Doctorial Forum Fudan-Kyoto Universities

Day : March 11– 14, 2011
Place : Faculty of Science Building No.6 Room 402

Invited speakers

Zhang Yongqian (Fudan University)
Takuro Mochizuki (RIMS)
Ying Jiangang (Fudan University)
Takashi Kumagai (RIMS)
Dong Yuxin (Fudan University)
Kenji Fukaya (Kyoto University)
Wu Quanshui (Fudan University)
Hiroshi Iritani (Kyoto University)

Program

	11 Fri.	12 Sat.	13 Sun.	14 Mon.
10:00 – 11:00	Zhang Yongqian	Takashi Kumagai	Dong Yuxin	Hiroshi Iritani
11:30 – 12:30	Takuro Mochizuki	Ying Jiangang	Kenji Fukaya	Wu Quanshui
14:00 – 14:30	Makoto Nakashima	Lv Longjin		Wu Yan
14:35 – 15:05	Qiu Jin-niao	Naotaka Kajino		Hirokazu Maruhashi
15:10 – 15:40	Huang Genggeng	Yang Ge		Wang Zhijie
16:00 – 16:30	Atarsaikhan Ganbat	Sanpei Hirose		Kei Irie
16:35 – 17:05	Ding Qi	Lai Ning-an	Excursion	Zhao Weixia
17:10 – 17:40	Ayaka Shimizu	Kentaro Mitsui		Mamoru Okamoto
17:40 – 18:10		Tatsuya Ohshita		Hu Dian
19:00 – 19:30	Kazuya Okamura			
19:35 – 20:05	Gao Qinjiao			
20:10 – 20:40	Ryokichi Tanaka			

March 11. Fri.

A.M.	Chair : Professors
10:00–11:00	Zhang Yongqian (Fudan University)
	Isentropic approximation of quasi-1-d unsteady nozzle flow
11:30–12:30	Takuro Mochizuki (RIMS)
	Kobayashi-Hitchin correspondence for D-module

P.M.	Chair : Naotaka Kajino, Huang Genggeng and Ryokichi Tanaka
14:00–14:30	Makoto Nakashima (Kyoto Univeristy)
	Minimal Positions of Branching Random Walks in Random Environment
14:35–15:05	Qiu Jin-niao (Fudan University)
	On Backward Doubly Stochastic Differential Evolutionary System
15:10–15:40	Huang Geggeng (Fudan University)
	L^p and Holder estimates for a class of degenerate elliptic partial differential equations and its applications
15:40–16:00	Tea Break
16:00–16:30	Atarsaikhan Ganbat (Kyoto University)
	Steady-State Bifurcations in Coupled Cell Systems
16:35–17:05	Ding Qi (Fudan University)
	Some results on Chern's problem
17:10–17:40	Ayaka Shimizu (Osaka City University)
	Unknotting Operations in Knot Theory
17:40–18:50	Dinner
19:00–19:30	Kazuya Okamura (Kyoto University)
	Quantum model selection
19:35–20:05	Gao Qinjiao (Fudan University)
	Applying Multi-quadric Quasi-Interpolation for Image Segmentation
20:10–20:40	Ryokichi Tanaka (Kyoto University)
	Hydrodynamics limit on equilibrium maps of crystal lattices

March 12. Sat.

A.M.	Chair : Professors
10:00–11:00	Takashi Kumagai (RIMS)
	Behavior of random walks on random media and their scaling limits
11:30–12:30	Ying Jiangang (Fudan University)
	Feller measures

P.M. Chair : Zhao Weixia and Makoto Nakashima

14:00–14:30 Lv Longjin (Fudan University)
Inverse Time Subordinator in Stochastic Models

14:35–15:05 Naotaka Kajino (Kyoto University)
"Riemannian structure" on the Sierpinski gasket and its heat kernel analysis

15:10–15:40 Yang Ge (Fudan University)
Smooth solution to the microscopic FENE model

15:40–16:00 Tea Break

16:00–16:30 Sanpei Hirose (RIMS)
WKB analysis for a holonomic system related to the Pearcey integral

16:35–17:05 Lai Ning-An (Fudan University)
Global existence of critical nonlinear wave equation with time dependent variable coefficients

17:10–17:40 Kentaro Mitsui (Kyoto University)
Multiple Fibers of Elliptic Fibrations

17:40–18:10 Tatsuya Ohshita (Kyoto University)
On the higher Fitting ideals of Iwasawa modules and cyclotomic units

March 13. Sun.

A.M. Chair : Professors

10:00–11:00 Dong Yuxin (Fudan University)
Monotonicity formulae and holomorphicity of harmonic maps between Kähler manifolds

11:30–12:30 Kenji Fukaya (Kyoto University)
Using symplectic topology to study rough geometry of the group of Hamiltonian diffeomorphism

Excursion

March 14. Mon.

A.M. Chair : Professors

10:00–11:00 Hiroshi Iritani (Kyoto University)
Quantum cohomology and period

11:30–12:30 Wu Quanshui (Fudan University)
Graded Calabi-Yau Algebras

P.M.	Chair : Hirokazu Maruhashi and Lai Ning-An
14:00–14:30	Wu Yan (Fudan Univeristy) Distortion of wreath product in Thompson's group F
14:35–15:05	Hirokazu Maruhashi (Kyoto University) Parameter rigid actions of simply connected nilpotent Lie groups
15:10–15:40	Wang Zhijie (Fudan Univeristy) K-Theory of Reduced Banach Algebras and Rapidly Decreasing Functions on Groups
15:40–16:00	Tea Break
16:00–16:30	Kei Irie (Kyoto University) Symplectic capacity and short periodic billiard trajectory
16:35–17:05	Zhao Weixia (Fudan Univeristy) Study on a Free Boundary Value Problem Arising from Peeling Phenomenon
17:10–17:40	Mamoru Okamoto (Kyoto University) Well-posedness of the Maxwell-Dirac system in $1+1$ space time dimensions
17:40–18:10	Hu Dian (Fudan Univeristy) Stability of E-H type Regular Refraction of Shocks

Isentropic approximation of quasi-1-d unsteady nozzle flow

Zhang Yongqian

We are concerned with the isentropic approximation of quasi-one-dimensional unsteady nozzle flow. Under the assumptions that both the initial data and the area of varying cross-sections have sufficiently small total variation, we proved that in any bounded domain the L^1 norm of the difference between solutions of isentropic and non-isentropic balance laws with the same initial data can be bounded by the cube of the total variation of the initial data and the area of varying cross-sections. This is a joint work with Prof. Shuxing Chen and Dr. Jinbo Geng.

Kobayashi-Hitchin correspondence for D-module

Takuro Mochizuki

Classical Kobayashi-Hitchin correspondence has provided us interesting interactions between global analysis and algebraic geometry. Rather recently, we obtained a variant relating global analysis and algebraic analysis, in some sense. Namely, we established the correspondence between polarized wild pure twistor D-modules and semisimple holonomic D-modules. It made us possible to prove a deep result on holonomic D-modules. We would like to give an overview of this story.

Minimal Positions of Branching Random Walks in Random Environment

Makoto Nakashima

We consider a branching random walks in random environment(BRWRE) on $\mathbb{N}$ with only one particle starting at the origin. Particles reproduce according to offspring distribution (which depends on its locations) and move one step to the right (with a probability in $(0, 1]$ which may depend on the locaton) or stay in the same site. We give an estimate to the minimal displacement of BRWRE at time n when supremum of mean number of offsprings which stay in the same place is 1.

On Backward Doubly Stochastic Differential Evolutionary System

Qiu Jin-niao

This paper is concerned with backward doubly stochastic differential evolutionary system (BDSDES for short). By using a variational approach based on monotone operator, we prove the existence and uniqueness of the solutions for these BDSDESs. We also establish an It'o formula for the Banach Space-valued BDSDESs. Backward doubly stochastic ordinary differential systems (BDSDEs, for short) were introduced by Pardoux and Peng to give a probabilistic representation of certain quasilinear stochastic partial differential equations

(SPDEs, for short). From the connection between BDSDEs and SPDEs, results for SPDEs have been obtained. Our BDSDES include as particular cases SDEs, BSDEs, BDSDEs, SPDEs, backward stochastic differential equations (BSPDEs, for short) and backward doubly SPDEs (BDSPDEs, for short). Our existence and uniqueness of the solutions for BDSDES generalize previous relevant results, and to our best knowledge, are new both for the finite dimensional case (BDSDEs) and the infinite dimensional case (BDSPDEs).

L^p and Holder estimates for a class of degenerate elliptic partial differential equations and its applications

Huang Genggeng

L^p and Holder estimates for a class of degenerate elliptic partial differential equations are obtained by means of some techniques of harmonic analysis on some integral operators. Such operators are of some degeneracy on boundary. In order to overcome the difficulties caused by such degeneracy, an anisotropic Calderon Zygmund decomposition is given. This paper also gives some applications of the above estimates to the study of boundary regularity for some degenerate elliptic Monge-Ampere equations related to the Aleksandrov positive disks.

Steady-State Bifurcations in Coupled Cell Systems.

Atarsaihan Ganbat

Study codimension-one synchrony-breaking steady-state bifurcations in a coupled ODE system from its coupling structure represented by a directed graph.

Some results on Chern's problem

Ding Qi

Let M be a compact minimal hypersurface in the unit sphere S^{n+1} with the squared length of the second fundamental form S. The second gap problem of S, proposed by Chern, is very interesting and not completely solved until now. In this paper, we continue to study the second gap problem without the constancy of the scalar curvature and confirm the second gap in all dimensions, namely, there exists a positive constant $\delta(n)$ depending only on n, such that if $n \leq S \leq n + \delta(n)$, then $S \equiv n$, i.e., M is a Clifford minimal hypersurface. In particular, when $n \geq 6$, the pinching constant is $\delta(n) = \frac{n}{23}$

Unknotting Operations in Knot Theory

Ayaka Shimizu

A knot is an embedded circle in S^3, and an unknotting operation is a pattern of local transformation on knot diagrams such that any knot diagram can be transformed into a trivial knot diagram by a finite sequence of this pattern (and Reidemeister moves). In this talk, we study several unknotting operations and show that a region crossing change is an unknotting operation.

Quantum model selection

Kazuya Okamura

We propose quantum model selection on the basis of sector theory and the central measure. This theory begins with a quantum version of Sanov's theorem, which gives operational meaning to the quantum relative entropy. We then define the Bayesian escort predictive state and the widely applicable information criteria (WAIC for short) for quantum states. It is proved that WAIC is asymptotically equal to the Bayes generalization loss.

Applying Multi-quadric Quasi-Interpolation for Image Segmentation

Gao Qinjiao

In this paper, we propose a novel scheme for simulating one kind of geometric active contours (GAC, geometric flow). We start with a brief introduction to the geometric active contour model in image segmentation. Since the multi-quadric quasi-interpolation(MQQI) can simulate shock-wave efficiently and Ma have even proved its advantage in stability over the finite difference method when simulating the derivatives of a function, We apply MQQI to solve the geometric active contour. The advantage of the resulting scheme is that the algorithm is simple, efficient and easy to implement. Also images with high curvature can be more easily proposed based on the properties of the MQ quasi-interpolation. Several biomedical and astronomical examples of applications are shown in the paper. The comparisons with other methods are included to illustrate the versatility of the method.

Hydrodynamics limit on equilibrium maps of crystal lattices

Ryokichi Tanaka

We investigate interacting particles systems on crystal lattices and their scaling limits. These models are considered as microscopic models of physical particles such as lattice gas on crystallines. By the hydrodynamics limit, we obtain nonlinear heat equations as macroscopic models and observe that the non linear terms arise from the interaction in microscopic models. The suitable scaling is taken by using the discrete harmonic maps on crystal lattices which are called equilibrium maps.

Behavior of random walks on random media and their scaling limits

Takashi Kumagai

In this talk, we summarize recent work on the behavior of random walks on random media. Examples of the random media include percolation clusters on $\mathbb{Z}^d$, on trees, and the Erdös-Rényi random graphs at criticality. We are interested in the average of the exit time for random walk from the ball of radius R, and the return probability to the starting point at time $2n$. The latter is related to the spectral property of the random walk. For some models, we will also discuss scaling limits of the random walks.

Feller measures

Ying Jiangang

In this talk, we shall introduce Feller measure on a domain for general dual Markov processes and prove that it is related to the time changed process associated with this domain. This generalizes well-known Douglas integral formula which was appeared in 1930's.

Inverse Time Subordinator in Stochastic Models

Lv Longjin

We investigate the stochastic representation of a modified advection dispersion equation, involving the first order derivative with respect time and its convolution integral with a function on the left hand side. We obtain that the process representing this equation should be a subordinated process, whose parent process is a classical diffusion process driven by Brownian motion, and the subordinator is the inverse of a Levy motion with characteristic function dependent on the function presented in the convolution. In order to describe this process clearly, two special cases are employed. Furthermore, we extend the parent process to the one driven by Levy motion. At last, taking advantage of this result, we apply the subordinated model to option pricing problem. The evaluation formula of an European option is obtained when the underlying of the option contract is supposed to be driven by a subordinated geometric Brownian motion.

"Riemannian structure" on the Sierpinski gasket and its heat kernel analysis

Naotaka Kajino

Kigami [Math. Ann. **340** (2008), 781–804] has proposed the notion of the "measurable Riemannian structure" on the Sierpinski gasket, where we have the analogues of the basic objects in Riemannian geometry like gradient vector fields of functions, the Riemannian volume measure and the geodesic metric. He has also proved in the same paper that the associated heat kernel is subject to the two-sided Gaussian bound, in spite of the fractal nature of the space.

In this talk more detailed short time asymptotic behaviors of this heat kernel will be presented, including Varadhan's asymptotic relation, some sharp one-dimensional asymptotics at vertices, and a non-integer-dimensional on-diagonal behavior at almost every point.

Smooth solution to the microscopic FENE model

Yang Ge

In the present paper, we consider the microscopic equation of finite extensible nonlinear elasticity (FENE) model for polymeric fluids. Based on study of a degenerate parabolic initial boundary value problem, we prove the existence of smooth solution to this model when the non-dimensional parameter $b > 4$.

WKB analysis for a holonomic system related to the Pearcey integral

Sanpei Hirose

Exact WKB analysis, that is, WKB analysis besed on the Borel resummation method, is a powerful tool to study the global structure of ordinary differential equations. However exact WKB analysis for a holonomic system has not been studied sufficiently. In this talk, we consider exact WKB analysis for a holonomic system related to the Pearcey integral.

Global existence of critical nonlinear wave equation with time dependent variable coefficients

Lai Ning-An

In this paper, we establish global existence of smooth solutions for the Cauchy problem of the critical nonlinear wave equation with time dependent variable coefficients in three space dimensions.

Multiple Fibers of Elliptic Fibrations

Kentaro Mitsui

Elliptic fibrations have been studied in algebraic geometry, complex analytic geometry, and rigid analytic geometry. If the base of the fibration is a curve, then the fibration is said to be global. If it is a "disk" (complete discrete valuation ring), then the fibration is said to be local. The classification problem was opposed for global elliptic fibrations in each geometry. To attack the problem in a unified method, I oppose the corresponding problem for local elliptic fibrations. I solve the local problem and, as an application, the global problem in interesting cases. I also discover new phenomena for elliptic fibrations over general"disks".

On the higher Fitting ideals of Iwasawa modules and cyclotomic units

Tatsuya Ohshita

M. Kurihara (Keio Univ.) determined the higher Fitting ideal of the "minus-part" of Iwasawa modules of ideal class groups by using Kolyvagin systems of "Gauss sums". In this talk, we will talk about our result on the higher Fitting ideals of the "plus-part" of Iwasawa modules. On the plus-part, we have succeeded in constructing some ideals which give upper bouds of the higher Fitting ideals by using cyclotomic units. This result can be regarded as a refinement of the plus-part of Iwasawa main conjecture.

Monotonicity formulae and holomorphicity of harmonic maps between Kähler manifolds

Dong Yuxin

In this paper, we introduce the stress-energy tensors of the partial energies $E'(f)$ and $E''(f)$ of maps between Kähler manifolds. Assuming the domain manifolds possess some special exhaustion functions, we use these stress-energy tensors to establish some monotonicity formulae of the partial energies of pluriharmonic maps into any Kähler manifolds and harmonic maps into Kähler manifolds with strongly semi-negative curvature respectively. These monotonicity inequalities enable us to derive some holomorphicity and Liouville type results for these pluriharmonic maps and harmonic maps. We also use the stress-energy tensors to investigate the holomorphic extension problem of CR maps.

Using symplectic topology to study rough geometry of the group of Hamiltonian diffeomorphism

Kenji Fukaya

I want to exlain how the idea of Mirror symmetry and pseudoholomorphic curve to obtain a 'almost homomorphism' from the group of symplectic diffeomorphism of $S^2 \times S^2$ to the product of an infinite number of copies of $\mathbf{R}$.

Quantum cohomology and period

Hiroshi Iritani

Mirror symmetry relates the quantum cohomology of a symplectic manifold X with periods of the mirror of X. I will explain an explicit relationship between solutions to quantum differential equations and periods of the mirror. This reveals a hidden integral structure in quantum cohomology.

Graded Calabi-Yau Algebras

Wu Quanshui

In the talk, I will survey some recent work about graded Calabi-Yau algebras. On one side, I will talk about the Hopf actions on graded Calabi-Yau algebras, and characterize when the smash products are Calabi-Yau in terms of the homological determinants of the Hopf actions. On the other side, I will talk about the PBW deformations of graded Calabi-Yau algebras and characterize when they are graded Calabi-Yau in terms of the Jacobi-type condition of the PBW deformations. Most of the results are restricted to the Koszul case.

Distortion of wreath product in Thompson's group F

Wu Yan

The interesting properties of Thompson's group F have made it a favorite object of study among group theorists and topologists. It was discovered by Richard Thompson in 1965, initially used to construct finitely presented groups with unsolvable word problems. Questions concerning distortion of subgroups is a topical subject of investigation in geometric group theory, Using the important tools of the reduced forest diagrams and the reduced tree diagrams, we prove that the restricted wreath products $F \wr \mathbb{Z}$ and $\mathbb{Z} \wr \mathbb{Z}$ are quasi-isometrically embedded subgroups of Thompson's group F.

Keywords Thompson's group F; The reduced forest diagram; The reduced tree diagram; Restricted wreath product; Quasi-isometrically

Parameter rigid actions of simply connected nilpotent Lie groups

Hirokazu Maruhashi

A locally free action ρ of a connected Lie group on a closed manifold is said to be parameter rigid if each action which has the same orbits as ρ is conjugate to ρ. There are not so many known parameter rigid actions of noncommutative groups. In this talk we give a criterion for parameter rigidity of nilpotent group actions and construct parameter rigid actions of nilpotent groups.

K-Theory of Reduced Banach Algebras and Rapidly Decreasing Functions on Groups

Wang Zhijie

In this paper, we associate to any length function L on a group Γ a space of rapidly decreasing functions on Γ (in the $l^p(\Gamma)$, $p \geq 1$ case) , denoted by $H_L^{p,\infty}(\Gamma)$. When $H_L^{p,\infty}(\Gamma)$ is contained in the reduced Banach algebra $B_r^p(\Gamma)$ of Γ, then it is a dense subalgebra of $B_r^p(\Gamma)$ and we prove a theorem which asserts that under this hypothesis $H_L^{p,\infty}(\Gamma)$ is the same K-theory as $B_r^p(\Gamma)$. In particular, when $p = 2$, it is just the P. Jolissaint's work.

Symplectic capacity and short periodic billiard trajectory

Kei Irie

We give an upper bound of the shortest length of periodic billiard trajectories on a domain in $\mathbb{R}^n$, in terms of the inradius of the domain. The proof is based on an estimate of symplectic capacity, which is defined via Floer homology.

Study on a Free Boundary Value Problem Arising from Peeling Phenomenon

Zhao Weixia

In this talk, we consider the following free boundary problem. The problem describes the peeling phenomenon. Different from the problem studied by K.Kikuchi and S.Omata the nonlinear effects in the vibrating string is also considered. Under some reasonable assumptions, the local existence and uniqueness of classical solution for the free boundary problem is proved. Besides, we study a free boundary problem which arises in the peeling phenomenon without an initial interval. It is proposed by K.Kikuchi and S.Omata as an open problem in the appendix of their paper. The local existence and uniqueness of the classical solution to the problem are obtained under some conditions which are naturally satisfied in the physical model. The global existence and uniqueness of the classical solution are also obtained under two kinds of assumptions which intersect but do not contain each other.

Well-posedness of the Maxwell-Dirac system in $1+1$ space time dimensions

Mamoru Okamoto

In this talk we consider the Cauchy problem for the Maxwell-Dirac system in $1+1$ time space dimensions. We determine the range of the Sobolev regularity for the system to be locally well-posed in time on the real line. Outside the range for well-posedness, we show either that the solution map fails to be continuous at zero or that the solution map is not twice differentiable at zero.

Stability of E-H type Regular Refraction of Shocks

Hu Dian

We are concerned with the global stability of the 2-D steady nonlinear wave structure of the E-H type regular refraction of shocks on the interface between two different media. In general, when a shock front attacks an interface between two media with the incident angle less than some critical value, a reflected wave and a refracted shock will appear with the interface being deflected. Such a reflection-refraction wave structure is called regular refraction. In this report, we concentrate on the E-H type regular refraction.