Final Version: 2015/02/24

Mathematical Society of Japan

2015 ANNUAL MEETING

Titles and Short Summaries of the Talks

March, 2015

at Meiji University

Final Version: 2015/02/24

2015 Mathematical Society of Japan

ANNUAL MEETING

Dates: March 21st (Sat)–24th (Tue), 2015

Venue: Meiji University, Suruga-dai Campus (Liberty Tower)
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	Plenary Talks (1013 (1F)) MSJ Spring Prize Winner ····· (15:15–16:15)								
	M. Kapranov (Univ. of Tokyo) ····· (16:45–17:45)								
	Official Party (Kishimoto Tatsuo HALL (23F)) ····· (18:00–20:00)								

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Plenary Talks

March 22nd (Sun) 1013 (1F)

MSJ Spring Prize Winner ..... (15:15–16:15)

Mikhail Kapranov (Univ. of Tokyo) Lie algebras and secondary polytopes ..... (16:30–17:30)

Summary: Secondary polytopes, introduced by I.M. Gelfand, A.V. Zelevinsky and the speaker more than twnety years ago, are convex polytopes whose vertices correspond to triagulations of other, "primary" polytopes. The original motivation for their introduction was the study of discriminants of polynomials in several variables. The talk, based on joint work with M. Kontsevich and Y. Soibelman, will discuss a completely different appearance of secondary polytopes, motivated by the study of Landau-Ginzburg models in mathematical physics. Here, secodary poylytopes give rise to Lie algebra-type structures which can be used to deform triangulated categories with exceptional collections.

Featured Invited Talks

March 21st (Sat)

Conference Room IIa

Nariyuki Minami (Keio Univ.) Questions in energy level statistics and the theory of point processes ..... (13:00–14:00)

Summary: Energy level statistics is a group of questions in mathematical physics in which one is interested in statistical nature of the fluctuation of energy levels (i.e. eigenvalues of quantum Hamiltonians), rather than their asymptotic or average distribution. In physics literature, it seems to be tacitly assumed that the spectrum of a quantum Hamiltonian, after suitably normalized (or unfolded), and observed in thermodynamic or semi-classical limit, looks like a typical realization of a stationary point process on the real line. In this talk, I will present a purely phenomenological, and somewhat personal view of energy level statistics based on the theory of point processes.

Conference Room IIIa

Nobuhiro Honda (Tokyo Tech) Geometry of twistor spaces ····· (13:00–14:00)

Summary: Consider an oriented 4-manifold. A Riemannian metric on the 4-manifold is said to be self-dual (or half-conformally flat) if the anti-self-dual component of the Weyl curvature tensor identically vanishes. A conformally flat metric is an important example of self-dual metrics, but the notion of self-duality makes sense only on 4-dimensional space. This notion originally arises from general relativity in physics, and plays an important role in gauge theory.

The most characteristic property of self-dual metric is that, there always naturally associates a complex 3-manifold, fibered over the 4-manifold with typical fiber being a 2-sphere. This complex 3-manifold is called the twistor space, and this is the main object of this talk.

In general, it is difficult to construct self-dual metrics and twistor spaces over a compact manifold. But it is known that such self-dual metrics (and therefore their twistor spaces) exist a lot. However, most of them are not projective-algebraic. On the other hand, there are a lot of non-projective but algebraic twistor spaces. These spaces may be investigated by a traditional method in complex algebraic geometry; namely a linear system, a vanishing theorem (which holds under certain positivity of the metric), and intersection numbers of subvarieties. In this talk, we would like to discuss some explicit construction and classification of such twistor spaces.

Conference Room Va

Kenji Yajima (Gakushuin Univ.) Meeting points of Schrödinger equation and real analysis ·· (13:00–14:00)

Summary: There are many problems in the theory of Schrödinger equation and real analysis which are closely connected: Strichartz estimates and the restriction theorem of Fourier transform onto the parabola, smoothness of solutions and changes of phases of generalized Fourier coefficients, wave operators of scattering theory and the transplantation and etc. I will discuss some of these examples, hoping to stimulate closer collaboration between these disciplines.

March 23rd (Mon)

Conference Room Ib

Keiko Takahashi (Japan Agency for Marine-Earth Sci. and Tech.) Mathematical issues on weather and climate variability prediction studies ····· (13:00–14:00)

Summary: It is known that a prediction for ten days and longer term prediction for weather and climate variability. One of reason for those difficulties is considered due to non-linear characteristics such as low or high atmospheric pressures having space scale of approximately 1,000km. I introduce our research activities to improve predictability for ten-days more and seasonal phenomena.

Conference Room IVa

Mitsuhiro Shishikura (Kyoto Univ.) Continued fractions and the renormalization of dynamical systems ..... (13:00–14:00)

Summary: We discuss the relationship between continued fractions for irrational numbers and dynamical systems via the idea called the renormalization.

Continued fraction is a way to express an irrational number α as the limit of a sequence of rational numbers. There is a simple algorithm which generate this approximation.

Dynamical systems are mathematical models of time evolution. In some class of dynamical systems, one can take a subdomain of the phase space and consider the first return map. The process assigning the return map to the original dynamics is called "renormalization" and this can be regarded as a "meta-dynamics" defined on the space of dynamical systems. It is often important to consider the iteration of the renormalization and to study its fixed points and invariant sets, and the knowledge of their properties (such as the hyperbolicity) leads to deep understanding of individual dynamical systems, such as universal structure in the phase space and the parameter space and the rigidity.

In this talk, we focus on several types of "rotation-like dynamics" which is similar to or related to $R_\alpha : z \mapsto e^{2\pi i\alpha}z$ on $\mathbb{S}^1 = \{z \in \mathbb{C} : |z| = 1\}$, with irrational number α. For the rigid rotation R_α, the process of renormalization coincides with the algorithm for the continued fractions. General renormalizations for rotation-like dynamics can be considered as a nonlinear and infinite dimensional version of continued fractions. We will see how to analyze the individual system via the properties of the meta-dynamics (renormalization) and the number theoretic properties of the rotation number α.

March 24th (Tue)

Conference Room Ib

Takashi Taniguchi (Kobe Univ.) Average rank of elliptic curves —Fields medal award by Manjul Bhargava and future prespectives— ..... (13:00–14:00)

Summary: In a joint work with Shankar, Bhargava showed that the average rank of elliptic curves over the rational number field, when ordered by height, is less than 1 (in fact, less than .885). Moreover, they determined the average size of 2, 3, 4 and 5-Selmer groups for those elliptic curves. Their proof is based on powerful new method in the geometry of numbers, dealing with the integer orbits of certain representations of algebraic groups. This talk is an introduction to the theory. A brief discussion for future perspectives is included.

Conference Room Va

Izumi Takagi (Tohoku Univ.) Mathematical approaches to biological pattern formation — Turing's unfinished project— ..... (13:00–14:00)

Summary: In the seminal paper "The chemical basis of morphogenesis" Alan Turing proposed the idea of Diffusion-Driven-Instability as the basis of pattern formation in developmental biology, where a group of cells develops spatially nontrivial structure spontaneously, starting from an almost uniform state. He assumed that this patterning process is guided by a "pre-pattern" appearing in the distribution of chemicals. He proved that, when two chemicals with different diffusion rates react, the spatially uniform state may become unstable under spatially non-uniform disturbance. This will lead to an emergence of a spatial pattern. Inspired by Turing, many mathematical models have been proposed to explain various pattern formation observed in the natural world.

In this talk we focus on the study of reaction-diffusion systems modeling pattern formation in developmental biology, the phenomenon Turing wanted to analyse. As a case study we first review the mathematical results concerning the activator-inhibitor system proposed by Gierer and Meinhardt. In particular, the effect of spatial heterogeneity on the resulting pattern has attracted much attention for the past decade. We shall report recent development in this direction together with other types of models.

Foundation of Mathematics and History of Mathematics

March 21st (Sat) Conference Room VII

10:00–11:25

1 Shigeru Masuda (Res. Workshop of Classical Fluid Dynamics)
The Correspondings as the *Eigenvalue* and the *Eigenfunction/Eigenspace* before Hilbert 15

Summary: The definition of eigenvalue and eigenfunction, based on the Sturm–Liouville type boundary value problem of heat, is introduced by Hilbert 1904, however, *la valeur particulière*, the French corresponding as the German *Eigenwert* have been traditionally discussed at least since Lagrange in the problem of trigonometric series, After him, Fourier explains *la valeur particulière* on heat diffusion equations, Laplace and Poisson use it on the secular perturbation equations. Gauss uses *indole function* in Latin. These problems contain the linear differential equations or its integral equations. However, its corresponding relation between the value and its function isn't emphasized until Hilbert.

2 Shigeru Masuda (Res. Workshop of Classical Fluid Dynamics)
Poincaré's *Analytic Theory of Propagation of Heat*, following after Provést, Fourier and Poisson 15

Summary: We discuss Poincaré's *Analytic Theory of Propagation of Heat*, following after Provést, Fourier and Poisson. He introduces the harmonic function to prove the theorem of the existence of a function which is expressed by a Fourier series, if the function satisfies with the Dirichlet condition. We talk comparatively among them, about their characteristics and meanings in the history of physico-mathematics.

3 Michiyo Nakane
Osaka University and the establishment of the history of mathematics in Japan 15

Summary: From 1950–1970, mathematicians in Japan mainly studied the history of western mathematics, and Osaka University played an important role in establishment of this subject. In the 1950s, Koshiro Nakamura began to teach the history of mathematics for graduate students in the mathematics department. He had a close connection with the department of French literature and developed his original research on seventeenth century mathematics. Kokichi Hara, a professor of French literature, worked with Nakamura and did excellent work on Pascal's mathematics. This cooperation between mathematicians and French literary men at Osaka University is one of the key factors that resulted in the establishment of the study of the history of mathematics in Japan.

4 Michiyo Nakane
Foundation and history of mathematics in Japan: From historical view point 10

Summary: The Japan mathematical society has a foundation and history section, although these are different subjects. This paper analyzes the reason for this. From the 1940s to the 1960s, the foundation, philosophy, and history of mathematics were discussed under the name 'foundation.' The nature of the foundation of mathematics, which was being developed in 1950s, suggested that mathematicians who studied this foundation would also have an interest in history.

5 Shotaro Tanaka * Methods of solving Rokuyaku power series and applying them to pyramidal power series 15

Summary: 1. Wada, old Japanese mathematician made six kinds of power series, i.e., Rokuyaku; thirty eight problems and solved them.
2. Example. $1-3x-6x^2+10x^3+15x^4--++\cdots=M$, where $1--++$: types of operations, 1: unit, $-$: subtraction, $+$: addition. Question: find M, Answer: $M=(1-3x-3x^2+x^3)\sum_1 d_2(k)x^{k-1}=(1-3x-3x^2+x^3)/(1-x^2)^3$.
3. Pyramidal power series: $p_m(k)=(1/2)k(k+1)+1/6(m-2)(k-1)k(k+1)(m\geq 3)$. Example. $p_6(k)$: hexapyramidal number. $\sum_1 p_6(k)x^{k-1}=(1+3x)\sum^1 d_3(k)x^{k-1}=(1+3x)/(1-x)^4$, $(|x|<1)$, $d_3(k)=(1/3!)k(k+1)(k+2)$.

11:30–12:00 Mathematics History Team Meeting

14:15–16:50

6 Hirotaka Kikyo (Kobe Univ.) Model complete generic graphs I 15

Summary: For a graph G, let $V(G)$ denote the set of vertex of G, and $E(G)$ the set of edges of G. Put $\delta_\alpha(G)=|V(G)|-\alpha|E(G)|$ for a real number α. Suppose $0<\alpha\leq 1/2$, $\alpha=p/m$ with positive integers p and m coprime. Let h be a real function on the set of real numbers such that h is concave, monotone increasing, unbounded, and for any positive integer x, $h(x)+1/m\geq h(2x+c)$, where c is a constant determined by α. Put $\mathbf{K}_{\alpha,h}=\{A : B\subseteq A\Rightarrow \delta(B)\geq h(|V(B)|)\}$. Then there is a $(\mathbf{K}_{\alpha,h},<)$-generic structure M, and $Th(M)$ is model complete.

7 Koichiro Ikeda (Hosei Univ.)
Hirotaka Kikyo (Kobe Univ.) A generic structure whose theory is not model complete 15

Summary: We construct an omega-categorical generic structure whose theory is not model complete.

8 Koichiro Ikeda (Hosei Univ.) Near model completeness of generic structures 15

Summary: We show that if the theory of a generic structure M is ultra-homogeneous then M is nearly model complete.

9 Kota Takeuchi (Univ. of Tsukuba) n-dependent theories 15

Summary: n-dependence is one of stability classes introduced by Shelah in 2009. In his papers, he asked about the existence of suitable upper bound of the number of types over finite sets in n-dependent theories and any simpler way reducting variables in a witness of n-dependence. In this talk we answer his questions by using finite combinatorics, especially VC-dimension and Ramsey property of linearly ordered hypergraphs.

10 Munehiro Kobayashi (Univ. of Tsukuba)
Takayuki Kuriyama (Grad. Univ. for Adv. Stud.)
Kota Takeuchi (Univ. of Tsukuba)

VC-dimension and PAC-learnability for higher dimensional spaces · · · · 15

Summary: In computer learning theory, it is well known that finiteness of VC-dimension is equivalent to PAC-learnability. On the other hand, the finiteness of VC-dimension is equivalent to the dependent property in the context of model theory. Recently, a generalization of dependent property was introduced by Shelah. In this talk we give a new learning theory correspondent to the generalization and discuss the relation to VC-dimension.

11 Nobu-Yuki Suzuki (Shizuoka Univ.)

A note on weak variants of existence property in intermediate predicate logics · 15

Summary: We discuss relationships between the *existence property* (EP) and its weak variants in intermediate predicate logics. An intermediate predicate logic $\mathbf{L}$ is said to have the *weak existence property* (wEP), if for every $\exists x A(x)$, $\mathbf{L} \vdash \exists x A(x)$ implies that $\mathbf{L} \vdash A(v_1) \vee \cdots \vee A(v_n)$ for any finite set $\{v_1, ..., v_n\}$ of free variables containing all free variables of $\exists x A(x)$. An $\mathbf{L}$ is said to have the *sentential existence property* (sEP), if for every *sentence* $\exists x A(x)$, $\mathbf{L} \vdash \exists x A(x)$ implies that there exists a *fresh* individual variable v such that $\mathbf{L} \vdash A(v)$. Then, it is easy to see that EP implies wEP, and that wEP implies sEP. We show that the converses of these implications do not hold.

12 Takahiro Seki (Niigata Univ.)

Halldén-completeness and Sahlqvist formulas · 15

Summary: To prove Halldén-completeness in terms of Kripke semantics, the van Benthem–Humberstone theorem is often used. The Sahlqvist theorem is one of the fundamental results on the correspondence between modal formulas and frame postulates. Combining the Sahlqvist theorem and the van Benthem–Humberstone theorem, we expect to obtain a range of Halldén-complete modal logics with Sahlqvist axioms.

13 Yoshihito Tanaka (Kyushu Sangyo Univ.)

A simple embedding of bounded semilattices with operators into Boolean algebras with operators · 15

Summary: Sofronie–Stokkermans gives an embedding of bounded semilattices with operators into Boolean algebras with operators. It is obtained by composing two injections, from bounded semilattices with operators to bounded distributive lattices with operators and from bounded distributive lattices with operators to Boolean algebras with operators. In this talk, we provide a simple embedding, which is defined directly from a given bounded semilattice with operators. In fact, it is simple in the sense of algebra, either, as the codomain of our embedding is a subalgebra of that of Sofronie–Stokkermans. Although the two codomains are isomorphic if the given bounded semilattice with operators is finite, but in general cases, there exists an example that the cardinality of our codomain is strictly smaller than that of Sofronie–Stokkermans.

14 Katsumi Sasaki (Nanzan Univ.) The exact **K4**-models and the exact **S4**-models in **S4** ····· 15

Summary: We treat modal logics **S4** and **K4**, and consider related exact models. In MSJ spring meeting 2014, we gave a method to list all the exact **K4**-models for $\mathbf{F}(n)$ in **S4**, where $\mathbf{F}(n)$ is the set of modal formulas with finite propositional variables $p_1, \cdots, p_m$ and with finite modal degree $\leq n$. Here, we give an easier method to list them by using the exact **S4**-models listed in 2010. Specifically, for any exact **K4**-model $M = \langle W, R, P\rangle$ for $\mathbf{F}(n)$ in **S4**, we define a subset $\mathbf{rep}(M)$ of W; and prove the equivalence between the following two conditions:
(1) M' is an exact **K4**-model for $\mathbf{F}(n)$ in **S4**,
(2) there exist an exact **S4**-model $M = \langle W, R, P\rangle$ for $\mathbf{F}(n)$ in **S4** an exact **S4**-model $M = \langle W, R, P\rangle$ for $\mathbf{F}(n)$ in **S4** and a subset W' of $\mathbf{rep}(M)$ such that $M' = \langle W, R - \{(\alpha, \alpha) \mid \alpha \in W'\}, P\rangle$.

17:00–18:00 Talk Invited by Section on Foundation and History of Mathematics

Katsuhiko Sano (JAIST) On coalgebraic modal logic and related topics

March 22nd (Sun) Conference Room VII

9:30–11:40

15 Takashi Oyabu ♭ Of parabolic type, and other 5 talks ····· 5

Summary: 1. Of parabolic type
It was shown: that of parabolic type partial differential equations are closelly related to onsager scheme of non-equilibrium thermo-dynamics
2. Theory of H-theorems
Boltzmann's H-function analogues are introduced and :maybe: dH/dt=<0==========>0: Ut==========>0: Uit==========>0: Which is entropy increase law:
3. Non-equilibrium thermodynamnics
General schemes of non-equilibrium thermodynamics which are closelly related to Prigogine's schemes:
4. $w = dJ/dzdz = f(z)dz$
Abelian differentials: Regular form: J::Modular:Elliptic curve:::$X_o(1)$;;$X(1)$;;;$X_o(N)$::$X(N)$: Modular curve::Regular differential form=== Auto-morphic form of $X_o(N)$:
5. Certain meta-physik
V==L::Problem: Godel's L::Constructible set: V={x | x=x}::Class of set of all sets: And::Kantian philosohy:Constructible world:Axiomatic set theory: ZF==========>Mathematics: ZF=L=V:::Our science:Constructible world:V::idea :as Greek philosophy
6. Isomorphism of Hilbert spaces: Laplacian
Hilbert spaces:H:Δ:{Hn}::H':Δ':{Hn'} H==H'*Iso:<====>Spec(H)=Spec(H'): F:Hn========>Hn': Δ:Hn==========>Hn: Δ':Hn'==========>Hn': F(ΔHn)=F(λnHn)=λnFHn: Δ'Hn'=λn'Hn'=λn'FHn:Hence: λn=λn':

Summary: It is known that there is a complete consistent extension of Peano arithmetic which is Σ_2 definable. Thus Gödel–Rosser's first incompleteness theorem cannot be extended to Σ_n definable theories directly. In this talk, we investigate the incompleteness phenomena for general Σ_n definable theories, and prove generalizations of first and second incompleteness theorems for Σ_n definable theories.

Summary: This research is part of a project to examine relations between RM (reverse mathematics) and CMI (concrete mathematical independence). In this talk we will concentrate mostly on independent statements for (fragments of) Peano Arithmetic and their relation to second order logical principles within ACAo. Many statements such as Ramsey's theorem in dimension 2 are equivalent to their finitary versions over WKLo, where for the converse direction RCAo is sufficient. Somewhat surprisingly, Koenig's lemma itself causes a peculier phenomenon in its finitisation.

Summary: The notion of probability plays an important role in almost all areas of science. In modern mathematics, however, probability theory means nothing other than measure theory, and the operational characterization of the notion of probability is not established yet. In this talk, based on the toolkit of algorithmic randomness we present an operational characterization of the notion of probability. Algorithmic randomness, also known as algorithmic information theory, is a field of mathematics which enables us to consider the randomness of an individual infinite sequence. We use the notion of Martin–Loef randomness with respect to Bernoulli measure to present the operational characterization. As the first step of the research of this line, in this talk we consider the case of finite probability space, i.e., the case where the sample space of the underlying probability space is finite, for simplicity.

Summary: We present a theory of classes which is strictly stronger than Morse–Kelley set theory. The axioms of our theory consist of only six axioms (or axiom schemes) including a new kind of axioms, Set Invention Axiom (SIA). We see that our theory is strong enough to prove the axiom of universes, i.e., every set has its smallest Grothendieck universe (as a set) containing the set.

Summary: The Weyl–von Neumann theorem states that two bounded self-adjoint operators on a Hilbert space are unitarily equivalent modulo compacts if and only if they have the same essential spectrum. In the talk we consider this result for unbounded operators using descriptive set theory. This is a joint work with Hiroshi Ando.

Summary: By analyzing Dow's construction, we introduce a general construction of regular Lindelöf spaces with points G_δ. Using this construction, we prove the following: Suppose that either (1) there exists a regular Lindelöf P-space of pseudocharacter $\leq \omega_1$ and of size $> 2^\omega$, (2) CH and $\square(\omega_2)$ hold, or (3) CH holds and there exists a Kurepa tree. Then there exists a regular Lindelöf space with points G_δ and of size $> 2^\omega$.

Summary: It is known, due to Büchi, that the monadic second order theories of $\langle \omega, < \rangle$ and $\langle \omega_1, < \rangle$ are both decidable. On the other hand, Gurevich–Magidor–Shelah proved that the decidability of the monadic second order theory of $\langle \omega_2, < \rangle$ is independent of ZFC. There are many open problems on the monadic second order theories of $\langle \kappa, < \rangle$ for $\kappa \geq \omega_2$. We give some of them and present some new results.

11:45–12:15 Research Section Assembly

13:15–14:15 Talk Invited by Section on Foundation and History of Mathematics

Daisuke Ikegami (Kobe Univ.) Gödel's program, large cardinals, and forcing axioms

Summary: In the late 19th century, Cantor regarded infinity as "object", not just a limit of finite objects, and identified the notion of ordinals, cardinals, and the cardinality of sets. In 1938, he proved that the cardinality of the set of real numbers ($|\mathbb{R}|$) is strictly greater than that of the set of natural numbers ($|\mathbb{N}|$), and then he conjectured that there is no cardinality of a set between $|\mathbb{R}|$ and $|\mathbb{N}|$. This conjecture is nowadays called the Continuum Hypothesis (CH).

In 1938, Gödel showed that one cannot refute CH in the standard axiom system of set theory so-called Zermelo–Fraenkel set theory with the Axiom of Choice (ZFC). After that, he anticipated that one cannot decide the truth-value of CH in ZFC, and in 1947, he announced the following research program nowadays called Gödel's Program:

"Decide the truth-values of mathematically interesting statements in well-justified extensions of ZFC."

What Gödel had in mind around that time for "well-justified extensions of ZFC" is the axiom systems ZFC + large cardinal axioms. He expected to decide the truth-value of CH in ZFC + large cardinal axioms.

In 1963, Cohen showed that one cannot decide the truth-value of CH in ZFC by introducing a new method "forcing". Using forcing, in 1967, Levy and Solovay proved that one cannot decide the truth-value of CH in ZFC + 'any' large cardinal axiom.

However, it has been shown in these 30 years that one can decide the truth-values of many mathematical statements in ZFC + large cardinal axioms, and we now have a rigid understanding of the theory of the standard second order arithmetic structure $(\mathbb{N}, \mathcal{P}(\mathbb{N}), \in)$ under ZFC + large cardinal axioms.

In this talk, we try to extend this understanding to the theory of the second order structure $(\omega_1, \mathcal{P}(\omega_1), \in)$, where ω_1 is the least uncountable cardinal, under ZFC + large cardinal axioms + forcing axioms. This is joint work with Matteo Viale from University of Turin.

Algebra

March 21st (Sat) Conference Room Ia

9:30–12:00

1 Akiyoshi Tsuchiya (Osaka Univ.) The δ-vectors of reflexive polytopes and of the dual polytopes ····· 15

Summary: Let $\delta(\mathcal{P})$ be the δ-vector of a reflexive polytope $\mathcal{P} \subset \mathbb{R}^d$ of dimension d and $\delta(\mathcal{P}^\vee)$ the δ-vector of the dual polytope $\mathcal{P}^\vee \subset \mathbb{R}^d$. In general, $\delta(\mathcal{P}) = \delta(\mathcal{P}^\vee)$ doesn't hold. For each $d \geq 2$, we show the existence of a reflexive polytope of dimension d whose δ-vector equals the δ-vector of the dual polytope.

2 Akihiro Higashitani (Kyoto Univ.) Unimodality of δ-vectors and two related properties ····· 15

Summary: In this talk, we investigate two properties concerning the unimodality of the δ-vectors of lattice polytopes, which are log-concavity and alternatingly increasingness. For lattice polytopes $\mathcal{P}$ of dimension d, we prove that the dilated lattice polytopes $m\mathcal{P}$ have log-concave and alternatingly increasing δ-vectors if $m \geq \max\{s, d+1-s\}$, where s is the degree of the δ-polynomial of $\mathcal{P}$. We also provide several kinds of unimodal (or non-unimodal) δ-vectors.

3 Akihiro Higashitani (Kyoto Univ.) Characterization of symmetric δ-trinomial ····· 10
Benjamin Nill (Stockholm Univ.)
Akiyoshi Tsuchiya (Osaka Univ.)

Summary: In this talk, we give a necessary and sufficient for a trinomial $1 + (m-2)t^k + t^{2k}$, where $m \geq 3$ and $d \geq 2$ are integers, to be a δ-trinomial of a lattice polytope of dimension d.

4 Naoki Taniguchi (Meiji Univ.) Sequentially Cohen–Macaulay Rees modules ····· 15

Summary: The aim of this talk is to study the question of when the Rees modules associated to arbitrary filtration of modules are sequentially Cohen–Macaulay. Although this problem was originally investigated by N. T. Cuong, S. Goto and H. L. Truong, their situation is quite a bit of restricted, so we are eager to try the generalization of their results.

5 Yusuke Nakajima (Nagoya Univ.) Ulrich modules over cyclic quotient surface singularities ····· 15

Summary: An Ulrich module is a certain class of maximal Cohen–Macaulay (= MCM) modules. Their properties are studied in several literatures. But it is not easy to decide which MCM module is an Ulrich one. In this talk, we investigate Ulrich modules over cyclic quotient surface singularities by using the notion of special CM modules.

6 Hidefumi Ohsugi (Kwansei Gakuin Univ.) * Centrally symmetric configurations of order polytopes ····· 15
Kazuki Shibata (Rikkyo Univ.)
Takayuki Hibi (Osaka Univ.)
Kazunori Matsuda (Rikkyo Univ.)

Summary: It is shown that the toric ideal of the centrally symmetric configuration of the order polytope of a finite partially ordered set possesses a squarefree quadratic initial ideal. It then follows that the convex polytope arising from the centrally symmetric configuration of an order polytope is a normal Gorenstein Fano polytope.

7 Kei-ichiro Iima (Nara Nat. Coll. of Tech.) * On the locally Gorensteinness and Serre's (S_n)-condition of modules ····· 15
Tokuji Araya (Okayama Univ. of Sci.)

Summary: In this talk, we shall characterize torsionfreeness of modules with respect to a semidualizing module in terms of the Serre's condition (S_n). As an application we give a characterization of Cohen–Macaulay rings R such that $R_{\mathfrak{p}}$ is Gorenstein for all prime ideals $\mathfrak{p}$ with height less than n.

8 Mitsuhiro Miyazaki (Kyoto Univ. of Edu.) * Actions of special linear groups to tensors of indeterminates and sagbi bases of the rings of invariants ····· 15

Summary: We consider the action of the products of special linear groups to tensors of indeterminates of sizes $2 \times 2 \times 3$ and $2 \times 2 \times 4$. And describe the rings of invariants by means of sagbi bases.

14:15–17:00

9 Takahisa Kawada (Nagoya Inst. of Tech.) Invariant code and its efficient decoding ····· 10

Summary: When a finite group acts on a curve, we construct an error-correcting code whose code length can be larger but which is efficiently decoded if the errors are repeated in each sub-blocks. We call the code an invariant code associated with the finite group. For these invariant codes, we evaluate the code parameters, the computation complexities for decoding using the SV-algorithm. We have some examples of decoding on a formula manipulation system.

10 Tetsuya Uematsu (Toyota Nat. Coll. of Tech.) Uniform generators of the Brauer group of affine diagonal quadrics ··· 10

Summary: In our previous studies, for a given family of varieties, we introduced the notion of uniform generators of its Brauer group. They are elements in the Brauer group of the family whose specializations at each variety in the family are generators of its Brauer group respectively. The main theorem of this work is that there are no uniform generators of the Brauer group for the family of general affine diagonal quadrics. In this talk, we briefly explain the definition of specialization of Brauer groups and the precise statement of this non-existence theorem.

Summary: In this talk, for Q-conic bundles of semistable type in the case of polarized log pairs, the author would like to alternatively show a variant of rationality criterion for Q-conic bundles by using the moduli part of the associated subadjunction,as succeeding to the author's previous work "A Variant of Iskovskikh's rationality criterion for conic bundles in the case of polarized log pairs", and moreover to partly prove "the finitely existence of the corresponding log models", which is called as "Kawamata conjecture" by Iskovskikh–Shokurov, by applying variation of mixed Hodge structures for the associated algebraic fiber spaces to such a moduli part.

Summary: Let $D_1, \ldots, D_N$ be N distinct theta divisors on a principally polarized abelian surface X. We assume that the divisor $D = \sum D_k$ has normal crossings. Set $M = X - D$. Let $\mathcal{L}$ be the locally constant sheaf associated to a many-valued function holomorphic on M, infinitely ramified along D. We discuss the structure of the non-vanishing cohomology group $H^2(M, \mathcal{L})$.

Summary: Let X be a K3 surface, let C be a smooth curve on X, and let Z be a base point free pencil on C. Then, the Lazarsfeld–Mukai bundle $E_{C,Z}$ of rank 2 associated to C and Z is given by an extension of the torsion free sheaf $\mathcal{J}_Z \otimes \mathcal{O}_X(C)$ by $\mathcal{O}_X$, where $\mathcal{J}_Z$ is the ideal sheaf of Z in X. We can easily see that if C is very ample as a divisor on X, $E_{C,Z}$ is an ACM bundle with respect to $\mathcal{O}_X(C)$. In this talk, by using this fact, we will characterize a necessary condition for $E_{C,Z}$ to be given by an extension of two line bundles on X, by ACM line bundles with respect to $\mathcal{O}_X(C)$.

Summary: We study Fano manifolds with nef tangent bundle and large Picard number.

Summary: The notion of Frobenius splitting was introduced by Mehta–Ramanathan to investigate the cohomology of Schubert varieties in positive characteristic. In Abelian varieties over an positive characteristic field, Frobenius splitting is equivalent to the ordinarity. Therefore Frobenius splitting varieties are considered as a generalization of ordinarity. In this talk, we consider that Frobenius splitting for some elliptic surfaces in positive characteristic. Especially we considered the Frobenius splitting in fibered varieties , then we can list up the Frobenius splitting elliptic surfaces without wild fibers.

16 Yukiko Konishi (Kyoto Univ.) Mixed Frobenius structure and local quantum cohomology ····· 10
Satoshi Minabe (Tokyo Denki Univ.)

Summary: The Frobenius structure on a manifold, defined by Dubrovin, has been vigorously studied in relation to mirror symmetry. We defined a generalization, called the mixed Frobenius sturucture (MFS), in the aim of understanding local mirror symmetry. In this talk, we will show that a MFS naturally appears at the nonequivariant limit of the equivariant cohomology of a smooth projective variety twisted by a concave vector bundle.

17 Makoto Sakurai Tannakian categories and chiral fermions ····· 15

Summary: I have tried to define the chiral conformal field theories of Beilinson and Drinfeld by Hitchin's generalized complex geometry. However, I did not explain the chapter 1: Non-symmetric tensor category and moduli of representable functors, which were casually used by Kapustin and Witten for the super-Yang–Mills–Higgs theory. I will re-examine the "tensor calculus" with regularity conditions on Riemann surfaces ("worldsheet" of topological sigma model for $\mathcal{N} = (0, 2)$ super-symmetry) for insertions of chiral vertex algebras. The vanishing of gerbes to chiral de Rham complex is discussed in cases of complex smooth quasi-projective surfaces by blowups. Rational CFTs and the super-string compactification are briefly explained for non-experts. No familiarity with differential geometry of Chern–Simons 3-forms or no "mixed anomalies" of gauge- and gravitational- anomalies is assumed for audiences.

18 Tetsuya Ando (Chiba Univ.) Discriminants of homogeneous inequalities ····· 15

Summary: Consider a certain family of homogeneous polynomials f. If a polynomial φ of the coefficients of f essentially determines whether $f \geq 0$ holds on a convex set A or not, then we call φ a discriminant. We presnt a theory of discriminant.

19 Shigeru Iitaka (Gakushuin Univ.*) Ultimate perfect numbers and φ- perfect numbers ····· 10

Summary: Let $\sigma(a)$ denote the sum of divisors of a positive integer a. Let P be a prime. If $\sigma(P^e)$ is a prime q, then $a = P^e q$ are called ultimate perfect numbers. In this case, $q = \frac{P^{e+1}-1}{\overline{P}}$. Here $\overline{P}$ stands for $P - 1$. $\overline{P}\sigma(a) - Pa = (P - 2)Maxp(a)$.
Here, $Maxp(a)$ denotes the maximal prime factor of a.

17:15–18:15 Talk Invited by Algebra Section

Kazushi Ueda (Osaka Univ.)$^{\flat}$ Moduli of relations of quivers

Summary: The derived category of coherent sheaves on an algebraic variety admitting a tilting object is described in terms of a quiver with relations, and one can study not necessarily commutative deformations of the algebraic variety by deforming the relations. In the talk, we will discuss the moduli space of non-commutative projective planes from the point of view of relations of the Beilinson quiver. This moduli space is closely related to Shioda's elliptic modular surface of level 3 and the moduli space of 3-qutrit states in quantum information theory. If the time permits, we will also discuss the moduli spaces of non-commutative quadric surfaces and non-commutative cubic surfaces. The moduli space of non-commutative cubic surfaces is 8-dimensional, and contains the configuration space of 6 points in general position as a locally closed subscheme. This is a joint work with Tarig Abdelgadir and Shinnosuke Okawa.

March 22nd (Sun) Conference Room Ib

9:30–12:00

20 Michio Yoshiwaki (Osaka City Univ.) * Relative derived dimensions for cotilting modules ····· 10

Summary: Let A be a finite-dimensional algebra over a field. We denote by $\operatorname{mod} A$ the category of finitely generated right A-modules. For a module $T \in \operatorname{mod} A$, we also denote by ${}^{\perp}T$ the left Ext-orthogonal subcategory of $\operatorname{mod} A$ with respect to T. In this talk, we will show that for a given cotilting module $T \in \operatorname{mod} A$ of injective dimension at least 1, the derived dimension of A with respect to ${}^{\perp}T$ is just the injective dimension of T. This generalizes a result of Krause and Kussin.

21 Hirotaka Koga (Tokyo Denki Univ.) Rings derived equivalent to $\mathbb{Z}$ ····· 10

Summary: We show rings derived equivalent to $\mathbb{Z}$ are just Morita equivalent to it.

22 Satoshi Yamanaka (Okayama Univ.) On weakly separable polynomials in skew polynomial rings ····· 10

Summary: N. Hamaguchi and A. Nakajima introduced the notion of weakly separable extensions as a generalization of separable extensions. They gave necessary and sufficient conditions for weakly separable polynomials in the skew polynomial rings $B[X;\rho]$ and $B[X;D]$ when B is a integral domain. In this talk, we shall generalize their results for a non-commutative cofficient ring B.

23 Gahee Kim (Shizuoka Univ.)
Sho Matsuzawa (Shizuoka Univ.) Calabi–Yau property of 3-dimensional quadratic AS-regular algebras ····· 10

Summary: An AS-regular algebra is one of the main objects in noncommutative algebraic geometry. Let A be a 3-dimensional quadratic AS-regular algebra, and $A^!$ a quadratic dual of A. It is known that A is a Calabi–Yau algebra if and only if the Nakayama automorphism of $A^!$ is the identity. Let φ be a graded algebra automorphism of A, and A^{φ} a twist of A by φ. It is also known that A and A^{φ} are graded Morita equivalent. In this talk, we show that many 3-dimensional quadratic AS-regular algebras are graded Morita equivalent to some Calabi–Yau algebras.

24 Kenta Ueyama (Hirosaki Univ.) Cyclic ample groups acting on the graded down-up algebra $A(0,1)$ ··· 10

Summary: Recently, the notion of ampleness of a finite group action on a noetherian graded algebra was introduced by Mori and the speaker. They found some nice properties of fixed subalgebras of AS-regular algebras under ample group actions. It is well-known that the down-up algebra $A(0,1)$ is an 3-dimensional cubic AS-regular algebra. In this talk, we give a sufficient condition for the ampleness of cyclic groups acting on the down-up algebra $A(0,1)$.

25 Yoshifumi Tsuchimoto (Kochi Univ.) On structure of non commutative projective varieties as non commutative Kähler maifolds ····· 15

Summary: We first define non commutative projective varieties as a non commutative Kähler manifolds. Then we study some of their structure.

26 Daiki Obara (Tokyo Univ. of Sci.) On the Hochschild cohomology ring modulo nilpotence of the quiver algebra defined by c cycles and a quantum-like relation ····· 15

Summary: We consider the quiver algebra A defined by c cycles and a quantum-like relation. We describe the minimal projective bimodule resolution of A, and determine the ring structure of the Hochschild cohomology ring of A modulo nilpotence. And we introduce some results.

27 Tomohiro Itagaki (Tokyo Univ. of Sci.)
Katsunori Sanada (Tokyo Univ. of Sci.) Notes on the Hochschild homology dimension and truncated cycles ··· 10

Summary: In this talk, we show that if an algebra KQ/I with an ideal I of KQ contained in R_Q^m for an integer $m \geq 2$ has an m-truncated cycle, then this algebra has infinitely many nonzero Hochschild homology groups, where R_Q denotes the arrow ideal. Consequently, such an algebra of finite global dimension has no m-truncated cycles and satisfies an m-truncated cycles version of the no loops conjecture.

28 Ryo Kanda (Nagoya Univ.)♭ Minimal atoms in Grothendieck categories ····· 15

Summary: The atom spectrum of a Grothendieck category is a generalization of the prime spectrum of a commutative ring. For a Grothendieck category with a noetherian generator, we show that the number of minimal atoms is nonzero and finite.

29 Masashi Kosuda (Univ. of Ryukyus)♭ Coxeter elements of the symmetric groups whose powers afford the longest ····· 10

Summary: We give a necessary and sufficient condition for Coxeter elements of the symmetric groups to become the longest by being taken powers.

13:15–14:15 Talk Invited by Algebra Section

Jun-ichi Miyachi (Tokyo Gakugei Univ.)♭ Homotopy categories and derived categories of N-complexes

Summary: We describe homological properties of N-complexes, that is, complexes with differentials d satisfying $d^N = 0$. The notion of N-complexes was introduced by Mayer in 1942. He studied the "generalized homologies" of the N-complexes of simplicial complexes. Afterwards, Kapranov studied properties of the homologies of N-complexes, homotopies of morphisms and the q-analog of homological algebra in 1991. In this talk, we approach homology theory of N-complexes from the point of view of triangulated categories. In particular we study the homotopy category $K_N(\mathcal{B})$ of N-complexes of an additive category $\mathcal{B}$ and the derived category $D_N(\mathcal{A})$ of N-complexes of an abelian category $\mathcal{A}$. For a ring A we show that the derived category $D_N(ModA)$ of N-complexes of right A-modules is triangle equivalent to $D(ModT_{N-1}(A))$, where $T_{N-1}(A)$ is the $(N-1)$-dimensional upper triangular matrix ring of A.

March 23rd (Mon) Conference Room Ib

9:30–11:45

30 Masanori Ando (Wakhok Univ.) Odd number and tranpezoidal number ····· 10

Summary: We know that the Lecture hall partition theorem is generalization of Euler's odd-strict theorem. It's binomial proof exists. We simplyfy this proof by considering finite set. And we add a new variable to this proof.

31 Shuhei Kamioka (Kyoto Univ.) Application of biorthogonal polynomials and the discrete two-dimensional Toda molecule to rhombus tilings ····· 10

Summary: A close relationship between rhombus tilings, and biorthogonal polynomials and an associated integrable system, the discrete two-dimensional (2D) Toda molecule, is revealed. It is shown that the famous product formula by MacMahon for plane partitions, equivalently for rhombus tilings of a hexagonal region, can be derived by solving an initial value problem of the discrete 2D Toda molecule.

32 Tsunekazu Nishinaka (Okayama Shoka Univ.) On primitivity of non-noetherian group algebras ····· 10

Summary: A ring R is (right) primitive provided it has a faithful irreducible (right) R-module. In this talk, we focus on a local property which is often satisfied by groups with non-abelian free subgroups:
$(*)$ For each subset M of G consisting of finite number of elements not equal to 1, there exist three distinct elements a, b, c in G such that whenever $x_i \in \{a, b, c\}$ and $(x_1^{-1} g_1 x_1) \cdots (x_m^{-1} g_m x_m) = 1$ for some $g_i \in M$, $x_i = x_{i+1}$ for some i.
We get the following result: Let G be a non-trivial group which has a free subgroup whose cardinality is the same as that of G. Suppose that G satisfies the condition $(*)$. If R is a domain with $|R| \leq |G|$, then the group ring RG of G over R is primitive.

33 Kenichi Shimizu (Nagoya Univ.) Frobenius properties of tensor functors ····· 15

Summary: For an extension A/B of finite-dimensional Hopf algebras, the relative modular function $\chi_{A/B}$ and the relative Nakayama automorphism $\beta_{A/B}$ are defined in terms of the modular functions of A and B. Fischman, Montgomery and Schneider showed that the extension A/B is β-Frobenius with $\beta = \beta_{A/B}$, *i.e.*, there exists an isomorphism ${}_B A_A \cong {}_\beta \mathrm{Hom}_B(A_B, B_B)$ of B-A-bimodules. I will talk about a generalization of this theorem in the setting of finite tensor categories.

34 Hironori Oya (Univ. of Tokyo) The representations of quantized function algebras and the transition matrices between canonical bases and PBW bases ····· 15

Summary: Let G be a complex simply connected simple algebraic group. Firstly, we study the relation between the certain irreducible representations of the quantized function algebra $\mathbb{Q}_q[G]$ and the positive part $U_q(\mathfrak{n}^+)$ of the quantized enveloping algebra $U_q(\mathfrak{g})$, taking account into the right $U_q(\mathfrak{g})$-algebra structure of $\mathbb{Q}_q[G]$. Next, using this relation, we prove that each canonical basis element is the $\mathbb{N}[q^{\pm 1}]$-linear combination of the PBW basis elements when $\mathfrak{g}$ is of type ADE. This is an another proof of Kato's result that is a generalization of Lusztig's result.

35 Fumihito Oda (Kinki Univ.)
Hokuto Idei (Yamagata Univ.)
The table of marks, the Kostka matrix, and the character table of the symmetric group 10

Summary: We introduce a short proof of $T = KC$, where T is the table of marks with respect to the Young subgroups, K is the Kostka matrix, and C is the character table of the symmetric group S_n. As a corollary of the result, we could determine the explicit elements of the unit group of the generalized Burnside ring with respect to the Young subgroups of S_n.

36 Hiroki Ishioka (Tokyo Univ. of Sci.)
Naoko Kunugi (Tokyo Univ. of Sci.)
Brauer indecomposability of Scott modules 15

Summary: Let k be an algebraically closed field of prime characteristic p, G a finite group and P a p-subgroup of G. We investigate the relationship between the fusion system $\mathcal{F}_P(G)$ and the Brauer indecomposability of the Scott kG-module in the case that P is not necessarily abelian. We give an equivalent condition for Scott kG-module with vertex P to be Brauer indecomposable.

37 Katsushi Waki (Yamagata Univ.)
Subgroups of J_4 for amalgamation 10

Summary: I will show how to construct concrete subgroups of J_4 for Amalgamation of Ivanov. We needs these subgroups to make the 1333 dimansional simple J_4-module over the field with characteristic 3.

38 Masahiko Miyamoto (Univ. of Tsukuba)
Matthew Krauel (Univ. of Cologne)
Representation of regular commutant 10

Summary: Let V be a holomorphic vertex operator algebra and U a subVOA. We show that every simple U-module appears in V if U and U^c are both regular and $(U^c)^c = U$, where U^c denotes the commutant of U.

14:15–14:30 Presentation Ceremony for the 2015 MSJ Algebra Prize

14:30–15:30 Award Lecture for the 2015 MSJ Algebra Prize

Syu Kato (Kyoto Univ.)
On affine highest weight categories arising from quantum groups and Hecke algebras and its applications

15:45–18:30

39 Akinari Hoshi (Niigata Univ.)
Birational classification of fields of invariants for groups of order 128 15

Summary: Let G be a finite group acting on the rational function field $\mathbb{C}(x_g : g \in G)$ by $\mathbb{C}$-automorphisms $h(x_g) = x_{hg}$ for any $g, h \in G$. Noether's problem asks whether the invariant field $\mathbb{C}(G) = k(x_g : g \in G)^G$ is rational (i.e. purely transcendental) over $\mathbb{C}$. We investigate the birational classification of $\mathbb{C}(G)$ for groups G of order 128 with $\mathrm{Br}_{\mathrm{nr}}(\mathbb{C}(G)) \neq 0$. Moravec showed that there exist exactly 220 groups G of order 128 with $\mathrm{Br}_{\mathrm{nr}}(\mathbb{C}(G)) \neq 0$ forming 11 isoclinism families Φ_j. We show that if G_1 and G_2 belong to Φ_{16}, Φ_{31}, Φ_{37}, Φ_{39}, Φ_{43}, Φ_{58}, Φ_{60} or Φ_{80} (resp. Φ_{106} or Φ_{114}), then $\mathbb{C}(G_1)$ and $\mathbb{C}(G_2)$ are stably $\mathbb{C}$-isomorphic with $\mathrm{Br}_{\mathrm{nr}}(\mathbb{C}(G_i)) \simeq C_2$. Explicit structures of non-rational fields $\mathbb{C}(G)$ are given for each cases including also the case Φ_{30} with $\mathrm{Br}_{\mathrm{nr}}(\mathbb{C}(G)) \simeq C_2 \times C_2$.

Summary: In this talk, we study about Mahler's exponent w_2 and Koksma's exponent w_2^* in the field of formal Laurent series over $\mathbb{F}_q$. When $2 \not| q$, we obtain that the set of values taken by $w_2 - w_2^*$ is including $(0, 1]$. Furthermore, we have a finiteness of a value of automatic continued fraction taken by w_2^*.

Summary: Rényi introduced the notion of β-expansions of real numbers for a real number base $\beta > 1$. It is important to investigate the digits of algebraic numbers. For instance, Borel's conjecture on the normality of algebraic irrational numbers in an integral base $b \geq 2$ is a well known open problem. In this talk, we introduce lower bounds for nonzero digits of algebraic numbers in a Pisot or Salem number base β, which gives partial results of normality.

Summary: We prove congruence identities of regularized multiple zeta values involving a pair of index sets. We also obtain a proof of the parity result, and a congruence sum formula for MZVs.

Summary: Finite polylogarithms were defined by Elbaz–Vincent and Gangl and studied by several authors. In this talk, we will introduce a multiple version of finite polylogarithms and prove that a certain module generated by finite multiple polylogarithms forms an algebra. This result is obtained by using a finite analogue of the shuffle relation for the usual multiple polylogarithms. This is a joint work with Shuji Yamamoto.

Summary: Multiple zeta values are real numbers which are defined from the n-tuple of natural numbers. Now, there are a lot of known linear relations among multiple zeta values. Eie–Liaw–Ong (2013) generalized the weighted sum formula proved by Ohno–Zudilin (2008). In this talk, I'm going to introduce the weighted sum formula with parameters, that is an extension of the weighted sum formula proved by Eie–Liaw–Ong.

Summary: Matsumoto gave the functional equation for double zeta-functions of the Hurwitz–Lerch type, which includes the Euler–Zagier double zeta-function. As a generalization of the functional equation for the Euler–Zagier double zeta-function, we gave the functional equation for the Mordell–Tornheim multiple zeta-function.

46 Takuya Okamoto (Nippon Inst. of Tech.)
Tomokazu Onozuka (Nagoya Univ.)
On the various mean values of the Dirichlet L-functions ····· 10

Summary: We give a method of obtaining explicit formulas for various mean values of Dirichlet L-functions which are expressed in terms of the Riemann zeta-function, the Euler function and Jordan's totient functions.

47 Hideaki Morita (Muroran Inst. of Tech.) Combinatorial zetas and monoids ····· 10

Summary: Combinatorial zetas are considered. Main examples are Ihara zeta functions for finite graphs, and Artin–Mazur zeta functions for finite dynamical systems. Their determinantal expressions are reviwed and a theorem of Foata–Zeilberger is introduced for giving a way of understanding these expressions in view of Lyndon words. Finally, a similar way of construction is given for absolute Weil zetas.

48 Yukihiro Hattori (Muroran Inst. of Tech.)
Hideaki Morita (Muroran Inst. of Tech.)
Koyama–Nakajima's L-functions and Ruelle zetas ····· 15

Summary: S. Koyama and S. Nakajima introduce an L-function for each permutation matrice whose nonzero entries are r-th roots of unity. Their L-functions are an generalization of Artin–Mazur zeta functions for permutation matrices. In this talk, we will see that their L-functions are generating functions of exponential type for quantities arising from certain finite discrete dynamical systems with weight functions.

49 Soichi Ikeda (Nagoya Univ.) ♭
Isao Kiuchi (Yamaguchi Univ.)
Kaneaki Matsuoka (Nagoya Univ.)
Power moments for the double zeta-function ····· 10

Summary: We study the even power moments for the double zeta-function of Euler–Zagier type.

50 Hidekazu Tanaka (Tokyo Tech) ♭ Transcendence of special values of log double sine function ····· 10

Summary: In 2009, S. Gun, M. R. Murty, P. Rath studied transcendental values of the logarithm of the gamma function. In this talk, we study transcendental values of log double sine function using their method.

March 24th (Tue) Conference Room Ib

9:30–12:00

51 Kenichi Shimizu * On SP numbers (II) ····· 10

Summary: We define a new number which we call an SP number. SP numbers are related to imaginary quadratic fields. It seems that the number of SP numbers is less than prime numbers. We consider the distribution of SP numbers.

52 Takafumi Miyazaki (Nihon Univ.) * On the sum of consecutive k-th powers and Schäffer's conjecture ····· 10

Summary: We consider the problem to ask when the sum of consecutive k-th powers is a perfect power. We solve this in a special case. Our result gives an affirmative answer to a classical conjecture of Schäffer.

Summary: By using the associated and restricted Stirling numbers of the second kind, we give some generalizations of the poly-Bernoulli numbers.

Summary: Zeros of the Riemann zeta function and its derivatives have been studied by many mathematicians. Among, the number of zeros and the distribution of the real part of non-real zeros of the derivatives of the Riemann zeta function have been investigated by Berndt, Levinson, Montgomery, Akatsuka, and the author. Berndt, Levinson, and Montgomery investigated the general case, meanwhile Akatsuka and the author gave sharper estimates under the truth of the Riemann hypothesis. In this talk, we introduce similar results related to the first derivative of the Dirichlet L-functions under the assumption of the generalized Riemann hypothesis.

Summary: In 1923, Hardy and Littlewood conjectured that every sufficiently large integer is either a square or the sum of a prime and a square. In this talk, I will present a conditional estimate of the exceptional set for this conjecture under GRH. It is an improvement of the previous results obtained by Mikawa (1993) or Perelli and Zaccagnini (1995).

Summary: We obtain new trigonometric identities, which are product-to-sum type formulas for derivative of the cotangent function. Further, from specializations of our formulas, we derive not only various known reciprocity laws of generalized Dedekind sums but also new reciprocity laws of generalized Dedekind sums.

Summary: Let x, y be positive real numbers, p a prime. We consider two sums $\sum_{n\leq x,p|n\Rightarrow p>y}\mu(n)$ and $\sum_{n\leq x,p|n\Rightarrow p>y}\mu^2(n)$, where μ is the Möbius function.

Summary: Let $k>1$ be an odd integer with $3\nmid k$ and let n and e be positive integers with $3^{2e}<4k^n$. We show that the class number of the imaginary quadratic field $\mathbb{Q}(\sqrt{3^{2e}-4k^n})$ is divisible by n if k, n, and e satisfy certain conditions.

59 Hirotaka Sato (Tokyo Univ. of Foreign Stud.) * On the anti-cyclotomic $\mathbb{Z}_p$-extension of an imaginary quadratic number field ····· 10

Summary: Let K be an imaginary quadratic number field and L_∞ be the ring class field of conductor p^∞. Then p-part of $Gal(L_\infty/K) \simeq \mathbb{Z}_p \oplus T$, where T is a finite abelian p-group. In order to study the anti-cyclotomic $\mathbb{Z}_p$-extension of K, we characterize T in terms of the form class group of K.

60 Daisuke Shiomi (Yamagata Univ.) * Unit indices of global function fields ····· 10

Summary: Let L be an imaginary bicyclic biquadratic function field over $\mathbb{F}_q(T)$. Let Q_L be the unit index of L. The main result of this talk is to give a necessary and sufficient condition for Q_L to be two.

61 Ryo Kato (Kyoto Univ.) ♭ A remark on the Wiener–Ikehara Tauberian theorem ····· 10

Summary: Let $\{a_n\}$ be a sequence of non-negative real numbers and L a Dirichlet series whose coefficients are $\{a_n\}$. We give the asymptotic behavior of $\sum_{n\leq X} a_n$ as $X \to \infty$ when L^m has a meromorphic continuation, and is holomorphic except for a pole of order l.

14:15–15:30

62 Kazuaki Tajima (Tohoku Univ.) GIT stratification of reductive group actions in the non-split case ···· 10

Summary: In early 80's, Kirwan and Ness introduced the notion of GIT stratification of reductive group actions in algebraic situation. If the group is split over k, their works tell us that these stratifications are rationally defined over a perfect ground field k. In this talk, we extend these stratifications for all (not necessarily split) reductive algebraic groups over k.

63 Yu Yasufuku (Nihon Univ.) Integer points in orbits in one- and higher-dimensions ····· 15

Summary: We describe several recent results on S-integral points in orbits under maps on $\mathbb{P}^1$ as well as on $\mathbb{P}^N$. How the map ramifies plays a key role. This talk is in part a joint work with H. Krieger, A. Levin, Z. Scherr, T. Tucker, and M. Zieve.

64 Yoshiyasu Ozeki (Kyoto Univ.) On weak Liu modules ····· 10

Summary: In this talk, we give an answer to a Tong Liu's question about the essential image of a functor on weak Liu modules in most cases.

65 Mariko Ohara (Tohoku Univ.) Algebraic K-theory of quasi-coherent modules over spectral schemes and the representation in affine case ····· 15

Summary: We study K-theory of spectral schemes by using quasi-coherent sheaves. We regard the K-theory as a functor K on the affine spectral schemes and prove that the group completion $\Omega B(BGL)$ represents the sheafification of K with respect to Zariski (resp. Nisnevich) topology, where we define BGL to be a classifying space of a colimit of affine spectral scheme GL_n. We also prove $K(R^b) \simeq K(\pi_0 R^b)$ for connective spectrum R^b which has only finitely many non-zero homotopy groups.

66 Tomomi Ozawa (Tohoku Univ.) Constant terms of Eisenstein series defined over a totally real field ··· 15

Summary: In this talk, we compute constant terms of Eisenstein series defined over a totally real field at all cusps. M. Ohta defined and computed congruence modules related to Eisenstein series defined over $\mathbb{Q}$ in a paper published in 2003. His theory of congruence modules has been applied to several important problems in number theory, particularly in Iwasawa theory. In his computation, the constant terms of Eisenstein series over $\mathbb{Q}$ at all the equivalence classes of cusps are necessary. We explicitly describe the constant terms of Eisenstein series over a general totally real field in terms of special values of Hecke L-functions, at each equivalence class of cusps.

15:45–16:45 Talk Invited by Algebra Section

Shunsuke Yamana (Kyushu Univ.)[♭] Exterior cube L-functions for $GL(6)$

Summary: It is an interesting problem to ask when an automorphic L-function has a pole or when its central critical value is nonvanishing. I will discuss this problem for the twisted exterior cube L-functions for $GL(6)$. I will determine the irreducible cuspidal automorphic representations of $GL(6)$ whose twisted exterior cube L-function has a pole. The proof is very short and uses quadratic base change. I will also review a conjecture on its central critical value formulated by Ginzburg and Rallis. The twisted exterior cube L-function is very similar to the triple product L-function, which was extensively studied by Piatetski-Shapiro, Rallis, Ikeda, Kudla, Harris, Ichino, and also to the spin L-function for $GSp(10)$, the half-spin L-function for $GSO(12)$ and the standard L-function for GE_7.

Geometry

March 21st (Sat) Conference Room IIIa

9:50–12:00

1 Hirotaka Ebisui (Oval Research Center) Drawing theorem and some compositions on the tangent of Doval (algebric 4th oder curve) 5

Summary: We found the Tangent of Doval (The Oval of DEscartes) can be drawn by using Elementary Geometry about 40 years ago, and found New Some Properties of The tangents. We already proved the method are true, and this time, We show New composition of the tangent which consist of asymmetry axes and Third Focus point of Doval, and consist of tangent-tangent closs points of Doval and second focus point. We show these composition figure and show these Composition-constructions. We hope these properties of Doval will be famila in order to apply Doval to many Mathematics field and Physics

2 Hirotaka Ebisui (Oval Research Center) 5 compositions of star star teorem 5

Summary: We found Strange Compositions on Two Overlap Triangles. This have been already as ADE theorem onrepoted Last MSJ2014 proceedind at Hirodai. That Composition has 5 Types. We show and explain all of them Plase enjoy their figures.

3 Hiroaki Izumi (Hiroshima Univ.) Mathematical formulization of phase transition and a branch of a concept or a power 10

Summary: We succeed in mathematical formulization of business cycle, phase transition, symmetry breaking, scale transformation, rhythm phenomenon, synchronization, pattern and a branch of a concept or a power.
At first, I state what the key point of Nash Equilibrium is.
Next, I state mathematical formulization of a branch of a concept or a power.
To my thinking, that is the heart of the theory of history and the paper “First-order phase transition of a vacuum and the expansion of the Universe” written by Katsuhiko Sato 1981.

4 Tomonori Fukunaga (Kyushu Sangyo Univ.)
Masatomo Takahashi (Muroran Inst. of Tech.) On convexity of frontals in the Euclidean plane 15

Summary: We study convexity of simple closed frontals in the Euclidean plane by using the curvature of Legendre curves. We introduce a characterization of convexity of the simple closed frontal of a Legendre curve by using the curvature.

5 Shun'ichi Honda (Muroran Inst. of Tech.)
Masatomo Takahashi (Muroran Inst. of Tech.)
Evolutes of framed curves in the Euclidean space 15

Summary: The evolute of a regular curve is the classical object and may have singularities. By using a moving frame of a framed curve and the curvature of the framed curve, we can define an evolute of the framed curve in the Euclidean space. In this case, we can consider an evolute of evolutes and discuss properties of them.

6 Kenji Kajiwara (Kyushu Univ.)
Toshinobu Kuroda (Kyushu Univ.)
Nozomu Matsuura (Fukuoka Univ.)
Conformal deformation of discrete plane curves and discrete Burgers hierarchy I 10

Summary: We consider a discrete conformal deformation of discrete plane curves, which give rise to the discrete Burgers hierachy. In this talk, we introduce the Burgers and the discrete Burgers hierarchies which naturally appear in the geometric framework.

7 Nozomu Matsuura (Fukuoka Univ.)
Kenji Kajiwara (Kyushu Univ.)
Toshinobu Kuroda (Kyushu Univ.)
Conformal deformation of discrete plane curves and discrete Burgers hierarchy II 10

Summary: We consider a discrete conformal deformation of discrete plane curves, which gives rise to the discrete Burgers hierachy. We also construct explicit formulas for the deformations by using the solution of linear diffusion differential/difference equations.

8 Tomoshige Yukita (Waseda Univ.)
Classification of hyperbolic Coxeter polytopes with 6 faces and their growth rates 15

Summary: We classify hyperbolic Coxeter polytopes with 6 faces and show that their growth rates are Perron numbers.

9 Yohei Komori (Waseda Univ.)
Coxeter garlands and 2-Salem numbers 15

Summary: We show that the growth rates of Coxeter garlands are 2-Salem numbers, where a real algebraic integer $\alpha > 1$ is called a 2-Salem number if it has a real conjugate $\beta > 1$ while other conjugates ω satisfy $|\omega| \leq 1$ and at least one of them is on the unit circle.

14:15–15:40

10 Atsufumi Honda * (Miyakonojo Nat. Coll. of Tech.)
Duality of singularities for spacelike CMC surfaces in Minkowski space 10

Summary: We show the duality of singularities for spacelike CMC surfaces with singularities in the Lorentz–Minkowski three-space.

11 Makoto Sakaki (Hirosaki Univ.) * On the structure equations and the curvature ellipse of minimal surfaces in product spaces 10

Summary: We discuss the structure equations and the curvature ellipse of minimal surfaces in product spaces. We also give some related problems.

12 Norihisa Ikoma (Tohoku Univ.) * Existence of Willmore type tori with small area 15
Andrea Malchiodi (SISSA)
Andrea Mondino (ETH, Zürich)

Summary: In this talk, we discuss the existence of Willmore type tori with small area embedded in 3-dimensional closed Riemannian manifold. Here a Willmore type torus means a surface of genus 1 which is a critical point of the Willmore functional under the area constraint. Supposing some curvature conditions for the ambient manifold, we shall show the existence of Willmore type tori having a small area.

13 Katsuhiro Moriya (Univ. of Tsukuba) Simple factor dressing of a minimal surface 10

Summary: The Gauss map of a constant mean curvature surface in the Euclidean space is a harmonic map. Theory of constant non-zero mean curvature surfaces is associated with theory of harmonic maps from a surface to the two-dimensional sphere. Dressing is a method to construct a harmonic map from a given one. For a minimal surface, its conformal Gauss map is a harmonic map and it plays similar role to the gauss map of a constant non-zero mean curvature surface. We define a simple factor dressing of a minimal surface and explain the relationship between simple factor dressing, the associated family, the Goursat transform, the Darboux transform and the Lopez-Ros deformations.

14 Yu Kawakami (Kanazawa Univ.) The Gauss map and total curvature of complete minimal Lagrangian surfaces in the complex two-space 15
Reiko Aiyama (Univ. of Tsukuba)
Kazuo Akutagawa (Tokyo Tech)

Summary: We give an Osserman-type inequality and the precise maximal number of exceptional values of the Gauss map for a complete minimal Lagrangian surface with finite total curvature in the complex two-space. Moreover, we prove that if the Gauss map of a complete minimal Lagrangian surface which is not a Lagrangian plane omits three values, then it takes all other values infinitely many times.

15 Katsuei Kenmotsu (Tohoku Univ.*) The classification of the surfaces with parallel mean curvature vector in two-dimensional complex space forms, revisited 15

Summary: In the meeting of MSJ on March 1999, I claimed the classification result for those surfaces stated in the title of this talk. But it was incomplete. Today, I give the correction to the result as follows: A parallel mean curvature surface in a complex two-dimensional complex space form depends on one real-valued harmonic function on the surface and five real constants if the ambient space is not flat, the mean curvature vector does not vanish, and the Kähler angle is not constant.

15:50–16:50 Talk Invited by Geometry Section

Nozomu Matsuura (Fukuoka Univ.) Deformations of discrete curves

Summary: It is well-known that there are deep connections between the differential geometry and the theory of integrable systems, and various integrable differential equations arise as the integrability condition of geometric objects. In order to develop its discrete analogue, the studies of discrete differential geometry (DDG) started from the mid 1990s. One of the themes of DDG is to construct the geometric framework, which is consistent with the theory of discrete integrable systems. Some of the motivations to study DDG may be, for example, an expectation that discrete systems may be more fundamental and have rich mathematical structures as was clarified in the theory of integrable systems, or the development of theoretical infrastructure for the visualization or the simulation of large deformation of geometric objects. The purpose of this talk is to present a discrete analogue of the deformation theory of curves in space or in plane from the viewpoint of DDG.

17:00–18:00 Talk Invited by Geometry Section

Wenjiao Yan ♭ Isoparametric foliation and Yau's conjecture on the first eigenvalue
(Tohoku Univ./Beijing Normal Univ.)

Summary: A well known conjecture of S. T. Yau states that the first eigenvalue of every closed minimal hypersurface in the unit sphere is just its dimension. We show that Yau's conjecture is true for minimal isoparametric hypersurfaces. Moreover, a more fascinating result is that the first eigenvalues of the focal submanifolds (which are minimal submanifolds in the unit sphere) are equal to their dimensions in the non-stable range.

March 22nd (Sun) Conference Room IIIb

9:30–12:00

16 Tuerxunmaimaiti Yaermaimaiti * (p,q)-Laplacians of regular Kaehler graphs 15
(Nagoya Inst. of Tech.)
Toshiaki Adachi (Nagoya Inst. of Tech.)

Summary: A Kaehler graph is a compound graph and is a discrete model of a Kaehler manifold admitting Kaehler magnetic fields. We define Laplacians corresponding to the random walk of (p,q)-step bicolored paths on this graph, give a condition that they are selfadjoint, and study their eigenvalues when the graph is finite.

17 Keita Kunikawa (Tohoku Univ.) Bernstein theorem for ancient solutions to the mean curvature flow 10

Summary: A solution of mean curvature flow which is defined on all negative time is called ancient solution. Ancient solutions are good models of singularities of the mean curvature flow. For example, all self-shrinkers and translators are ancient solutions. It is important to study these solutions to investigate the shapes of singularities. In this talk, I give a non-existence theorem of entire graphic ancient solutions.

18 Keita Kunikawa (Tohoku Univ.) Bernstein theorem of translating solitons in higher codimension ····· 10

Summary: In this talk, I give a Bernstein-type theorem of entire graphs of translating solitons in higher codimension. In the case of hypersurfaces, Bao–Shi showed that a translating soliton whose image of the Gauss map is contained in a compact subset in an open hemisphere is a hyperplane. This means that there is no nontrivial translating soliton whose slope is bounded. In the present article, we generalize this theorem in a higher codimensional case. Moreover we obtain an optimal growth condition which allows unbounded slopes.

19 Hajime Koba (Waseda Univ.)* On fluid-flow on an evolving hypersurface ····· 15
Yoshikazu Giga (Univ. of Tokyo)
Chun Liu (Pennsylvania State Univ.)

Summary: We consider fluid-flow on an evolving hypersurface. We focus on kinetic and dissipation energies to derive governing equations for the motion of incompressible viscous flow on an evolving hypersurface. More precisely, we use a variational approach to derive the incompressible Euler and Navier–Stokes equations on a prescribed evolving hypersurface.

20 Tatsuyoshi Hamada On star-Ricci flat real hypersurfaces of complex space forms ····· 10
(Fukuoka Univ./Osaka City Univ.)

Summary: In this article, we studied star-Ricci flat real hypersurfaces of non-flat complex space forms.

21 Makoto Kimura (Ibaraki Univ.) Gauss map of real hypersurfaces in complex projective space and submanifolds in complex 2-plane Grassmannian ····· 15

Summary: We define Gauss map g from real hypersurfaces M in complex projective space CP^n to complex 2-plane Grassmannian $G_2(C^{n+1})$. If M is a Hopf hypersurface, then $g(M)$ is a half-dimensional totally complex submanifold in $G_2(C^{n+1})$ with respect to quaternionic Kähler structure. Conversely, from a half-dimensional totally complex submanifold in $G_2(C^{n+1})$, we can construct Hopf hypersurface in CP^n by using twistor space of $G_2(C^{n+1})$.

22 Sadahiro Maeda (Saga Univ.)* Some remarks on ruled real hypersurfaces in a nonflat complex space form ····· 15
Toshiaki Adachi (Nagoya Inst. of Tech.)

Summary: In this talk, we clarify geometric properties of ruled real hypersurfaces in a nonflat complex space form.

23 Kazuyuki Hasegawa (Kanazawa Univ.) Twistor holomorphic affine surfaces and projective invariants ····· 10

Summary: We study affine immersions from surfaces with twistor lifts and their projective invariants. In particular, affine immersions with holomorphic twistor lifts are considered. In the case of compact surfaces with holomorphic twistor lifts, we see a quantization phenomenon for a projective invariant. Moreover, we prove that a real analytic twistor holomorphic affine surface with the symmetric Ricci tensor with respect to both complex structures is totally geodesic or totally umbilic.

24 Masaro Takahashi (Kurume Nat. Coll. of Tech.)
Oscar Macia (Univ. of Valencia)
Yasuyuki Nagatomo (Meiji Univ.)
Holomorphic isometric embeddings of the projective line into quadrics 15

Summary: We discuss holomorphic isometric embeddings of the projective line into quadrics from the viewpoint of gauge theory. We get a description of their moduli spaces up to image and gauge–equivalence.

13:00–14:15

25 Naoyuki Koike (Tokyo Univ. of Sci.)
Homogeneity by a Banach Lie group action of infinite dimensional anti-Kähler isoparametric submanifolds 15

Summary: Recently, we proved that, if a full irreducible infinite dimensional anti-Kähler isoparametric submanifold of codimension greater than one has J-diagonalizable shape operators, then it is an orbit of a Banach Lie group action consisting of isometries of the ambient space whose associated holomorphic Killing fields are defined on the whole of the ambent space. In this talk, we explain the result and the outline of the proof.

26 Kotaro Kawai (Univ. of Tokyo)
Some associative submanifolds of the squashed 7-sphere 15

Summary: The squashed 7-sphere S^7 is a 7-sphere with an Einstein metric given by the canonical variation and its cone $\mathbb{R}^8 - \{0\}$ has full holonomy Spin(7). There is a canonical calibrating 4-form Φ on $\mathbb{R}^8 - \{0\}$. A minimal 3-submanifold in S^7 is called associative if its cone is calibrated by Φ.
We classify two types of fundamental associative submanifolds in the squashed S^7. One is obtained by the intersection with a 4-plane and the other is homogeneous. Then we study their infinitesimal associative deformations and explicitly show that all of them are integrable.

27 Hideya Hashimoto (Meijo Univ.)
Misa Ohashi (Nagoya Inst. of Tech.)
On G_2, $Spin(7)$-orbit decomposition of Stiefel manifolds related to Octonions and its applications 10

Summary: We investigate the real Stiefel manifolds $V_k(\mathbf{R}^n) = SO(n)/SO(n-k)$ for $n = 7$ or $n = 8$. If we identify $\mathbf{R}^7$ and $\mathbf{R}^8$ with $\mathrm{Im}\mathfrak{C}$ and $\mathfrak{C}$, respectively, then we have $V_2(\mathbf{R}^7) = G_2/SU(2)$, $V_2(\mathbf{R}^8) = Spin(7)/SU(3)$, and $V_3(\mathbf{R}^8) = Spin(7)/SU(2)$. These real Stiefel manifolds can be represented as a orbit of the action of the Lie group G_2 or $Spin(7)$. In this paper, we give the orbit decomposition of the another Stiefel manifolds related to the octonions $\mathfrak{C}$ under the action of Lie group G_2 and $Spin(7)$.

28 Takayuki Okuda (Hiroshima Univ.)
Osamu Ikawa (Kyoto Inst. Tech.)
Hiroshi Iriyeh (Tokyo Denki Univ.)
Takashi Sakai (Tokyo Metro. Univ.)
Hiroyuki Tasaki (Univ. of Tsukuba)
The intersection of two real flag manifolds in a complex flag manifold 15

Summary: We show a necessary and sufficient condition for the intersection of two real flag manifolds in a complex flag manifold to be discrete. In the case where the intersection is discrete we prove that it is an antipodal set and describe it as an orbit of a certain Weyl group.

March 23rd (Mon) Conference Room IIIa

9:45–12:00

29 Shigehiro Sakata (Waseda Univ.) The location of centers of a body with the outer cone condition ····· 15

Summary: We consider the renormalized Riesz potential of a body with the outer cone condition. We call a maximizer of the potential a radial center of a body. It is well-known that all radial centers are contained in the heart of the body. In this talk, we show that we can restrict the location of the centers into a smaller region contained in the heart of the body.

30 Akifumi Sako (Tokyo Univ. of Sci.) * Feature of gauge theory on noncommutative homogeneous Kähler manifold ····· 15
Toshiya Suzuki (Kushiro Nat. Coll. of Tech.)
Hiroshi Umetsu (Kushiro Nat. Coll. of Tech.)

Summary: We construct a gauge theory on a noncommutative homogeneous Kähler manifold by using the deformation quantization with separation of variables for Kähler manifolds. A model of noncommutative gauge theory that is connected with an ordinary Yang–Mills theory in the commutative limit is given. As examples, we construct noncommutative $\mathbb{C}P^N$ and noncommutative $\mathbb{C}H^N$ and gauge thoeories on them. We track the phenomena that local gauge symmetry breaks down under noncommutative deformation by an obserbation of concreate model and explicit geometrical calculations. As a result, topological symmetries are also broken by higher quantum collection by the deformation.

31 Masanori Adachi (GAIA, POSTECH/Nagoya Univ.) A CR proof for a global estimate of the Diederich–Fornaess index of Levi-flat real hypersurfaces ····· 15

Summary: Yet another proof is given for a global estimate of the Diederich–Fornaess index of relatively compact domains with Levi-flat boundary, namely, the index must be smaller than or equal to the reciprocal of the dimension of the ambient space. This proof reveals that this kind of estimate makes sense and holds also for abstract compact Levi-flat CR manifolds.

32 Daisuke Tarama (Kyoto Univ.) Stability analysis for the free rigid body dynamics on normal and compact real forms of complex semi-simple Lie algebras ····· 15

Summary: This talk is based on a joint work with Tudor Ratiu (EPFL). The stability of the isolated equilibria is considered for the generalized free rigid body dynamics on the normal and the compact real forms of complex semi-simple Lie algebras, by using the results of Bolsinov and Oshemkov. It is shown that all the isolated equilibria on generic orbits for the system on normal real forms are hyperbolic and that those for the system on compact real forms are elliptic.

33 Hiroshi Sawai (Numazu Nat. Coll. of Tech.) * Necessary conditions for LCK structures on compact solvmanifolds ··· 15

Summary: In this talk, we give necessary conditions for locally conformal Kähler structures with non-parallel Lee from on compact solvmanifolds. Moreover, we construct a locally conformal symplectic solvmanifold without a locally conformal Kähler structure.

34 Hisashi Kasuya (Tokyo Tech)♭ Flat bundles and hyper-Hodge decomposition on solvmanifolds ····· 10

Summary: By using Hodge theoretical properties for all topologically trivial rank 1 flat bundles, we represent the structure theorem of Kähler solvmanifolds as extensions of Hasegawa's result and Benson–Gordon's result for nilmanifolds.

35 Hisashi Kasuya (Tokyo Tech)♭ Cohomologies of Sasakian groups and Sasakian solvmanifolds ····· 10

Summary: We show certain symmetry of the dimensions of cohomologies of the fundamental groups of comapct Sasakian manifolds and show that Sasakian solvmanifolds are finite quotients of Heisenberg nilmanifolds.

36 Hisashi Kasuya (Tokyo Tech)♭ Tamed symplectic structures of solvmanifolds ····· 10

Summary: We study the existence of tamed symplectic structures on solvmanifolds with left-invariant complex structures.

14:15–16:45

37 Hikaru Yamamoto (Univ. of Tokyo) Ricci-mean curvature flows in gradient shrinking Ricci solitons ····· 15

Summary: G. Huisken studied asymptotic behavior of a mean curvature flow moving in a Euclidean space when it develops a singularity of type I, and proved that its parabolic rescaled flow converges to a self-shrinker in the Euclidean space. In this talk, we generalize this result for Ricci-mean curvature flows in gradient shrinking Ricci solitons.

38 Ryosuke Takahashi (Nagoya Univ.) On the modified Futaki invariant of complete intersections in projective spaces ····· 15

Summary: Let M be a Fano manifold. We call a Kähler metric $\omega \in c_1(M)$ a Kähler–Ricci soliton if it satisfies the equation $\mathrm{Ric}(\omega) - \omega = L_V\omega$ for some holomorphic vector field V on M. It is known that a necessary condition for the existence of Kähler–Ricci solitons is the vanishing of the modified Futaki invariant introduced by Tian–Zhu. In a recent work of Berman–Nyström, it was generalized for (singular) Fano varieties and the notion of algebro-geometric stability of the pair (M, V) was introduced. In this paper, we propose a method of computing the modified Futaki invariant for Fano complete intersections in projective spaces.

39 Shunsuke Saito (Univ. of Tokyo) On the vanishing of the modified Futaki invariants ····· 10

Summary: In 2002, G. Tian and X. Zhu defined the modified Futaki invariant, which is an obstruction to the existence of Kähler–Ricci solitons. This is a KRS analogue of the Futaki invariant. Using this, they proved that there exists a unique holomorphic vector field such that the invariant associated to this vector field vanishes on the reductive part of the Lie algebra of all holomorphic vector fields. Meanwhile, they asked whether this obstruction vanishes on the unipotent part. Except for the toric case, there has been no investigation for this. Hence, their question has been still open.
In this talk, we prove that the modified Futaki invariant vanishes on the unipotent part. This gives an affirmative answer to the Tian–Zhu problem.

40 Homare Tadano (Osaka Univ.) Gap theorems for Harmonic-Ricci solitons 15

Summary: In this talk, we shall give some gap theorems for Harmonic-Ricci solitons, which show some necessary and sufficient conditions for Harmonic-Ricci solitons to be Harmonic-Einstein. Our results extend the recent work by H. Li (Arch. Math. (Basel) 91: 187–192, 2008), and M. Fernández-López and E. García-Río (Internat. J. Math. 23: 1250072, 2012).

41 Homare Tadano (Osaka Univ.) A lower bound for the generalized scalar curvature of Harmonic-Ricci solitons 10

Summary: In this talk, we shall give a lower bound for the generalized scalar curvature on complete domain manifolds of certain Harmonic-Ricci solitons. Our results extend the recent work on a lower bound for the scalar curvature on gradient Ricci solitons by Chow, Lu and Yang (C. R. Acad. Sci. Paris, Ser. I 349: 1265–1267, 2011), and Fernández-López and García-Río (Proc. Amer Math. Soc. 141: 2145–2148, 2013).

42 Takayuki Moriyama (Mie Univ.) Smoothness of deformations of submanifolds characterized by differential forms 15

Summary: We provided the smoothness theorem for deformations of submanifolds characterized by a sytem of differential forms on Riemannian manifolds in the previous talk. In this talk, we show the "refined" smoothness theorem.

43 Mamoru Doi * A new example of Calabi–Yau 3-folds by the doubling construction
Naoto Yotsutani (Fudan Univ.) 15

Summary: We give a differential-geometric construction and examples of Calabi–Yau 3-folds, at least one of which is new. Ingredients in our construction are admissible pairs, which were dealt with by Kovalev and further studied by Kovalev and Lee. An admissible pair $(\overline{X}, D)$ consists of a 3-dimensional compact Kähler manifold $\overline{X}$ and a smooth anticanonical $K3$ divisor D on $\overline{X}$. If two admissible pairs $(\overline{X}_1, D_1)$ and $(\overline{X}_2, D_2)$ satisfy the gluing condition, we can glue $\overline{X}_1 \setminus D_1$ and $\overline{X}_2 \setminus D_2$ together to obtain a Calabi–Yau 3-fold M. In particular, if $(\overline{X}_1, D_1)$ and $(\overline{X}_2, D_2)$ are identical to an admissible pair $(\overline{X}, D)$, then the gluing condition holds automatically, so that we can always construct a Calabi–Yau 3-fold from a single admissible pair $(\overline{X}, D)$ by doubling it. Furthermore, we can compute all Betti and Hodge numbers of the resulting Calabi–Yau 3-folds in the doubling construction.

44 Mamoru Doi * Doubling construction of Calabi–Yau 4-folds from toric Fano 4-folds
Naoto Yotsutani (Fudan Univ.) 10

Summary: We use our doubling construction to obtain Riemannian 8-manifolds with holonomy contained in Spin(7). In order to construct Calabi–Yau 4-folds, we use an admissible pair $(\overline{X}, D)$ consisting of a 4-dimensional compact Kähler manifold $\overline{X}$ and a smooth anticanonical Calabi–Yau divisor D on $\overline{X}$. As in the doubling construction of Calabi–Yau 3-folds, smooth Fano 4-folds give admissible pairs $(\overline{X}, D)$ which are said to be of Fano type. We can construct a Calabi–Yau 4-fold by the doubling construction from any of the 124 types of smooth toric Fano 4-folds by showing that the $\hat{A}$-genus of the resulting manifold is equal to 2.

45 Kota Hattori (Keio Univ.) * Compact special Lagrangian submanifolds embedded in hyper-Kähler manifolds 15

Summary: We construct smooth families of compact special Lagrangian submanifolds embedded in some toric hyper-Kähler manifolds, which never become holomorphic Lagrangian submanifolds via any hyper-Kähler rotations. These families converge to special Lagrangian immersions with self-intersection points in the sense of current. To construct them, we apply the desingularization method developed by Joyce.

17:00–18:00 Talk Invited by Geometry Section

Yuji Odaka (Kyoto Univ.) * Moduli of Kähler–Einstein manifolds and their canonical compactifications

Summary: After the development of the last half century of Kähler geometry [(..Poincare, Koebe..), Calabi, Matsushima, Yau, Futaki, Mabuchi, Tian, Donaldson etc], now it is a theorem that existence of a "canonical metric" —Kähler–Einstein metrics— on a fixed complex manifold is equivalent to an algebro-geometric notion called K-stability [Tian, Donaldson] of the manifold, which is essentially "infinite" variant of GIT stability of David Mumford.

The protagonist of this talk would be Moduli space of those manifolds (rather than metric itself) —we will show partially from our results as well as from [Fujiki, Donaldson etc], how the above stories of metrics fits to, or can be applied to, construction of their nice moduli spaces. Furthermore, we get algebro-geometric nice compactifications of the moduli spaces, in a Gromov–Hausdorff manner where interesting tractable singularities appear.

I would (only) briefly explain algebro-geometric aspect, which is actually my origin. Algebro-geometrically, the program above is to construct moduli of K-stable varieties (which I call "K-moduli"), which in turn originally came from my following observations: K-stability directly links to the theory of the minimal-model-program ("MMP") in birational algebraic geometry, and thus the recent Kollár–Shepherd–Barron–Alexeev's higher dimensional generalisation of $\bar{M}_g$ (the Deligne–Mumford compactification of moduli of compact Riemann surfaces) are examples of K-moduli.

March 24th (Tue) Conference Room IIIa

9:30–12:00

46 Vasile Sorin Sabau (Tokai Univ.) Jin-ichi Itoh (Kumamoto Univ.) On the cut locus of a family of Finsler manifolds 15

Summary: Firstly we show that if (M, g) is a complete Riemannian manifold, then by an appropriate choice of a function $f : M \to R$ we can construct a Finsler structure of Randers type $F = \alpha + df$ such that the cut locus of this Randers metric coincides with the cut locus of the Riemannian metric (M, g) as set of points. As application, we show that there are Finsler (and Riemannian) structures on some spheres whose cut locus is a fractal, provided these structures are not C^∞-structures.

47 Tetsuya Nagano (Univ. of Nagasaki) On reversible geodesics in Finsler space 15

Summary: Geodesics in Finsler space depend on a direction, in general. Namely, the geodesic from p to q is different from the geodesic from q to p. We call it "reversible" when the forward geodesic coincides with the backward geodesic. In this lecture, existence conditions for reversible geodesics are stated.

Summary: We first discuss three distances induced from a Finsler metric F. It motivates us to decompose F into its symmetric part and skew-symmetric part. We show a condition of the reversibility of geodesics in (M, F) by using the skew-symmetric part when it is a 1-form. We introduce Busemann–Pedersen's results concerning geodesics in tori with one-parameter group of motions. After that, we give two exmples of Randers metrics on tori with one-parameter group of motions and study the behaviors of geodesics in their universal covering planes.

Summary: We investigate geometrical properties of geodesics defined on a space of probability measures on a compact smooth manifold in terms of Fisher information metric. It is known that geodesics are all periodic, of period 2π, non-complete by T. Friedrich. However, we obtain a new simple explicit formula for geodesics from which we conclude that any two measures can be joined by a geodesic. We also apply the simple formula to a barycenter map which is associated to probability measures defined on ideal boundary of an Hadamard manifold.

Summary: In this talk we would like to report a recent geometrical study of harmonic Hadamard manifolds, which we call as those being of hypergeometric type, on which the inversion formula for Fourier spherical transform can be defined.

Summary: We recently proved that if a bi-Lipschitz map between compact manifolds and its inverse map have no singular point in the sense of F. H. Clarke, respectively, then they are diffeomorphic. We will introduce this result to you.

Summary: In this talk, I talk about metric on the space of quantum metric measure spaces. We define the distance between two quantum metric measure spaces and consider relation between Gromov's box distance function on the space of metric measure spaces and it. We also generalize the concentration function for quantum metric measure space and consider the relation between the convergence of quantum metric measure spaces and it.

Summary: We give an explicit estimate of the area of a closed surface by the diameter and a lower bound of curvature. This is better than Calabi–Cao's estimate for a nonnegatively curved two-sphere.

54 Ayato Mitsuishi (Tohoku Univ.)* Collapsing three-dimensional Alexandrov spaces with boundary ····· 15
Takao Yamaguchi (Kyoto Univ.)

Summary: Alexandrov spaces are complete length spaces with the notion of curvature bounds. They naturally appear in collapsing phenomena of Riemannian manifolds with a lower curvature bound, and have played important roles in the study of collapsing Riemannian manifolds with a lower curvature bound. In this talk, I will announce that the topologies of collapsing compact Alexandrov three-spaces with nonempty boundaries are determined.

14:15–15:50

55 Tatsuki Seto (Nagoya Univ.) Toeplitz operators and the Roe–Higson type index theorem ····· 15

Summary: In 1988, Roe proved some index theorem on a complete Riemannian manifold M which is partitioned by a closed hypersurface N. His theorem states that Connes' pairing of Roe's cyclic one cocycle with the Cayley transform of a Dirac operator on M is calculated by the Fredholm index of the Dirac operator D_N on N. Higson gave a simple proof of Roe's index theorem in 1991.
If M is even dimensional, Roe–Higson's index theorem is trivial in some sense since the Fredholm index of D_N is always zero. In this talk, I will show another non-trivial index formula with Toeplitz operators as an even dimensional analogue of Roe–Higson's theorem.

56 Mamoru Tanaka (Tohoku Univ.) Property (T_{L^Φ}) for Orlicz spaces L^Φ ····· 15

Summary: A finitely generated group is said to have Property (FH) if every affine isometric action on a real Hilbert space has a fixed point. It is well known that Property (FH) is equivalent to Kazhdan's Property (T). These properties ware generalized to properties (F_B) and (T_B) for Banach spaces B, and they are well studied when B are L^p spaces. We give some relations between (T_{L^Φ}) and (T), and between (F_{L^Φ}) and (FH) for Orlicz spaces L^Φ, which are generalization of L^p spaces.

57 Ryosuke Mineyama (Osaka Univ.) Coarse geometry of the Hilbert metric ····· 15
Shin-ichi Oguni (Ehime Univ.)

Summary: We give a necessary and sufficient condition for which the natural boundary of a Hilbert geometry to be a corona, i.e., it admits a continuous surjection from the Higson corona. In addition, we show that the Hilbert geometry is with coarse bounded geometry. As a consequence of this we see that the coarse Novikov conjecture holds for Hilbert geometries whose boundaries are coronae. On the other hand, we determine the asymptotic dimension of 2-dimensional Hilbert geometries and 2-dimensional Hadamard manifolds.

58 Tomohiro Fukaya (Tohoku Univ.) Coronae of product spaces and the coarse Baum–Connes conjecture ····· 15

Summary: We study the coarse Baum–Connes conjecture for product spaces and product groups. We show that a product of CAT(0) groups, polycyclic groups and relatively hyperbolic groups which satisfy some assumptions on peripheral subgroups, satisfies the coarse Baum–Connes conjecture. For this purpose, we construct and analyze an appropriate compactification and its boundary, "corona", of a product of proper metric spaces.

59 Masato Mimura (Tohoku Univ.)* Group approximations in Cayley topology and coarse geometry: part II:
Hiroki Sako (Niigata Univ.) Fibered coarse embeddings 15

Summary: We study "fibered coarse embeddings", in the sense of Chen–Wang–Yu, of a sequence of finite Cayley graphs in terms of the convergence in the space of marked groups of Grigorchuk.

16:00–17:00 Talk Invited by Geometry Section

Ayato Mitsuishi (Tohoku Univ.)♭ Topology of Alexandrov spaces

Summary: In this talk, I will discuss about some naive problem on topology of Alexandrov spaces. Here, Alexandrov spaces are complete metric space having a lower curvature bound in the sense that they satisfy triangle comparison, which are generalized objects of complete Riemannian manifolds having a lower sectional curvature bound. They naturally appear in convergence and collapsing phenomena of Riemannian manifolds with a lower curvature bound, and have played important roles in the study of collapsing Riemannian manifolds with a lower curvature bound. So, it is important to study geometric and topological structures of Alexandrov spaces.

I will talk about the following topics on topology of Alexandrov spaces. (1) Several notions of "orientability" of Alexandrov spaces are considered. I will announce that they are equivalent. (2) For every closed Alexandrov space, its orientability (in the sense of (1)) implies and is implied by the existence of fundamental homology class. (3) Orientable closed Alexandrov spaces satisfy "Poincaré duality" in special degrees. It follows from this study that every orietable closed Alexandrov space of positive curvature has trivial integral homology of codimension one.

Complex Analysis

March 23rd (Mon) Conference Room VII

9:30–11:45

1 Saburou Saitoh * (Gunma Univ.*/Inst. of Reproducing Kernels)
Masao Kuroda (Gunma Univ.*)
Hiroshi Michiwaki (NejiLaw Inc.)
Masami Yamane (Inst. of Reproducing Kernels)
New meanings of the division by zero and interpretations on 100/0= 0 and on 0/0=0 ····· 15

Summary: We shall give simple and natural, however, the surprising identities 100/0=0 and 0/0 =0 by a natural extension of fractions with the concept of Tikhonov regularization using the theory of reproducing kernels. We shall give interpretations and the situation of the results.

2 Saburou Saitoh * (Gunma Univ.*/Inst. of Reproducing Kernels)
Hiroshi Michiwaki (NejiLaw Inc.)
Masako Takagi (Inst. of Reproducing Kernels)
A new concept for the point at infinity and the division by zero z/0=0 (note) ····· 15

Summary: We shall introduce a new concept for the point at infinity on the Riemann sphere and the zero division z/0=0. As a typical result, we shall derive the surprising result: At an isolated singular point of an analytic function, it takes a definite value with a natural meaning. As the important applications of this result, the extension formula of functions with analytic parameters may be obtained and singular integrals may be interpretated with the division by zero, naturally.

3 Rikio Yoneda * (Otaru Univ. of Commerce)
The Fredholm Toeplitz operator and the Berezin transform ····· 10

Summary: In this talk, we study the Fredholm Toeplitz operator on the Bergman spaces using the Berezin transform.

4 Kiyoki Tanaka (Osaka City Univ.)
Masaharu Nishio (Osaka City Univ.)
Boundary behavior of harmonic Bergman kernels ····· 15

Summary: We deal with radial measure weighted harmonic Bergman spaces on the ball. For two radial measures, we introduce an averaging function, to give the condition for corresponding Toepitz operators to be bounded and compact. We discuss the boundary behavior of harmonic Bergman kernels.

5 Hiroaki Aikawa (Hokkaido Univ.)
Construction of a domain which fails to satisfy the global boundary Harnack principle with the aid of the Helmholtz equation ····· 15

Summary: We study the Poisson representation for the Helmholtz equation in the half space and give a precise estimate of the Poisson integrals. This estimate is applied to show the sharpness of the modulus of continuity of a function f for which the domain above the graph of f satisfies the global boundary Harnack principle.

Summary: Let f be a transcendental holomorphic curve from $\boldsymbol{C}$ into the n-dimensional complex projective space $P^n(\boldsymbol{C})$ and $\boldsymbol{a} \in \boldsymbol{C}^{n+1} \setminus \{\boldsymbol{0}\}$, where f is linearly non-degenerate over $\boldsymbol{C}$. If $\boldsymbol{a}$ has multiplicity m for f, we put $\mu(\boldsymbol{a}, f) = (1 - n/m)^+$, where $m = \infty$ when $(\boldsymbol{a}, f) = a_1 f_1 + \cdots + a_{n+1} f_{n+1}$ has no zero. Let X be a subset of $\boldsymbol{C}^{n+1} \setminus \{\boldsymbol{0}\}$ in N-subgeneral position, where $N \geq n$, M^1 the set of $\boldsymbol{a} \in X$ for which $\mu(\boldsymbol{a}, f) = 1$ and $\Delta = \sum_{\boldsymbol{a} \in X} \mu(\boldsymbol{a}, f)$. We estimate Δ when $\Delta > N + 1$, $\sharp M^1$ is relatively large and $\sharp M^1 \leq N$.

Summary: We show that for a generic random dynamical system of complex polynomials of degree two or more, the Lyapunov exponents are negative and the chaoticity is much weaker than a usual iteration dynamical system of a single polynomial. This is due to a non-trivial effect of randomness. We call such phenomena "randomness-induced phenomena".

Summary: We consider dynamics of rational semigroups whose Julia sets are Cantor targets.

14:15–14:45

Summary: I will discuss the Bers density problem for the asymptotic Teichmüller space of the unit disk. I will show that the Schwarzian derivative for Gehring's spiral domain is asymptotically equivalent to the Schowarzian derivative of a Jordan domain which is in the closure of the universal Teichmüller space. I will also observe that the asymptotic class of the Schwarzian derivative of Flinn's domain is not contained in the closure of the asymptotic Teichmüller space.

Summary: We can show that if h_1, h_2 are two distance non-increasing mappings from the unit disk $\mathbb{D}$ with hyperbolic metric to itself, and if the mapping (h_1, h_2) from $\mathbb{D}$ to the polydisk $\mathbb{D}^2$ is isometric, then either h_1 or h_2 is isometric. From this results, we can show that new result on isometric mappings from the unit disk to Teichmüller spaces.

15:10–16:10 Talk Invited by Complex Analysis Section

Hiroshige Shiga (Tokyo Tech) On the deformation spaces of Kleinian groups

Summary: Let G be a non-elementary Kleinian group. We consider the deformation space $D(G)$ of G, the space of quasiconformal deformations of G, and its complex analytic properties. We show some analytic properties of $D(G)$ which are improvements of results obtained by Bers, Kra, Maskit and McMullen. In particular, we clarify that the structures for Kleinian groups with non-simply connected components are different from those for Kleinian groups without non-simply connected components.

16:25–17:25 Award Lecture for 2014 Analysis Prize

Hidetaka Hamada (Kyushu Sangyo Univ.) Approximation of holomorphic mappings on spirallike domains in $\mathbb{C}^n$

Summary: In this talk, we will show that any domain D in $\mathbb{C}^n$ which is spirallike with respect to a linear operator A, where $m(A) > 0$, is Runge. We also show the local uniform approximation of biholomorphic mappings on a spirallike domain D with respect to A, where $k_+(A) < 2m(A)$, by automorphisms of $\mathbb{C}^n$. Finally, as an application of the above result, we will show that any Loewner PDE in a complete hyperbolic spirallike domain D with respect to A, where $k_+(A) < 2m(A)$, of $\mathbb{C}^n$ admits an essentially unique univalent solution with values in $\mathbb{C}^n$.

March 24th (Tue) Conference Room VII

9:30–11:45

11 Atsuhira Nagano (Waseda Univ.) Icosahedral invariants and Shimura curves 10

Summary: Shimura curves are the moduli space of principally polarized abelian surfaces with quaternion multiplication. In this talk, we obtain explicit and simple models of Shimura curves with small discriminant. Our Shimura curves appear as divisors in a weighted projective space whose coordinates are given by icosahedral invariants.

12 Atsuhira Nagano (Waseda Univ.) Icosahedral invariants and CM points 10

Summary: We shall give an example of the unramified class field over a quartic CM field. Our class field is generated by special values of analytic functions in two variables which have an expression coming from icosahedral invariants.

13 Takayuki Koike (Univ. of Tokyo)* On the minimality of canonically attached singular Hermitian metrics on certain nef line bundles 10

Summary: We apply Ueda theory to a study of singular Hermitian metrics of a (strictly) nef line bundle L. Especially we study minimal singular metrics of L, metrics of L with the mildest singularities among singular Hermitian metrics of L whose local weights are plurisubharmonic. In some situations, we determine a minimal singular metric of L. As an application, we give new examples of (strictly) nef line bundles which admit no smooth Hermitian metric with semi-positive curvature.

14 Katsusuke Nabeshima (Univ. of Tokushima), Shinichi Tajima (Univ. of Tsukuba) An extended ideal membership algorithm in a local ring 15

Summary: It is known that a membership problem of ideals in a local ring, is solved by local cohomology. In this talk, an extended ideal membership algorithm is considered in the ring of convergent power series. The key of the proposed method is to compute syzygyies in a polynomial ring (global ring) and the use of local cohomology.

15 Shinichi Tajima (Univ. of Tsukuba) Integral dependence relations and local cohomology ····· 15
Katsusuke Nabeshima (Univ. of Tokushima)

Summary: Integral dependence relations are considered in the ring of convergent power series for the Jacobi ideal of an isolated hypersurface singularity. An effective algorithm of computing integral dependence relations is described. The key of the proposed method is the use of local cohomology and of Grothendieck local duality theorem.

16 Kohei Ueno (Daido Univ.)* Böttcher coordinates at superattracting fixed points of holomorphic skew products ····· 15

Summary: Let $f : (\mathbf{C}^2, 0) \to (\mathbf{C}^2, 0)$ be a germ of holomorphic skew product with a superattracting fixed point at the origin. If it has a suitable weight, then we can construct a Böttcher coordinate which conjugates f to the associated monomial map. This Böttcher coordinate is defined on an open set whose interior or boundary contains the origin.

17 Tomoko Shinohara (Tokyo Metro. Coll. of Ind. Tech.) Local dynamics at an indeterminate point of Newton's method ····· 15

Summary: In this talk, consider the local dynamics at an indeterminate point of Newton's method. Y. Yamagishi studied that Newton's method of some holomorphic function of two variables. He showed that there exists a neighborhood of its indeterminate point that is divided into three subsets A, B and C, where A is an attracting set, B is a bursting set and C is a Cantor bouquet. By using a sequence of blow ups, we try another approach to the construction of a local dynamics of its indeterminate point.

18 Junichi Mukuno (Nagoya Univ.) On the automorphism groups of unbounded homogeneous domains with
Yoshikazu Nagata (Nagoya Univ.) the boundaries of light cone type ····· 15

Summary: In this talk, we determine the automorphism groups of some unbounded homogeneous domains with the boundaries of light cone type.

19 Atsushi Yamamori (POSTECH) The autormophism group of a certain unbounded Reinhardt domain
Hyeseon Kim (POSTECH) ····· 10
Van Thu Nihn (POSTECH)

Summary: In this talk, we give a description of the holomorphic automorphism group of a certain unbounded Reinhardt domain.

14:15–15:10

20 Akio Kodama (Kanazawa Univ.)♭ On the holomorphic automorphism group of a generalized Hartogs triangle and a related question ····· 15

Summary: In this talk, we completely determine the structure of the holomorphic automorphism group of a generalized Hartogs triangle and obtain natural generalizations of some results due to Landucci and Chen–Xu. These give affirmative answers to some open problems posed by Jarnicki and Pflug. Also we discuss some related question with our results.

21 Tatsuhiro Honda (Hiroshima Inst. of Tech.)
Ian Graham (Univ. of Toronto)
Hidetaka Hamada (Kyushu Sangyo Univ.)
Gabriela Kohr (Babeş-Bolyai Univ.)
Kwang Ho Shon (Pusan National Univ.)
Sufficient conditions for univalence and starlikeness in complex Banach spaces 15

Summary: In this talk, we discuss some sufficient conditions for univalence and starlikeness of normalized holomorphic mappings on the unit ball in a complex Banach space.

22 Sachiko Hamano (Fukushima Univ.) *
Masakazu Shiba (Hiroshima Univ.*)
Hiroshi Yamaguchi (Shiga Univ.*)
Hyperbolic span and pseudoconvexity 15

Summary: The planar open Riemann surface R admits Schffer span $s(R,\zeta)$ with pole $\zeta \in R$. M. Shiba showed that the open Riemann surface of genus one admits the hyperbolic span $\sigma_h(R)$. We establish the variation formula of $\sigma_H(t) := \sigma_H(R(t))$ for the moving open Riemann surface $R(t)$ of genus one with complex parameter t in a disk Δ. This formula implies the following intimite relation between the hyperbolic span and the pseudoconvexity: If the total space $\mathcal{R} = \cup_{t\in\Delta}(t, R(t))$ is a two dimensional Stein manifold, then $\sigma_H(t)$ is subharmonic on Δ. Further, $\sigma_H(t)$ is harmonic on Δ iff $\mathcal{R}$ is biholomorphic to the product $\Delta \times R(0)$.

15:30–16:30 Talk Invited by Complex Analysis Section

Yusaku Tiba (Tokyo Tech) A minimum principle of a maximal plurisubharmonic function and its application to the complex Monge–Ampère equation

Summary: In this talk, we study a geometric property of a solution of the Monge–Ampère equation which has a convex level set by using our minimum principle of a maximal plurisubharmonic function. We also show a relation between the supports of the Monge–Ampère currents and complex extreme points of closed balls for the Kobayashi distance in a bounded convex domain in $\mathbb{C}^n$.

Functional Equations

March 21st (Sat) Conference Room Va

9:15–12:00

1 Mika Tanda (Kinki Univ.)
Takashi Aoki (Kinki Univ.)
The hypergeometric function and WKB solutions 10

Summary: We consider the relation between the hypergeometric function and WKB solutions of the hypergeometric differential equation with a large parameter. The hypergeometric function is equal to a constant multiple of the Borel sum of the WKB solution recessive at the origin. We give the multiplicative constant in some cases. These results yield some formulas that describe asymptotic expansions of the hypergeometric function with respect to the large parameter.

2 Toshinori Takahashi (Kinki Univ.)
Kohei Iwaki (Kyoto Univ.)
Takashi Aoki (Kinki Univ.)
Exact WKB analysis of Schrödinger equation with a Stokes curve of loop type 10

Summary: We consider a Schrödinger-type ordinary differential equation with a large parameter in the complex domain. Our main interest is the Stokes phenomena of WKB solutions of the equation associated with a Stokes curve of loop type. To analyze them, we employ a modified Bessel equation as a canonical form and compute the Voros coefficient of the equation. Combining the formula describing the Stokes automorphism for the Voros coefficient and the formal coordinate transformation connecting the Schrödinger-type equation and the modified Bessel equation, we have some formula concerning parametric Stokes phenomena for WKB solutions.

3 Yoshiaki Goto (Kobe Univ.)
Contiguity relations of Lauricella's F_D and contingency tables 10

Summary: In this talk, I would like to give contiguity relations of Lauricella's F_D, in terms of the twisted cohomology group and the intersection form. Our formulas are applied to the numerical evaluation of the normalizing constant of the hypergeometric distribution on the $2 \times (m+1)$ contingency tables with a fixed marginal sums.

4 Youko Umeta (Tokyo Univ. of Sci.)
Shinichi Tajima (Univ. of Tsukuba)
Toshinori Oaku (Tokyo Woman's Christian Univ.)
On the monodromy structure of holonomic D-modules associated with simple line singularities 10

Summary: We construct algebraic local cohomology solutions for holonomic D-modules associated with simple line singularities and we study the monodromy structure of holonomic D-modules.

Summary: We will study global properties of evolutional Lotka–Volterra system. We assume that the predatory efficiency is a function of a character of species whose evolution obeys a quantitative genetic model. We will show that the structure of a solution is rather different from that of a non-evolutional system. We will analytically show new ecological features of the dynamics.

Summary: In this talk we are interested in the Borel summability of formal solutions with a parameter of first order semilinear system of partial differential equations with n independent variables. In [1], Balser and Kostov proved the Borel summability of formal solutions with respect to a singular perturbation parameter for a linear equation with one independent variable. We will extend their results to a semilinear system of equations with general independent variables.

Summary: We consider a Hamiltonian system equivalent to confluent Okubo equation, and show that a certain perturbation destroys the integrability of it.

Summary: We consider the system $\dot{x} = \varphi_C^{-1}(y)$, $\dot{y} = -f(x)y - g(x)$ which is equivalent to the Liénard type equation $(\varphi_C(\dot{x}))^{\cdot} + f(x)\varphi_C(\dot{x}) + g(x) = 0$, where $\varphi_C(x) = x/\sqrt{1+x^2}$, and $f(x)$ and $g(x)$ are smooth functions. Since the range of φ_C is bounded, some solutions of the system may not be global solutions. Using phase plane analysis, time maps and Poincaré–Bendixson Theorem, we obtain a sufficient conditon under which the system has at least one limit cycles.

Summary: The feature of the present work is to demonstrate that the method of regular variation can be effectively applied to fourth order sub-half-linear differential equations providing full information about the existence and the precise asymptotic behavior of all possible postive solutions.

10 Tetsutaro Shibata (Hiroshima Univ.) Global and local behavior of oscillatory bifurcation curve ····· 10

Summary: We consider the positive solutions for the equation $u''(t) + \lambda f(u(t)) = 0$, $t \in I =: (-1, 1)$ with the boundary condition $u(\pm 1) = 0$, where $\lambda > 0$ is a parameter. We know that under the suitable conditions on $f(u)$, the bifurcation curve $\lambda = \lambda(\alpha)$ ($\alpha = \|u_\lambda\|_\infty > 0$) is a continuous function of $\alpha > 0$ and $\lambda(\alpha) \to \pi^2/4$ as $\alpha \to 0$ and $\alpha \to \infty$. Furthermore, it intersects the line $\lambda = \pi^2/4$ infinitely many times as $\alpha \to 0$. We show that the bifurcation curve $\lambda(\alpha)$ does not intersect the line $\lambda = \pi^2/4$ infinitely many times as $\alpha \to \infty$ by establishing the precise asymptotic formula for $\lambda(\alpha)$ as $\alpha \to \infty$.

11 Hiroyuki Usami (Gifu Univ.)* Asymptotic behavior of solutions of a Lanchester-type model ····· 10
Huyen Trang Tran Thi (Gifu Univ.)

Summary: We consider asymptotic behavior of all solutions of initial value problems to a Lanchester-type model. We can show how they behave at the infinity depending on initial data.

12 Seiji Saito (Doshisha Univ.) On Graef–Qian's theorem of difference equations ····· 10

Summary: In this talk we show an extension of Graef–Qian's theorem which is concerning the globally asymptotic stability of difference equations.

13 Motohiro Sobajima (Univ. of Salento) Analytic semigroups generated by $|x|^\alpha \Delta$ with singular lower-order terms
Giorgio Metafune (Univ. of Salento) ····· 10
Noboru Okazawa (Tokyo Univ. of Sci.)
Chiara Spina (Univ. of Salento)

Summary: In this talk we deal with generation of analytic semigroups on $L^p = L^p(\mathbb{R}^N)$ $(1 < p < \infty)$ by elliptic operators of the form $L = |x|^\alpha \Delta + c|x|^{\alpha-2} x \cdot \nabla - b|x|^{\alpha-2}$ $(x \in \mathbb{R}^N \setminus \{0\})$, where $c, b \in \mathbb{R}$ and $\alpha \in \mathbb{R}$ with $\alpha \neq 2$ are fixed constants. We give the necessary and sufficient condition for generation of positive and analytic semigroups.

14 Motohiro Sobajima (Univ. of Salento) Spectral properties of non-selfadjoint extensions of Calogero Hamiltonian
Giorgio Metafune (Univ. of Salento) ····· 10

Summary: In this talk we consider the Calogero Hamiltonian in $L^2(\mathbb{R}_+)$ $(\mathbb{R}_+ = (0, \infty))$, that is, we deal with one-dimensional Schrödinger operators with inverse-square potentials $H = -\frac{d^2}{dr^2} + \frac{b}{r^2}$ $(r \in \mathbb{R}_+)$, where $b < -1/4$. We give the spectrum of all realizations of H having non-empty resolvent sets.

15 Fumihiko Hirosawa (Yamaguchi Univ.) On the energy estimates of the wave equation with time dependent propagation speed asymptotically monotone functions ····· 10
Marcelo Rempel Ebert (Univ. de São Paulo)
Fitriana Laila (Yamaguchi Univ.)

Summary: We consider the energy estimates for the wave equation with time dependent propagation speed. It is known that the asymptotic behavior of the energy is determined by the interactions of the properties of the propagation speed: smoothness, oscillation and the difference from a reference function. The main purpose of our talk is that if the propagation speed behaves asymptotically a monotone decreasing function, then we can extend the preceding results to allow faster oscillating coefficients. Moreover, we prove that the regularity of the initial data in the Gevrey class can essentially contribute for the energy estimate.

14:15–16:30

16 Wataru Ichinose (Shinshu Univ.) The Feynman path integral for the Dirac equation (1), the electron going across the infinite past and future 10

Summary: The Feynman path integral for the Dirac equation has been determined mathematically in the form of the sum-over-histories satisfying the superposition principle. That is, it is given in the form of the "sum" of the probability amplitudes with a common weight, over all possible paths that go in any direction at any speed forward and backward in time. In this talk we show that the path space taken into account can be made of paths going across the infinite past and future. Considering the path space like this will be important for the Feynman path integral to be applied to the theory of quantum electrodynamics.

17 Wataru Ichinose (Shinshu Univ.) The Feynman path integral for the Dirac equation (2), Causality (finite propagation property not exceeding c) 10

Summary: The Feynman path integral for the Dirac equation has been determined mathematically in the form of the sum-over-histories satisfying the superposition principle over the path space. The path space is made of all possible paths that go in any direction at any speed forward and backward in time, and go across the infinite past and future. In this talk we show directly that the Feynman path integral has the propagation speed not exceeding the velocity of light c and so that causality is preserved under the Lorentz transformation. It is well known in the theory of the partial differential equations that the Dirac equation has the propagation speed not exceeding c.

18 Sojiro Murai (Univ. of Electro-Comm.) * Smoothing and Strichartz estimates for wave equation in an exterior domain 10
Kiyoshi Mochizuki
(Tokyo Metro. Univ.*/Chuo Univ.)

Summary: In this talk we shall show the smoothing and Strichartz estimates for the wave equation with large potential in an exterior domain. The fundamental tool is the uniform estimate for the resolvent of the Schrödinger operators.

19 Masato Hashizume (Osaka City Univ.) L^p-Lyapunov inequality on Neumann boundary condition 10
Futoshi Takahashi (Osaka City Univ.)

Summary: Lyapunov inequality is a necessary condition for some ordinary differential equation. Cañada, Montero and Villegas considered this problem in partial differential equations which is L^p-Lyapunov inequality. In this talk, the author introduce the result of L^p-Lyapunov inequality in Neumann deta case.

20 Shinji Adachi (Shizuoka Univ.) Asymptotic uniqueness of ground states of quasilinear elliptic equations with H^1-supercritical exponent 10
Tatsuya Watanabe
(Kyoto Sangyo Univ.)

Summary: In this talk, we show the asymptotic uniqueness of ground states for a class of quasilinear elliptic equations with H^1-supercritical exponent. To this aim, the uniqueness and the non-degeneracy of positive solutions of the corresponding limit equation, which is a zero mass problem, play important roles. Thus we also show the uniqueness and non-degeneracy result for a class of zero mass problems by applying ODE techniques.

21 Yohei Sato (Saitama Univ.) * Remark on Nehari type condition for a least energy solution of semi-linear elliptic equations 10
Masataka Shibata (Tokyo Tech)

Summary: To study existence of solutions for semi-linear elliptic equation, Nehari manifold is useful. We introduce that we can find the Nehari-type variational structure under the general assumption than former results. We also give applications.

22 Kenichiro Umezu (Ibaraki Univ.) * On the role of indefinite weights in the positive solutions set for an elliptic boundary value problem with convex-concave mixed nonlinearity 10
Humberto Ramos Quoirin (Univ. de Santiago de Chile)

Summary: In this talk we consider some indefinite superlinear elliptic boundary value problem with a nonlinear boundary condition, having convex-concave mixed nonlinearity. The goal is to understand the role of indefinite weight functions included in the problem in determining the structure of its nontrivial non-negative solutions. Variational and bifurcation approaches are both used in our argument.

23 Ryo Takahashi (Osaka Univ.) Extremal boundedness of a variational functional in point vortex mean field theory associated with probability measures 10
Takashi Suzuki (Osaka Univ.)
Xiao Zhang (Osaka Univ.)

Summary: We study a variational functional of Trudinger–Moser type associated with one-sided Borel probability measure. Its boundeness at the extremal parameter holds when the residual vanishing occurs.

24 Kotaro Watanabe (Nat. Defense Acad. of Japan) L^p elastic closed curves and flat-core solutions on $\mathbf{S}^2(G)$ 10
Naoki Shioji (Yokohama Nat. Univ.)

Summary: In this talk, we consider L^p elastica problem on $\mathbf{S}^2(G)$, where G is a Gaussian curvature. Especially, we show the existence of flat-core type solution if $p > 2$.

25 Atsushi Kosaka (Osaka City Univ.) Structure of solutions to the Emden–Fowler equation on a spherical cap 10
Yasuhito Miyamoto (Univ. of Tokyo)

Summary: In this talk, we speak of the result on the structure of positive and radial solutions to the Emden–Fowler equation defined on a spherical cap. In our problem, the structure of solutions is qualitatively different from the structure of solutions to a similar problem defined on the Euclidean space or the hyperbolic space, especially, the exponent of a nonlinear term is greater than the critical Sobolev exponent. Hence we focus our attention on our problem, and obtain the result on the global structure of solutions.

26 Yasuhito Miyamoto (Univ. of Tokyo) Nonradial maximizers for a Hénon type problem and Liouville–Gel'fand problem 10

Summary: We study the radiality and nonradiality of the maximizers of

$$\sup\left\{\int_D |x|^\alpha(e^u-1)dx;\ u\in H_0^1(D),\ \int_D |\nabla u|^2\,dx=\beta^2\right\}$$

from a viewpoint of the bifurcation diagram of the Euler–Lagrange equation

$$\Delta u+\beta^2\frac{|x|^\alpha e^u}{\int_D |x|^\alpha u e^u dx}=0\ \text{ in }\ D,\qquad u=0\ \text{ on }\ \partial D,$$

where $D:=\{x\in\mathbb{R}^2;\ |x|<1\}$.

27 Ryuji Kajikiya (Saga Univ.) Symmetric mountain pass lemma and sublinear elliptic equations 10

Summary: In this lecture, we study the p-Laplace elliptic equations under the Dirichlet boundary condition and give a general and weak sufficient condition for the existence of a sequence of solutions converging to zero. This result is proved by applying the symmetric mountain pass lemma obtained in our earlier paper.

16:50–17:50 Talk Invited by Functional Equations Section

Kazuyuki Yagasaki (Kyoto Univ.) Existence and bifurcation of positive radial solutions in elliptic equations

Summary: In this talk I review my recent results on existence and bifurcation of positive radial solutions in elliptic equations, including collaborations with Profs. Miyamoto and Nawa.

March 22nd (Sun) Conference Room Vb

9:15–12:00

28 Toshiharu Kawasaki (Tamagawa Univ.) Masashi Toyoda (Tamagawa Univ.) Fixed point theorem and fractional differential equation with multiple delays 10

Summary: In this talk we show a new fixed point theorem which is a generalization of both of Lou's fixed point theorem and de Pascale and de Pascale's fixed point theorem. Moreover our result can be applied existence theorem of a unique solution for fractional differential equations with multiple delays. Using the existence theorem, we discuss a unique solution for the fractional chaos neuron model.

29 Tatsuya Miura (Univ. of Tokyo) Singular limit of an adhesive obstacle problem 10

Summary: In this talk, we consider an obstacle problem of a total energy consisting of a bending energy, tension, and an adhesion energy. This problem corresponds to, for example, determining the shape of membranes or filaments on some substrates. In this case, the total energy functional is not convex and there may exist multiple minimizers. We give some results about the shape of minimizers in the case that the bending energy is negligible. Moreover, we also give a singular limit of this energy when the bending energy is small.

30 Toshikazu Kuniya (Kobe Univ.) Asymptotic behavior of age-structured SIS epidemic models with spatial heterogeneity ····· 10

Summary: In this talk, we are concerned with some age-structured SIS epidemic models with spatial heterogeneity. By virtue of the monotonicity of semiflows defined by their solutions, we can prove the existence, uniqueness and global attractivity of the nontrivial endemic equilibrium in the case where the spectral radius of a linear operator is greater than unity. Concretely, a model with patch structure (as discrete spatial heterogeneity) and a model with diffusion (as continuous spatial heterogeneity) are planned to be presented.

31 Saori Nakamori (Hiroshima Univ.) Bernstein type theorem for the parabolic k-Hessian equation ····· 10
Kazuhiro Takimoto (Hiroshima Univ.)

Summary: In this talk, we are concerned with the characterization of entire solutions to the parabolic k-Hessian equation of the form $-u_t F_k(D^2 u) = 1$ in $\mathbb{R}^n \times (-\infty, 0]$. We prove that for $1 \leq k \leq n$, any strictly parabolically convex solution $u = u(x,t) \in C^{4,2}(\mathbb{R}^n \times (-\infty, 0])$ to $-u_t F_k(D^2 u) = 1$ in $\mathbb{R}^n \times (-\infty, 0]$ must be a linear function of t plus a quadratic polynomial of x, under some growth assumptions on u.

32 Masato Iida (Univ. of Miyazaki) Generalization of fast reaction limit for a two-component system ····· 10
Hideki Murakawa (Kyushu Univ.)
Harunori Monobe (Meiji Univ.)
Hirokazu Ninomiya (Meiji Univ.)

Summary: In this talk, we consider the fast reaction limit of a two-component system which corresponds approximately to the system studied by Hilhorst et al., where the system has different reaction terms. Our goal is to show that the propagation speed of free boundary arising from the fast reaction limit become zero, finite or infinity, depending on the combination of two reaction terms in the system. This talk is based on a joint work with M. Iida, H. Murakawa and H. Ninomiya.

33 Hiroshi Matsuzawa (Numazu Nat. Coll. of Tech.) Spreading speed and sharp asymptotic profiles of solutions in free boundary problems for nonlinear advection-diffusion equations ····· 10
Yuki Kaneko (Waseda Univ.)

Summary: In this talk we are interested in free boundary problems for nonlinear advection-diffusion equations of the form $u_t - u_{xx} + \beta u_x = f(u)$ for $t > 0$, $g(t) < x < h(t)$, where $x = g(t)$ and $x = h(t)$ are free boundaries. Such a problem may be used to describe the spreading of a biological or chemical species with the free boundaries representing the expanding fronts. When f is a logistic nonlinearity, it has been shown by Gu, Lin and Lou that the asymptotic spreading speeds of the two fronts $h(t)$ and $g(t)$ are different due to the advection term. In this paper, for monostable, bistable and combustion types nonlinearities, we give a much sharper estimate for the different spreading speeds of the fronts, and also prove that the solution converges to a semi-wave in C^2-norm as $t \to \infty$ when spreading happens.

Summary: We are interesting in a reaction diffusion model for cell polarization proposed by Y. Mori, A. Jilkine and L. Edelstein-Keshet in SIAM J.Appl Math (2011). Several mathematical bifurcation results of stationary solutions are obtained by Kuto and Tsujkawa in DCDS Supplement (2013). We have obtained exact expressions of all the solution for it and a bifurcation sheet by using the Jacobi's elliptic functions and complete elliptic integrals. In this talk, we prove properties of profile of the global bifurcation sheet.

Summary: We consider a solution of a Cauchy problem for a semilinear heat equation with inhomogeneous terms. We study the solution which does not blow up in the total space at the blow-up time. It does only at space infinity.

Summary: We consider the Cauchy problem of a semilinear heat equation $\partial_t u = \Delta u + u^p$ in the whole space. For initial data φ with $\|\varphi\|_{L^\infty} > 1$, we investigate the asymptotic behavior of the life span T_p of the classical solution u as $p \to \infty$.

Summary: We study blow-up problems for a complex-valued semilinear heat equation. A goal of this talk is to discuss the possibility of a non-simultaneous blow-up from the view point of the asymptotic forms of blow-up solutions.

Summary: The stability of (possibly non-isolated) asymptotic profiles of solutions to the Cauchy–Dirichlet problem for the fast diffusion equation is discussed for general smooth bounded domains.

Summary: We establish the local existence and the uniqueness of solutions of the heat equation with a nonlinear boundary condition for the initial data in uniformly local L^r spaces. Furthermore, we study the sharp lower estimates of the blow-up time of the solutions with the initial data $\lambda\psi$ as $\lambda \to 0$ or $\lambda \to \infty$ and the lower blow-up estimates of the solutions.

40 Yohei Fujishima (Osaka Univ.) * On the effect of higher order derivatives of initial data on the blow-up set for a semilinear heat equation 10

Summary: In this talk, we consider a semilinear heat equation with large initial data, and study the location of the blow-up set of the solution for the case where the initial function has several maximum points. In particular, we discuss the relationship between the location of the blow-up set and higher order derivatives of initial data.

41 Shigeru Sakaguchi (Tohoku Univ.) * Stationary isothermic surfaces and curves have some symmetry 10

Summary: Let S and C be a smooth hypersurface and a smooth curve both of which are properly embedded in $\mathbb{R}^N$ with $N \geqq 3$ and consider their tubular neighborhoods $\mathcal{N}$. We show that, if some heat flow over $\mathcal{N}$ has S (or C) as a stationary isothermic surface (or a stationary isothermic curve), then S (or C) must have some symmetry.

13:15–14:15 Talk Invited by Functional Equations Section

Hiroyoshi Mitake (Hiroshima Univ.) ♭ Large-time asymptotics and selection problems for degenerate viscous Hamilton–Jacobi equations

Summary: In the talk, I will present recent results about (i) large-time asymptotics and (ii) selection problems for Hamilton–Jacobi equations with possibly degenerate diffusion terms. We derive new estimates on long time averaging effects and stochastic Mather measures by the nonlinear adjoint method which has been recently developed. We then apply them to establish new results of the asymptotic analysis on the above (i), (ii). These are the first general ones concerning equations which are neither uniformly parabolic nor first order. These are joint works with F. Cagnetti, D. A. Gomes, and H. V. Tran.

March 23rd (Mon) Conference Room Va

9:30–12:00

42 Koichi Osaki (Kwansei Gakuin Univ.) * L_p-estimates of solutions to n-dimensional parabolic-parabolic chemotaxis system with weak degradation 10
Etsushi Nakaguchi (Tokyo Med. Dent. Univ.)

Summary: We study the global existence of solutions to an n-dimensional parabolic-parabolic chemotaxis system with weak degradation of population and sublinear production of chemoattractant. We will show the global existence of solutions in L_p space ($p > n$) under certain relations between the degradation and production orders, applying the theory of semilinear parabolic evolution equations in Banach spaces.

43 Sachiko Ishida (Tokyo Univ. of Sci.) Boundedness in chemotaxis-Navier–Stokes systems with position dependent sensitivity in 2D domains 10

Summary: This talk presents boundedness in degenerate Keller–Segel–Navier–Stokes systems with position dependent sensitivity on 2D bounded domains Ω. In MSJ Autumn Meeting 2014, we dealt with the same system and showed global existence. However, $L^\infty(\Omega)$-bounds of the solution depended on the time variable even if we knew the uniform in time bounds in $L^p(\Omega)$ for any $p \in [1, \infty)$. So, we prove the uniform in time L^∞-bounds of the weak solution.

Summary: This talk is concerned with a parabolic-elliptic Keller–Segel system with signal-dependent sensitivity $\chi(v)$ under homogeneous Neumann boundary condition in a smoothly bounded domain $\Omega \subset \mathbb{R}^2$ with nonnegative initial data $u_0 \in C^0(\bar{\Omega})$, $\not\equiv 0$. In the special case $\chi(v) = \chi_0 \log v$ ($\chi_0 > 0$), global existence and boundedness of the solution to the system was proved under some smallness condition on χ_0 by Biler (1999) and Fujie, Winkler and Yokota (2014). In this talk, global existence and boundedness in the system will be established for general $\chi \in C^2((0,\infty))$ satisfying $\chi' > 0$ and $\chi'(s) \to 0$ as $s \to \infty$. The main idea in the derivation of our result is in estimation in a neighborhood of each point.

Summary: It was recently shown that finite-time blowup occurs for a large class of radial initial data in the parabolic-parabolic Keller–Segel system in the two dimention. However type of blowup has been unknown except a peculiar solution given by Herrero and Velazquez. In this talk, we show that each blowup is of type II in the system in the radial case.

Summary: We consider the Cauchy problem for the weakly coupled semilinear damped wave system with k-components. We show that there exists a unique global solution for small data in supercritical cases for any space dimension.

Summary: We discuss combined effects of two nonlinearities in lifespan of small solutions to semi-linear wave equations. Using the method of vector fields in Klainerman (Comm. Pure Appl. Math. **38** (1985), 321–332) together with some of techniques developed in Li and Zhou (Indiana Univ. Math. J. **44** (1995), 1207–1248), we show that the upper bound on the lifespan recently obtained by Han and Zhou (Comm. Partial Differential Equations **39** (2014), 651–665) is sharp in general, at least in space dimensions $n = 2, 3$. Moreover, we also study the threshold case and show that the equation admits global (in time) solutions.

Summary: We consider the Cauchy problem for the damped wave equaiton in Euclidean space. We investigate the shape of the graph of the solution. In particular, we study the asymptotic behavior of spatial maximizers of the solution.

49 Hiroshi Takeda (Fukuoka Inst. of Tech.) * Large time behavior of solutions for a nonlinear damped plate equation 10

Summary: In this talk we consider the initial value problem for a nonlinear plate equation with the weak damping term. We show the unconditional global well-posed result in a weighted Sobolev space for small data. Moreover we prove decay estimates of the solution in the same framework.

50 Takamori Kato (Nagoya Univ.) Invariant measure for the periodic fourth order Schrödinger equation 10

Summary: We prove the invariant measure of the Gibbs measure for the periodic forth order Schrödinger equation.

51 Shinya Kinoshita (Nagoya Univ.) * The Cauchy problem of nonlinear Schrödinger equations below L^2 10

Summary: This paper is concerned with the Cauchy problem of Hartree (HNLS) and pure power nonlinear Schrödinger equations (PNLS) with L^2-subcritical regularity. It is known that the global well-posedness in the scale invariant homogeneous Sobolev space with radially symmetry or some angular regularity was established provided that the initial data have small norm. We generalize these results by new weighted Strichartz estimates.

52 Kota Uriya (Tohoku Univ.) * On the ill-posedness for a quadratic nonlinear Schrödinger equation
Tsukasa Iwabuchi (Chuo Univ.) 10

Summary: We are concerned with the ill-posedness issue for the nonlinear Schrödinger equation with the quadratic nonlinearity $|u|^2$ and prove the norm inflation in the dimensions $1 \le n \le 3$. This is the extension of the ill-posedness result by Kishimoto–Tsugawa in one dimension and also a remaining case of Iwabuchi–Ogawa.

53 Toshiyuki Suzuki (Kanagawa Univ./Kogakuin Univ.) Scattering problem for Hartree equations with inverse-square potentials 10

Summary: We consider the scattering problem for Hartree equations with inverse-square potentials $(\mathrm{HE})_a$:

$$i\frac{\partial u}{\partial t} = \Big(-\Delta + \frac{a}{|x|^2}\Big)u + u\,(|x|^{-\gamma} * |u|^2).$$

If $a = 0$, then Hayashi–Tsutsumi(1987) studied the asymptotic behavior in time and the scattering theory. In a way similar to this we study for $(\mathrm{HE})_a$ with careful application of contraction principle.

14:15–16:00

54 Yoshihisa Nakamura (Kumamoto Univ.) * Global existence and asymptotic behavior of solutions to some nonlinear systems of Schrödinger equations 10
Akihiro Shimomura (Univ. of Tokyo)
Satoshi Tonegawa (Nihon Univ.)

Summary: We study the global existence and the large time behavior of solutions to the coupled system of the Schrödinger equations with cubic nonlinearities in one space dimension. We construct modified wave operators to the system for small final data.

Summary: We consider the transverse instability for a nonlinear Schrödinger equation with a linear potential on $\mathbb{R} \times \mathbb{T}_L$, where $2\pi L$ is the period of the torus $\mathbb{T}_L$. Rose and Weinstein showed the existence of a stable standing wave for a nonlinear Schrödinger equation with a linear potential on $\mathbb{R}$. We regard the standing wave of nonlinear Schrödinger equation on $\mathbb{R}$ as a line standing wave of nonlinear Schrödinger equation on $\mathbb{R} \times \mathbb{T}_L$. We show the result of the stability of line standing waves for all $L > 0$.

Summary: We study the global Cauchy problem for the mass critical NLS. We prove the global existence of analytic solutions in both space and time variables for sufficiently small and exponentially decaying data. The method of proof depends on the Leibniz rule for the generator of pseudo-conformal transforms.

Summary: We consider the nonstationary Navier–Stokes system in a smooth bounded domain $\Omega \subset \mathbb{R}^3$ with initial value $u_0 \in L^2_\sigma(\Omega)$. It is an important question to determine the optimal initial value condition in order to prove the existence of a unique local strong solution satisfying Serrin's condition. In this paper, we introduce a weighted Serrin condition that yields a necessary and sufficient initial value condition to guarantee the existence of local strong solutions $u(\cdot)$ contained in the weighted Serrin class $\int_0^T (\tau^\alpha \|u(\tau)\|_q)^s \, \mathrm{d}\tau < \infty$ with $\frac{2}{s} + \frac{3}{q} = 1 - 2\alpha$, $0 < \alpha < \frac{1}{2}$. Moreover, we prove a restricted weak-strong uniqueness theorem in this Serrin class.

Summary: This presentation is concerned with a joint work with Dr. Ken Abe, Professor Yosikazu Giga, and Ms. Katharina Schade. Our work is related to the initial boundary problem for the Stokes system under zero Dirichlet boundary condition with initial condition. We establish that L^p-Helmholtz decomposition is not necessary to get the analyticity of the Stokes semigroup in $C_{0,\sigma}$, the L^∞-closure of the space of all compactly supported smooth solenoidal vector fields. In fact, in a sector-like domain for which the L^p-Helmholtz decomposition does not hold, the analyticity of the Stokes semigroup in $C_{0,\sigma}$ is proved.

Summary: In this talk, the two dimensional Euler flow under a simple symmetry condition with hyperbolic structure in a unit square $D = \{(x_1, x_2) : 0 < x_1 + x_2 < \sqrt{2}, 0 < -x_1 + x_2 < \sqrt{2}\}$ is considered. It is shown that the Lipschitz estimate of the vorticity on the boundary is at most single exponential growth near the stagnation point.

60 Yasunori Maekawa (Tohoku Univ.) Hideyuki Miura (Tokyo Tech) On Ukai-type solution formula for the Stokes system in a domain with graph boundary 10

Summary: We consider the Stokes system for viscous incompressible flows in a domain with graph boundary. We provide an approach using the isomorphism between $X(\Omega)^{n-1}$ and $X_\sigma(\Omega)$, where $X(\Omega)$ is a Banach space of functions in the domain $\Omega \subset \mathbb{R}^n$, while $X_\sigma(\Omega)$ is the space of solenoidal vector fields in Ω. Our approach reduces the Stokes system to the system of $n-1$ unknowns, and in particular, it is shown that this reduction yields a Ukai-type solution formula for the Stokes semigroup, which is known when Ω is the half space, to the case of the curved boundary.

61 Teppei Kobayasi (Meiji Univ.)* A stationary solution of the Navier–Stokes equations in a perturbed layer domain in $\mathbb{R}^3$ 10

Summary: Many mathematicians treat stationary problems of the Navier–Stokes equations in various unbounded domains with compact and noncompact boundaries. For example, exterior domains, half spaces, aperture domains, channels. In this paper we prove that for a perturbed layer domain there exists a stationary solution of the Navier–Stokes equations approaching the Poiseuille flow with the restricted condition.

62 Toshiaki Hishida (Nagoya Univ.)♭ Asymptotic structure of steady Stokes flow around a rotating obstacle in two dimensions 10

Summary: We provide asymptotic structure at spatial infinity of plane Stokes flow in exterior domains when the obstacle is rotating.

16:20–17:20 Award Lecture for 2014 Analysis Prize

Kazuhiro Ishige (Tohoku Univ.) Concavity properties of solutions for parabolic equations

Summary: This talk is based on the joint works with Professor Paolo Salani (University of Florence, Italy) and it is concerned with concavity properties of the solutions for parabolic equations. We first prove that the super-level set convexity property is not necessarily preserved by the heat flow. Next we give a sufficient condition for the solutions of parabolic equations to be parabolically power concave. Furthermore, we find relationship among the Minkowski addition of convex domains and the parabolic Minkowski convolution of the solutions of parabolic equations.

March 24th (Tue) Conference Room Va

9:30–11:30

63 Tetu Makino (Yamaguchi Univ.)* On spherically symmetric solutions to the Einstein–Euler equations .. 10

Summary: We consider spherically symmetric solutions to the Einstein equations with the energy-momentum tensor of the barotropic perfect fluid with realistic equations of state. Equilibria are given by the Tolmann–Oppenheimer–Volkoff equations, around which there are time-periodic solutions of the linearized problem. We can construct true solutions near that with physical boundary with the vacuum, applying the Nash–Moser(–Hamilton) theorem.

Summary: We consider the nonlinear Timoshenko system with frictional damping in one dimensional whole space. We introduce the Sobolev space H^2 (critical index), and show the global existence and uniqueness of the solutions only by assuming the initial data in H^2: We employ the energy method and apply the refined Lyapnov function of the linear system to this nonlinear system. Moreover, we show the optimal decay $t^{-1/4}$ under the assumption of the initial data in $H^2 \cap L^1$. The key to the optimal decay result is to use the L^2-L^q-L^r type decay estimate effectively.

Summary: We construct a global-in-time strong solution of the primitive equations for the ocean. The free boundary problem in 3-dimensional strip-like region for the ocean is studied, that is to say, the interface between the atmosphere and ocean is free, not rigid lid approximated. Our proof for the existence of a strong solution is given in Sobolev–Slobodetskii spaces.

Summary: We consider two-dimensional motion of liquid film of a viscous incompressible fluid down an inclined plane in the influence of the gravity and the surface tension. In order to investigate such a motion, a method of the thin film approximation is often used. It is the approximation by the perturbation expansion of the solution for the non-dimensional parameter δ defined by ratio between the thickness of the liquid film and the typical wave length. In this study, we will give the error estimate between the solution of the original Navier–Stokes equations and that of Burgers equation when the Reynolds number, the angle of inclination, and the initial date are sufficiently small.

Summary: We are concerned with the Cauchy problem of the full compressible Navier–Stokes equations satisfied by viscous and heat conducting fluids in the whole space. We focus on the so-called critical Besov regularity framework. After recasting the whole system in Lagrangian coordinates, and working with "the total energy along the flow" rather than with the temperature, we discover that the system may be solved by means of Banach fixed point theorem in a critical functional framework whenever the space dimension is greater than two. Back to Eulerian coordinates, this allows to improve the range of the Lebesgue exponent for which the system is locally well-posed, compared to previous results.

Summary: The existence of a time periodic solution of the compressible Navier–Stokes–Korteweg system on the whole space is shown for sufficiently small time periodic external force when the space dimension is equal to 3. The time periodic solution is shown to be asymptotically stable under sufficiently small initial perturbations and the L^∞ norm of the perturbation decays as time goes to infinity.

69 Ryouta Oomachi (Kyushu Univ.) Stability of time periodic solution of incompressible Navier–Stokes equation on the half-space under oscillatory moving boundary condition · · 10

Summary: We consider initial boundary value problem for the Navier–Stokes equation on the half space under oscillatory moving boundary condition. We prove the existence of the time periodic solution which depends only on time variable and vertical variable. The aim of our study is to investigate the stability of the time periodic solution. It is proved that the time periodic solution is asymptotically stable under the sufficient small initial perturbations when the boundary data is sufficient small.

70 Yoshiyuki Kagei (Kyushu Univ.) Takaaki Nishida (Kyoto Univ.) Instability of plane Poiseuille flow in viscous compressible gas · · · · · · · · 10

Summary: We consider the stability of plane Poiseuille flow in viscous compressible gas. We will establish a condition for the Reynolds and Mach numbers in order for plane Poiseuille flow to be unstable. It will be shown that plane Poiseuille flow is unstable for Reynolds numbers much less than the critical Reynolds number for the incompressible flow when the Mach number is suitably large.

71 Miho Murata (Waseda Univ.) Matthias Hieber (TU Darmstadt) On the local in time unique existence to the Fluid–Rigid body interaction problem for compressible fluids · 10

Summary: We consider the system of equations describing the motion of a rigid body immersed in a viscous, compressible fluid within the barotropic regime. It is shown that this system admits a unique, local strong solution within the L_p-L_q framework. Boulakia and Guerrero proved an existence result for strong solution to the coupled system within the L_2 framework as long as no collisions occurs. One of the merits of our approach is the less compatibility condition and regularity on initial data.

72 Senjo Shimizu (Shizuoka Univ.) Shintaro Yagi (Shizuoka Univ.) On local L_p-L_q well-posedness of incompressible two-phase flows with phase transitions: Non equal densities with large initial data · · · · · · · · 10

Summary: The basic model for incompressible two-phase flows with phase transitions where the interface is nearly flat in the case of non-equal densities is considered. The local well-posedness of the model in L_p in time L_q in space settting was proved in [2] under smallness assumption for initial data. We remove the smallness assumption for initial data.

14:15–15:15

73 Hirokazu Saito (Waseda Univ.) Matthias Hieber (TU Darmstadt) Strong solutions for two-phase free boundary problems for a class of non-Newtonian fluids · 10

Summary: In this talk, we consider incompressible two phase flows for generalized Newtonian fluids as a class of non-Newtonian fluids. The flows are described as some free boundary problem of the incompressible Navier–Stokes equations mathematically. By using optimal regularity theorems, concerning the linearized problem, established by Prüss and Simonett '10 and '11, we show the unique existence theorem of strong solutions to the free boundary problem locally in time for sufficiently small initial data.

Summary: I would like to talk about the local well-posedness of compressible-incompressible two-phase flows with phase transitions when the intersurface is close to the flat surface. The point is to represent the mass density along the characteristic curve, so that the equations transfer to the quasilinear parabolic equations. The local well-posedness is proved for given time with small initial data with the help of L_p-L_q maximal regularity theorem for the linearized equations. This is a joint work with Maria Schonbek, Department of Math., Univ. California, Santa Cruz.

Summary: I would like to talk about the L_p-L_q maximal regularity theorem which enable us to prove local well-posedness of the interface problem for the Navier–Stokes equations describing the compressible-incompressible two-phase flows with phase transitions. To prove it, I proved the existence of $\mathcal{R}$ bounded solution operators of the corresponding generalized problem, which, combined with the Weis operator valued Fourier multiplier theorem, implies the requiared maximal regularity theorem.

Summary: I would like to talk about the local wellposedness in a uniform $W_r^{2-1/r}$ domain and the global wellposedness in a bounded domain with small initial data for the strong solutions of simplicied Ericksen–Leslie model describing the motion of a viscous compressible liquid crystal flow. This is a joint work with Dr. Katharina Schade, Department of Mathematic, TU Darmstadt who is a member of IRTG program of Germany. After the Lagrange transformation, we solved the problem by using the L_p-L_q maximal regularity theorem for the linearized equations.

Summary: I would like to talk about the global wellposedness of the initial problem for the viscous incompressible liquid crystal flow in the N-dimensional Euclidean space $\mathbb{R}^N$. The proof is done by combining L_p-L_q maximal regularity results and L_p-L_q decay estimates for the Stokes equations and heat equations. We need essentially two Lebesgue spaces in time with value L_q in space. This is somehow first result concerning global well-posedness for strong soluutions with small initial data for the quasilinear parabolic equations in unbounded domains. I need two different p's.

15:30–16:30 Talk Invited by Functional Equations Section

Satoshi Masaki (Hiroshima Univ.)[♭] On mass-subcritical nonlinear Schrödinger equation

Summary: Recently, there is much progress on analysis of time global behavior of solutions to nonlinear Schrödinger equation based on a so-called concentration compactness/rigidity type argument, after a pioneering work by Kenig and Merle. In energy-critical case, mass-critical case, and intermediate cases of these two, behavior of solutions around ground states are precisely analyzed, and it is clearly understood that ground state solutions are thresholds. In this talk, I would like to introduce my attempt to apply the argument to mass-subcritical cases, in which case the ground states are known to be orbitally stable.

More specifically, as a first step, we investigate a threshold phenomenon between scattering and non-scattering, and give a sharp sufficient condition for scattering by showing existence of a special solution such that; (1) the solution does not scatter for positive time; (2) the solution has minimum size at the initial time, in a suitable sense, among all solutions satisfying property (1). In mass-critical case, the ground state is the solution satisfies these two properties. However, in mass-subcritical case, the above threshold solution is not a ground state solution, or any other standing-wave solutions.

Real Analysis

March 21st (Sat) Conference Room IX

9:30–12:00

1 Noriaki Yoshino (Tokyo Univ. of Sci.)
Tomomi Yokota (Tokyo Univ. of Sci.)
An operator theoretic approach to a quasi-linear degenerate parabolic-elliptic Keller–Segel system ····· 15

Summary: In this talk, we present an operator theoretic approach to a quasi-linear degenerate parabolic-elliptic Keller–Segel system. Under some conditions we will show local existence of weak solutions.

2 Kentarou Fujie (Tokyo Univ. of Sci.)
Global existence and asymptotic behavior in a chemotaxis-growth model for tumor invasion ····· 15

Summary: This talk is concerned with global existence and asymptotic behavior of solutions to a chemotaxis-growth system in a smoothly bounded domain $\Omega \subset \mathbb{R}^n$, $n \leq 3$. Without the logistic source $ru - \mu u^\alpha, r > 0, \mu > 0, \alpha > 1$, the stabilization of this system has been shown by Fujie, Ito, Winkler and Yokota (preprint), whereas especially about asymptotic behavior, the logistic source disturbs applying this method directly. In this talk, a way out of this difficulty is introduced and the asymptotic behavior of solutions to the system with logistic source is precisely determined.

3 Yutaka Tsuzuki (Tokyo Univ. of Sci.)
Solvability of heat equations with hysteresis coupled with Navier–Stokes equations in 2D and 3D domains ····· 15

Summary: This talk is concerned with a system of heat equations with hysteresis and Navier–Stokes equations. Recently, an existence result for the problem with the Navier–Stokes equation in a weak sense has been obtained. This result does not include uniqueness for the problem. This talk establishes existence and uniqueness for the problem with the Navier–Stokes equation in a stronger sense by introducing the fractional power of the Stokes operator.

4 Kota Kumazaki
(Tomakomai Nat. Coll. of Tech.)
On a system of parabolic type equations with a hysteresis operator ····· 15

Summary: In this talk, we consider a system of some parabolic type equation with a hysteresis operator as a mathematical model of concrete carbonation process in three dimensions. This system consists of a diffusion equation of moisture transport involving a hysteresis relation between moisture and the degree of saturation and a diffusion equation of carbon dioxide transport. In this talk, we discuss the existence and uniqueness of a solution for a initial boundary value problem of this system.

5 Akio Ito (Kinki Univ.)
Asymptotic behavior of global-in-time solutions to 1D tumor invasion model of Chaplain–Anderson type with quasi-variational structure ··· 15

Summary: We consider a one-dimensional tumor invasion model of Chaplain–Anderson type with quasi-variational structure. One object is to show the existence of global-in-time solutions by using the limit procedure for suitable approximate solutions. The other is to consider the asymptotic behaviors of global-in-time solutions as time goes to ∞. Actually, we construct at least one global-in-time solution, which enables us to consider the onvergence to a certain constant steady-state solution as time goes to ∞ whenever the initial data satisfy suitable conditions.

Summary: The state variables of ordinary differential equations that describe dynamics in chemical reaction systems or ecosystems are required to be non-negative and bounded. In the present report, sufficient conditions for the solutions to non-autonomous differential equations to be non-negative are given in two theorems: one is for the case the function that describes the equation is continuous with respect to the time variable, and the other is for the case the equation is with an external force term that is not assumed to be continuous with respect to the time variable. The later theorem is applied to proving the non-negativity and boundedness of the solutions to the system of equations that describes the dynamics of cardiac hypertrophy.

Summary: We study the mechanism of cardiac hypertrophy by the cooperation with mathematical science, molecular biology and systems biology. From the viewpoint of theoretical analysis and numerical analysis, we analyze the factors concerned with cardiac hypertrophy comprehensively by using systems biology. From the approach of systems biology, we derive the original systems of ordinary differential equations as the mathematical model. We propose a new model in which two new effects are given to the original system of ordinary differential equations from the mathematical point of view. We analyze a new model theoretically and numerically, and obtain some interesting numerical results.

Summary: In 1978, Brakke proved the existence of weak solutions defined by using geometric measure theory, for the mean curvature flow. The weak solution is called Brakke's mean curvature flow. In 1993, Ilmanen proved the existence of Brakke's mean curvature flow by using the phase-field method. In this talk we show the existence of Brakke's mean curvature flow via a singular limit of solutions for Allen–Cahn equation with constraint.

Summary: In this talk, we give some numerical experiments of Allen–Cahn equation with constraint by using the properties of the Lagrange multiplier. Also, we consider the approximation problem of Allen–Cahn equation with constraint by using the Yosida approximation. Then, we show the numerical results of the approximation problem. Also, we clarify the difference between these numerical results.

14:15–16:30

10 Shoji Shimizu (Waseda Univ.)
Mitsuharu Ôtani (Waseda Univ.)
Solvability of complex Ginzburg–Landau equation in a general domain 15

Summary: The main purpose of this talk is to study the initial boundary value problem for complex Ginzburg–Landau equation (CGL) in a general domain. In former studies, (CGL) is always treated in a bounded domain since Rellich's theorem is used to derive the convergence of approximate solutions. However, in a general domain case, one cannot apply Rellich's theorem directly. So here by using the diagonal argument we construct a sequence of approximate solutions which converges weakly and a.e. in the whole domain and strongly in any bounded sub-domains. By this approach we can show that a weak limit of approximate solutions gives the desired solution of (CGL).

11 Shun Uchida (Waseda Univ.)
Mitsuharu Ôtani (Waseda Univ.)
Exponential attractor of some autonomous double-diffusive convection system 15

Summary: We consider the large time behavior of solutions of some system which describes double-diffusive convection phenomena in some porous medium. In our previous work, it has been already showed that this system possesses the global attractor. In this talk, we show that our system has an exponential attractor by applying "smoothing property" between two distinct solutions. Moreover, using this smoothing property, we can also derive the upper estimate of fractal dimension of the global attractor.

12 Hiroshi Watanabe (Salesian Polytech.)
Solvability of strongly degenerate parabolic equations with variable coefficients 15

Summary: We consider the initial value problem (CP) for strongly degenerate parabolic equations with variable coefficients. Strongly degenerate parabolic equations are regarded as a linear combination of the time-dependent conservation laws (quasilinear hyperbolic equations) and the porous medium type equations (nonlinear degenerate parabolic equations). Thus, this equations has both properties of hyperbolic equation and those of parabolic equations and describes various nonlinear convective diffusion phenomena such as filtlation problems, Stefan problems and so on.
In this talk, we employ an entropy triplet to define entropy solutions asociated with (CP). Our purpose is to prove the uniquneness and existence of the entropy solution in the space BV.

13 Takeshi Fukao (Kyoto Univ. of Edu.)
Pierluigi Colli (Pavia Univ.)
Some equations and dynamic boundary conditions of Cahn–Hilliard type with singular potentials 15

Summary: The well-posedness of a system of partial differential equations and dynamic boundary conditions, both of Cahn–Hilliard type, is discussed. The existence of a weak solution and its continuous dependence on the data are proved using the suitable setting for the conservation of a total mass in the bulk puls the boundary. A very general class of double-well like potentials is allowed.

14 Risei Kano (Kochi Univ.)
Takeshi Fukao (Kyoto Univ. of Edu.)
The existence of solutions for the model of perfect plasticity with time dependent 15

Summary: we discuss the solvability of the perfect plasticity model with time dependent.

15 Yusuke Murase (Meijo Univ.)
Masahiro Kubo (Nagoya Inst. of Tech.)
Solvability of quasi-variational inequalities generated by a quasi-subdifferential operator 15

Summary: We discuss a solvability of a functional inclusion which corresponds to elliptic variational and quasi-variational inequalities. Our functional inclusion is generated by so-called "quasi-subdifferential operator". "quasi-subdifferential operator" is a extension of sub differential operator in some sense. We show you a existence result under a certain assumptions.

16 Ken Shirakawa (Chiba Univ.)
Hiroshi Watanabe (Salesian Polytech.)
Phase-field models of grain boundary motions under non-isothermal settings 15

Summary: In this talk, a system of PDEs which is based on a non-isothermal phase-field model of planar grain boundary motion, proposed in [Warren, J. A. et al.; Acta Materialia, 51 (2003), 6035–6058]. On the basis of the previous study in isothermal cases, the existence result for the non-isothermal system will be demonstrated as the main theorem in this talk.

17 Toyohiko Aiki (Japan Women's Univ.)
Oleh Krehel (TU Eindhoven)
Adrian Muntean (TU Eindhoven)
Homogenization for differential equations describing change of mass of colloids 15

Summary: In this talk we consider a system of partial differential equations describing a mass conservation law for colloids in a porous medium having periodic structure. Here, we treat the Smoluchowski population balance equation as a reaction rate of generation of colloid particles on the domain. For this problem we have already shown the results concerned with existence and uniqueness for each period. The aim of this talk is to discuss a homogenization process for these equations. Namely, as the period tends to 0 the sequence of solutions has a limit and the limit solves some partial differential equations in a weak sense.

16:40–17:40 Talk Invited by Real Analysis Section

Koichi Osaki (Kwansei Gakuin Univ.) Nonlinear analysis for a chemotaxis-growth system

Summary: We are concerned with nonlinear analysis for the solutions to a parabolic-parabolic chemotaxis system with logistic growth: $u_t = \Delta u - \chi\nabla(u\nabla v) + u - \mu u^\alpha$, $\tau v_t = \Delta v - v + u(u+1)^{\beta-1}$, in a bounded domain in R^n. Under some relations between the degradation and secretion orders $\alpha(\leq 2)$ and $\beta(\leq 1)$, we have shown global existence of solutions, and also existence of attractors by obtaining some a priori uniform estimates. For a typical case of orders $\alpha = 2$ and $\beta = 1$, we have also shown pattern formation of solutions, exhibiting several spatial patterns, including stripe or hexagonal patterns, in a rectangle by using the local bifurcation theory. In this talk we will review the results and show the analysis in detail.

March 22nd (Sun) Conference Room IX

9:30–12:00

18 Yōhei Yamasaki (Yamato Univ.) * The limit and "singular integrals of 1 veriables" 15

Summary: In 2009, the presenter gave a talk to clarify the condition to commute with limit for singular integrals of 1 variable. This talk clarifies the condition to commute with limit for singular integrals of 1 variable.

Summary: In this paper, we study the Fourier transformation of distributions in $\mathcal{D}'$.
We prove the several structure theorems by virtue of the Paley–Wiener theorem for the Fourier transformation of distributions with compact support.

Summary: In this paper, we study the Fourier transformation of L^2_{loc}-functions by virtue of the Fourier transformation of distributions in $\mathcal{D}'$.
Thereby we determine the space of functions to where the all solutions of any type of Schrödinger equations belong.

Summary: This talk presents an endpoint case of div-curl lemma in dimension three with Hardy spaces associated with Herz spaces. The proof relies on that the continuity of solutions to the Neumann problem of Poissonn equations and a generalization of Fefferman–Stein vector-valued inequality for Hardy–Littlewood maximal operator.

Summary: We consider Ostrowski's inequalities and some examples. This is a continuation of the talk given in the previous meeting of MSJ.

Summary: We consider the lifting and density problems for a hyperboloid of one sheet in fractional Sobolev spaces. Using the higher order differentiation formula of the composite function and the higher order difference formula of the composite function, we solve the lifting question and show the density of the smooth mapping in fractional Sobolev spaces into a hyperboloid of one sheet.

Summary: The purpose of this talk is to introduce $B^u_w(E)$-funciton spaces which unify many function spaces, Lebesgue, Morrey–Campanato, Lipschitz, Bp, CMO, local Morrey-type spaces, etc. We investigate the interpolation property of $B^u_w(E)$-funciton spaces and apply it to the boundedness of linear and sublinear operators, for example, the Hardy–Littlewood maximal operator, singular and fractional integral operators, and so on, which contains previous results and extends them to $B^u_w(E)$-funciton spaces.

25 Yoshiaki Okazaki (Kyushu Inst. of Tech.) A linear quasi-metric structure of the function space $M_p(\mu)$ ····· 15

Summary: The function space $M_p(\mu)$ and the quasi-metric $|u-v|_p$ is introduced on $M_p(\mu)$. The topological linear structure of $(M_p(\mu), |u-v|_p)$ is studied. $(M_p(\mu), |u-v|_p)$ is a complete topological linear quasi-metric space. The necessary and sufficient condition for $M_p(\mu) = L_p(\mu)$ is given.

26 Yoshihiro Sawano (Tokyo Metro. Univ.) ♭ Morrey-type spaces on Gauss measure spaces and boundedness of singular integrals ····· 15

Summary: We aim to show that Morrey spaces with non-doubling measures defined earlier appear in a natural context. In the probability setting, the Gauss measure is of importance and we can realize our setting in the context of the Gauss measure.

27 Yoshihiro Sawano (Tokyo Metro. Univ.) ♭ Weak type inequalities for some integral operators on generalized non-homogeneous Morrey spaces ····· 15

Summary: We discuss weak type inequalities for some integral operators, especially generalized fractional integral operators, on generalized Morrey spaces of non-homogeneous type. The inequality for generalized fractional integral operators is proved by using two different techniques: one uses the Chebyshev inequality and some inequalities involving the modified Hardy–Littlewood maximal operator, and another uses a Hedberg type inequality and weak type inequalities for the modified Hardy–Littlewood maximal operator.

13:15–14:15 Talk Invited by Real Analysis Section

Neal Bez (Saitama Univ.) Some inequalities from geometric and harmonic analysis via induction-on-scales

Summary: Induction-on-scales is a powerful technique which has been a key ingredient in a number of important developments on the Restriction Conjecture for the Fourier transform and related geometric inequalities, including the Kakeya Conjecture and the family of Brascamp–Lieb inequalities. In this talk, I will discuss an induction-on-scales approach to certain nonlinear generalisations of the classical Brascamp–Lieb inequalities, and applications of these inequalities to multilinear restriction estimates and multilinear Radon-like transform estimates. A somewhat closely related approach has recently been employed by Larry Guth to give a remarkably short proof of multilinear Kakeya estimates, and this will also be covered during the talk.

March 23rd (Mon) Conference Room IX

9:30–12:00

28 Ryotaro Tanaka (Niigata Univ.), Kichi-Suke Saito (Niigata Univ.) Recent progress on the duality of James constant ····· 15

Summary: It is known that the James constant of a Banach space does not coincide with that of its dual space in general. In this talk, we study conditions that guarantee the coincidence. A sufficient condition is given.

Summary: In this talk, we introduce new geometric properties of Banach spaces that generalize p-uniform smoothness and q-uniform convexity. To characterize these properties, we also study generalized Beckner inequalities.

Summary: In this talk, we introduce the concept of k-acute points of a mapping for $k \in [0, 1]$. We study some properties of k-acute points and relations among k–acute points, attractive points and fixed points. We also study properties of some classes of nonlinear mappings by using these concepts. Then, we prove some weak and strong convergence theorems for nonlinear mappings.

Summary: The notion of orthogonality for vectors in inner product spaces is simple, interesting and fruitful. When moving to normed spaces, we have many possibilities to extend this notion. Recently, some constants which measure the differences between two orthogonality notions in normed space have been investigated. However, these constant are considered only in the unit sphere S_X of the normed space X. In this talk, we introduce new constants to measure the difference between Birkhoff and isosceles orthogonalities in the entire normed space X.

Summary: The aim of this talk is to prove that every iterative sequence generated by the viscosity approximation method with a sequence of contractions is convergent whenever so is every iterative sequence generated by the Halpern type iterative method. Then we show some convergence theorems for fixed point problems.

Summary: In this talk we will give new criteria for the improper Lebesgue integral.

Summary: We establish an exact version of Fatou's lemma for Gelfand integrals of functions and multifunctions in dual Banach spaces without any order structure, and under the saturation property on the underlying measure space. The necessity and sufficiency of saturation for the Fatou property is demonstrated. Our result has a direct application to the equilibrium existence result for saturated economies without convexity assumptions.

Summary: The well-known theorem of single integral by parts for 1-variable functions is derived as the limit at infinity of Abel's lemma on summation by parts. Two of the terms are defined by the Stieltjes integral. The Stieltjes integral is extended to the Stieltjes triangular double integral. Double integration by parts based on a triangular element method is also derived as the limit at infinity of Abel's lemma on summation by parts.

Summary: In this talk, we discuss the pseudometric generating property and the continuity of non-additive measure μ taking values in an ordered vector space V. It is known that the pseudometric generating property plays important roles in fuzzy measure theory and many authors investigate this property and progress toward establishing a unified theory of fuzzy or non-additive measures. The purpose of this talk is to consider this property on vector valued non-additive measures and establish its characteristic.

Functional Analysis

March 21st (Sat) Conference Room VIII

10:00–12:00

1 Hiroyuki Yamagishi (Tokyo Metropolitan Coll. of Indus. Tech.)
Kohtaro Watanabe (Nat. Defense Acad. of Japan)
Yorimasa Oshime (Doshisha Univ.)
The best constant of L^p Sobolev inequality corresponding to periodic and Neumann boundary value problem for $(-1)^M(d/dx)^{2M}$ 15

Summary: We study the best constant of L^p Sobolev inequality including j-th derivative with periodic or Neumann boundary condition. The best constants are expressed as L^q norm of Bernoulli polynomial.

2 Takeshi Wada (Shimane Univ.)
Makoto Nakamura (Yamagata Univ.)
The Cauchy problem for nonlinear Schrödinger equation in fractional order Sobolev spaces 15

Summary: The Cauchy problem for nonlinear Schrödinger equation is considered in the Sobolev space of fractional order. An improved Strichartz estimate is constructed and applied to the problem to obtain small global solutions with less regularity assumption for the nonlinear term.

3 Atsuhide Ishida (Otemon Gakuin Univ.)
Non-existence of the wave operators for the repulsive Hamiltonians ... 15

Summary: We consider the scattering theory for the Schrödinger equation with the repulsive Hamiltonian. In this quantum system, we can see the characteristic property in which the free dynamics of the particle disperse in an exponential order in time. This fact indicates that the borderline between the short-range and long-range has to be the log-type decaying. I will report in this talk that we can decide this borderline affirmatively by finding concrete counter-example such that the wave operators do not exist.

4 Akito Suzuki (Shinshu Univ.)
Shogo Ito (Shinshu Univ.)
Hidden spectra of the discrete Schrödinger operators with density zero potentials 15

Summary: We consider the discrete Schrödinger operators H on $\mathbb{Z}^d$ with density zero potentials. We show that for a class of density zero potentials, H has a hidden spectrum that does not contribute to the density of states.

5 Hajime Moriya (Shibaura Inst. of Tech.)
Univalence superselection rule 10

Summary: We discuss univalence superselection rule for many electron systems. We do not merely assume this, rather, we shall dereive this fundamental rule rigorously.

6 Shûichi Ohno (Nippon Inst. of Tech.) *
Weighted composition operators on the minimal Möbius invariant space 10

Summary: We will characterize the boundedness and compactness of weighted composition operators on the minimal Möbius invariant space.

7 Hideyuki Ishi (Nagoya Univ.)* The Gindikin–Wallach set for a non-homogeneous cone ····· 15

Summary: We introduce the Gindikin–Wallach set for a regular cone of positive definite symmetric matrices with prescribed zero-components. Under a certain condition for the zero-pattern, we describe the Gindikin–Wallach set.

14:15–15:15 Talk Invited by Functional Analysis Section

Hidetoshi Tahara (Sophia Univ.) q-Analogues of Laplace and Borel transforms with application to q-difference equations

Summary: Certain q-analogues of Laplace and Borel transforms are discussed, and a new inversion formula between q-Laplace and q-Borel transforms is given. q-Analogues of Watson type lemma and convolution operators are also discussed. These results give a new framework of the summability of formal solutions of q-difference equations. As an application, the summability of formal power series solution of a typical q-difference equation is proved.

March 22nd (Sun) Conference Room VIII

9:30–12:00

8 Mariko Giga (Nippon Medical School) Superadditivity and derivative of operator functions ····· 15
Mitsuru Uchiyama (Ritsumeikan Univ.)
Atsushi Uchiyama (Yamagata Univ.)

Summary: We consider bounded linear operators on Hilbert space. We first show an equivalence for operators $A_i \geq 0$ $(i = 1, 2, \cdots, n)$ among (i) $\sum_{i \neq j} A_i A_j \geq 0$, (ii) $g(\sum_i A_i) \geq \sum_i g(A_i)$ for every operator convex function $g(t)$ on $[0, \infty)$ with $g(0) \leq 0$, (iii) $f(\sum_i A_i) \leq \sum_i f(A_i)$ for every non-negative operator monotone function $f(t)$ on $[0, \infty)$. Next, let $A, B \geq 0$ and A be invertible. Then the followings are equivalent (i) $AB + BA \geq 0$, (ii) the Fréchet derivative $Df(sA)(B)$ is decreasing with respect to $s > 0$ for every operator monotone function $f(t)$ on $(0, \infty)$, (iii) $Dg(sA)(B)$ is increasing with respect to $s > 0$ for every operator convex function $g(t)$ on $(0, \infty)$.

9 Haruka Watanabe (Chiba Univ.) Examples of operator monotone functions ····· 15
Albania Nugraha Imam (Chiba Univ.)
Masaru Nagisa (Chiba Univ.)

Summary: We consider functions with special forms (here, we call them of Szabó type). Using the result of M. Nagisa and S. Wada, their oerator monotonicity is decided by the computation of their some quantity. By this idea, we will completely decide the operator monotonicity of some classes of functions of Szabó type.

10 Sin-Ei Takahasi (Toho Univ.)* An order-preserving function on a quotient space of strictly monotone
Yasuo Nakasuji (Open Univ. of Japan) functions and its applications ····· 15

Summary: This is a research report about an order-preserving average function on a certain space. We introduce an order in a quotient space of strictly monotone continuous functions on a finite interval of real numbers and show that a new average function on this quotient space is order-preserving. We also apply this new order-preserving function to derive a finite form of Jensen type inequality with negative weights.

11 Masatoshi Ito (Maebashi Inst. of Tech.)
Hiroshi Isa (Maebashi Inst. of Tech.)
Eizaburo Kamei
Hiroaki Tohyama
(Maebashi Inst. of Tech.)
Masayuki Watanabe
(Maebashi Inst. of Tech.)

Shannon type inequalities of a relative operator entropy including Tsallis and Rényi ones 15

Summary: In this talk, we introduce a relative operator entropy of operator distributions including Tsallis and Rényi ones, and we obtain generalizations of Shannon type inequalities shown by Furuta, Yanagi–Kuriyama–Furuichi and ourselves.

12 Yuki Seo (Osaka Kyoiku Univ.)

Hadamard product and Karcher mean of positive definite matrices ... 10

Summary: In this talk, we show several operator inequalities involving the Hadamard product and the Karcher mean of n positive definite matrices, which are regarded as n-variable version of results due to Ando and Aujla–Vasudeva. As an application, we show an estimate from above to an n-variable version of the Fiedler type inequality and an n-variable version of majolization relation for the Hadamard product via the Karcher mean.

13 Toshikazu Abe (Niigata Univ.)
Osamu Hatori (Niigata Univ.)

On generalized gyrovector spaces 15

Summary: We introduce a notion of generalized gyrovector sapces and give an example of it.

14 Toshikazu Abe (Niigata Univ.)
Osamu Hatori (Niigata Univ.)

On a Mazur–Ulam theorem for generalized gyrovector spaces and its application 15

Summary: We show a Mazur–Ulam theorem for generalized gyrovector spaces. As an application of it we give the form of Thompson type isometries on the set of positive invertible elements in unital C^*-algebras.

15 Junichi Fujii (Osaka Kyoiku Univ.)

On holonomies for the curve of the operator geometric means 15

Summary: Motivated by TQC (the topological quantum computing), I discuss again the holonomies on the geometry of the positive-definite matrices by Corach–Porta–Recht where the geodesic is the operator geometric means in the sense of Kubo–Ando. It is shown that the holonomy group is the special unitary one $\mathcal{SU}(n)$ which plays an important role in TQC. We give a horizontal lift of any geodesic to the principal bundle and its parallel transport along the geodesic. Approximating any differential curve by the polygons of geodesics, we can obtain any holonomies.

16 Yoichi Udagawa (Tokyo Univ. of Sci.)
Shuhei Wada
(Kisarazu Nat. Coll. of Tech.)
Takeaki Yamazaki (Toyo Univ.)
Masahiro Yanagida
(Tokyo Univ. of Sci.)

A family of operator means including the power, power difference and Stolarsky means 10

Summary: We shall introduce a new way to make a family of operator means. We shall also give a concrete application which interpolates the power, power difference and Stolarsky means.

13:15–14:15 Talk Invited by Functional Analysis Section

Hiroyuki Osaka (Ritsumeikan Univ.) Gap problems of matrix monotone functions and matrix convex functions and their applications

Summary: Let I be an open interval in the real line R and f be a real valued continuous function defined in I. For a pair of self-adjoint matrices A and B in M_n, n by n matrix algebra, with spectra in I we say the function f is a matrix monotone function of degree n, n-monotone in short if $f(A) \leq f(B)$ whenever $A \leq B$. When f is n-monotone for an arbitrary n, it is called operator monotone. We say that the function f is convex of degree n, n-convex in short if

$$f(\lambda A + (1-\lambda)B) \leq \lambda f(A) + (1-\lambda)f(B)$$

for $0 \leq \lambda \leq 1$. Similarly, when f is n-convex for an arbitrary n, it is called operator convex. Denote these classes of functions as $P_\infty(I)$, and $P_n(I)$ (resp. as $K_\infty(I)$ and $K_n(I)$).
In this talk we will present the problems of gaps between $P_n(I)$ and $P_{n+1}(I)$ as well as $K_n(I)$ and $K_{n+1}(I)$ and show their applications to matrix inequalities and quantum entropies.

March 23rd (Mon) Conference Room VIII

9:30–12:00

17 Tatsuya Tsurii (Osaka Pref. Univ.)
Satoshi Kawakami (Nara Univ. of Edu.)
Satoe Yamanaka (Nara Univ. of Edu.)
A hypergroup arising from representations of a finite group and its subgroup 15

Summary: For a pair of a finite group G and its subgroup G_0, one can obtain a graph (Dinkin diagram) $D(G \supset G_0)$ by restrictions of irreducible representations of G and by inducing of irreducible representations of G_0 owing to Frobenius reciprocity theorem. We introduce a hypergroup associated with this graph $D(G \supset G_0)$.

18 Satoe Yamanaka (Nara Univ. of Edu.)
Satoshi Kawakami (Nara Univ. of Edu.)
Tatsuya Tsurii (Osaka Pref. Univ.)
A hypergroup arising from representations of a hypergroup and its subhypergroup 15

Summary: For a pair of a hypergroup L and its subhypergroup L_0, one can obtain a graph (Dinkin diagram) $D(L \supset L_0)$ by restrictions of irreducible representations of L and by inducing of irreducible representations of L_0. We introduce a hypergroup associated with this graph $D(L \supset L_0)$ and twisted by a hypergroup of order two.

19 Ryosuke Nakahama (Univ. of Tokyo)
Norm computation and analytic continuation of vector-valued holomorphic discrete series 15

Summary: In this talk the speaker presents the result on the norm computation of the holomorphic discrete series representations. From this, we can determine when the highest weight modules is unitarizable. Today we mainly deal with $G = Sp(r, \mathbb{R})$ case.

20 Toshihisa Kubo (Univ. of Tokyo) Covariant differential operators and the Rankin–Cohen bracket ····· 15

Summary: The goal of this talk is to find explicit formulas for certain $SL(2,\mathbb{R})$-intertwining differential operators from $C^\infty(\mathbb{R}^2) \oplus C^\infty(\mathbb{R}^2)$ to $C^\infty(\mathbb{R})$. The Rankin–Cohen bracket, Jacobi polynomials, and Gegenbauer polynomials play a key role.

21 Kyo Nishiyama (Aoyama Gakuin Univ.) Enhanced orbit embedding ····· 15

Summary: We give a theory of orbit embeddings and some examples.

22 Kyo Nishiyama (Aoyama Gakuin Univ.)
Lucas Fresse (Univ. Lorraine) Nilpotent variety of double flag varieties ····· 15

Summary: We give a definition of nilpotent variety for a double flag variety associated with a symmetric pair and prove there are finitely many K-orbits.

23 Koichi Shimada (Univ. of Tokyo) Classification of actions of compact abelian groups on subfactors with index less than 4 ····· 15

Summary: We classify actions of discrete abelian groups on some inclusions of von Neumann algebras which may not be factors, up to cocycle conjugacy. As a corollary, we classify actions of compact abelian groups on inclusions of AFD factors with index less than 4, up to stable conjugacy.

24 Yosuke Morita (Univ. of Tokyo) A topological obstruction for the existence of compact quotients of homogeneous spaces ····· 15

Summary: Extending the idea of Kobayashi–Ono, we provide a necessary condition, which is written in terms of relative Lie algebra cohomology, for that a given homogeneous space G/H admits a compact Clifford–Klein form. Using the Chern–Weil theory of characteristic classes, we classify the irreducible symmetric spaces satisfying this necessary condition.

14:15–16:00

25 Takeshi Miura (Niigata Univ.)
Tomas Tonev (Univ. of Montana) Generalizations of multiplicatively spectrum preserving maps on function algebras ····· 15

Summary: We characterize mappings S_i, T_i, not necessarily linear, from parameter sets $\mathcal{J}_i$, $i = 1, 2$, onto multiplicative subsets of function algebras, subject to the following conditions on the peripheral spectra of their products: $\sigma_\pi(S_1(a)S_2(b)) \subset \sigma_\pi(T_1(a)T_2(b))$ and $\sigma_\pi(S_1(a)S_2(b)) \cap \sigma_\pi(T_1(a)T_2(b)) \neq \emptyset$, $a \in \mathcal{J}_1, b \in \mathcal{J}_2$. As a direct consequence we obtain a large number of previous results about mappings subject to various spectral conditions.

26 Yasuo Watatani (Kyushu Univ.) *
Masatoshi Enomoto General Brenner decomposition of the relative position of three subspaces of a Hilbert space ····· 15

Summary: We study the relative position of three subspaces in a separable infinite-dimensional Hilbert space. In the finite-dimensional case, Brenner described the general position of three subspaces completely. We extend it to a certain class of three subspaces in an infinite-dimensional Hilbert space. We give a general condition that the Brenner type decomposition holds.

27 Yuki Arano (Univ. of Tokyo)
Yosuke Kubota (Univ. of Tokyo)
A categorical approach to the Atiyah–Segal completion theorem in KK-theory 15

Summary: We introduce a new perspective on the Atiyah–Segal completion theorem and generalize it to equivariant KK-theory. The homological algebra of the Kasparov category, which is developed by Ralf Meyer and Ryzard Nest, plays a central role. It contains most of known generalizations of the Atiyah–Segal completion theorem. Moreover, as a corollary, an analogue of McClare's result on the restriction maps is also proved and applied to the stability of the Baum–Connes conjecture under extensions.

28 Kengo Matsumoto * (Joetsu Univ. of Edu.)
Hiroki Matui (Chiba Univ.)
Full groups of Cuntz–Krieger algebras and Higman–Thompson groups 15

Summary: We will study presentations of the continuous full group Γ_A of a one-sided topological Markov shift (X_A, σ_A) for an irreducible matrix A with entries in $\{0,1\}$ as a generalization of the Higman–Thompson groups $V_N, 1 < N \in \mathbb{N}$. We will show that the group Γ_A can be represented as a group Γ_A^{tab} of matrices, called A-adic tables, with entries in admissible words of the shift space X_A, and a group Γ_A^{PL} of right continuous piecewise linear functions, called A-adic PL functions, on $[0,1]$ with finite singularities.

29 Tsuyoshi Kajiwara (Okayama Univ.)
Yasuo Watatani (Kyushu Univ.)
Analysis of the cores of C*-algebras associated dynamical systems with branched points 15

Summary: In this talk, we report new results for the analysis of the cores of the C*-algebras associated with dynamical systems with branched points. We determine the dimensions of GNS representations given by the model traces of the core of the C*-algebras associated with rational functions. We define the shift map on the cores, and calculate its action on the set of discrete traces and K_0-groups. We clarify the relation between the shift map and the dimension groups which have been defined for C*-algebras associated with Markov chain.

30 Shuhei Masumoto (Univ. of Tokyo)
The countable chain condition and tensor products of operator algebras 10

Summary: The countable chain condition has been fairly studied in set theory, being related to the behavior of cardinals in forcing extensions. An appropriate interpretation of this condition in the setting of operator algebras gives a generalization of σ-compactness for measure spaces. We shall present that ZFC does not determine whether this condition is preserved under minimal tensor products of operator algebras, which should be contrasted with the fact that σ-compactness is preserved under Cartesian products.

16:30–17:30 Talk Invited by Functional Analysis Section

Kenji Taniguchi
(Aoyama Gakuin Univ.)

Composition series of the standard Whittaker $(\mathfrak{g}, K)$-modules

Summary: For a real reductive linear Lie group G, the space of Whittaker functions is the representation space induced from a non-degenerate unitary character of the Iwasawa nilpotent subgroup. The speaker defined the standard Whittaker $(\mathfrak{g}, K)$-modules, which are K-admissible submodules of the space of Whittaker functions. They are characterized by (1) infinitesimal character, (2) right action of the stabilizer of the character of nilpotent subgroup, (3) moderate growth condition at infinity. In this talk, we discuss the $(\mathfrak{g}, K)$-module structure of them.

We first explain the case when the infinitesimal character characterizing such module is generic. In this case, this module is completely reducible, and its structure is explicitly determined. On the other hand, if the infinitesimal character is integral, very little is known about the structure of the standard Whittaker $(\mathfrak{g}, K)$-modules so far. In the second part of this talk, we exhibit the cases when $G = U(n, 1)$ or $G = Spin(n, 1)$ in which the module structures are completely determined even if the infinitesimal character is regular integral. Studies of higher rank cases are now in progress. We want to introduce some parts of them, if possible.

Statistics and Probability

March 21st (Sat) Conference Room IIa

9:30–12:00

1 Isamu Dôku (Saitama Univ.) Unbiased estimator related to some integral equations ····· 15

Summary: We have already constructed a probabilistic solution to a certain class of deterministic nonlinear integral equations. Related to the same equations, we show that there exist a suitable sequence of random variables and a proper functional such that the functional is a realizable unbiased estimator of the solutions to the above-mentioned integral equations.

2 Taro Murayama (Kanazawa Univ.) * The zero-mass limit problem for three relativistic Schrödinger heat semigroups ····· 15

Summary: Heat semigroups for three magnetic relativistic Schrödinger operators can be represented by Feynman–Kac–Itô type path integral. We discuss convergences of these semigroups by using their path integral representations if mass-parameter goes to zero.

3 Naotaka Kajino (Kobe Univ.)
Alexander Grigor'yan (Univ. of Bielefeld)
Localized heat kernel upper bounds for diffusions via a multiple Dynkin–Hunt formula ····· 15

Summary: The aim of this talk is to present the authors' result on obtaining heat kernel upper bounds for diffusion processes from assumptions on the behavior of the process only within a fixed open subset of the state space. The proof is based on a seemingly new formula, which we call a *multiple Dynkin–Hunt formula*, expressing the transition function of the diffusion process on the whole space in terms of that of the part process on a given open set. This result has an application to heat kernel analysis for the canonical diffusion in a certain random geometry, called the *Liouville Brownian motion*.

4 Shigeyoshi Ogawa (Ritsumeikan Univ.)
Hideaki Uemura (Aichi Univ. of Edu.)
On the identification of noncausal functions from the SFCs ····· 15

Summary: Let $f(t,\omega)$ be a noncausal random function. We consider the stochastic Fourier coefficient (SFC in abbr.) $\tilde{f}_n$ of $f(t,\omega)$ defined by $\int_0^1 f(t,\omega)\overline{e_n(t)}dW_t$, where $\{e_n(t)\}$ is a CONS and $\int dW_t$ stands for some stochastic integral. The question whether we can identify the original function $f(t,\omega)$ by its SFCs arises spontaneously. We study this problem under the condition that $e_n(t)$ is the trigonometric function and $\int dW_t$ is the Ogawa integral, and give an affirmative answer.

Summary: The BPE (Brownian particle equation) is a class of SPDEs (stochastic partial differential equation) of the first order including the white noise, at least in its principal part.
The equation was first introduced by the author in 1973 as a model that serves as a bridge between PDEs of two different types; the PDE of the first order on one hand and the PDE of parabolic type and this program is realized in the framework of the *noncausal calculus*

In this talk we are to show first some recent results on basic properties of the Brownian particle equation and results in the noncausal calculus. As an application of the theory, we will show an elementary derivation of a noncausal counterpart of Girsanov's theorem.

Summary: Linear diffusions which are not far from Bessel diffusions will be discussed. We talk on some results on the asymptotic behavior of the transition denssity in the large time.

Summary: For one-dimensional Brownian motion, the first hitting time of a point has infinite mean while the exit time from an interval has finite exponential moments. In this note we establish its counterparts for symmetric stable processes. The Laplace transform of the first hitting time of the integer lattice is obtained.

Summary: In this talk, we prove a Gaussian upper bound for the density of a skew diffusion. The idea of proof is the parametrix method for skew diffusion which is a Taylor-like expansion for a semigroup. This expansion leads to a probabilistic representation which can be used Monte Carlo simulation.

Summary: We introduce a Vasicek-type short rate model with memory effect. The model can describe more complex yield curves than those the original Vasicek model can. We derive two types of explicit representations of bond prices in this term-structure model. The second one is of Markovian type, whence would be useful in numerical calculations.

14:15–14:45

10 Ryoki Fukushima (Kyoto Univ.)
Marek Biskup (UCLA)
Wolfgang König (WIAS)
Eigenvalue fluctuations for lattice Anderson Hamiltonians ····· 10

Summary: We study a homogenization problem for the eigenvalues of discrete random Schrödinger operator. The operator is restricted to a lattice approximation of a smooth domain and we consider the asymptotics as the mesh-size tending to zero. It is shown that the eigenvalues converges to those of a natural limiting operator and also that the fluctuation of them around the means obeys Gaussian limit law.

11 Ryoki Fukushima (Kyoto Univ.)
Francis Comets (Univ. Paris 7)
Nobuo Yoshida (Nagoya Univ.)
Limiting results for the free energy of directed polymers in random environment with unbounded jumps ····· 10

Summary: We study asymptotic behaviors of the free energy for the directed polymer in random environment. The polymer is allowed to make unbounded jumps and the environment is given by the Bernoulli variables. We first establish the continuity including the negative infinity value of the coupling constant β. Secondly, we identify the asymptotics of the free energy at $\beta = -\infty$ in the limit of the success probability of the Bernoulli variables tending to one.

12 Katusi Fukuyama (Kobe Univ.) *
Yutaro Noda (Kobe Univ.)
On permutational invariance of the metric discrepancy results ····· 5

Summary: If a sequence of non-zero real numbers $\{n_k\}$ satisfies $|n_{k+1}/n_k| \to \infty$, then the law of the iterated logarithm for discrepancies of $\{n_k x\}$ is permutational invariant.

15:00–16:00 Talk Invited by Statistics and Probability Section

Naotaka Kajino (Kobe Univ.) Heat kernel analysis for Brownian motion of 2-dimensional Liouville quantum gravity

Summary: This talk is mainly based on a joint work with Sebastian Andres (Universität Bonn).
Liouville quantum gravity is a mathematical model for 2-dimensional quantum gravity proposed in theoretical physics, which is formally given by "multiplying" a prescribed Riemannian metric g on a 2-dimensional surface (say $\mathbb{R}^2$) by a random "weight function" of the form $e^{\gamma X(\cdot)}$ for a Gaussian free field $X(\cdot)$ and a positive parameter γ. Since $X(\cdot)$ is only a random distribution because of the logarithmic singularity of its covariance kernel, the "function" $e^{\gamma X(\cdot)}$ is a highly ill-defined object and it has not yet been sufficiently well-understood even what such a "weighted Riemannian metric" should mathematically mean.
In recent years there have been researches attempting to make rigorous sense of various objects which should be given rise to by such a "weighted Riemannian metric". On the basis of Kahane's construction (in 1985!) of the associated volume measure $M_\gamma(dz) :=$ "$e^{\gamma X(z)-\gamma^2\mathbb{E}[X(z)^2]/2}dz$", $\gamma \in (0,2)$, the canonical diffusion process associated with this "metric", called the *Liouville Brownian motion*, has been rigorously constructed recently by Garban, Rhodes and Vargas and in a weaker form also by Berestycki. Mathematically it is an M_γ-symmetric diffusion defined as the time change of the 2-dimensional Brownian motion by the positive continuous additive functional with Revuz measure M_γ.
In this talk I will present a detailed analysis of the heat kernel $p_t(x,y)$ of the Liouville Brownian motion. The results include its joint continuity, a locally uniform sub-Gaussian upper bound of the form $p_t(x,y) \leq C_1 t^{-1}\log(t^{-1})\exp\bigl(-C_2\bigl(\frac{|x-y|^\beta \wedge 1}{t}\bigr)^{\frac{1}{\beta-1}}\bigr)$ for $t \in (0,\frac{1}{2}]$ and an on-diagonal lower bound of the form $p_t(x,x) \geq C_3 t^{-1}\bigl(\log(t^{-1})\bigr)^{-\eta}$ for small (depending heavily on x) $t>0$ for M_γ-a.e. x with some concrete constant $\eta > 0$. As immediate corollaries it then turns out that the pointwise spectral dimension equals 2 M_γ-a.e. and that the global spectral dimension is also 2.

16:15–17:15 Award Lecture for 2014 Analysis Prize

Hirofumi Osada (Kyushu Univ.) Stochastic dynamics and geometry for infinite particle systems

Summary: We discuss infinite particle systems in $\mathbb{R}^d$ controlled by free potential $\Phi(x)$ and interacting potentials $\Psi(x,y)$. Such systems, from view point of stochastic geometry, are governed by (Φ,Ψ) quasi-Gibbs measures, and the associated stochastic dynamics are given by infinite-dimensional stochastic differential equations called interacting Brownian motions in infinite dimensions. We give general theorems to construct unique, strong solutions of infinite-dimensional stochastic differential equations describing interacting Brownian motions. As applications, we construct infinite-dimensional labeled dynamics naturally arising from random matrices. The associated unlabeled dynamics are reversible with respect to random point fields related to random matrices. Typical examples are Dyson (Sine_β), Airy, and Bessel random point fields, and the Ginibre random point field. All canonical Gibbs measures with Ruelle's class interaction potentials (satisfying suitable marginal assumptions) are covered by our theorems. We detect the infinite-dimensional stochastic differential equations describing the stochastic dynamics related to Airy random point fields with $\beta = 1,2,4$. When $\beta = 2$, this dynamics coincides with that given by the space-time correlation functions constructed by Spohn, Johansson, and others. Interacting Brownian motions arising from random matrix theory have logarithmic interaction potentials. Because of the long range nature of this potential, the systems have geometric and dynamic rigidity. I show novel and surprisingly interesting phenomena of interacting Brownian motions in infinite-dimensions with logarithmic interaction potentials.

March 22nd (Sun) Conference Room IIb

9:30–11:30

13 Shin-Ichiro Takazawa (Kobe Univ.) * The convergence rate of the strong law of large numbers by a finite number of strategies in the unbounded forecasting game II ····· 10

Summary: We consider the convergence rate of the strong law of large numbers in the framework of game-theoretic probability of Shafer and Vovk. We prove that in the unbounded forecasting game with double hedges Skeptic can weakly force the strong law of large numbers by two strategies.

14 F. Alberto Grünbaum (UC Berkeley) Takuya Machida (JSPS) A long-time limit distribution of a 3-period time-dependent quantum walk ····· 15

Summary: Quantum walks are quantum analogs of random walks and have a background of quantum physics. Also, their applications have largely headed for quantum computers. From the view point of mathematics, the long-time limit theorems of quantum walks have been studied to mention the behavior of the walker after a lot of evolutions. In this talk, our focus is put on a discrete-time quantum walk on the line. The walker determines its evolution by unitary operators which are chosen depending on time. The new result presented this time is a long-time limit distribution for a 3-period time-dependent quantum walk. The limit distribution shows an interesting behavior which we have never seen in a time-independent quantum walk or a 2-period time-dependent quantum walk.

15 Akihito Hora (Hokkaido Univ.) Hydrodynamic limit for restriction-induction chains and free probability ····· 15

Summary: We use notions of free probability to describe time evolution of the rescaled Young diagrams through hydrodynamic limit for restriction-induction chains.

16 Takayoshi Setokuchi (Setokuchi Roof Tile Factory Co. Ltd.) Keizo Takashima (Okayama Univ. of Sci.) Discrepancies of irrational rotations based on numbers having single isolated large partial quotient ····· 15

Summary: We give some refinements of results of Schoissengeier on the discrepancies of irrational rotations. Using these refinements, we give general mathematical explanations for the appearances of several parabola-like hills in behaviors of discrepancies of irrational rotations having single isolated large partial quotient in their continued fraction expansion.

17 Shintaro Suzuki (Osaka Univ.) The Artin–Mazur zeta function of generalized beta transformations ·· 15

Summary: In this talk, we consider the generalized beta-transformation, introduced by Pawl Gora in 2007 and study analytic properties of its Artin–Mazur zeta function. We state that it can be extended to the open unit disk as a meromorphic function which is expressed by using the f-expansion of 1. The main theorem enables us to study the analytic properties of its poles.

18 Hiroki Takahashi (Keio Univ.)* Zero temperature limit for the Hénon map at the first bifurcation ···· 15

Summary: We develop a thermodynamic formalism for a strongly dissipative Hénon-like map at the first bifurcation parameter at which the uniform hyperbolicity is destroyed by the formation of tangencies inside the limit set. For any $t \in \mathbb{R}$ we prove the existence of an invariant Borel probability measure which minimizes the free energy associated with a non continuous geometric potential $-t \log J^u$, where J^u denotes the Jacobian in the unstable direction. Under a mild condition, we show that these measures accumulate as $t \to +\infty$ to measures which minimize the unstable Lyapunov exponent. We also show that the equilibrium measures converge to a Dirac measure as $t \to -\infty$.

19 Michael Keane (Wesleyan Univ.)
Masato Takei (Yokohama Nat. Univ.)
On the number of infinite clusters in percolation on a class of fractal-like graphs ····· 15

Summary: We consider the site percolation problem on a class of fractal-like graphs in the d-dimensional space, and show that for every such graph the critical probability lies strictly between zero and one, and the number of the infinite cluster is at most two with probability one. Moreover for almost every such graph, the number of the infinite cluster is at most one with probability one.

11:30–12:00 Research Section Assembly

March 23rd (Mon) Conference Room IIa

9:30–12:00

20 Naoto Nakano (JST PRESTO / Hokkaido Univ.)
Masaru Inatsu (Hokkaido Univ.)
Seiichiro Kusuoka (Tohoku Univ.)
Yoshitaka Saiki (Hitotsubashi Univ.)
Ensemble predictability estimate of vector-valued time-series analysis based on stochastic differential equation model ····· 15

Summary: Ensemble predictability estimate of vector-valued time-series analysis based on stochastic differential equation (SDE) model is studied. Here, we regard the time-series as one realization of a solution path of a SDE of the Markovian type. We can obtain the coefficient of the SDE by using empirical evaluating formulae, and we can perform numerical simulations by the use of the empirically estimated SDE. Comparing the ensemble variance of the result of the simulations to that of the reference time-series, we validate the framework of this study and estimate the predictability of the time-series.

21 Fumiya Akashi (Waseda Univ.)
GMM estimator for symmetric α-stable linear processes and its second-order asymptotic properties ····· 15

Summary: This talk focuses on the parameter estimation problem of the symmetric α-stable linear process. In particular, we make use of the empirical characteristic function and apply the generalized method of moments (GMM) estimator for characteristic exponent α, scale parameter σ and the coefficients of the stable process. It is shown that the estimator has consistency and asymptotic normality, and the stochastic expansions are given up to second-order. We also provide the bias adjustment procedure for the estimator, and give some theoretical and numerical examples.

Summary: In this talk, we study asymptotic distributions of minimum contrast estimators which naturally originated in time series analysis. Generally, the Whittle estimator for Gaussian process is a special form of the minimum contrast estimators in time series analysis. The estimator has been extended to the several classes of minimum contrast estimators. The extension, however, cannot be explained in the statistical sense. We focused on the statistical errors (e.g. prediction error, interpolation error, etc.), which has to be minimized, and defined a new class of the minimum contrast estimators. We examined the properties of the class for the spectral densities and investigated asymptotic distribution of the estimators.

Summary: In this talk, we derive reference priors which maximize a general divergence measure (called α-divergence) in multiparameter non-regular models in presence of nuisance parameter. In non-regular case, the prior is different from the reference prior given in Bernardo (1979). The comparison between regular and non-regular cases is also discussed.

Summary: A new functional central limit theorem for the number of a partition by the Ewens sampling formula is presented. As a framework of the weak convergence, the L^2 space is argued, whereas the Skorokhod space is argued in existing functional CLTs for random combinatorial structures. It enables us to treat a weight function, which requires new methods of proofs, and the limit law becomes a weighted Brownian motion.

Summary: In any database, some fields are continuous and others discrete. However,in any statistics, when we consider dependency among the variables, they are assumed to be either all Gaussian or all discrete. In this paper, we consider to estimate the model that expresses its dependency based on maximizing the posterior probability from examples w.r.t. a given prior probability. We show that such a model is always obtained and converges with probability one. The same idea can be applied to obtain dependency among variables in the same way as BIC even when a continuous variable is contained.

Summary: In a similar way to Akahira (2013, in revision in Ann. Inst. Statist. Math.), for a truncated exponential family of distributions with a truncation parameter and a natural parameter as a nuisance parameter, the bias-adjusted maximum likelihood estimators (MLEs) S and T of the truncation parameter when the natural parameter is known and unknown, respectively, are obtained, and their stochastic expansions are derived. Further, the second order asymptotic variances of S and T are obtained and the second order asymptotic loss of T relative to S is also given.

27 Nao Ohyauchi (Univ. of Tsukuba)
Masafumi Akahira (Univ. of Tsukuba)
Asymptotic loss of the MLE of a truncation parameter for a two-sided truncated exponential family of distributions 10

Summary: In a similar way to Akahira et al. (2014, to appear in Comm. Stat. Theor. Meth.), for a two-sided truncated exponential family of distributions with two truncation parameters and a natural parameter as a nuisance parameter, the bias-adjusted MLE S of one of the truncation parameters when the natural parameter and another truncation parameter are known and the bias-adjusted MLE T of the truncation parameter when they are unknown, are obtained, and their stochastic expansions are derived. Further, the second order asymptotic variances of S and T are obtained and the second order asymptotic loss of T relative to S is also given.

14:15–15:15

28 Yuri Sekiya (Hokkaido Univ. of Edu.)
Nobuhiro Taneichi (Kagoshima Univ.)
On an application of a discontinuous term of the asymptotic expansion for distribution of multinomial goodness-of-fit test statistic 15

Summary: In the multinomial goodness-of-fit test, Siotani and Fujikoshi (1984) derived an asymptotic expansion for the null distribution of the loglikelihood ratio statistic under a simple null hypothesis. They proposed an expression as an approximation of the lower probability of the loglikelihood ratio statistic. The expression consists of continuous and discontinuous terms. We consider a new test using the discontinuous term.

29 Seiichi Iwamoto (Kyushu Univ.*)
Yutaka Kimura (Akita Pref. Univ.)
Is Da Vinci Code in itself optimal? 15

Summary: It is shown that Da Vinci Code —the first eight Fibonacci numbers— is in itself optimal for two quadratic programming problems under linear constraints. This result applies to Fibonacci Code —the consecutive Fibonacci numbers—. Some relations to reversed problem and dual problem are discussed.

30 Seiichi Iwamoto (Kyushu Univ.*)
Three dual approaches to least squares method 15

Summary: The least squares method results in solving a quadratic convex programming problem without constraint. In this talk, it is shown that its dual problem, together with equality condition, is derived through three approaches —(1) dynamic method, (2) plus-minus method, and (3) inequality method. (1) applies Lagrange duality for mathematical programming under linear constraints. (2) is an improvement of Fenchel duality. (3) is a series of applications of arithmetic mean— geometric mean inequality under the constraints.

15:30–16:30 Talk Invited by Statistics and Probability Section

Taka-aki Shiraishi (Nanzan Univ.) Advanced theory of multiple comparison procedures in multi-sample models

Summary: We consider multiple comparison procedures in k sample models. Suppose under the i-th treatment a random sample $X_{i1}, \cdots, X_{in_i}$ of size n_i is taken ($i = 1, \cdots, k$), where X_{ij}'s are independent. Furtheremore assume that X_{ij} has a distribution function $F_i(x)$ with finite mean $\mu_i = E(X_{ij})$. Then we can derive the following conclusions (i)–(v). (i) Suppose that $F_i(x)$ is a normal distribution function with mean μ_i and unkown variance σ^2. Then, for the differences among mean responses, from a mathematical theory, the closed testing procedure proposed by Shiraishi (2011a) is superior to the single step Tukey–Kramer test (Tukey (1953), Kramer (1956)). By a simulation, the power of the former is fairy higher than the latter. The confidence region of $\boldsymbol{\mu} \equiv (\mu_1, \cdots, \mu_k)$ derived from the closed testing procedure is equivalent to a single step simultaneous confidence intervals of $\{\mu_i - \mu_{i'} : \ 1 \leq i < i' \leq k\}$. (ii) Suppose that the simple order restriction of $\mu_1 \leq \mu_2 \leq \cdots \leq \mu_k$ is satisfied under the condition of the above (i). Then, for the differences among mean responses, a closed testing procedure is superior to the single step Hayter's test (Hayter (1990)). To compute the upper 100αth percentiles of the distributions of statistics $\max_{i<i'}(-t_{ii'})$, the sinc method described in Lund and Bowers (1992) and Stenger (1993) is utilized. (these contents are stated in Shiraishi (2014a) and Shiraishi and Sugiura (2015)) (iii) Suppose that $F_i(x)$ is a normal distribution function with mean μ_i and unkown variance σ_i^2. Then, for the differences among mean responses, Shiraishi and Hayakawa (2015) propose a closed testing procedure superior to the single step Games–Howell test (Games and Howell (1976)). By a simulation, the power of the former is fairy higher than the latter. (iv) Suppose that $F_i(x) = F(x - \mu_i)$ holds. Then nonparametric multiple comparison procedures are discussed corresponding to the above (i) and (ii). (these contents are stated in Shiraishi (2008), (2011b), (2014a)) (v) Suppose that $F_i(x)$ is Bernoulli, Poisson, or exponential. Then the theory of multiple comparison procedures are constructed. (these contents are stated in Shiraishi (2009), (2011c), (2012a), (2012b), (2013), (2014b))

16:45–17:45 Talk Invited by Statistics and Probability Section

Masashi Hyodo (Tokyo Univ. of Sci.) Estimation of the probabilities of misclassification for a linear discriminant function in high-dimensional settings

Summary: In this talk we consider the estimation of the probabilities of misclassification for a linear discriminant function in high-dimensional settings. We discuss misclassification probability for Fisher's linear discriminant function and Euclidean distance-based linear discriminant function. Based on the large sample theory, Lachenbruch and Mickey (1968) proposed the asymptotic unbiased estimator of misclassification probability for Fisher's linear discriminant function. Since this method is based on large sample asymptotic results, it does not perform well in high dimensional settings. We treat the estimation of misclassification probability for Fisher's linear discriminant function and related topics when the dimension, p, of the observation vectors is less than the total number, N, of observation vectors from the two groups, but both p and N tend to infinity with the same order. On the other hand, we are interested to explore the discrimination procedure that can accommodate $p > N$ cases. In this case, Euclidean distance-based linear discriminant function is often used. We introduce the consistent estimator of misclassification probabilities when the dimension of the vector, p, may exceed the sample size, N, and the underlying distribution need not necessarily be normal.

March 24th (Tue) Conference Room IIa

9:45–12:00

31 Akira Shibuya (Tokyo Univ. of Sci.)
Kiyotaka Iki (Tokyo Univ. of Sci.)
Sadao Tomizawa (Tokyo Univ. of Sci.)
Orthogonal decomposition of extended diagonal exponent symmetry model in square contingency tables with ordered categories ····· 15

Summary: For square contingency tables with ordered categories, we propose new models, which are the extension of Tomizawa's (1992) diagonal exponent symmetry model. Also we give the orthogonal decomposition of proposed model.

32 Mana Aizawa (Tokyo Univ. of Sci.)
Kouji Yamamoto (Osaka Univ.)
Sadao Tomizawa (Tokyo Univ. of Sci.)
Decompositions of sum-symmetry model for square contingency tables with ordered categories ····· 10

Summary: For square contingency tables, Yamamoto et al. (2013) proposed the sum-symmetry (SS) model. We propose three kinds of symmetry model, and give two kinds of decompositions of the SS model.

33 Kouji Tahata (Tokyo Univ. of Sci.)
Masato Naganawa (Tokyo Univ. of Sci.)
Sadao Tomizawa (Tokyo Univ. of Sci.)
Decomposition of symmetry based on extended linear asymmetry model for square contingency tables with ordered categories ····· 10

Summary: For the analysis of square contingency tables with ordered categories, it may be useful to apply some kinds of asymmetry model when the symmetry model does not hold. In this talk, the symmetry model is separated into two models. One is the extended linear asymmetry model and the other is a model which indicates both global symmetry and moment equality. Also, the relationship between test statistics is given.

34 Shoko Chisaki (Tokyo Univ. of Sci.)
Nobuko Miyamoto (Tokyo Univ. of Sci.)
On a difference systems of set from a family of subsets in $\mathbb{F}_p$ ····· 10

Summary: A *regular difference systems of set* is a collection of t disjoint m-subsets $Q_i, 0 \leq i \leq t-1$, of $\mathbb{Z}_n$ such that every element of $\mathbb{Z}_n^*$ appears at least ρ times in the multiset $\{a-b|a \in Q_i, b \in Q_j, 0 \leq i \neq j \leq t-1\}$. A DSS is perfect if every element of $\mathbb{Z}_n^*$ is contained in exactly ρ times in the above multiset. In this talk, we will show a condition that a family of subsets in a finite field of order p forms a regular DSS, where p is an odd prime. Additionally, we will give a lower bound on the parameter ρ of the DSS and talk about a condition that the DSS is perfect.

35 Masanori Sawa (Kobe Univ.)
Developing the theory of designs on measure spaces II —a generalization of Tchakaloff's Theorem— ····· 15

Summary: An existence theorem is given for cubature formulas for finite-dimensional spaces of L^1-integrable functions, designed as a natural generalization of Tchakaloff's Theorem for classical polynomial-type cubature formulas. Statistically, this result states that any probability measure can be represented by a discrete probability measure over a finite-dimensional space of L^1-integrable functions. One more statistical application will also be discussed in connection with optimal experimental designs.

36 Masahide Kuwada (Int. Inst. for Nat. Sci.)
Yoshifumi Hyodo (Okayama Univ. of Sci./Int. Inst. for Nat. Sci.)
Hiromu Yumiba (Int. Inst. for Nat. Sci.)
Kazuma Ozoe (Okayama Univ. of Sci.)

Existence conditions for balanced fractional 2^m factorial designs of resolution $\mathrm{R}^*(\{1,2\}|\Omega_4)$ with $N < \nu_4(m)$ 15

Summary: Consider a fractional factorial design with m factor each at two levels, which is derived from a simple array (SA), where $m \geq 8$, and the five-factor and higher-order interactions are assumed to be negligible. Under these situations, if the main effect and the two-factor interaction are estimable, and furthermore some of the remaining non-negligible factorial effects may or may not be estimable, then a design is said to be of resolution $\mathrm{R}^*(\{1,2\}|\Omega_4)$. Using the algebraic structure of the TMDPB association scheme, we give a necessary and sufficient condition for an SA to be a 2^m-BFF design of resolution $\mathrm{R}^*(\{1,2\}|\Omega_4)$, where the number of assemblies is less than the number of non-negligible factorial effects.

37 Kazuki Matsubara (Matsunaga High School)
Masatake Hirao (Aichi Pref. Univ.)
Sanpei Kageyama (Hiroshima Inst. of Tech.)

The existence of 2 pairwise additive cyclic BIB designs with an even number of points 10

Summary: The existence of pairwise additive balanced incomplete block (BIB) designs has been discussed with direct and recursive constructions in Sawa et al. (2007) and Matsubara et al. (2013). In this talk, we provide 2 PACB$(32, 2, 1)$ found out by use of a computer, and then it is shown that 2 PACB$(2^m, 2, 1)$ for any $m \geq 2$ and 2 PACB$(2^m t, 2, 1)$ with any integer $m \geq 2$ and any odd integer $t \geq 1$ such that $\gcd(t, 27) \neq 3, 9$ can be constructed.

38 Xiao-Nan Lu (Nagoya Univ.)
Masakazu Jimbo (Nagoya Univ.)

Unifying some graphs related to quadruple systems 15

Summary: A quadruple system denoted by $\mathrm{QS}_\lambda(v)$, is a pair $(V, \mathcal{B})$, where V is a finite set of v elements, and $\mathcal{B}$ is a set of 4-subsets of V, called block, such that each 3-subset of V appears exactly λ times in $\mathcal{B}$. Moreover, $(V, \mathcal{B})$ is said to be cyclic if it admits an automorphism consisting of a cycle of length v. By identifying V with $\mathbb{Z}_v$ (the additive group of integers mod v), if every unit of $\mathbb{Z}_v$ is a multiplier, then $(V, \mathcal{B})$ is said to be affine-invariant. It is known that some constructions of cyclic and affine-invariant QS's are related to graphs. In this talk, we unify these graphs related to QS's, such that progresses to the existence problem of affine-invariant QS's can be made from the point of view of number theory.

14:15–15:15

39 Kazuyoshi Yata (Univ. of Tsukuba)
Makoto Aoshima (Univ. of Tsukuba)

Asymptotic properties of the extended cross-data-matrix methodology for high-dimensional data and their applications 15

Summary: In this talk, we consider the extended cross-data-matrix methodology (ECDM) developed by Yata and Aoshima (2013). By applying the ECDM, we give a variety of unbiased estimators for parameters in high-dimensional inference. We show that the estimators enjoy the consistency property when the data dimension grows. Also, we show that the test statistics by the ECDM are asymptotically distributed as a normal distribution under certain conditions. Finally, we study the performance of the ECDM in actual high-dimensional data analyses.

Summary: We review some recent results on complex non-central Wishart distribution, which came from problems of statistical models in wireless communicationss.

Summary: A variable selection criterion is derived for GMANOVA model with random coefficient.

Applied Mathematics

March 21st (Sat) Conference Room VIa

9:50–12:00

1 Nobuo Shindo (Kyoto Gaidai Nishi High School) 3-color resolution of the edges of maximum plane graph —by "peninsula" method— 10

Summary: I prove that edges of every maximum plane graph G are 3-color resoluble. G does not contain any separate triangle. To prove this theorem, I prove the supportive theorem that if edges of the maximum plane graph without any single triangle are 3-colors resoluble, the edges of the maximum plane graph as a whole are 3-color resoluble, too. To prove the main theorem, I reflect number of cases, covering the maximum plane graph G with chains of triangles, a number of which is 1/2f. f is the number of the faces of G. At least one case of 3-color resolution of the edges of the graph G exists, through constructing the "peninsula" which contains almost of the chains of triangles.

2 Kenta Noguchi (Keio Univ.) Control of cycle parities of quadrangulations 15

Summary: A triangulation is a simple graph on a surface where every face is triangular. A quadrangulation is a simple graph on a surface where every face is quadrilateral. Quadrangulations has an algebraic structure called cycle parities. Let $\mathscr{F}$ be a set of all quadrangulations on a fixed non-orientable closed surface $\mathbb{N}_k$. It is known that the cycle parity divides $\mathscr{F}$ into four congruence classes. In this talk, we focus on quadrangulations as a subgraph of triangulations. For a given triangulation G on $\mathbb{N}_k$, we try to find a quadrangulation with any type of cycle parities as a subgraph of G.

3 Masato Mimura (Tohoku Univ.)* Cayley verifiable expander 15

Summary: We show that any Cayley graph Gamma of a group with "Kazhdan's property (T)" is a "Cayley verifiable expander." That means, there exists a radius R such that any Cayley graph Lambda with the same R-ball as Gamma has a first positive Laplace eigenvalue which is bounded away from zero uniformly on Lambda.

4 Takuya Ikuta (Kobe Gakuin Univ.)
Akihiro Munemasa (Tohoku Univ.) Complex Hadamard matrices coming from 4-class association schemes 15

Summary: Let q be a power of 2. Let n be odd and $n \geq 3$. Consider the vector space $V(n,q)$ with a nondegenerate quadratic form. Last year, Frédéric Vanhove noted that in Brouwer, Cohen and Neumaier, "Distance-Regular Graphs", Theorem 12.1.1 is incorrect for $n \geq 5$, and showed that the existence of a 4-class association scheme for $(n,q) = (5,4)$. After that, Andries E. Brouwer generalized his result for any n and q. In this talk, we are to give an infinite families of complex Hadamard matrices attached to such association schemes.

5 Kohei Yamada (Nagoya Univ.)
Masanori Sawa (Kobe Univ.)
Masakazu Jimbo (Nagoya Univ.)
Graham and Lovász's problem on the inertia of distance matrix and quasi-symmetric designs 10

Summary: Let $n_+(G)$ and $n_-(G)$ be the number of positive and negative eigenvalues of the distance matrix of a graph G, respectively. Graham and Lovász (1978) asked whether there exists an undirected and connected graph G with $n_+(G) > n_-(G)$. Azarija (2014) proved that every conference graph of order $v > 9$ satisfies $n_+(G) = n_-(G) + 1$. In this talk, we mainly present another class of graphs with $n_+(G) > n_-(G)$ which is not strongly regular in connection with quasi-symmetric combinatorial 2-designs.

6 Ryoko Oishi-Tomiyasu (High Energy Accelerator Res. Organ.)
Application of reduction theory of quadratic forms to a lattice determination problem in crystallography 15

Summary: When $P \subset \mathbb{R}^3$ is a periodic point set with the period lattice L, an efficient method to determine the equivalent class of L from the average theta series of P has a useful application to the problem known as "powder indexing" in crystallography. By using the C-type reduction theory of quadratic forms, we succeeded in developing an algorithm robust against loss and errors of information due to observational problems, suppressing the computation time. We introduce how the C-type reduction theory was used in the method.

7 Michiaki Kabe (Kanto Polytechnic Coll.)
Solution for soil improvement problem 15

Summary: Every plant produced in the field requires appropriate own cultivate soil. We solve the so-called soil improvement problem which means the way to improve the soil in order to produce plants after investigating the present soil. Then using the solution, we develop the software system to improve the soil for plants.

14:30–16:00

8 Iwao Sato (Oyama Nat. Coll. of Tech.)
Norio Konno (Yokohama Nat. Univ.)
Etsuo Segawa (Tohoku Univ.)
Yusuke Higuchi (Showa Univ.)
Quantum graph walk 15

Summary: By giving attention to a common point of the scattering matrix of a quatum graph and the time evolution (transition matrix) of a discrete-time quantum walk on a graph, we consider a discrete-time quantum walk on a graph with the scattering matrix of a quatum graph as its transition matrix, and define a quantum graph walk on a graph. Through a quantum graph walk, we discuss the relation between a quatum graph and a discrete-time quantum walk on a graph. Furthermore, we generalize the scattering matrix of a quatum graph.

9 Norio Konno (Yokohama Nat. Univ.)
Masato Takei (Yokohama Nat. Univ.)
On stationary measures for discrete-time quantum walks in one dimension 10

Summary: We consider stationary measures of the one-dimensional discrete-time quantum walks with two chiralities, which is defined by a 2×2 unitary matrix U. By a simple argument, we show that any uniform measure becomes a stationary measure. If U is diagonal, then any stationary measure is uniform. Except the diagonal case, we can construct several non-uniform stationary measures.

10 Shunsuke Nakamura (Tokyo Univ. of Sci.)
Keiko Kotani (Tokyo Univ. of Sci.)
The number of contractible edges in a 4-connected graph having a small number of edges not contained in triangles ····· 15

Summary: Let G be a 4-connected graph, and let $\tilde{E}(G)$ denote the set of those edges of G which are not contained in a triangle and let $E_c(G)$ denote the set of contractible edges of G. Ando and Egawa proved that if $|\tilde{E}(G)| \geq 15$, then $|E_c(G)| \geq (|\tilde{E}(G)| + 8)/4$. In this talk, we prove if $|\tilde{E}(G)| \geq 7$, then $|E_c(G)| \geq (|\tilde{E}(G)| + 8)/4$.

11 Kiyoshi Ando (Nat. Inst. of Information / JST ERATO)
A forbidden subgraph condition for 5-contractible edges ····· 15

Summary: An edge of k-connected graph is said to be k-contractible if the contraction of it results in a k-connected graph. Kawarabayashi showed that for each odd integer k, every k-connected graph with no K_4^- has a k-contractible edge, where K_4^- stands for the graph obtained from K_4 by deleting one edge. We prove every 5-connected graph with no $K_1 + (K_2 \cup P_3)$ has a 5-contractible edge. Since $K_4^- \subset K_1 + (K_2 \cup P_3)$, this is an extension of Kawarabayashi's result in case of $k = 5$.

12 Kazuhiko Ushio (Kinki Univ.) Balanced C_7-foil designs and related designs ····· 15

Summary: In graph theory, the decomposition problem of graphs is a very important topic. Various type of decomposition of many graphs can be seen in the literature of graph theory. This paper gives balanced C_7-foil designs and related designs.

16:10–17:10 Talk Invited by Applied Mathematics Section

Midori Kobayashi (Univ. of Shizuoka) Dudeney's round table problem —a survey—

Summary: Dudeney's round table problem was proposed about one hundred years ago. It has already been solved when the number of people is even, but it is still unsettled when the number of people is odd, except in only a few cases. Here is a statement of the problem. A set of n people sits at a round table on each of $(n-1)(n-2)/2$ consecutive days. Is it possible to arrange the seating such that no person has the same two neighbours twice?

We survey the history of the problem, known results on the problem, generalization and some related topics such as 3-designs, perfect 1-factorizations and perfect sets of Hamilton decompositions. We also mention some open problems.

March 22nd (Sun) Conference Room VIb

9:30–11:30

13 Minoru Fujimoto (Seika Science Lab.)
Kunihiko Uehara (Tezukayama Univ.)
Twin prime theorem fixed ····· 15

Summary: We give an estimation of the existence density for the $2d$ different primes by using a new and simple algorithm for getting the $2d$ different primes. We may conclude that there exist infinitely many $2d$ different primes including the twin primes in case of $d = 1$ because we can give the lower bounds of the existence density for them in this algorithm. We also discuss the Hardy–Littlewood conjecture about them.

Summary: We discuss the existence density of the Sophie Germain primes and the primes constellation like as primes triplet and primes quadruplet by using a simple algorithm for getting the $2d$ different primes. After we refer to the Legendre's conjecture which is known as one of the Landau problems: "Does there always exist at least one prime between consecutive perfect squares?".

Summary: The Ryjáček closure is a powerful tool in the study of hamiltonian properties of claw-free graphs. Because of its usefulness, we may hope to use it in the classes of graphs defined by another forbidden subgraph. In this talk, we give a negative answer to this hope, and report that the claw is the only forbidden subgraph that produces non-trivial results on hamiltonicity by the use of the Ryjáček closure.

Summary: Enomoto conjectured that if G is a graph of order n and the minimum degree $\delta \geq \frac{n}{2} + 1$, then for any two vertices x and y in G, there exists a Hamilton cycle C of G such that $d_C(x, y) = \lfloor \frac{n}{2} \rfloor$, where $d_C(x, y)$ is the distance between x and y in C. In this talk, we consider several conjectures which generalize Enomoto's conjecture and show several results relating to the conjectures.

Summary: Let $G = (V(G), E(G))$ be a connected graph. A non-empty subset $S \subset V(G)$ is called a *safe set*, if for every component C of $G[S]$ and every component of $G - S$, we have $|C| \geq |D|$ whenever C is adjacent to D in G. We discuss this new concept in this talk.

Summary: A fundamental problem in graph theory is deciding whether a graph has a particular type of spanning subgraph. It was conjectured that every 4-connected plane triangulation has a spanning Halin subgraph, but it was disproved. In this talk, we introduce recent results on the spanning Halin subgraph problem.

19 Masataka Kaneko (Toho Univ.)
Satoshi Yamashita (Kisarazu Nat. Coll. of Tech.)
Kazushi Ahara (Meiji Univ.)
Akira Iritani (Iwataminami High School)
Setsuo Takato (Toho Univ.)

Effective TeX drawing with dynamic geometry software 15

Summary: In this talk, we will introduce some new methodology to generate fine graphics on TeX documents using Cinderella, which is one of the most popular dynamic geometry softwares. Our strategy is to transfer the data and process for drawing on Cinderella into (1) TeX graphical codes, or (2) command lines of computer algebra systems to generate them. Using the resulting package "KETCindy", more simple and more interactive drawing on TeX should be enabled.

13:00–13:50

20 Kosuke Suzuki (Univ. of Tokyo)

Accelerating convergence and the tractability of multivariate integration for the Walsh spaces 15

Summary: We study multivariate integration for a weighted Walsh space for which the b-adic Walsh coefficients decay as $|\widehat{f}(k)| \in b^{-\mu_a(k)}$, where μ_a is the weighted Dick weight and b is an integer larger than 1. This function space is closely related to a criterion WAFOM, which is used in quasi-Monte Carlo integration. In this talk, we study accelerating convergence of the minimal worst-case error and accelerating convergence with polynomial and strong tractability.

21 Norihiro Nakashima (Toyota Tech. Inst.)
Hajime Matsui (Toyota Tech. Inst.)

A decoding algorithm for projective Reed–Muller codes by DFT and BMS algorithm 15

Summary: Projective Reed–Muller (RM) codes were introduced as a generalization of RM codes, and the lowest wight and the dual code of PRM codes are known. Roughly speaking, a PRM code is divided into the direct sum of RM codes. Then we may considered syndromes related to PRM codes as syndromes related to corresponding RM codes. By using Berlekamp–Massey–Sakata algorithm and discrete Fourier transformation, we construct a decoding method for PRM codes.

22 Shin Harase (Tokyo Tech)
Takamitsu Kimoto (Tokyo Tech)

Implementing 64-bit maximally equidistributed Mersenne Twister pseudorandom number generators 15

Summary: In Monte Carlo simulations, Mersenne Twister pseudorandom number generators are widely used. Mersenne Twisters are based on linear recursions on the two-element field, and we can assess the quality criterion $k(v)$ called the dimension of equidistribution with v-bit accuracy. Recently, we often use 64-bit computers, so 64-bit generators are preferable. Up until now, there has been no 64-bit long-period linear pseudorandom number generator with optimal $k(v)$'s. In this talk, we introduce an implementation of 64-bit Mersenne Twisters with optimal $k(v)$'s.

13:50–14:10 Presentation Ceremony for the 2014 MSJ Prize for Excellent Young Applied Mathematicians

March 23rd (Mon) Conference Room VIa

10:00–11:30

23 Shunzi Horiguchi (Niigata Sangyo Univ.) Tsuchikura–Horiguchi–Murase–Halley method (Expansion of Halley Method) and the convergences II 10

Summary: We give expansions of Halley method (Tsuchikura–Horiguchi–Murase–Halley method). Next we give the formula of the comparison of the speeds of convergences for the Halley method and the expansions.

24 Shunzi Horiguchi (Niigata Sangyo Univ.) Numerical Calculations of Convergences II of Tsuchikura–Horiguchi–Murase–Halley's method (Expansion of Halley's Method) 10

Summary: We perform the numerical calculations of the comparisons of the speeds of convergences of the Halley method and the expansions for elementary functions.

25 Shy Der Lin (Chung Yuan Christian Univ.)
H. M. Srivastava (Univ. of Victoria) Some special properties and application of fractional calculus 15

Summary: In recent years, various operators of fractional calculus have been investigated and applied in many remarkably diverse fields. The main object of this paper is to consider some miscellaneous properties and applications. We first investigate various families of series identities which emerged in connection with some of these fractional differ-integral formulas. By using such operators of fractional calculus, a number of integral formulas as well as fractional differ-integral formulas involving inverse hyperbolic functions are also evaluated.

26 Pin-Yu Wang (Nanya Inst. of Tech.)[♭] The N-Fractional Calculus of The Functions $1/f(z)$ and $\log f(z)$, and Identities 10

Summary: In this article, the N-fractional calculus are discussed. Moreover, some identities that are derived from them are reported.

27 Fumio Nakajima (Iwate Univ.)[*] Harmonic function property of the geometry of the surface of Mt. Fuji 15

Summary: We shall propose the fundamental problem whether the height of a mountain may be described by a harmonic function , and answer this problem to Mt. Fuji by inspecting its contour map statistically.

14:30–16:00

Summary: Walsh figure of merit (WAFOM) is a criterion for digital nets, a quasi-Monte Carlo (QMC) method for numerical integration on $[0..1)^s$. It has been introduced by Matsumoto, Saito and Matoba, and gives an upper bound on QMC integration error for a space of functions defined by Dick. We propose that we change the function space according to the amount of resources available and optimize point sets for each function space.

Summary: Quasi Monte Carlo integration for a function f is the approximation of the integration f by the average of f over a finite point set P. In the study of Quasi Monte Carlo integration for a function f over an unit cube by a digital net, it is important to obtain a good point set P which makes the integration error small. For this purpose, it is important to estimate the upper bound of Walsh coefficients $\hat{f}(k)$ of a function f. For a function f in a Sobolev space, the upper bound of $\hat{f}(k)$ by Dick is known. In this talk, we introduce the extra expansion of $\hat{f}(k)$. By using this, we get the improved result in some cases.

Summary: We study an invertible map which admits a weak hyperbolic product structure region, which is the intersection of two transeversal families of weak stable and weak unstable disks, with countably many branches and integrable return times. We introduce that for such maps the hitting time distributions converge to an exponential distribution. Applications of our resutls are some almost Anosov diffeomorphisms.

Summary: Microbial depolymerization processes are categorized into exogenous type and endogenous type. Monomers are separated from the terminals of molecules in an exogenous depolymerization processes. Polymers depolymerized in exogenous type depolymerization processes include polyethylene and polyethylene glycol. Molecules reduce by arbitrary scission in an endogenous type depolymerization process. Polymers depolymerized in endogenous type depolymerization processes include polyvinyl alcohol and polylactic acid. In this presentation, a mathematical model for an exogenous type depolymerization process is described, inverse problems for a time factor and a molecular factor of a degradation rate are illustrated, and numerical results based on experimental results are introduced.

16:15–17:15 Talk Invited by Applied Mathematics Section

Elliott Ginder (Hokkaido Univ.) Methods for approximation of constrained interfacial dynamics

Summary: From cavitation, to the motion of DNA strands and soap bubbles, oscillating and constrained interfacial motions are a recurrent theme in nature and which play an important role in applications. The need for approximation schemes treating these topics is clear and our focus is on the development of methods for multiphase interfacial motions, including possible volume and contact angle constraints. Particular emphasis is on methods of the thresholding dynamical type, of which we have developed an algorithm for approximating acceleration dependent interfacial motions (the so-called hyperbolic mean curvature flow). Here we have found that minimizing movements (MM) provide one with a natural framework for both analyzing constrained evolutionary equations, as well as for realizing the computational implementation of our approximation schemes. In particular, by discretizing time, this approach allows one to construct time-local approximations of the target evolutionary equation as the Euler–Lagrange equations of corresponding energy functionals. In turn, we will show how this variational aspect allows one, by controlling the set of admissible functions for each minimization, to design evolutions with prescribed constraints.

March 24th (Tue) Conference Room VIa

9:45–11:45

32 Hidenori Ogata (Univ. of Electro-Comm.)
Koya Sakakibara (Univ. of Tokyo)
Masashi Katsurada (Meiji Univ.)
Approximations of complex analytic functions by the charge or dipole simulation method 15

Summary: We present an application of the charge or dipole simulation methods, which are known as numerical solvers of boundary value problems of the Laplace equation, to the approximations of the complex analytic functions.

33 Akitoshi Takayasu (Waseda Univ.)
Makoto Mizuguchi (Waseda Univ.)
Takayuki Kubo (Univ. of Tsukuba)
Shin'ichi Oi (Waseda Univ. / JST CREST)
A method of verified computations for solutions to semilinear parabolic equations 15

Summary: This talk presents a numerical method of verifying existence and local uniqueness of a solution for semilinear parabolic equations. The main theorem of this talk gives a sufficient condition for enclosing the solution in a neighborhood of a numerical solution.

34 Yoshitaka Watanabe (Kyushu Univ.)
Takehiko Kinoshita (Kyoto Univ.)
Mitsuhiro T. Nakao
(Sasebo Nat. Coll. of Tech.)

Constructive norm bounds of Laplacian for second-order elliptic operators 15

Summary: This talk presents constructive L^2-norm estimates of Laplacian for second-order elliptic operators with Dirichlet boundary condition. They are applications of the authors' previous result related to a posteriori estimates of inverse operators. These norm estimations are expected to provide invaluabe information for explicit H^2-estimates and pointwise bounds for solutions of second-order elliptic boundary value problems.

35 Daisuke Koyama
(Univ. of Electro-Comm.)
Fumio Kikuchi (Univ. of Tokyo*)

On the robustness of a hybridized DGFEM for nearly incompressible elasticity 15

Summary: We can overcome volume locking if we use our hybridized DGFEM with regular triangulations. To prove this fact, we reformulate the elasticity problem as a Stokes problem with nonzero divergence constrain, and establish a uniform inf-sup condition by constructing a Fortin operator. This inf-sup condition implies that one can use a discontinuous P_k approximation for velocity and a discontinuous P_{k-1} approximation for pressure ($\forall k \in \mathbb{N}$) in our hybridized DGFEM for the Stokes problem with the divergence free constraint.

36 Hirofumi Notsu (Waseda Univ.)
Masahisa Tabata (Waseda Univ.)

Error estimates of Galerkin-characteristics finite element schemes for natural convection problems 15

Summary: Error estimates of Galerkin-characteristics finite element schemes for natural convection problems are proved. A conventional scheme with P2/P1/P2 element and a stabilized scheme with P1/P1/P1 element are considered. The results are optimal and are proved by mathematical induction.

37 Tomoya Kemmochi (Univ. of Tokyo)
Norikazu Saito (Univ. of Tokyo)

An application of discrete maximal regularity to the semilinear heat equation 15

Summary: Maximal regularity is a very significant property for parabolic partial differential equations. It is widely used for analysis of quasilinear parabolic equations and the Navier–Stokes equation. Thus, it is important to consider whether the discrete analogy holds when the equation is discretized for numerical computations. If this is the case, it is expected that the discrete version of maximal regularity can be applied to the error analysis of the numerical approximation for nonlinear equations.
From the above perspective, we have studied the discrete analogy of maximal regularity for abstract linear Cauchy problems. In this talk, we apply these results to the finite element approximation of the semilinear parabolic equation. The time variable is discretized by the backward Euler method. We shall report an optimal error estimate.

14:15–15:45

38 Ippei Obayashi (Kyoto Univ. / JST CREST) — Formation mechanism of basin of attraction for simple bipedal walking models ····· 15

Summary: In this presentation, I will talk about the stability of simple bipedal walking models. Especially, I focus on the geometric structure of basin of attraction. By some numerical computations for the basin of attraction, interesting and complex geometric structures, for example, the region is thin and fractal-like, but the formation mechanism is not known. I will explain the formation mechanism of the basin of attraction using the saddle property and hybridness of bipedal walking models.

39 Takeshi Gotoda (Kyoto Univ.) — The α point vortex system and enstrophy variations ····· 15

Summary: It is considered that enstrophy dissipation in weak solutions of the Euler equations are closely related with the turbulence theory in two dimension. However, it is uncertain what kind of weak solutions can dissipate. Under such a background, I am studying the Euler-alpha equations, specially the alpha-point-vortex system (alpha-PV). Since the alpha-PV is a regularization of the point-vortex system (PV), there is a possibility of obtaining the dissipating solutions of the PV by utilizing the alpha-PV. I will talk about the alpha-PV and the relationship between the alpha-PV and the PV in terms of enstrophy dissipation.

40 Kei Nishi (Hokkaido Univ.), Yasumasa Nishiura (Tohoku Univ.), Takashi Teramoto (Asahikawa Medical Univ.) — On the motion of the two interacting interfaces of a pulse solution in a bistable reaction-diffusion system ····· 10

Summary: The dynamics of a pulse solution arising in a bistable reaction-diffusion system is investigated from a viewpoint of bifurcation theory, by deriving a finite-dimensional ODEs for the motion of the two pulse interfaces. Application to a spatially heterogeneous case will be also mentioned if time permits.

41 Sungrim Seirin Lee (Hiroshima Univ.) — Application of Phase-field method for elucidating the pattern formation of life ····· 15

Summary: We introduce two novel applications of phase-field method to life sciences. One is a mathematical modeling which elucidate the mechanism of chromatin pattern formation in the nucleus. The other is the application for multi-scaling modeling of the cells.

42 Masakazu Akiyama (Hokkaido Univ.), Tomonori Ayukawa (Akita Univ.), Masakazu Yamazaki (Akita Univ.) — A mathematical model of planar cell polarity ····· 15

Summary: Many cells within epithelial tissues display polarity along a particular axis. This axis is perpendicular to the tissue plane and apicobasal axis (from top to bottom of tissues) of the cell. This phenomenon is called “planar cell polarity, PCP”, and is a common phenomenon found in many multicellular organisms. For example, hair cells in the inner ear of humans have many hairs on each individual cell, and since the hairs are regularly arranged on the cell plane, we can hear the sound. Not only hair cells, but fish scales, and body hair on mammals and the wings of birds etc., have cell polarity. As a result, these creatures carry out macroscopic morphogenesis.

In this talk, we will introduce our mathematical model and simulation result. Despite of our model is very simple formulation, it can reproduce various aspects of the PCP.

16:00–17:00 Talk Invited by Applied Mathematics Section

Yuichiro Wakano (Meiji Univ.) Dynamics and its mathematical analysis in evolutionary biology

Summary: Evolution occurs when individuals carry different genes, some individuals are more successful in reproduction than others and hence some genes increase in the next generation. Evolutionary dynamics is complicated if the reproductive success of a focal individual depends not only on her own gene but also on the distribution of genes in the whole population (i.e., evolutionary game theory). Many biologically interesting topics (e.g., cooperative behavior, speciation, viral pathogenesis) have been modeled and studied by using individual-based model (IBM). Several results have been obtained by computer simulations of IBM. In order to fully understand the behavior of IBMs, however, we need a simplified and analytically tractable model which grasps the essence of IBMs. Adaptive Dynamics is one of such models. In this talk, I introduce some important concepts in Adaptive Dynamics; invasion fitness, singular point, convergence stability (CS) and evolutionary stability (ES). Then, replicator-mutator equation, which is a kind of integro-differential equations, is introduced. This formalism allows us to define CS and ES in a straightforward manner by rewriting replicator-mutator equation (single integro-differential equation) with central moment equations (infinite-dimensional ODE). When we adopt the Gaussian distribution assumption, the moment equations become a 2-dimensional ODE system and the traditional result in Adaptive Dynamics are naturally derived. The validity of the Gaussian distribution assumption is discussed.

Topology

March 21st (Sat) Conference Room IVa

9:30–12:00

1 Shouta Tounai (Univ. of Tokyo) * Homotopy types of Frobenius complexes 10

Summary: An affine monoid is an additive monoid which is cancellative, pointed, and finitely generated. A Frobenius complex is the order complex of an open interval of an affine monoid with respect to a certain partial order. Frobenius complexes were introduced by Laudal and Sletsjøe to compute torsion groups and Poincaré–Betti series of some monoid algebras. Clark and Ehrenborg determined homotopy types of Frobenius complexes of some affine monoids by using discrete Morse theory. I extended their result by using basic properties of homotopy colimits, and compute some examples.

2 Ryo Kato (Kochi Univ.) On harmonic invertible spectra 10
Katsumi Shimomura (Kochi Univ.)

Summary: We introduce some new results around of the Hopkins' Picard group of the stable homotopy category of harmonic spectra. In particular we define the notion of normal invertible spectra, and then it is shown that the group has no such spectrum.

3 Masaki Nakagawa (Okayama Univ.) A Gysin formula for the universal Schur functions 15
Hiroshi Naruse (Okayama Univ.)

Summary: It is known that the usual Schur functions can be characterized via the Gysin homomorphism for the flag bundle in the ordinary cohomology theory. In this talk, we introduce a universal analogue of the usual Schur functions, which we call the "universal Schur functions", and give a similar characterization via the Gysin homomorphism for the flag bundle in the complex cobordism theory.

4 Takahito Naito (Univ. of Tokyo) The Sullivan's coproduct on the homology of free loop spaces 10

Summary: In the theory of string topology, Sullivan defined a coproduct on the loop homology which is different from the loop coproduct constructed by Cohen and Godin. In this talk, we give computations of the Sullivan's coproduct and show that the coproduct is a nontrivial operation.

5 Misako Yokoyama (Shizuoka Univ.) The fundamental pregroupoids, the fundamental semi-groups, and the fundamental groupoids of orbifolds 15

Summary: In this paper, we consider b-paths and constant paths in orbifolds, and introduce the fundamental pregroupoids(or category), the fundamental semi-groups, and the fundamental groupoids of orbifolds. The fundamental pregroupoids, semi-groups, groupoids of orbifolds are isomorphism invariants, but not b-homotopy invariants. The fundamental pregroupoids of a discal 2-orbifold and an ordinal 2-disc are not isomorphic, and those of $D^2(3)$ and $D^2(2)$ are not isomorphic.

Summary: In 1987, Brehm and Kühnel proved that every combinatorial triangulation of the product of spheres $\mathbb{S}^i \times \mathbb{S}^j$ has at least $i + 2j + 4$ vertices. Kühnel and Lutz conjectured that a combinatorial triangulation of $\mathbb{S}^i \times \mathbb{S}^j$ has exactly $i + 2j + 4$ vertices if and only if it is a tight triangulation. In this talk, we present some partial affirmative answers to the conjecture of Kühnel and Lutz.

Summary: We consider an embedding of a 2-dimensional CW complex into the 3-sphere, and construct its dual graph. Then we obtain a homogeneous system of linear equations from the 2-dimensional CW complex in the first homology group of the complementof the dual graph. By the non-existence of an integer solution for the homogeneous system of linear equations, we show that some 2-dimensional CW complexes cannot be embedded into the 3-sphere.

Summary: I consider the kernel of the natural projection from the Artin group of dihedral type to the correspoding Coxeter group, which we call a pure Artin group of dihedral type, and present rational function expressions for both the spherical growth series and the geodesic growth series of the pure Artin group of dihedral type with respect to a natural generating set. Moreover, I show that their growth rates are Pisot numbers.

Summary: Thompson group V can be described as a subgroup of the homeomorphism group of the Cantor set C. Brin defined higher dimensional Thompson groups nV as a generalization of V. It is a subgroup of the homeomorphism group of C^n. We prove that the number of ends of nV is equal to 1 and there is a subgroup of nV such that the relative number of ends is ∞. This is the generalization of the corresponding result of Farley on Thompson group V. As a corollary, nV has Haagerup property and does not have the structure of Kähler group.

Summary: We study the topological configurations of lines of curvature, the asymptotic and characteristic curves on a cuspidal edge, in the domain of a parametrisation of this surface as well as on the surface itself. Such configuration is characterized in terms of the 3-jet of the map.

14:15–15:30

11 Miho Hatanaka (Osaka City Univ.) Spin toric manifolds associated to pseudographs 15

Summary: We describe a necessary and sufficient condition for a toric manifold to admit a spin structure. This implies that a toric manifold admits a spin structure if and only if its real part is orientable. It is known that a Delzant polytope can be constructed from a pseudograph, so that one can associate a toric manifold to a pseudograph. We characterize pseudographs whose associated toric manifolds admit spin structures.

12 Hideya Kuwata (Osaka City Univ.) On finiteness of global sections of a certain line bundle on a nice topological toric manifold 10

Summary: Topological toric manifolds was introduced as an analogue of compact smooth toric varieties in the category of closed smooth manifolds by H. Ishida, Y. Fukukawa, M. Masuda. Considering an appropriate line bundle and sections for nice topological toric manifolds, we will show that the space of global sections is finite dimensional.

13 Kazumasa Inaba (Tohoku Univ.) On deformations of isolated singularities of polar weighted homogeneous mixed polynomials 15

Summary: In this talk, we deform isolated singularities of a certain class of polar weighted homogeneous mixed polynomials, and show that there exists a deformation which has only definite fold singularities and mixed Morse singularities.

14 Takefumi Nosaka (Kyushu Univ.) Ddiagrammatic computation for the Blanchfield pairing and twisted Milnor signature 15

Summary: I introduce a summary of diagrammatic computation for the Blanchfield pairing and twisted Milnor signature, from the viewpoint of quandle theory. These results are corollaries of the previous results, which I talked in the plenary session of the last year.

15:45–16:45 Talk Invited by Topology Section

Shoji Yokura (Kagoshima Univ.) On characteristic classes of singular spaces —from a viewpoint of counting—

Summary: I will give a survey on characteristic classes of singular spaces, in particular the three well-known theories of characteristic classes of singular varieties: MacPherson's Chern class (Ann. of Math., 1974), Baum–Fulton–MacPherson's Todd class (Publ. IHES., 1975) and Cappell–Shaneson's L-class (J. Amer. Math. Soc., 1991) (cf. Goresky–MacPherson's L-class (Topology, 1980) , and a "unification" of them. I will start by reviewing counting.

March 22nd (Sun) Conference Room IVb

9:30–12:00

15 Hisashi Kasuya (Tokyo Tech) ♭ Cohomology of polycyclic groups and algebraic groups · · · · · · · · · · · · · · 15

Summary: We show that the group cohomology of torsion-free virtually polycyclic groups and the continuous cohomology of simply connected solvable Lie groups can be computed by the rational cohomology of algebraic groups.

16 Hisashi Kasuya (Tokyo Tech) ♭ Cohomology of algebraic groups and Sullivan's minimal models · · · · · · 15

Summary: We obtain explicit Sullivan's minimal models of certain differential graded algebras defined on simplicial classifying spaces of torsion-free virtually polycyclic groups and we give de Rham homotopy theorem for simplicial complexes with torsion-free virtually polycyclic fundamental groups.

17 Hisashi Kasuya (Tokyo Tech) ♭ Cohomology of proalgebraic groups and 1-minimal models · · · · · · · · · · · 10

Summary: On a simplicial complex or manifold with the fundamental group Γ, for a representation $\rho : \Gamma \to T$ into a reductive algebraic group T with the Zariski-dense image, considering the differential graded algebra of differential forms with values in the coordinate ring of T as a local system, we show that the 1-minimal model of this differential graded algebra is the dual of the Lie algebra of the prounipotent radical of the ρ-relative completion by using the cohomology of proalgebraic groups.

18 Tatsuhiko Yagasaki (Kyoto Inst. Tech.) Taras Banakh (Ivan Franko Nat. Univ. of Lviv) Diffeomorphism groups of non-compact manifolds endowed with the Whitney C^∞-topology · 15

Summary: We discuss topological type of the diffeomorphism group $D(M)$ of any non-compact connected smooth n-manifold M without boundary endowed with the Whitney C^∞-topology. It is shown that the identity connected component $D(M)_0$ of $D(M)$ is homeomorphic to $N \times \mathbb{R}^\infty$ for some ℓ_2-manifold N. For example, if $n = 1$, 2 or $n = 3$ and M^3 is orientable and irreducible, then $D(M)_0$ is homeomorphic to $\ell_2 \times \mathbb{R}^\infty$.

19 Katsuhisa Koshino (Univ. of Tsukuba) The property of being a Baire space of certain function space · · · · · · · · 15

Summary: Let X be a compact metrizable space and Y be a non-degenerate dendrite with a distinguished end point $\mathbf{0}$. For each function $f : X \to Y$, we define the hypo-graph $\downarrow f = \bigcup_{x \in X} \{x\} \times [\mathbf{0}, f(x)]$ of f, where $[\mathbf{0}, f(x)]$ is the unique arc between $\mathbf{0}$ and $f(x)$ in Y. We can regard $\downarrow C(X,Y) = \{\downarrow f \mid f : X \to Y \textit{ is continuous}\}$ as a subspace of the hyperspace consisting of non-empty closed subsets in $X \times Y$ endowed with the Vietoris topology. In this talk, we show that $\downarrow C(X,Y)$ is a Baire space if and only if the set of isolated points of X is dense.

20 Naoki Kato (Univ. of Tokyo) Lie foliations transversely modeled on nilpotent Lie algebras ····· 15

Summary: We talk about the following two problems of realization for Lie foliations. (i) Which pair of Lie algebras $(\mathfrak{g}, \mathfrak{h})$ can be realized as a Lie $\mathfrak{g}$-foliation with the structure Lie algebra $\mathfrak{h}$? (ii) Which pair $(\mathfrak{g}, m)$ can be realized as a Lie $\mathfrak{g}$-flow with the structure Lie algebra $\mathbb{R}^m$? In this talk, we give a complete answer to (i) in the case where $\mathfrak{g}$ is a nilpotent Lie algebra and give a complete answer to (ii) in the case where $\mathfrak{g}$ is a nilpotent Lie algebra with a rational structure.

21 Naoki Kato (Univ. of Tokyo) Classification of solvable Lie flows of codimension 3 ····· 15

Summary: É. Ghys proved that any Lie $\mathfrak{g}$-flow is homogeneous if $\mathfrak{g}$ is a nilpotent Lie algebra. In the case where $\mathfrak{g}$ is solvable, we expect that any Lie $\mathfrak{g}$-flow is homogeneous. In this talk, we talk about this problem in the case where $\mathfrak{g}$ is a three-dimensional solvable Lie algebra.

22 Atsuhide Mori (Osaka City Univ.) * Spinnable foliations of the 5-sphere ····· 15

Summary: We can deform the standard contact structure of the 5-sphere into the spinnable foliations associated to certain Milor fibrations. A topological construction of such foliation will be presented.

13:15–14:15 Talk Invited by Topology Section

Anton Alekseev (Univ. of Geneva) Geometry and Topology of Lie-group valued moment maps

Summary: A Hamiltonian G-space is a symplectic manifold which carries an action of a connected Lie group G preserving the symplectic structure and generated by the moment map with values in the dual of the Lie algebra of G. The classical moment map theory is built around several extraordinary results including the Marsden–Weinstein Reduction Theorem, the Atiyah–Guillemin–Sternberg and Kirwan convexity Theorems, the Duistermaat–Heckman localization and the Guillemin-Sternberg "Quantization commutes with Reduction" principle.

In this talk, we will introduce the theory of Lie group-valued moment maps where the moment map takes values in the group G (instead of the dual of its Lie algebra) and the 2-form on the manifold is relatively closed (rather than closed). Surprisingly, this new theory preserves all the good features of the classical moment map theory while relaxing a number of topological restrictions. Interesting examples for this new formalism are provided by moduli spaces of flat connections on orientable 2-dimensional manifolds.

March 23rd (Mon) Conference Room IVa

9:30–12:00

23 Erika Kuno (Osaka Univ.) Uniform hyperbolicity for curve graphs of nonorientable surfaces ····· 10

Summary: Let $\mathcal{C}(N)$ be a curve graph of a compact connected nonorientable surface N. Bestvina-Fujiwara in 2007 and Masur–Schleimer in 2013 showed that $\mathcal{C}(N)$ is (Gromov) hyperbolic. On the other hand, Aougab, Bowditch, Clay–Rafi–Schleimer, and Hensel–Przytycki–Webb independently proved that curve graphs of orientable surfaces are uniformly hyperbolic in 2013. In this talk, we prove that $\mathcal{C}(N)$ is uniformly 17-hyperbolic applying the Hensel–Przytycki–Webb's argument to the case of nonorientable surfaces, and especially we describe about the differences between the orientable case and the nonorientable case.

24 Yuichi Kabaya (Kyoto Univ.) Exotic components in linear slices of quasi-Fuchsian groups 15

Summary: The linear slice of quasi-Fuchsian punctured torus groups is defined by fixing the length of some simple closed curve to be a fixed positive real number. It is known that the linear slice is a union of disks, and it has one 'standard' component containing Fuchsian groups. Komori–Yamashita proved that there exist non-standard components if the length is sufficiently large. In this talk, I will give another proof based on the theory of complex projective structures.

25 Kenta Hayano (Hokkaido Univ.)
Refik İnanç Baykur (Univ. of Massachusetts)
Multisections of Lefschetz fibrations and topology of symplectic 4-manifolds 15

Summary: A multisection of a Lefschetz fibration is a 2-dimensional submanifold in the total space on which the restriction of the fibration is a simple branched covering. Recently we gave a way to understand topology and configuration of multisections in a combinatorial way via mapping class groups. In this talk we will explain applications of this result to the problems on topology of symplectic 4-manifolds.

26 Takayuki Morifuji (Keio Univ.) Reducibility of automorphisms of Hurwitz surfaces and the η-invariant 10

Summary: In this talk we discuss a relationship between the surface symmetry and the spectral asymmetry. More precisely we show that an automorphism of the Macbeath surface of genus 7, or one of the three Hurwitz surfaces of genus 14 is reducible if and only if the η-invariant of the corresponding mapping torus vanishes.

27 Naoyuki Monden (Osaka Electro-Comm. Univ.)
R. Inanc Baykur (Univ. of Massachusetts)
Jeremy Van Horn-Morris (Univ. of Arkansas)
Positive factorizations of mapping classes 15

Summary: We study which surface mapping classes can be factorized into arbitrarily large number of positive Dehn twists or only of a fixed number. In connection to fundamental questions regarding the uniform topology of symplectic 4-manifolds/Stein fillings of contact 3-manifolds coming from the topology of Lefschetz pencils/open books on them, we completely determine when a boundary multitwist admits arbitrarily long positive Dehn twist factorizations along nonseparating curves, and which mapping class groups contain elements with such factorizations.

28 Jun Murakami (Waseda Univ.) Volumes of hyperbolic and spherical polyhedrons 10

Summary: Formulas for volumes of hyperbolic and spherical polyhedrons are given by using the volume formula for hyperbolic and spherical tetrahedrons. Here a polyhedron is parametrized by its combinatorics and the dihedral angles at every edges. In these formulas some auxiliary parameters are introduced and we have to solve a system of equations with respect to these parameters. If the faces of the polyhedron is given actually, we don's need to solve such equations and we have closed formulas for the volumes of such polyhedrons. These formulas are based on the face model of the $\mathcal{U}_q(sl_2)$ quantum invariant for knotted graphs. This is a joint work with A. Kolpakov.

29 Ken'ichi Yoshida (Univ. of Tokyo) Stable presentation length of 3-manifold groups 15

Summary: We introduce the stable presentation length of a finitely presented group. The stable presentation length of the fundamental group of a 3-manifold is an analogue of the simplicial volume. We explain some similarities of them.

30 Teruaki Kitano (Soka Univ.) Reidemeister torsion of a homology 3-sphere obtained by $\frac{1}{n}$-Dehn surgery along the figure-eight knot for $SL(2,\mathbb{C})$-irreducibe representation 10

Summary: Let M be a homology 3-sphere and $\rho : \pi_1 M \to SL(2,\mathbb{C})$ an irreducible representation. Here we assume that M is obtained by $\frac{1}{n}$-Dehn surgery along the figure-eight knot. We take and fix an element $m \in \pi_1 M$ which is corresponding to a meridian of the group of the figure-eight knot. We give the explicit formula of Reidemeister torsion of M for ρ in terms of the trace of $\rho(m)$.

31 Yoshikazu Yamaguchi (Akita Univ.) The asymptotics of the Reidemeister torsion for Seifert manifolds and $\mathrm{PSL}_2(\mathbb{R})$-representations of Fuchsian groups 10

Summary: I will talk about the asymptotic behavior of the Reidemeister torsion for Seifert manifolds starting with $\mathrm{PSL}_2(\mathbb{R})$-representations of Fuchsian groups.

14:15–16:45

32 Shunsuke Tsuji (Univ. of Tokyo)* The action of Dehn twists and the Johnson kernel on the skein modules 10

Summary: We give an explicit formula for the action of the Dehn twists on the completed skein modules in terms of the action of the completed skein algebra of the surface. As an application, we describe the action of the Johnson kernel on the completed skein modules.

33 Wataru Yuasa (Tokyo Tech)* Skein quantization and Poisson algebras of curves on bordered surfaces 10

Summary: We define Poisson algebras of curves on bordered surfaces. A bordered surface is a surface with boundaries which have marked points on the boundaries. Curves on the bordered surface are oriented loops and oriented arcs with its endpoints in marked points. The Poisson bracket is defined on the symmetric algebra on the vector space spanned by the homotopy classes of curves on the bordered surface. This bracket is an extension of the Goldman bracket, Kawazumi–Kuno's action of loops on arcs and Labourie's swapping bracket. We also define a Poisson cobracket on the Poisson algebra. Therefore, we get a bi-Poisson bialgebra. The Poisson algebra contains the Poisson algebra of unoriented curves. We show that the Kauffman bracket skein algebra of a bordered surface defined by Muller is a quantization of the Poisson algebra of unoriented curves on the bordered surface.

34 Nariya Kawazumi (Univ. of Tokyo) A tensorial description of the Turaev cobracket on compact genus 0 surfaces 15

Summary: We give a tensorial description of the Turaev cobracket on any compact genus 0 surface through the standard exponential expansion.

Summary: We describe a finite presentation of $\mathcal{T}_{g,r}$ for $g \geq 3$. Here $\mathcal{T}_{g,r}$ is the universal central extension of the mapping class group of the surface of genus g with r-boundaries.

Summary: Let $\Gamma_2(n)$ denote the kernel of the natural homomorphism $GL(n;\mathbb{Z}) \to GL(n;\mathbb{Z}_2)$. We call $\Gamma_2(n)$ the level 2 principal congruence subgroup of $GL(n;\mathbb{Z})$. In our work, we obtain an explicit finite presentation of $\Gamma_2(n)$. We note that a finite presentation of $\Gamma_2(n)$ has been independently obtained also by Fullarton and Margalit–Putman recently.

Summary: Let N_g denote a genus-g non-orientable closed surface, that is, N_g is a connected sum of g real projective planes, and let $\mathcal{I}(N_g)$ be the subgroup of the mapping class group of N_g consisting of elements acting trivially on $H_1(N_g;\mathbb{Z})$. We call $\mathcal{I}(N_g)$ the Torelli group of N_g. In our work, we obtain a normally generating set for $\mathcal{I}(N_g)$.

Summary: Let N_g be a closed non-orientable surface of genus g and let $\cdot$ be the mod 2 intersection form on the first homology group $H_1(N_g;\mathbb{Z}_2)$ with $\mathbb{Z}_2$ coefficient of N_g. Then we denote the group of automorphisms on $H_1(N_g;\mathbb{Z}_2)$ preserving the intersection form $\cdot$ by $\mathrm{Aut}(H_1(N_g;\mathbb{Z}_2),\cdot)$. It is known that $\mathrm{Aut}(H_1(N_g;\mathbb{Z}_2),\cdot)$ is finitely presented. In this talk, we give an explicit presentation for $\mathrm{Aut}(H_1(N_g;\mathbb{Z}_2),\cdot)$. As applications we calculate the second homology group of $\mathrm{Aut}(H_1(N_g;\mathbb{Z}_2),\cdot)$ for $g = 7$ and $g \geq 9$, by applying the discussions of Pitsch and using the result of Stein.

Summary: We give an observation of a structure of the symplectic derivation Lie algebra of genus 1 by comparing it with higher genus cases.

Summary: Cheptea, Habiro and Massuyeau constructed the LMO functor, which is defined on a certain category of cobordisms between two surfaces with at most one boundary component. In this talk, we extend the LMO functor to the case of any number of boundary components.

17:00–18:00 Talk Invited by Topology Section

Yusuke Kuno (Tsuda Coll.) * Fatgraph complexes and mapping class groups

Summary: The fatgraph complex associated to an orientable surface is a combinatorial tool to study the Teichmuller space and the mapping class group action on it. This talk is about the study of the fatgraph complex with emphasis on its application to the low dimensional cohomology of the mapping class groups.

March 24th (Tue) Conference Room IVa

9:30–12:00

41 Keiji Tagami (Tokyo Tech) Annulus presentations compatible with fiber surfaces 10
Tetsuya Abe (Tokyo Tech)

Summary: Inspired by Osoinach's and Teragaito's works, Abe, Jong, Omae and Takeuchi introduced the notion of a certain presentation of a knot which is called an annulus presentation. In this talk, we consider annulus presentations of fibered knots and introduce the notion of annulus presentations compatible with the fiber surfaces. Moreover, we describe a relation between the monodromies and the twistings along the annuli. This is a joint work with Tetsuya Abe.

42 Louis H. Kauffman (Univ. of Illinois at Chicago) Local moves on knots and products of knots 10
Eiji Ogasa (Meiji Gakuin Univ.)

Summary: Suppose that a 1-knot J is obtained from a 1-knot K by one crossing-change. Then the $(2\nu+1)$-submanifold $J\otimes^{\nu}[2]\subset S^{2\nu+3}$ is obtained from the $(2\nu+1)$-submanifold $K\otimes^{\nu}[2]\subset S^{2\nu+3}$ by one twist-move. ([2] is the empty knot of degree two. $[2]\otimes[2]$ is the Hopf link.)

A 1-knots J and K are pass-move equivalent if and only if the $(2\nu+1)$-submanifolds $J\otimes^{\mu}$(the Hopf link) and $K\otimes^{\mu}$(the Hopf link)$\subset S^{2\nu+3}$ are $(2\mu+1, 2\mu+1)$-pass-move equivalent.

Let $\mathcal{S}_n$ be the set of n-dimensional simple knots. We assign $K\otimes$(the Hopf link) to an n-knot K. It makes a bijective map $\mathcal{S}_n \longrightarrow \mathcal{S}_{n+4}$, where $n \geqq 5$ if n is odd and $n \geqq 8$ if n is even. (If n takes the other values, some results are obtained by the authors.)

43 Kanako Oshiro (Sophia Univ.) An interpretation of finite-degree connected Alexander quandle colorings 10

Summary: Fox p-colorings of a knot K are interpreted as group representations from the fundamental group of the double branched cover of S^3 with branch set K to $\mathbb{Z}_p$. The interpretation is extended for quandle colorings by connected Alexander quandles of the form $\mathbb{Z}_p[t]/(t^k + a_{k-1}t^{k-1} + \cdots + a_1 t + a_0)$.

44 Makoto Ozawa (Komazawa Univ.)
Yuya Koda (Hiroshima Univ.)
Knot homotopy in subspaces of the 3-sphere · 10

Summary: We say that a knot in a subspace of the 3-sphere is transient if it is moved by a homotopy within the subspace to the trivial knot in the 3-sphere. We show that every knot in a subspace of the 3-sphere is transient if and only if the exterior of the subspace is a disjoint union of handlebodies. Using the notion of transient knot, we define an integer-valued invariant of knots in the 3-sphere that we call the transient number. We then show that the union of the sets of knots with unknotting number one and those with tunnel number one is a proper subset of that with transient number one.

45 Yusuke Takimura
(Gakushuin Boy's Junior High School)
Noboru Ito (Waseda Univ.)
Sub-chord diagrams of knot projections · 10

Summary: In this talk, we introduce a new integer-valued invariant of spherical curves under RI and strong RIII that provides a complete classification of prime reduced spherical curves with up to at least seven double points. The invariant produces the necessary and sufficient condition that spherical curves can be related to a simple closed curve by a finite sequence consisting of RI and strong RIII.

46 Shosaku Matsuzaki (Waseda Univ.)
Noboru Ito (Waseda Univ.)
Circle arrangements on spherical curves · 10

Summary: In this talk, we introduce definitions of circle arrangements for multi-component spherical curves and circle numbers of oriented links. This talk gives a necessary and sufficient condition that any two spherical curves have the same circle arrangements. We also show that every odd (resp. even) component link has circle number one (resp. two).

47 Tetsuya Abe (Tokyo Tech)
Keiji Tagami (Tokyo Tech)
Fibered knots with the same 0-surgery and the slice-ribbon conjecture · 15

Summary: We prove that if the slice-ribbon conjecture is true, then (modified) Akbulut–Kirby's conjecture on knot concordance is false. We also give a fibered potential counterexmaple to the slice-ribbon conjecture. This is a joint work with Keiji Tagami.

48 Motoo Tange (Univ. of Tsukuba)
A traversable theorem of Alexander polynomial of lens space knot · · · · 15

Summary: The Alexander polynomial of a knot yielding lens space has remarkable properties. The coefficients is ± 1 or 0 and the non-zero coefficients are alternating. We will show the below. Lining the coefficients of Alexander polynomial in the plane, we can find a curve which is traversing on the non-zero coefficients. Let $(n_1 > n_2 > n_3 > \cdots)$ be the non-zero coefficients of Alexander polynomial of K. By using the curve, we show the distribution of n_1, n_2, n_3, n_4. As a result, it follows that the adjacent $1, -1$ are not so far away each other.

49 Masakazu Teragaito (Hiroshima Univ.)
Quasi-alternating links and Q-polynomials · 10

Summary: Qazaqzeh and Chbili showed that for any quasi-alternating link, the degree of the Q-polynomial is less than its determinant. We give a refinement of their evaluation.

Summary: The oriented Gordian distance between two oriented links is the minimal number of crossing changes needed to deform one into the other. We compile a table of oriented Gordian distances between 2-component non-splittable links with up to six crossings.

Summary: In this talk, we consider Dehn surgeries on knots in the 3-sphere which yield 3-manifolds with non left-orderable fundamental groups, and report a result that certain twisted torus knots admit such surgeries.

Infinite Analysis

March 23rd (Mon) Conference Room IX

14:15–15:30

1 Takuya Matsumoto (Nagoya Univ. / Nagoya Univ.) — Classical r-matrices and the deformed gravity solutions ····· 15

Summary: In this talk, we will explain the Yang–Baxter sigma models proposed by Klimcik, which provide a systematic way of the integrable deformation of the principal chiral model by utilizing the classical r-matrices. Then, we apply this formulation for the superstring action on the $AdS_5 \times S^5$ background. We will show that some of the deformed backgrounds correspond to the well-known deformed gravity solutions such as Lunin–Maldacena backgrounds. This talk is based on the collaboration works with Kentaroh Yoshida (Kyoto U.) and P. Marcos Crichigno (Utrecht U.).

2 Yas-Hiro Quano (Suzuka Univ. of Med. Sci.) — Form factors of spin 1 analogue of the eight-vertex model ····· 15

Summary: The spin 1 analogue of the eight-vertex model (21-vertex model) is considered on the basis of free field representations of vertex operators in the 2×2-fold fusion SOS model and vertex-face transformation. Correlation functions and form factors in the 21-vertex model can be expressed in terms of type I and type II vertex operators of the corresponding fused SOS model and so-called tail operators. We need the tail operators in order to translate correlation functions and form factors in SOS model into those of elliptic vertex model. For correlation functions we use the tail operators for diagonal matrix elements with respect to the ground state sectors, and for form factors we use the ones for off diagonal matrix elements. In this talk we will construct the free field representations of the tail operators for off diagonal matrix elements with respect to the ground state sectors. As a result, integral formulae for form factors of any local operators in the 21-vertex model can be obtained, in principle.

3 Ayumu Hoshino (Kagawa Nat. Coll. of Tech.), Masatoshi Noumi (Kobe Univ.), Jun Shibahara (Univ. of Tokyo), Jun'ichi Shiraishi (Univ. of Tokyo) — Tableau foumula for Macdonald polynomials of type C_n with one row diagrams ····· 15

Summary: We present explicit formulas for Macdonald polynomials of type C_n with one row diagrams which are called "tableau formulas". For the construction of tableau formulas, we give some transformation formulas of the basic hypergeometric series. We note the relation between Macdonald polynomials and the deformed $\mathcal{W}$ algebras.

4 Masatoshi Noumi (Kobe Univ.), Yasushi Komori (Rikkyo Univ.), Yasuho Masuda (Kobe Univ.) — Duality transformation formulas for multiple elliptic hypergeometric series of type BC ····· 15

Summary: New duality transformation formulas are proposed for multiple elliptic hypergeometric series of type BC and of type C. Various transformation and summation formulas are derived as special cases to recover some previously known results.

5 Masahiko Ito (Tokyo Denki Univ.) Masatoshi Noumi (Kobe Univ.) Derivation of a BC_n elliptic summation formula via the fundamental invariants 15

Summary: We will explain a way to derive a BC_n elliptic summation formula from the fundamental invariants.

15:45–16:45 Talk Invited by Infinite Analysis Special Session

Shintarou Yanagida (Kyoto Univ.) Motivic Hall algebras and quantum toroidal algebras

Summary: For a smooth projective curve defined over a finite field, one can construct Ringel–Hall algebra associated to the abelian category of the coherent sheaves on the curve considered. By Kapranov's work in the late 1990s, a certain subalgebra (so-called the composition subalgebra) of the Ringel–Hall algebra for the projective line is isomorphic to the positive half of the quantum affine algebra for sl_2. By the work of Burban and Schiffmann in the 2000s, an analogue of Kapranov's result holds for the elliptic curve, and the corresponding algebra is the so-called Ding–Iohara–Miki algebra (or the quantum toroidal gl_∞).
In this talk I consider the Ringel–Hall algebras and their composition subalgebras for the singular fibers in the elliptic surfaces. The first main result is that the composition subalgebras for the cycles of the projective lines turns out to be isomorphic to the quantum toroidal gl_n.
The second main result is that these Ringel–Hall algebras have non-trivial symmetry. In the case of the cycle of the projective lines, our non-trivial automorphism coincides with the one found by Miki for the quantum toroidal gl_n.
In order to prove the second result, it is convenient to consider not the original Ringel–Hall algebra but the motivic Hall algebra. The latter one can be introduced for the curves defined over the complex number field. For elliptic surfaces defined over the complex number field, one can consider the relative Fourier–Mukai transforms, and the non-trivial automorphisms mentioned above are the ones induced by these transforms on the Drinfeld doubles of the motivic Hall algebras.

March 24th (Tue) Conference Room IX

9:45–11:45

6 Yoko Shigyo (Tsuda Coll.) Plücker coordinates of the BKP hierarchy 15

Summary: In this talk, I describe the Plücker coordinates of the BKP hierarchy. This Plücker coordinates satisfy the Giambelli type formula. I prove that a formal power series tau(x) is a solution of the BKP hierarchy if and only if the Plücker coordinates satisfy the Giambelli type formula.

7 Saburo Kakei (Rikkyo Univ.) Hirota bilinear method and GUE, NLS, Painlevé IV 15

Summary: Tracy and Widom showed that a Fredholm determinant associated with the Gaussian unitary ensemble (GUE) is related to a particular solution of the fourth Painlevé equation. We reconsider this problem from the viewpoint of Hirota's bilinear method in soliton theory and present another proof.

Summary: We introduce a deformation of the affine Hecke algebra of type GL which describes the commutation relations of the divided difference operators found by Lascoux and Schützenberger and the multiplication operators. Making use of its representation we construct an integrable stochastic particle system. It is a generalization of the q-Boson system due to Sasamoto and Wadati. We also construct eigenfunctions of its generator using the propagation operator. As a result we get the same eigenfunctions for the (q, μ, ν)-Boson process obtained by Povolotsky.

Summary: The tropical periodic Toda lattice (trop p-Toda) is a dynamical system attracting attentions in the interplay of integrable systems and tropical geometry. We show that the Young diagrams associated with trop p-Toda given by two very different definitions are identical. The first definition is given via a Lax representation of discrete periodic Toda lattice, and the second one is associated with a generalization of the Kerov–Kirillov–Reshetikhin bijection in combinatorics of Bethe ansatz. By means of this identification, it is shown for the first time that the Young diagrams given by the latter definition are preserved under the time evolution. This result is regarded as an important first step to clarifying the iso-level set structure of this dynamical system in general cases, i.e. not restricted to generic cases.

Summary: We reformulate the singularity confinement of the discrete Toda equation. We prove that the co-primeness condition, which has been introduced as a new integrability criterion, is satisfied for the discrete Toda equation under several types of boundary conditions (semi-infinite, molecule, and periodic). In particular, we focus on the equation with the periodic boundary condition, and explain how to define the τ-functions compatibly with the boundary condition. We provide a sketch of a proof of irreducibility of the τ-functions. The main theorem on the co-primeness follows from the irreducibility of the τ-functions.

Summary: We study generalized cluster algebras introduced by Chekhov and Shapiro. When the coefficients satisfy the normalization and quasi-reciprocity conditions, one can naturally extend the structure theory of seeds in the ordinary cluster algebras by Fomin and Zelevinsky to generalized cluster algebras. As the main result, we obtain formulas expressing cluster variables and coefficients in terms of c-vectors, g-vectors, and F-polynomials. Furthermore, quantization can be formulated using the generalized quantum dilogarithms.

12 Kohei Iwaki (Kyoto Univ.) Exact WKB analysis and cluster algebras II ····· 15
Tomoki Nakanishi (Nagoya Univ.)

Summary: This is a continuation of developing mutation theory in exact WKB analysis using the framework of cluster algebras. Here we study the Schrodinger equation on a compact Riemann surface with turning points of simple-pole type. We show that the orbifold triangulations by Felikson, Shapiro, and Tumarkin provide a natural framework of describing the mutation of Stokes graphs, where simple poles correspond to orbifold points. We then show that under the mutation of Stokes graphs around simple poles the Voros symbols mutate as the variables of generalized cluster algebras introduced by Chekhov and Shapiro.

14:15–15:30

13 Takeshi Morita (Osaka Univ.) A bilateral extension of the Ramanujan entire function ····· 15

Summary: In this talk, we introduce a bilateral extension of the Ramanujan entire function. We study the connection problem on the q-difference equation which the extended function satisfies. We also define the "extended" q-Borel–Laplace transformations to study the connection problem.

14 Toshiyuki Mano (Univ. of Ryukyus) * Flat structure on the space of isomonodromic deformations ····· 15
Mitsuo Kato (Univ. of Ryukyus)
Jiro Sekiguchi
(Tokyo Univ. of Agri. and Tech.)

Summary: In this talk, we show the extence of a *flat structure without potential* on the space of isomonodromic deformations, which implies the equivalence between a generalization of the WDVV equation and the (full-parameter) Painlevé VI equation as a particular case.
We also show the existence of a *flat generator system* of the ring of invariant polynomials of a finite irreducible complex reflection group, which corresponds to an algebraic solution of a (higher-order) Painlevé type equation.

15 Hideshi Yamane (Kwansei Gakuin Univ.) Asymptotic analysis for the integrable discrete nonlinear Schrödinger equation ····· 15

Summary: We study the asymptotic behavior of a solution to the defocusing integrable discrete nonlinear Schrödinger equation (Ablowitz–Ladik model). We employ the inverse scattering transform and the Deift–Zhou nonlinear steepest descent method.

16 Takao Suzuki (Kinki Univ.) Drinfeld–Sokolov hierarchy of type $A_5^{(1)}$ and Simpson's even four hypergeometric function ····· 15

Summary: In a recent work, the sixth order Painlevé system which contains Simpson's even four hypergeometric function as a particular solution has been proposed. In this talk, we investigate its relationship to the Drinfeld–Sokolov hierarchy of type $A_5^{(1)}$ corresponding to a partition $(2, 2, 2)$ of natural number 6.

17 Hiroyuki Kawamuko (Mie Univ.) Initial value space of the second Matrix Painlevé equation ····· 10
Yoshiaki Ushiku (Mie Univ.)

Summary: We construct the initial value space of the second Matrix Painlevé equation by using Backlund transformations.

15:45–16:45 Talk Invited by Infinite Analysis Special Session

Hidetaka Sakai (Univ. of Tokyo) Studies on the Painlevé equations

Summary: We will look over theories on the Painlevé equations. The Painlevé equations are expected to define new special functions as their solutions, next to elliptic functions and hypergeometric functions.

The Painlevé equations were originally defined as second order algebraic ODE's of normal form, satisfying the Painlevé property. But if we only present a set of eight nonlinear ODE's, we seem to be unable to convey true figure of the equations. They are natural generalizations of elliptic functions, and this kind of generalization is only the eight Painlevé equations. In this talk, we see them as a non-autonomous analog of biquadratic Hamiltonian system, which is solved by elliptic functions.

From this formulation, we naturally obtain a correspondence to certain rational surfaces, and we can understand symmetries of equations, or particular solutions called Riccati solutions, by using the surfaces' theory.

The Painlevé equations are also derived from a deformation theory of linear ODE's. This is the second foundation of studies on the Painlevé equations. In this talk, we will see this concept connecting to a generalization to higher dimensional case.