 3D axisymmetric MHD equations with partial viscosity.In the two-dimensional case, we consider the Cauchy problem of the MHD equations with magnetic diffusion only. We will give a regularity criterion to guaranttee the global-well-posedness and prove the global well-posedness on time $[0, T]$ for any $T > 0$ for small initial data. Under some special axisymmetric assumptions, we can show the global well-posedness to the 3D axisymmetric MHD equations with only vertical viscosity.

On an axisymmetric model for the 3D incompressible Euler and Navier-Stokes equations

Shu Wang

June 30-July 1, 2016

Beijing University of Technology
E-mail : **wangshu@bjut.edu.cn**

Abstract

We study the singularity formation and global regularity of an axisymmetric model for the 3D incompressible Euler and Navier-Stokes equations. This 3D model is derived from the axisymmetric Navier-Stokes equations with swirl using a set of new variables. The model preserves almost all the properties of the full 3D Euler or Navier-Stokes equations except for the convection term which is neglected. If we add the convection term back to our model, we would recover the full Navier-Stokes equations. We prove rigorously that the 3D model develops finite time singularities for a large class of initial data with finite energy and appropriate boundary conditions. Moreover, we also prove that the 3D inviscid model has globally smooth solutions for a class of large smooth initial data with some appropriate boundary condition. The related problems are surveyed and some recent results will also be reviewed.

Spectrum analysis of some kinetic equations

Hongjun Yu

June 30-July 1, 2016

South China Normal University
E-mail : **yuhj2002@sina.com**

Abstract

In this talk we analyze the spectrum structure of some kinetic equations qualitatively by using semigroup theory and linear operator perturbation theory. The models we consider include the classical Boltzmann equation for hard potentials with or without angular cutoff and the Landau equation with appropriate potentials.

Well-posedness of the Prandtl equations and zero viscosity limit

Zhifei Zhang

June 30-July 1, 2016

Peking university
E-mail : **zfzhang@math.pku.edu.cn**

Abstract

I will first talk about the well-posedness results of the Prandtl equations in Sobolev spaces and Gevery class 2. Then we will revisit the proof of zero viscosity limit of the Navier-Stokes equations in the analytic framework by direct energy method.

Session : Mathematical Fluid Mechanics and Related Topics

Recent advances concerning geophysical models

Edriss E. Titi

June 30-July 1, 2016

Texas A&M University and Weizmann Institute of Science
E-mail : **titi@math.tamu.edu**

Abstract

In this talk I will present some recent results concerning global regularity of certain geophysical models. This will include the three-dimensional primitive equations with various anisotropic viscosity and turbulence mixing diffusion, and certain tropical atmospheric models with moisture. Moreover, I will show that in the non-viscous (inviscid) case there is a one-parameter family of initial data for which the corresponding smooth solutions of the primitive equations develop finite-time singularities (blowup).

Well posedness for a two-fluid model for plasma

Slim Ibrahim

June 30-July 1, 2016

Ibrahim
E-mail : **ibrahims@uvic.ca**

Abstract

We study a two fluid system which models the motion of a charged fluid with Rayleigh friction, and in the presence of an electro-magnetic field satisfying Maxwell's equations. We study the well-posedness of the system in both space dimension two and three. Regardless of the size of the initial data, we first prove the global well-posedness of the Cauchy problem when the space dimension is two. However, in space dimension three, we construct global weak-solutions'a la Leray, and we prove the local well-posedness of Kato-type solutions. These solutions turn out to be global when the initial data are sufficiently small. Our results extends Giga-Yoshida ones to the space dimension two, and improve them in terms of requiring less regularity on the electromagnetic field.

On the Hall-MHD equations

Dongho Chae

June 30-July 1, 2016

Chung-Ang University
E-mail : **dchae@cau.ac.kr**

Abstract

In this talk we discuss the the Cauchy problem of the Hall-MHD system, where the "Hall term" is added to the usual incompressible MHD equations. After reviewing various recent results of the problem, we focus on the issue of the finite time singularity when the resistivity constant is zero. In this case we show that there exists a smooth initial data for which either the Cauchy problem is locally ill-posed, or it is locally well-posed but the apparition of finite time singularity happens.

Analysis of the full Navier-Stokes and Q-tensor system for nematic liquid crystal flows

Hao Wu

June 30-July 1, 2016

Fudan University
E-mail : **haowufd@fudan.edu.cn**

Abstract

In this talk, we consider a full Navier-Stokes and Q-tensor system for incompressible liquid crystal flows of nematic type. In the two dimensional periodic case, we prove the existence and uniqueness of global strong solutions that are uniformly bounded in time. This result is obtained without any smallness assumption on the physical parameter ξ that measures the ratio between tumbling and aligning effects of a shear flow exerting over the liquid crystal directors. Moreover, we will discuss the long-time behavior of the system.

Asymptotic properties of stationary Navier-Stokes flows in the setting of hyperbolic spaces

Chi Hin Chan

June 30-July 1, 2016

National Chiao Tung University
E-mail : **cchan@math.nctu.edu.tw**

Abstract

In this talk, I will present a piece of recent joint work with Che-Kai Chen and Magdalena Czubak. In this work, we consider a stationary Navier-Stokes flow which passes a circular-shape obstacle in a 2-dimensional hyperbolic space. We suppose that the stationary Navier-Stokes flow under our consideration satisfies the finite Dirichlet-norm property. Under this assumption alone, we show that the velocity field itself will decay to zero at infinity, and that we can obtain an exponential decay of the associated vorticity of the flow in the far range. The material which will be reported in this talk is a preliminary version of a piece of unpublished recent joint work with Che-Kai Chen and Magdalena Czubak. During the talk, we will also mention the relations between this piece of work with the standard working knowledge in the classical theory of stationary Navier-Stokes flows passing an obstacle in the 2D Euclidean setting. In the meanwhile, I will also mention my previous joint research works with my friend professor Magdalena Czubak about our studies of global analytic properties of Navier-Stokes flows in the hyperbolic setting.

Recent progress on the vanishing viscosity limit in the presence of a boundary

James Kelliher

June 30-July 1, 2016

University of California Riverside
E-mail : **kelliher@math.ucr.edu**

Abstract

We give an overview of results by several authors over the past several years on whether solutions to the Navier-Stokes equations converge to a solution to the Euler equations as the viscosity vanishes in domains with a boundary.

Session : Operator Algebra and Functional Analysis

Weak amenability of Fourier algebras and local synthesis of the anti-diagonal

Hun Hee Lee

June 30-July 1, 2016

Seoul National University
E-mail : **hunheelee@snu.ac.kr**

Abstract

In this talk we focus on the weak amenability question of the Fourier algebras. We say that a Banach algebra A is weakly amenable if all bounded derivation from A into its dual A^* is inner. It has been conjectured that The Fourier algebra $A(G)$ is weakly amenable if and only if G_e, the connected component of G, is abelian. The aim of this talk is to give a general introduction of the problem and the main ideas of the solution for the general Lie group case. The new ingredient for the solution is the set of antidiagonal and its property of local synthesis for $A(G \times G)$.

A functional analysis proof of Gromov's polynomial growth theorem

Narutaka Ozawa

June 30-July 1, 2016

RIMS, Kyoto University
E-mail : **narutaka@kurims.kyoto-u.ac.jp**

Abstract

The celebrated theorem of Gromov in 1980 asserts that any finitely generated group with polynomial growth is virtually nilpotent, i.e., it contains a nilpotent subgroup of finite index. Alternative proofs have been given by Kleiner (2007), etc. In this talk, I will give yet another proof of Gromov's theorem, based on functional analysis and random walk techniques.

Secondary invariants of elliptic operators and applications

Guoliang Yu

June 30-July 1, 2016

Texas A&M University
E-mail : **guoliangyu@math.tamu.edu**

Abstract

In this talk, I will introduce certain secondary index invariants of elliptic differential operators and discuss their applications to topology and geometry of manifolds. This is joint work with Shmuel Weinberger and Zhizhang Xie.

Finite simple labeled graph C^*-algebras associated with Cantor minimal subshifts

Ja A Jeong

June 30-July 1, 2016

Seoul National University
E-mail : **jajeong@snu.ac.kr**

Abstract

As generalizations of the Cuntz-Krieger algebras, C^*-algebras constructed from various sort of graphs have been studied for over twenty years and the class of labeled graph C^*-algebras which includes all C^*-algebras of directed graphs is one of them. A simple C^*-algebra of a directed graph is known to be either AF or purely infinite, so that lots of interesting and important simple C^*-algebras are excluded from the class of directed graph C^*-algebras. In this paper, we show that the crossed product of any Cantor minimal subshift is realized as a simple labeled graph C^*-algebra from which it follows that the class of simple labeled graph C^*-algebras is large enough to include plenty of simple AT algebras(circle algebras) which are clearly neither AF nor infinite.

An overview of noncommutative sigma model theory

Hyun Ho Lee

June 30-July 1, 2016

University of Ulsan
E-mail : **hadamard@ulsan.ac.kr**

Abstract

In this talk, we review the notion of noncommutative sigma model theory which consists of $(2,\infty)$-summable spectral triple (A, H, D) and a positive element in the space of universal 2 forms on B due to Mathai and Rosenberg. Then we discuss some examples appeared in the literature of the theory and recent advances in the Ising model based on the observation that the Rieffel type projections are linked with Gabor frames.

Haagerup approximation property via bimodules

Reiji Tomatsu

June 30-July 1, 2016

Hokkaido university
E-mail : **tomatsu@math.sci.hokudai.ac.jp**

Abstract

I will talk about a characterization of Haagerup approximation property for arbitrary von Neumann algebras by using bimodules.

Session : Probability

Asymptotical properties of distributions of isotropic Levy processes

Panki Kim

June 30-July 1, 2016

Seoul National University
E-mail : **pkim@snu.ac.kr**

Abstract

In this talk, we discuss asymptotics of the tail probability and the transition density of a large class of isotropic Levy processes when the scaling order is between 0 and 2 including 2. We also discuss asymptotics of the tail probability of subordinators when the scaling order is between 0 and 1 including 1. The asymptotics are given in terms of the radial part of characteristic exponent and its derivative. This is a joint work with Ante Mimica.

Universality in the two matrix model with a quadratic potential

Dong Wang

June 30-July 1, 2016

National University of Singapore
E-mail : **matwd@nus.edu.sg**

Abstract

A two matrix model is defined by the joint probability distribution function of random Hermitian matrices M_1 and M_2

$$P(M_1, M_2) \propto \exp\left(-\mathrm{Tr}(V(M_1) + W(M_2) - \tau M_1 M_2)\right).$$

In this talk, we assume that $V(x) = \frac{a}{2}x^2$, and V is a general analytic function. We consider the local statistics of the eigenvalues of M_1, as the dimension goes to ∞. As part of our result, we confirm that the phase transition found in [Duits–Geudens] with quartic V holds universally for a large class of potential function V. We also find new phase transition phenomena for different types of V, especially for V that is not an even function. This is joint work with Tom Claeys, Arno Kuijlaars, and Karl Liechty.

Inverse M-matrices and random walks on trees

Jaime San Martin

June 30-July 1, 2016

Universidad de Chile, CMM
E-mail : **jsanmart@dim.uchile.cl**

Abstract

We relate the inverse M-matrix problem, from linear algebra, and random walks. In particular we study random walks on trees and give a full answer to the inverse M-matrix problem in this context.

Quenched tail estimate for the random walk in random scenery and in random layered conductance

Ryoki Fukushima

June 30-July 1, 2016

Kyoto University
E-mail : **ryoki@kurims.kyoto-u.ac.jp**

Abstract

We discuss the quenched tail estimates for the random walk in random scenery. The random walk is the symmetric nearest neighbor walk and the random scenery is assumed to be independent and identically distributed, non-negative, and has a power law tail. We identify the long time asymptotics of the upper deviation probability of the random walk in quenched random scenery, depending on the tail of scenery distribution and the amount of the deviation. The result has an application to the tail estimates for a random walk in random conductance which has a layered structure. This talk is based on a joint work with Jean-Dominique Deuscel (TU-Berlin).

Critical correlation for long-range self-avoiding walk with power-law couplings

Lung-Chi Chen

June 30-July 1, 2016

Department of Mathematical Sciences, National Chengchi University, Taiwan
E-mail : **lcchen@nccu.edu.tw**

Abstract

We consider a self-avoiding walk on $\mathbb{Z}^d$ whose 1-step distribution is given by D. Suppose that $D(x)$ decays as $|x|^{-d-2}$. The upper-critical dimension d_c is 4. Assume certain heat-kernel bounds on the n-step distribution of the underlying random walk. In this talk, I will present for $d \geq 4$, the critical Green function $G_{z_c}(x)$ is asymptotically $\frac{C}{|x|^{d-2}\log|x|}$ using lace expansion where the constant $C \in (0, \infty)$ is expressed in terms of the model-dependent lace-expansion coefficients.

Scaling limits of disordered systems : marginal relevance and universality

Rongfeng Sun

June 30-July 1, 2016

National University of Singapore
E-mail : **matsr@nus.edu.sg**

Abstract

We consider disordered systems of directed polymer type, for which disorder is so-called marginally relevant. This includes the disordered pinning model with tail exponent 1/2, the usual (short-range) directed polymer model in dimension two, and the long-range directed polymer model with Cauchy tails in dimension one. We show that in a suitable weak disorder and continuum limit, the partition functions of these different models converge to a universal limit: a log-normal random field with a multi-scale correlation structure, which undergoes a phase transition as the disorder strength varies. As a by-product, we show that the solution of the two-dimensional Stochastic Heat Equation, suitably regularized, converges to the same limit. Joint work with F. Caravenna and N. Zygouras.