Final Version: 2016/08/25

Mathematical Society of Japan

2016 Autumn Meeting

Titles and Short Summaries of the Talks

September, 2016

at Kansai University

Final Version: 2016/08/25

2016 Mathematical Society of Japan
AUTUMN MEETING

Dates: September 15th (Thu)–18th (Sun), 2016

Venue: Senriyama Campus, Kansai University
3–3–35 Yamate-cho, Suita, Osaka 564-8680

Contact to: Kansai University,
Graduate School of Science and Engineering
E-mail kansai16sept@mathsoc.jp
During session: Phone +81 (0) 90 1791 3483
Mathematical Society of Japan
Phone +81 (0) 3 3835 3483

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	MSJ Prizes Presentation (BIG Hall 100) ····· (14:30–15:00) Plenary Talks (BIG Hall 100) MSJ Autumn Prize Winner ····· (15:10–16:10) Shigefumi Mori (Kyoto Univ.) ····· (16:25–17:25) Official Party (Mediapark "RINPUKAN") ····· (18:00–20:00)								
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Plenary Talks

September 16th (Fri) BIG Hall 100

MSJ Autumn Prize Winner ..... (15:10–16:10)

70th Anniversary Lecture

Shigefumi Mori (Kyoto Univ./Kyoto Univ.) Rational curves on algebraic varieties —minimal models and extremal rays— ..... (16:25–17:25)

Summary: I have been studying algebraic varieties through rational curves on them. I was first interested in a special problem called the Hartshorne Conjecture, and when I solved it I encountered a notion called an extremal ray as a biproduct, through which I got attracted to the biregular classification and the minimal model program, and furthermore to a general theory of higher dimensional birational classification. Reviewing them, I will also touch the study of 3-dimensional extremal contractions which I have been interested in.

Featured Invited Talks

September 15th (Thu)

Conference Room II

Guest Talk from Taiwan Mathematical Society

Tai-Chia Lin (Nat. Taiwan Univ.) Analysis of Poisson–Nernst–Planck type equations and its applications ..... (13:00–14:00)

Summary: The Poisson–Nernst–Planck (PNP) system is a well-known model of ion transport, which belongs to Keller–Segel type systems and plays a crucial role in the study of many physical and biological phenomena. With a small parameter ε, PNP systems over annular domains have steady state boundary layer solutions with radial symmetry, which profiles form boundary layers near boundary curves and become flat in the interior domain as ε approaches zero. For the stability of boundary layer solutions to the radial PNP systems, we estimate the solution of the perturbed problem of the radial PNP system (with respect to the boundary layer solution) with global electroneutrality. We prove that the H_r^{-1} norm of the solution of the perturbed problem decays exponentially (in time) with exponent independent of ε if the coefficient of the Robin boundary condition of electrostatic potential has a suitable positive lower bound. The main difficulty is that the gradients of boundary layer solutions on boundaries may blow up as ε tends to zero. The main idea of our argument is to transform the perturbed problem into another parabolic system with a new and useful energy law for the proof of the exponential decay estimate.

Due to the size effect of crowded ions, we derive extra diffusion terms from the energy functional with hard-sphere repulsion and get PNP-steric equations. Symmetry and non-symmetry breaking conditions are represented by their coupling coefficients. When symmetry breaking condition holds true, two steady state solutions can be found and the excess currents (due to steric effects) associated with these two steady state solutions are derived and expressed as two distinct formulas. Our results indicate that PNP-steric equations may become a useful model to study spontaneous gating of ion channels.

Conference Room VII

70th Anniversary Lecture

Takashi Kumagai (Kyoto Univ.) Anomalous diffusions on disordered media ..... (13:00–14:00)

Summary: In this talk, we summarize results concerning anomalous behaviour of random walks and diffusions on disordered media. Examples of disordered media include fractals and various models of random graphs, such as percolation clusters, random conductance models, Erdős–Rényi random graphs and uniform spanning trees. Geometric properties of such disordered media have been studied extensively and their scaling limits have been obtained. Our focus here is to analyse properties of dynamics on such media. Due to the inhomogeneity of the underlying spaces, we observe anomalous behaviour of the heat kernels and obtain anomalous diffusions as scaling limits of the random walks. We will give a chronological overview of the related research, and describe how the techniques have developed from those introduced for exactly self-similar fractals to the more robust arguments required for random graphs.

Conference Room IX

70th Anniversary Lecture

Kenji Fukaya (Simons Center for Geometry and Physics, SUNY) — Present status of the proof of homological Mirror symmetry ····· (13:00–14:00)

Summary: Homological Mirror symmetry is prposed by M. Kontsevitch in 1996 as a way to understand Mirror symmetry beyond the coincidence of various numbers. It decribe Mirror symmetry as an equivalence of two categories: one is derived category of coherent sheaves on complex manifold, the other is so called Fukaya category, whose object is a Lagrangian submanifold of a symplectic manifolds (together with certain data) and the morphisms between two objects are Floer homology. At the begining homological Mirror symmetry was a difficult subject to study and thought widely believed to be correct, examples where it was confirmed was restricted to elliptic curve and partially a higher dimensional complex torus. Recent developement changes the situation and now there are many cases where homological Mirror symmetry is proved, and various approaches exists for its proof. I would ilke to survey some of them.

September 17th (Sat)

Conference Room I

70th Anniversary Lecture

Toshiyuki Kobayashi (Univ. of Tokyo / Univ. of Tokyo) — Birth of new branching problems ····· (13:00–14:00)

Summary: The local to global study of geometries was a major trend of 20th century, with remarkable developments achieved particularly in Riemannian geometry. In contrast, surprising little was known 30 years ago about global properties of locally homogeneous spaces with indefinite-metric, which led us to the theory of discontinuous groups beyond the Riemannian setting.

Concerning linear actions (representation theory), one of fundamental problems is to understand how things are built from smallest objects (irreducible decomposition). Branching problems are typical case, but were supposed to be out of control for reductive Lie groups. Breakthrough ideas for branching problems in representation theory emerged partially from the study of discontinuous groups beyond Riemannian setting, and conversely, they have opened new research such as global analysis of indefinite-Riemannian locally symmetric spaces (e.g. anti-de Sitter manifolds).

Based on the developments over the last two decades, we present a program on branching problems, from the general theory to concrete construction of symmetry breaking operators.

Conference Room IX

70th Anniversary Lecture

Tohru Eguchi (Rikkyo Univ.) String theory and moonshine phenomenon ····· (13:00–14:00)

Summary: Several years ago we have discovered a curious phenomenon in string theory, i.e. the appearance of exotic new discrete symmetry in its spectrum. Specifically we have found that the group M24 acts on the elliptic genus of string theory compactified on the K3 surface. This phenomenon appears somewhat similar to the famous monstrous moonshine in the sense that the symmetry under some esoteric discrete group suddenly appears in the series expansion of modular functions or (mock) Jacobi forms. We were able to compute analogues of McKay–Thompson series and the group action of M24 has been proved mathematically in all orders of expansion of K3 elliptic genus in q. Unfortunately, however, we still do not have simple understanding or physical explanation of this moonshine phenomenon. Recently several more examples of new moonshine phenomena have been discovered and are receiving much attentions. There are still many puzzles and mysteries which are waiting for our resolutions.

September 18th (Sun)

Conference Room I

70th Anniversary Lecture

Kazuya Kato (Univ. of Chicago)♭ On recent developments in Number Theory ····· (13:00–14:00)

Summary: I describe several big progresses in number theory which happened in these twenty years. One subject is to introduce the great progresses in Langlands correspondences which led to the solution of Sato–Tate conjecture. Another subject is the progresses in (generalized) Iwasawa theory. I also hope to introduce some works in the area which I myself had studied (ramification theory, etc.).

Conference Room II

70th Anniversary Lecture

Hitoshi Ishii (Waseda Univ.) Viscosity solutions and asymptotic problems ····· (13:00–14:00)

Summary: It is about 35 years since the notion of viscosity solution for partial differential equations was introduced by M. G. Crandall and P.-L. Lions. The theory of viscosity solutions has developed with a close connection with its applications to asymptotic problems on partial differential equations. In my talk, I will discuss the development of study in viscosity solutions and asymptotics problems featuring on the vanishing discount problem for fully nonlinear second-order elliptic equations including Hamilton–Jacobi–Bellman equations.

Foundation of Mathematics and History of Mathematics

September 17th (Sat) Conference Room VIII

9:30–11:20

1 Makoto Tamura (Osaka Sangyo Univ.) Indeterminate equation in "Shu" housed at Yuelu Academy ····· 15

Summary: We see one problem on indeterminate equation in the *Shu* housed at *Yuelu* Academy. Unlike the other problems, the procedure in the text was meaningless. Later, in 5th century, the similar problem was treated as Hundred Hens Problem in the *Zhangqiujian Suanjing*, where the principle of the solution was shown; however, the calculations in its annotation made no sense. Thus even though the procedure had not been solved, it is a significant fact that indeterminate equation had already been considered in the era of *Qin* dynasty.

2 Shunzi Horiguchi (Niigata Sangyo Univ.) Handwriting analysis of Chinese characters in the Koutaku Hosoi work Hiden Chiiki Zuhou Daizensyo and Koutaku Hosoi autograph 1000 characters of ten bodies ····· 15

Summary: We do the Handwriting analysis of Chinese characters in the Koutaku Hosoi work Hiden Chiiki Zuhou Daizensyo and Koutaku Hosoi autograph 1000 characters of ten bodies.

3 Mitsuo Morimoto (Yokkaichi Univ./Sophia Univ.*) Volume 12 (Geometric Quantities) of the *Taisei Sankei* and the *Tetsujutsu Sankei* ····· 15

Summary: Takebe Katahiro (1664–1739) wrote the *Tetsujutsu Sankei* (Mathematical Treatise on the Technique of Linkage, 1722) and published his discovery on the infinite series expansion of the arc length in terms of the sagitta. This is exactly the Taylor expansion of an inverse trigonometric function. Takebe claimed he had arrived at this discovery considering sagittas smaller and smaller. More than 10 years earlier, Takebe Katahiro, Takebe Kata'akira and Seki Takakazu completed the encyclopedic work of mathematics, the *Taisei Sankei* (Great Accomplished Mathematical Treatise (20 Volumes), 1711), Volume 12 of which treats the same topic as the *Tetsujutsu Sankei*. At two double lined notes of Volume 12, it was remarked the situation where the sagitta becomes extremely small.

4 Shigeru Jochi (Osaka Kyoiku Univ.) The evaluation of the questions on the mathematical votive tablets by AIDA Yasuaki ····· 15

Summary: There were few systematic study about the mathematical votive tablets in Japan. Mathematicians at the Seki School collected questions on the mathematical votive tablets, then published these questions in 18th century. But there were no critical evaluation by mathematicians. We discovered the Zoku Shiheki Sanpo Gyorin (AIDA Yasuaki, 1708) at Taiwan University Library. We can know that this book was written at the same year with the Zoku Shiheki Sanpo (FUJITA Sadasuke, FUJITA Kagen, 1807). AIDA Yasuaki studied the Zoku Shiheki Sanpo quickly, then evaluated questions in this book. We can understand the evaluation by mathematicians at the same age.

5 Shigeru Masuda (Res. Workshop of Classical Fluid Dynamics) — The contributions by Lagrange, Laplace and Legendre to the mathematical ground of heat theory ····· 15

Summary: The heat theories are made up of the integral theories, core theory of the mathematics, contributed by Euler, Lagrange, Laplace, Legendre, Fourier, Poisson, et al., in the arena of mathematical physics. We occupied so far these topics. In this session, especially, we talk about Lagrange's, Laplace' and Legendre's reciprocal works which Fourier and Poisson absorb.

6 Shigeru Masuda (Res. Workshop of Classical Fluid Dynamics) — The mathematical digressions in the heat theories come from Fourier and Poisson ····· 15

Summary: We discuss the mathematical digressions on the heat problems, comparing the books by Fourier and Poisson. The latter is late 13 years from Fourier, however, he works since 1815. Not only the title and its volume, both also discuss each the mathematical points in the mathematical physics. Both are made up of, not come from the basis of the pure phicist but the phisical mathematician.

11:30–12:00 Mathematics History Team Meeting

14:15–16:00

7 Shotaro Tanaka — Representations of k^p and $\Sigma^k n^p$ by suida ····· 15

Summary: Suida theory had founded by T. Seki and completed by Y. Wada. The definition is: $d_p(k) \equiv (p+k-1)!/p!(k-1)! = (1/p!)k(k+1)\cdots(k+p-1)$, Rule: $d_p(k-1) + d_{p-1}(k) = d_p(k)$, (integer $p \geqq 0, k$: natural number). We call it (suida, p order, number k). formula (A): $d_1(k)d_p(K-\alpha) = (1+\alpha)d_{p+1}(K-\alpha) + (p-\alpha)d_{p+1}(K-\alpha-1)$, (integer $\alpha \geqq 0$). (A-1): $d_1(k)d_p(K) = d_{p+1}(K) + pd_{p+1}(K-1)$. (A-2): $d_1(k)d_p(K) = (1+p)d_{p+1}(K) - pd_p(K)$. Then we have Ex. 1-1. By (A-2), $k^4 = 24d_4(k) - 36d_3(k) + 14d_2(k) - d_1(k)$. Ex. 1-2. By (A-2), $\Sigma^k n^4 = 24d_5(k) - 36d_4(k) + 14d_2(k) - d_2(k)$. 1 order up!

8 Ken Saito (Osaka Pref. Univ.) — Syntactic analysis of the whole text of Euclid's *Elements* ····· 15

Summary: The extant text of Euclid's *Elements* contains considerable additions and emendations of later commentators, which we know from different readings of Greek manuscripts and Arabo–Latin traditions. However, even where all the manuscripts agree, the genuineness of the text is not guaranteed, for the text may have been altered before the archetype reconstructed from the extant testimonies. If we performed syntactic analysis of every sentence of the *Elements*, we could hope to find syntactic inhomogeneity which would suggest traces of later interventions.

9 Michiyo Nakane — Algebra and analysis vs. algebraic analysis in 18th century ····· 15

Summary: Noting the similarity of procedures between Islamic algebra and Greek analysis, mathematicians used algebra and analysis in the same meaning in 17th century. A modern historian of mathematics describes that they developed algebraic analysis. In 18th century mathematicians began to give different meaning to analysis from that of algebra. The other historian adopts the term of algebraic analysis to characterize Euler's theory developed in his book of 1748. This paper clarifies the difference of two historians' usage of algebraic analysis noting the change of mathematicians' attitude.

Summary: The Rudin–Keisler ordering for ideals over $P_\kappa\lambda$ is defined by $J \leq I$ if $J = f_*(I) = \{X \subset P_\kappa\lambda : f^{-1}[X] \in I\}$ for some $f : P_\kappa\lambda \to P_\kappa\lambda$.
Let $I_{\kappa,\lambda}$ be the bounded ideal, that is the minimal ideal over $P_\kappa\lambda$ and $NS_{\kappa,\lambda}$ be the non-stationary ideal, that is the minimal normal ideal.
We show $NS_{\kappa,\lambda} \not\subset J$ if $J \leq I_{\kappa,\lambda}$ and there is an unbounded set with the cardinality λ.

Summary: Von Neumann asked whether the countable chain condition and the weak distributivity characterize measure algebras. From this problem, Maharam, and Horn and Tarski asked problems on Boolean algebras respectively. These two problems has been negatively solved by Taragrand and Thümmel respectively. They solved then by introducing new ccc complete Boolean algebras. In my talk, these new ccc cBas are examined from forcing theoretic viewpoint.

Summary: In the context of ZF, we prove the following: Suppose either 1) there is a poset which forces the axiom of choice, or 2) there are proper class many supercompact cardinals. Then every ground model of the universe is uniformly definable.

16:15–17:15 Talk Invited by Section on Foundation and History of Mathematics

Summary: In the proofs of Gödel's incompleteness theorems, a formula $\mathrm{Pr}_T(x)$ expressing the relation "x is provable in T" plays an essential role. Such a formula is called a provability predicate. In this talk, we discuss a close connection between the incompleteness theorems and provability predicates. Also we give an overview of modal logical investigations of provability predicates.

September 18th (Sun) Conference Room VIII

9:30–11:20

13 Takashi Oyabu ♭ The mathematical principle of the natural philosophy · · · · · · · · · · · · · · · 5

Summary: 1. The mathematical principle of the natural philosophy
NEWTONIAN: PRINCIPIA: MODERN MATHEMATICAL PRINCIPLE OF THE NATURAL PHILOSOPHY: ====DIFF(M): −MATHEMATICS: AUT(R): −MATHEMATICS: ===DIFFEOMORPHISM::DIFFERENTIAL EQUATION:
2. On consistency
ON THE CONSISTENCY PROBLEM OF THE GEOMETRY K[X]/I:::I==0 ::V=V(I): G*(I)=I: CONSISTENCY OF THE NUMBER SYSTEM OF K: CONSISTENCY OF AUT(R): −MATHEMATICS: SOME PROBLEMS ARE DISCUSSED
3. Group·ring·field
GALOIS GEOMETRY WAS PROPOSED:: ALGEBRAIC FUNCTION::: K[X]/I;:;G*(I) =I: V=G\H::K(V)G=K(V);: G=SnXSL2(Z): AUTOMORPHIC FUNCTIONS:
4. Symmetric space and Laplacian
THE SPACE WHICH WE USUALLY ENCOUNTER IS MOSTLLY SYMMETRIC SPACE: METRIC====>LAPLACIAN:: INVARIANT METRIC; INVARIANT DIFFERENTIAL OPERATOR: ΔG=GΔ G FORMS A GROUP: G=======>DIFF(M);: G=======>AUT(R): M=G/K::?????G/Σ:???
5. Steady state
Ut= 0::Uit=:: STEADY STATE:: NON-EQUILIBRIUM:: dS= 0:: diS= −deS: PHASE TRANSITION: EIGEN-VALUE PROBLEM: PU=EU:LERAY-SCHAUDER 1934: Jox−λcx+N(X:λ)= 0: SYMMETRY;;SYMMETRY BREAKING: BIFURCATION:GAUGE THEORY;: MASS PRODUCTION MECHANISM:
6. Geometry
THE HISTORY OF THE GEOMETRY: MANIFOLD@@ZERO:@@@LOCALLY: MODERN ABSTRACT ALGEBRA: ====MODERN ALGEBRAIC GEOMETRY: SCHEME THEORY: KLEINNIAN: MY THOUGHTS::
R<====================>SPEC(R)
DIFF(R) AUT(R):G:G':G":
R================>SPEC(R):
R================>M(R):

14 Nobu-Yuki Suzuki (Shizuoka Univ.) Weak variants of disjunction and existence properties in intermediate predicate logics · 15

Summary: We discuss relationships between the *disjunction* and *existence properties* (DP and EP), and their weak variants in intermediate predicate logics. We determined relationships among EP, the *weak existence property* (wEP) and the *sentential existence property* (sEP) in my previous presentation at MSJ Spring Meeting 2015. In [5] we introduced Z*-normality*, which is a very weak variant of DP, and used it to consider the relations between DP and EP; that is, EP plus Z-normality imply DP. We show relationships among these properties, and their combinations.

Summary: Let $\{\to\} \subseteq \mathcal{S} \subseteq \{\to, \wedge, \vee, \neg\}$ and $\mathbf{H}$ be the intuitionistic propositional calculus. An intermediate propositional calculus $\mathbf{L}$ is separable if $\mathbf{L}$ satisfies the following : (1) for every $\mathcal{S}$-formula α satisfies $\mathbf{L} \vdash \alpha$, there is a deduction of α contains no logical symbols other than $\mathcal{S}$; (2) each of axiom of $\mathbf{L}$ contains at most two logical symbols, one of them being the implication if there are exactly two. The Gabbay–de Jongh logic $\mathbf{D}_m$ ($m \geq 2$) is defined by all Kripke frames of finite m-ary tree. Gabbay and de Jongh proved $\mathbf{D}_m$ is axiomatized by the calculus $\mathbf{H} + A_m$, where $A_m = \bigwedge_{i=0}^{m}((p_i \to \bigvee_{j\neq i} p_j) \to \bigvee_{j\neq i} p_j) \to \bigvee_{i=0}^{m} p_i$ (the conjunction ($\bigwedge$) occurs in A_m can be easily removed). We give a separable axiomatization of Gabbay–de Jongh logic $\mathbf{D}_m$ and prove $\mathbf{H} + A_m$ is not separable by using algebraic method with Jankov's characteristic formula.

Summary: A set of propositional formulas Γ has strong disjunction property, if $B \vee C$ is provable from instances $A_1, A_2, \ldots, A_n$ of Γ then B or C is provable from $A_1, A_2, \ldots, A_n$.
We give an example of fomulas with strong disjunction property by modifying Anderson's proof for the disjunction property of Scott's logic.

Summary: Intuitionistic second order propositional logic is obtained from intuitionistic propositional logic by adding quantifiers which bind propositional variables. In this talk, we give alternative proofs of the completeness of two variants of intuitionistic second order propositional logic with respect to Kripke models. One is the logic having the full comprehension axiom, and the other has the constant domain axiom in addition. Moreover we show that the constant domain axiom is not needed for the completeness with respect to constant domain models if the language does not have disjunction.

Summary: Shelah–Spencer's random graph is a generic structure with the full amalgamation property. It is known that this generic structure is strictly stable. We prove that a generic structure with the full amalgamation property is stable.

Summary: It is well-known that a countable complete theory is ω-categorical if and only if the number of the n-types is finite, for all n. This does not remain true for an uncoutable theory. We give several critical examples of uncountable theories with $I(\omega, T) = 1$. We also present a conjecture concerning such theories.

11:30–12:00 Research Section Assembly

14:15–16:00

20 Toshio Suzuki (Tokyo Metro. Univ.) Separation of parallel advice and serial advice on real-time deterministic context-free languages 15

Summary: Non-uniform computation is well-studied for resource-bounded Turing machines. On the other hand, unlike Turing machines, pushdown automaton reads an input string under rigid regulations. Thus, when we study non-uniform computation of pushdown automaton, we confront the following question: Do the serial advice and the parallel advice have equal computational power? In this talk, we investigate the question for real-time deterministic context-free languages. By combining palindromes and random strings, we show that the parallel class is not a subset of the serial class.

21 Kenshi Miyabe (Meiji Univ.) On computability of reals on the space where the triangle inequality does not hold 15

Summary: There are some study on weaker computability of reals such as weak computability and computable approximability. In this talk we define notions between them and show that the hierarchy does not collapse. These notions can be extended to real functions and are used to study the relation between L^p-computability and layerwise computability.

22 Kohtaro Tadaki (Chubu Univ.) An operational characterization of the notion of probability by algorithmic randomness III 15

Summary: The notion of probability plays an important role in almost all areas of science and technology. 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 our former works, based on the toolkit of algorithmic randomness we presented an operational characterization of the notion of probability for an arbitrary discrete probability space. We used the notion of Martin–Loef randomness with respect to Bernoulli measure and its extension over Baire space to present the operational characterization. In this talk, we present an operational characterization of the notion of probability to an arbitrary probability space whose sample space is Cantor space in a strong setting regarding the effectiveness in the decision of which outcome occurred.

23 Kenetsu Fujita (Gunma Univ.) On the Church–Rosser theorem 15

Summary: The Church–Rosser theorem in the type-free lambda-calculus is well investigated both for beta-equality and beta-reduction. We provide a new proof of the theorem for beta-equality with no use of parallel reductions, but simply with Takahashi translation (Gross–Knuth reduction strategy). Based on this, upper bounds for reduction sequences on the theorem are obtained as the fourth level of the Grzegorczyk hierarchy.

24 Satoru Kuroda (Gunma Pref. Women's Univ.) A formal system of Sprague–Grundy theory 15

Summary: It is known that computing the winning strategies of various combinatorial games are complete for the class PSPACE. Many of such games satisfy the condition for Sprague–Grundy theory which generalizes the seminal result on the game NIM, so Grundy numbers play important rolls in computing such strategies. In this talk we show that the theory PV extended by a function which computes Grundy numbers of the game Node Kayles, which is known to be PSPACE-complete, captures PSPACE.

Summary: In this talk, I will show that the proof-theoretic strength of Ramsey's theorem for pairs and two colors is the same as that of primitive recursive arithmetic, and the proof-theoretic strength of Ramsey's theorem for pairs and arbitrary many color is the same as that of $\mathrm{I}\Sigma^0_2$.

Algebra

September 15th (Thu) Conference Room I

9:30–11:45

1 Hideto Asashiba (Shizuoka Univ.) Decomposition theory of modules: the case of Kronecker algebra ····· 15
Ken Nakashima (Shizuoka Univ.)
Michio Yoshiwaki
(Shizuoka Univ. / Osaka City Univ.)

Summary: Let A be a finite-dimensional algebra over an algebraically closed field k. For any finite-dimensional A-module M we give a general formula that computes the indecomposable decomposition of M without decomposing it. As an example we apply this formula to the Kronecker algebra A and give an explicit formula to compute the indecomposable decomposition of M, which enables us to make a computer program.

2 Kenta Ueyama (Hirosaki Univ.) Graded endomorphism algebras of cluster tilting modules ····· 10

Summary: In this talk, we study the relationship between equivalences of noncommutative projective schemes and cluster tilting modules. Let A be an AS-Gorenstein algebra of dimension $d \geq 2$. If the noncommutative projective scheme of A has finite global dimension, and A has a $(d-1)$-cluster tilting module X satisfying that its graded endomorphism algebra is $\mathbb{N}$-graded, then the graded endomorphism algebra B of a ν-stable $(d-1)$-cluster tilting submodule of X is a two-sided noetherian AS-regular algebra over B_0 of dimension d such that the noncommutative projective schemes of B and A are equivalent.

3 Yuta Kozakai (Tokyo Univ. of Sci.) On two-sided tilting complexes for Brauer tree algebras ····· 10
Naoko Kunugi (Tokyo Univ. of Sci.)

Summary: We construct a two-sided tilting complex corresponding to a one-sided tilting complex taking Brauer tree algebras as an example.

4 Sota Asai (Nagoya Univ.) bricks and 2-term simple-minded collections ····· 15

Summary: We are interested in bricks of a finite-dimensional algebra A over an algebraically closed field K, which is an A-module with $\mathrm{End}_A(M) = K$. By Schur's lemma, every simple A-module is an example of a brick. In this talk, we construct a correspondence between the "nice" sets of bricks in the module category $\mathrm{mod}\, A$ and the 2-term simple-minded collections in the bounded derived category $D^{\mathrm{b}}(\mathrm{mod}\, A)$. We prove that it is a bijection. As applications, we introduce some concepts on the module category and the derived category which have one-to-one correspondences between the nice sets of bricks.

5 Shigeto Kawata (Osaka City Univ.) * Auslander–Reiten components and vertecies for group rings ····· 10

Summary: Let $\mathcal{O}G$ be the group ring of a finite group G over a complete discrete valuation ring $\mathcal{O}$. Let L be an indecomposable $\mathcal{O}G$-lattice belonging to a block of $\mathcal{O}G$ of infinite representation type, and let Θ be an Auslander–Reiten component containing L. Let Q be a vertex of L. Suppose that a kG-module $L/\pi L$ has an indecomposable direct summand with Q as a vertex. Then Q is a vertex of Θ.

Summary: For a positive integer n and a finite tensor category $\mathcal{C}$ over an algebraically closed field k, we define the n-th indicator $\nu_n(\mathcal{C}) \in k$ of $\mathcal{C}$. If $\mathcal{C}$ is the representation category of a finite-dimensional Hopf algebra H, then $\nu_n(\mathcal{C})$ is equal to the n-th indicator $\nu_n(H)$ of H introduced and studied by Kashina, Montgomery and Ng. Thus we give a conceptual proof of the gauge invariance of $\nu_n(H)$.

Summary: Let G be a group and A a finite-dimensional algebra over a field k that is given by a quiver Q with relations. When A is G-graded by a *G-weight*, i.e., by a map : $Q_1 \to G$, we give a quiver presentation of the smash product $A\#G$. We apply this to Brauer graph algebras to give a way how to compute their coverings. Namely, for a group G (not necessarily abelian or finite) and a Brauer graph with an admissible G-weight we define their smash product, which is again a Brauer graph and is a covering of the original one with group G, and introduce another presentation of a Brauer graph, which is convenient for describing the smash product and also Brauer quivers. When G is a finite abelian group, it gives simple descriptions of coverings of Brauer graphs investigated by Green–Schroll–Snashall.

Summary: Throughout this talk $\Bbbk$ is a commutative ring. A 2-cateogrical covering theory (developed in arXiv:0807.4706, 0905.3884, 1111.2239, 1204.0196 and their journal paper versions) enables us to have strict arguments on coverings of $\Bbbk$-categories in wide range, which sometimes makes the argument clear and simple as the present application shows. We are interested in when the orbit category of a triangulated category by an auto-equivalence is again triangulated. An answer was given by Keller, which was practical in many cases such as in defining cluster categories. When $\Bbbk$ is an algebraically closed field we give a special constructive theorem to have this phenomenon, which gives an alternative simple unified proof of the key statement of a result due to Grimeland–Jacobsen (arXiv:1508.02970).

14:15–15:45

Summary: In this study, we worked on the structure of two-sided Harada rings. In particular, focusing on the position of i-pair, by examining the relation of right Harada rings and left Harada rings, we studed the structure of two-sided Harada rings.

Summary: Let G be a finite group, and let A be a finite abelian on which G acts via a homomorphism from G to the group of automorphisms of A. For a subgroup H of G, let $\Omega(H)$ denote the Burnside ring of H, and let $\Omega(H, A)$ denote the monomial Burnside ring of H with respect to A. The multiplicative induction map $\Omega(H, A) \to \Omega(G, A)$ is defined as a generalization of the tensor induction map $\Omega(H) \to \Omega(G)$. Tensor induction for 1-cocycles plays an important role in a description of multiplicative induction.

11 Shuhei Kamioka (Kyoto Univ.) Product formulae for skew plane partitions and the discrete two-dimensional Toda molecule 15

Summary: A close connection between skew plane partitions and a discrete dynamical system, the discrete two-dimensional (2D) Toda molecule, is revealed. In particular a new product formula for skew plane partitions is derived from a specific solution to the discrete 2D Toda molecule. The new product formula gives a boxed generalization of the trace generating function for reverse plane partitions of any shape derived by E. R. Gansner.

12 Naoki Genra (Kyoto Univ.) Screening operators for W-algebras 10

Summary: We show that all W-algebras defined by the generalized Drinfeld–Sokolov reduction with generic level are isomorphic to the vertex subalgebras of the tensor vertex superalgebras of a universal affine vertex superalgebra and a neutral fermion vertex superalgebra, which are the intersections of kernels of the screening operators. As applications, we prove two conjectures for the isomorphisms between some vertex superalgebras and the certain W-algebras.

13 Shunsuke Tsuchioka (Univ. of Tokyo)
Masaki Watanabe (Univ. of Tokyo) On a general Schur partition theorem 15

Summary: In 1926, Schur found a mod 6 analog of Rogers–Ramanujan partition theorem. In this talk, we will give a generalization of Schur partition theorem for $p \geq 3$. When $p = 3$, it is the Schur partition theorem. When $p = 5$, it is a partition theorem that was proposed by Andrews in a course of his 3 parameter generalization of Rogers–Ramanujan identities in 1970s and settled affirmatively in 1994 by Andrews–Bessenrodt–Olsson utilizing computers. Our proof is based on representation theory of quantum groups, especially Kashiwara's crystal theory.

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

Satoshi Naito (Tokyo Tech) Character formula for Demazure submodules of level-zero extremal weight modules and a specialization of Macdonald polynomials

Summary: We first prove a character formula for Demazure submodules of level-zero extremal weight modules over a quantum affine algebra, which is described in terms of the (parabolic) quantum Bruhat graph associated with the finite Weyl group W and the corresponding finite root system. Then, we show a recursive formula for the characters of Demazure submodules above, which is described by the (so-called) Demazure operators associated with elements of the affine Weyl group. Also, we give a combinatorial formula for the specializations at $t = 0$, $t = \infty$ of the nonsymmetric Macdonald polynomial $E_{w_0\lambda}(x; q, t)$ associated with the longest element w_0 of the finite Weyl group W and a dominant integral weight λ, which is again described in terms of the (parabolic) quantum Bruhat graph. Finally, by combining the formulas above, we explain the relationship between the (graded) characters of Demazure submodules associated with the identity element e and longest element w_0 of W, and the specializations at $t = 0$, $t = \infty$ of the nonsymmetric Macdonald polynomial $E_{w_0\lambda}(x; q, t)$.

September 16th (Fri) Conference Room I

9:20–12:00

14 Haruhisa Nakajima (J. F. Oberlin Univ.) * Pseudo-reflections of stable regular actions of finite central extensions of algebraic tori in free characteristics 10

Summary: Pseudo-reflections of linear representations of groups can be extended to the affine group actions on affine Krull domains over an algebraically closed field K. Consider an affine group G with an algebraic torus G^0 and give a criterion for G to be a central extension of G^0 in terms of valuations of between affine normal G-domains and their invariant rings. Next, we study on pseudo-reflections of a regular action of a finite central extension G of G^0 on an affine normal domain R. We show that pseudo-reflections of G on R^{G^0} can be lifted to ones of G on R in characteristic-free.

15 Akiyoshi Tsuchiya (Osaka Univ.) On the sign patterns of the coefficients of Hilbert polynomials 10

Summary: In this talk, we discuss whether all sign patterns of the coefficients of Hilbert polynomials of standard graded k-algebras are possible or not.

16 Akiyoshi Tsuchiya (Osaka Univ.), Takayuki Hibi (Osaka Univ.) Flat δ-vectors and their Ehrhart polynomials 15

Summary: We call the δ-vector of an integral convex polytope of dimension d flat if the δ-vector forms $(1, 0, \ldots, 0, a, \ldots, a, 0, \ldots, 0)$, where $a \geq 1$. In this talk, we give the complete characterization of possible flat δ-vectors. Moreover, we discuss their Ehrhart polynomials.

17 Akihiro Higashitani (Kyoto Sangyo Univ.), Kohji Yanagawa (Kansai Univ.) Non-level semi-standard graded Cohen–Macaulay domains with h-vectors (h_0, h_1, h_2) 15

Summary: Let k be an algebraically closed field of characteristic 0, and $A = \bigoplus_{n \geq 0} A_n (A_0 = k)$ a graded Cohen–Macaulay domain with the h-vector (h_0, h_1, h_2). If A is standard graded, then it is known that A is always level. However, we will show that if A is semi-standard, then A can be non-level (even in the normal case). However, in this case, we will also show that $h_1 + 1$ must divide h_2.

18 Kazunori Matsuda (Osaka Univ.) *, Hidefumi Ohsugi (Kwansei Gakuin Univ.), Kazuki Shibata (Rikkyo Univ.) Toric rings and ideals of stable set polytopes 15

Summary: In this paper, we discuss the normality of the toric rings of stable set polytopes, and the set of generators and Gröbner bases of toric ideals of stable set polytopes by using the results on that of edge polytopes of finite nonsimple graphs. In particular, for a graph of stability number two, we give a graph theoretical characterization of the set of generators of the toric ideal of the stable set polytope, and a criterion to check whether the toric ring of the stable set polytope is normal or not. One of the application of the results is an infinite family of stable set polytopes whose toric ideal is generated by quadratic binomials and has no quadratic Gröbner bases.

19 Ryota Okazaki (Fukuoka Univ. of Edu.) On construction of $\mathbb{Z}$-graded finite free resolutions of finitely generated $\mathbb{Z}$-graded modules over a polynomial ring 10

Summary: In this talk, we present a method to construct, canonically, a $\mathbb{Z}$-graded (not necessarily minimal but) *finite* free resolution for *any* $\mathbb{Z}$-graded finitely generated module over a polynomial ring (over a field). The construction is quite simple; in the resolution, each free module is described by some finite dimensional subspace of the given module and each differential map is defined by making use of multiplication of the variables.

20 Tadahito Harima (Niigata Univ.) * The EGH conjecture and the Sperner property of complete intersections 10
Akihito Wachi (Hokkaido Univ. of Edu.)
Junzo Watanabe (Tokai Univ.*)

Summary: A garded Artinian K-algebra $A = \oplus_{i=0}^{c} A_i$ is said to have the Sperner property if $\max\{\mu(\mathfrak{a})\} = \max\{\dim_K A_i\}$, where $\mu(\mathfrak{a})$ is the minimal number of generators of $\mathfrak{a}$ and $\mathfrak{a}$ runs over all ideals in A. It is a long standard conjecture that every complete intersection has the Sperner property. We show that if the EGH (Eisenbud–Green–Harris) conjecture is true for a complete intersection A, then A has the Sperner property.

21 Akihito Wachi (Hokkaido Univ. of Edu.) The Strong Lefschetz property of zero-dimensional complete intersection with the action of the symmetric group 15
Tadahito Harima (Niigata Univ.)
Junzo Watanabe (Tokai Univ.*)

Summary: We prove that any quadratic complete intersection with a certain action of the symmetric group has the strong Lefschetz property over a field of characteristic zero. Furthermore we discuss under what conditions its ring of invariants by a Young subgroup is a homogeneous complete intersection with a standard grading.

22 Futoshi Hayasaka * A formula for the associated Buchsbaum–Rim multiplicity of a direct sum of cyclic modules 10
(Hokkaido Univ. of Edu.)

Summary: In this talk, we will give a formula for the last positive Buchsbaum–Rim multiplicity of a direct sum of cyclic modules in terms of the Hilbert–Samuel multiplicity of a certain ideal associated to the direct sum of cyclic modules. This can be viewed as a generalization of Kirby–Rees formula for the associated Buchsbaum–Rim multiplicities of a direct sum of cyclic modules in a special case.

23 Hiraku Kawanoue (Kyoto Univ.) $^\flat$ On embedded resolution for surfaces 15

Summary: Resolution of singularities over an algebraically closed field of positive characteristic is open if the dimension is greater than 3, and embedded version is open if the dimension is greater than 2. We introduce our approach for this problem, called Idealistic Filtration Program (IFP for short). IFP yields an alternative proof for embedded resolution of surfaces. We discuss the current status of this problem and the novelty of our proof.

13:00–14:00 Talk Invited by Algebra Section

Yoshiyuki Kimura (Kobe Univ.) Quantum unipotent subgroups and dual canonical bases

Summary: Quantum unipotent subgroups are the quantum analogue of the coordinate ring of unipotent subgroups associated with finite (or cofinite) biconvex subset of positive roots. Quantum unipotent subgroups of finite type were introduced by De Concini–Kac–Procesi and also by Lusztig as the quantized coordinate ring of Schubert cells. In this talk, we discuss the compatibility between the Lusztig–Kashiwara dual canonical bases and quantum unipotent subgroups. As an application of the compatibility and the multiplicity-free property of the multiplications among base elements, we obtain the tensor product decomposition of the half of quantized universal enveloping algebra associated with a Weyl group element that was conjectured by Berenstein and Greenstein using the theory of the dual canonical basis. We also discuss the behaviour of the dual canonical bases under quantum analogue of twist maps. Part of this talk is based on joint work with Hironori Oya.

September 17th (Sat) Conference Room I

9:20–11:15

24 Shigeru Iitaka (Gakushuin Univ.*) On Euler's perfect numbers 10

Summary: Let P be a prime and m an integer.
If $\varphi(P^e)+1+m$ is prime, then $a=P^eq$ is called φ perfect number with transition parameter m.
Thus we obtain

$$P\varphi(a)=(P-1)a-P(\mathrm{Maxp}(a)-1)+Pm. \tag{1}$$

Here, let $\mathrm{Maxp}(a)$ denote the highest prime factor of a.
If $m\geq 0$, the equation can be solved rather easily.
If $m<0$, the equation can be solved for small negative numbers m.

25 Genki Shibukawa (Osaka Univ.) Modified higher order Fibonacci and Lucas numbers 10

Summary: We introduce a higher order analogue of classical Fibonacci and Lucas numbers from the view point of special values of complete symmetric polynomials and power symmetric polynomials. Especially, we substitute division values of cosine for the variables in the complete symmetric polynomials and power symmetric polynomials, which we call "modified higher order Fibonacci numbers" and "modified higher order Lucas numbers" respectively, and establish fundamental properties of our Fibonacci and Lucas numbers precisely.

26 Takao Komatsu (Wuhan Univ.) Incomplete multi-poly-Bernoulli numbers 15

Summary: By using the restricted and associated Stirling numbers of the second kind, we define the incomplete multi-poly-Bernoulli numbers which generalize poly-Bernoulli numbers. We study their analytic and combinatorial properties. As an application, we present a new infinite series representation of the multiple zeta values via the Lambert W. We also give similar results for incomplete Bernoulli numbers of Hurwitz type and incomplete multi-poly-Bernoulli-star numbers.

27 Yoshitaka Sasaki (Osaka Univ. of Health and Sport Sci.)
Ohno Yasuo (Tohoku Univ.)
On sum formula for generalized poly-Bernoulli numbers 10

Summary: We first show certain sum formula for poly-Bernoulli numbers. Secondly, we describe its generalization.

28 Kazuhito Kozuka * (Miyakonojo Nat. Coll. of Tech.)
On power sums for lattice points in certain rational polytopes and multiple Dedekind sums 15

Summary: In this talk, as a generalization of counting lattice points in rational polytopes, we consider power sums for the lattice points. In the main result, higher order multiple Dedekind sums appear. In the special case of one dimensional polytopes, the result reduces to the well known formula due to Takakazu Seki and Jakob Bernoulli.

29 Takashi Miyagawa (Nagoya Univ.) * Mean values of the Barnes zeta-function 10

Summary: In recent years, as the multiple analogues of the mean value of the Riemann zeta-function, the mean values of sevral double zeta-functions have been studied. In this talk, we introduce result of asymtotic formulas for mean squre values of the Barnes double zeta-function $\zeta_2(s,\alpha;v,w)=\sum_{m=1}^{\infty}\sum_{n=1}^{\infty}(\alpha+vm+wn)^{-s}$ with respect to $\mathrm{Im}(s)$.

30 Makoto Minamide (Yamaguchi Univ.) *
Jun Furuya (Hamamatsu Univ. School of Medicine)
Yoshio Tanigawa
On the approximate functional equation for $\zeta'(s)^2$ 10

Summary: Let $\zeta(s)$ be the Riemann zeta function. Hardy and Littlewood proved the approximate functional equation for $\zeta(s)^2$. Later, Titchmarsh improved the error term in the equation. Using the method of Hardy and Littlewood Hall showed the approximate functional equation for $\zeta'(s)^2$. Applying the method of Titchmarsh we now improve the error term.

31 Maki Nakasuji (Sophia Univ.)
Ouamporn Phuksuwan((Chulalongkorn Univ.)
Jacobi–Trudi type formula for Schur multiple zeta functions 10

Summary: Schur multiple zeta function was introduced by Yamasaki (2010) as an analogues of the Schur functions. In this study, we obtain the analogue of Jacobi–Trudi formula of Schur functions for Schur multiple zeta functions. The first formula is the expression of the Schur multiple zeta function as a determinant in terms of the multiple zeta functions, and the second formula is that as a determinant in terms of the multiple zeta-star function of the Euler–Zagier type. These two formulae lead us to the family of the relations between multiple zeta values and multiple zeta-star values.

11:30–12:00 Research Section Assembly

14:20–15:15

32 Fumitake Hyodo (Kawasaki Univ. of Med. Welfare) Formal power series of Hecke rings associated with some Lie algebras 15

Summary: We study formal power series with coefficients in Hecke rings associated with some Lie algebras, and relate our results to the rationality theorems of classical Hecke series and zeta functions of Lie algebras.

33 Yuichi Shimada (Nagoya Univ.) Modularity lifting and Oda's conjecture for Hilbert modular varieties 10

Summary: In the theory of modularity lifting due to Kisin, by considering the behavior of local deformations at unramified primes we obtained a new result for the global structure of the Galois representations associated to Hilbert modular forms. It also gives a result for Oda's conjecture for the Galois representations (ℓ-adic realization of motives) obtained from Hilbert modular varieties. In this talk I would like to explain these results.

34 Hiroyasu Miyazaki (Univ. of Tokyo) An invariance property of higher Chow groups with modulus and its applications 15

Summary: The higher Chow group with modulus of a pair (X, D), where X is an algebraic scheme and D a Cartier divisor, is an object introduced by Binda–Saito as a common generalization of Bloch's higher Chow group and the additive higher Chow group. In this talk, we formulate and prove a generalization of $\mathbb{A}^1$-homotopy invariance of Bloch's higher Chow group to an invariance property of higher Chow groups with modulus, called cube invariance. As applications, over a field of positive characteristic $p > 0$, we can prove that the higher Chow group with modulus with p inverted is $\mathbb{A}^1$-homotopy invariant and is independent of the multiplicity of modulus divisor D.

15:30–16:30 Talk Invited by Algebra Section

Takuya Yamauchi (Tohoku Univ.) Serre conjecture for GSp4 and weight reduction theorem

Summary: In this talk I will explain my recent work on a kind of weight reduction theorem for mod p Siegel modular forms of degree 2 without increasing level via Galois representations. The weight we are concerning here means the classical weight and it corresponds to a couple of non-negative two integers. We introduce various theta operators to reduce the difference of such integers and make use of partial Hasse invariants to reduce the lower one.

16:40–17:40 Talk Invited by Algebra Section

Takeshi Saito (Univ. of Tokyo)♭ Characteristic cycle of an ℓ-adic sheaf

Summary: For an ℓ-adic sheaf on a smooth variety over a perfect field, its characteristic cycle is defined as a $\mathbf{Z}$-linear combination of irreducible components of the singular support defined as a closed conical subset of the cotangent bundle, recently by Beilinson. It gives an analogue of that defined by Kashiwara–Schapira in a transcendental setting. We will discuss its basic properties, including the index formula, relation with the MacPherson Chern class, etc.

September 18th (Sun) Conference Room I

9:30–11:45

35 Tomohiro Iwami (Kyushu Inst. of Tech.) * Construction of deformation family of semistable extremal neighborhoods via framed form fans 15

Summary: For some of datum required to the division algorithm which gives some criterion for the existence of divisorial or flipping contraction for a 3-dimensional semi-stable extremal neighborhood given by Prof.Shigefumi Mori, the author describe them by framed form fans (or,fixed form fans,or,"kotei-keisiki-oogi",in japanese),which correspond to toric varieties for formal schemes or formal fans,developed by Prof.Masanori Ishida,and show a construction of formal family for 3-dimensional semistable extremal neighborhoods.

36 Khulan Tumenbayar (Tokyo Metro. Univ.) Examples of Zariski pairs for arrangements of line-conic-irreducible with 2 nodes and 1 cusp 15

Summary: Let $\mathcal{Q}$ be an irreducible quartic with two nodes and one cusp as its singularities and let $\mathcal{C}$ be a conic such that the intersection multiplicity at each point of $\mathcal{C} \cap \mathcal{Q}$ is even and $\mathcal{C} \cap \mathcal{Q}$ contain at least one smooth point z_o of $\mathcal{Q}$. In this talk, considering conics $\mathcal{C}$ as above we construct Zariski pairs of degree 7 and degree 8, whose irreducible components consist of $\mathcal{Q}$, $\mathcal{C}$ and line passing through two of the singular points of $\mathcal{Q}$.

37 Hirokazu Nasu (Tokai Univ.) Obstructions to deforming curves lying on a $K3$ surface in a Fano 3-fold 15

Summary: We study the deformations of a smooth curve C on a smooth Fano threefold V, assuming that C is contained in a smooth $K3$ surface $S \subset V$. We give a sufficient condition for C to be (un)obstructed in V, in terms of (-2)-curves and elliptic curves on S. Applying this result, we prove that the Hilbert scheme of smooth connected curves on a smooth quartic threefold $V_4 \subset \mathbb{P}^4$ contains a generically non-reduced irreducible component.

38 Kiwamu Watanabe (Saitama Univ.) * A characterization of symplectic Grassmanianns 15

Summary: We provide a characterization of symplectic Grassmannians in terms of their varieties of minimal rational tangents.

39 Ryo Kawaguchi (Nara Medical Univ.) The volume of integral convex polytopes and the sectional genus of polarized varieties 15

Summary: As is well known, an increasing amount of works have revealed the relation between the volume of an integral polytope and the number of lattice points in it. In fact, however, it is not easy to carry this computation out. This difficulty comes from the intricate behavior of the number of lattice points in a dilated polytope. Therefore, from the application standpoint, it is desirable to find a more simple formula. In this talk, we give a lower bound for the volume of a three-dimensional integral convex polytope. Moreover, we see that this bound is attained if and only if the associated polarized toric variety is a Castelnuovo variety.

Summary: Let $f : X \to Y$ be a smooth morphism between smooth projective varieties. It is known that if X is Fano or a variety with the nef anti-canonical divisor, then so is Y. Furthermore in characteristic zero, if X is weak Fano, then so is Y. In this talk, we will discuss surjective morphisms between smooth projective varieties with F-pure general fibers, and show that (generalizations of) the above results hold in positive characteristic. Also, we show that relative anti-canonical divisors are not nef and big in any characteristic.

Summary: Ogus and Vologodsky constructed a positive characteristic analogue of Simpson's correspondence (Cartier transform) over the complex number field between local systems and Higgs bundles. One of the key technical results for their construction is the fact that the sheaf of differential operators of level 0 forms an Azumaya algebra over its center. In this talk, we generalize the Azumaya nature of the sheaf of differential operators to the case of log differential operators of higher level. We also give some splitting modules of this Azumaya algebra over a certain infinitesimal neiborhood to get the equivalence between certain $\mathcal{D}$-modules and certain Higgs modules. Our result can be regarded as a generalization of results of Ogus–Vologodsky and Gros–Le Stum–Quirós to the case of log schemes and that of Schepler to the case of higher level.

14:15–15:45

Summary: In this talk, we deal with 2-dimensional traceless representations in characteristics 2. We construct the moduli of representations with unipotent mold over $\mathbb{F}_2$. We also introduce the moduli of tilde representations with unipotent mold over $\mathbb{F}_2$. We describe explicitly the moduli in the finitely generated free monoid case.

Summary: In this talk, we discuss an upper bound of the Rouquier dimension of triangulated categories associated with a singular variety. Rouquier dimension, which is first introduced by Rouquier, is a concept of dimension for triangulated categories. I will give new upper bounds for the Rouquier dimensions of the derived and singularity category of varieties that have at worst rational isolated singularity. At the end of the talk, we will also discuss some results for the Orlov's dimension spectrum of singularity categories for hypersurface singularities.

Summary: To an exact endofunctor of a triangulated category with a split-generator, the notion of entropy is given by Dimitrov–Haiden–Katzarkov–Kontsevich, which is a (possibly negative infinite) real-valued function of a real variable. It is important to evaluate the value of the entropy at zero in relation to topological entropy. Actually, we prove that the entropy of a derived pull-back of a smooth projective variety is equal to its topological entropy, and propose a conjecture which naturally generalizes the theorem by Gromov–Yomdin. When the dimension is one or the (anti-)canonical sheaf is ample, we show that the conjecture is true. Some contents of this talk are based on a joint work with Atsushi Takahashi.

Summary: We develop theory of Dolbault complex on complex projective vaeieties.

Geometry

September 15th (Thu) Conference Room IX

9:30–11:40

1 Keita Kunikawa (Nagoya Univ.)[b] Rigidity of eternal solutions to Lagrangian mean curvature flow ····· 15

Summary: Eternal solutions to mean curvature flow appear after the parabolic rescaling near type II singularities. Translating solitons are typical examples of eternal solutions. In codimension one, R. Hamilton showed that complete convex eternal solutions whose curvature attains its maximum at a point in space-time must be translating solitons. However this fact is still not clear in higher codimension. So, it is natural to consider not only translating solitons, but also eternal solutions to study type II singulaties. In this talk, I will show a non-existence result for eternal solutions to almost calibrated Lagrangian mean curvature flow.

2 Naoyuki Koike (Tokyo Univ. of Sci.) Long time behavior of the volume-preserving mean curvature flow for tubes in rank one symmetric spaces of non-compact type ····· 15

Summary: First we state the evolutions of the radius function and its gradient along the volume-preserving mean curvature flow starting from a tube (of nonconstant radius) over a compact closed domain of a reflective submanifold in a symmetric space under certain condition. In particular, we consider the case where the ambient space is a rank one symmetric space of non-compact type and the reflective submanifold is an invariant submanifold and the radius function of the initial tube is radial. In this case, we prove that one of the following statements holds: (I) The flow reaches to the invariant submanifold, (II) The flow converges to another tube of constant mean curvature over the invariant submanifold in infinite time.

3 Hiroshi Konno (Meiji Univ.) Examples of Lagrangian mean curvature flows via torus actions ····· 15

Summary: Suppose that a torus acts on a Calabi–Yau manifold, preserving its Kähler structure and admitting a moment map. In addition, suppose that there exists a special Lagrangian submanifold which is perpendicular to the torus orbit at each point. Then we construct examples of Lagrangian mean curvature flows in the Calabi–Yau manifold. Moreover, we describe some examples of Lagrangian mean curvature flows in 4-dimensional ALE spaces in detail. In particular, we describe the structures of singularities of the flows explicitly.

4 Ryosuke Takahashi (Tohoku Univ.) Bergman iteration and C^∞-convergence towards Kähler–Ricci flow ··· 10

Summary: Bergman iteration is a numerical algorithm to find a solution of Kähler–Ricci flow. We study the limiting behavior of Bergman iteration and show the C^∞-convergence towards Kähler–Ricci flow.

5 Masaya Kawamura (Tokyo Metro. Univ.) On the non-existence of static pluriclosed metrics on non-Kähler minimal complex surfaces ····· 15

Summary: The pluriclosed flow is an example of Hermitian flows generalizing the Kähler–Ricci flow. We classify static pluriclosed solutions of the pluriclosed flow on non-Kähler minimal compact complex surfaces. We show that there are no static pluriclosed metrics on Kodaira surfaces, non-Kähler minimal properly elliptic surfaces and Inoue surfaces.

6 Ryosuke Nomura (Univ. of Tokyo) Blow-up behavior of the scalar curvature along the conical Kähler–Ricci flow 15

Summary: We investigate the scalar curvature behavior along the normalized conical Kähler–Ricci flow ω_t, which is the conic version of the normalized Kähler–Ricci flow, with finite maximal existence time $T < \infty$. We prove that the scalar curvature of ω_t is bounded from above by $C/(T-t)^2$ under the existence of a contraction associated to the limiting cohomology class $[\omega_T]$. This generalizes Z. Zhang's work to the conic case.

7 Ryosuke Nomura (Univ. of Tokyo) Schwarz lemma for cone metrics 15

Summary: The Schwarz–Pick lemma states that any holomorphic map between the unit disk in the complex plane decreases the Poincaré metrics. This result was generalized in many ways. Jeffres obtained the Schwarz lemma for cone metrics. His results was restrictive in cone angles. We generalized his result to more general cone angles.

8 Takumi Yokota (Kyoto Univ.) Convex functions and p-barycenter on CAT(1)-spaces of small radii 10

Summary: CAT(1)-spaces are metric spaces with curvature ≤ 1 in the sense of Alexandrov. The main theorem states that the p-barycenter of probability measures concentrated on a ball of small radius exist and are unique on complete CAT(1)-spaces. Several properties, e.g. variance inequality, of p-barycenter on CAT(1)-spaces are also presented. Moreover, we can formulate and prove an analogue of Banach–Saks property with p-barycenter for CAT(1)-spaces.

14:15–15:40

9 Homare Tadano (Osaka Univ.) Remark on lower diameter bounds for compact Ricci solitons 15

Summary: In this talk, inspired by Fernández–López and García–Río, we shall give a new lower diameter bound for compact non-trivial shrinking Ricci solitons depending on the potential function, as well as on the scalar curvature. Moreover, using a universal lower diameter bound for compact non-trivial shrinking Ricci solitons by Chu and Hu and by Futaki, Li and Li, we shall provide a new sufficient condition for four-dimensional compact non-trivial shrinking Ricci solitons to satisfy the Hitchin–Thorpe inequality. We shall also give a lower diameter bound for compact self-shrinkers of the mean curvature flow.

10 Homare Tadano (Osaka Univ.) Some Ambrose and Galloway type theorems via Bakry–Émery and modified Ricci curvatures 15

Summary: In this talk, we shall establish some compactness theorems of Ambrose and Galloway types for complete Riemannian manifolds via Bakry–Émery and modified Ricci curvatures. Our compactness theorems generalize previous ones obtained by Fernández–López and García–Río, Wei and Wylie, Limoncu, Rimoldi and Zhang.

11 Homare Tadano (Osaka Univ.) Diameter bounds, gap theorems and Hitchin–Thorpe inequalities for compact quasi-Einstein manifolds 15

Summary: In this talk, we shall give some lower diameter bounds for non-trivial compact quasi-Einstein manifolds in terms of the Ricci and scalar curvatures. As an application, we shall give a gap theorem for compact quasi-Einstein manifolds by showing a necessary and sufficient condition for the manifolds to be Einstein. Moreover, following recent work by Ma and by Brasil, Costa and Ribero Jr., we shall provide some sufficient conditions for four-dimensional compact quasi-Einstein manifolds to satisfy the Hitchn–Thorpe inequality and to be isometric to the standard four-dimensional sphere $\mathbb{S}^4$. Finally, we shall prove that under some simple conditions, a four-dimensional compact quasi-Einstein manifold with harmonic self-dual part of the Weyl tensor must be Kähler–Einstein.

12 Youhei Sakurai (Univ. of Tsukuba) Rigidity phenomena in manifolds with boundary under a lower weighted Ricci curvature bound 15

Summary: In this talk, we talk about rigidity phenomena in Riemannian manifolds with boundary under a lower N-weighted Ricci curvature bound for N at most 1, and under a lower weighted mean curvature bound for the boundary. For such manifolds with boundary, we establish a splitting theorem under the assumption of the existence of a single ray orthogonally emanating from the boundary. We also prove a volume growth rigidity theorem for the metric neighborhoods of the boundaries. Furthermore, we show a rigidity theorem for the smallest Dirichlet eigenvalues for the weighted p-Laplacians.

13 Nobuhiro Innami (Niigata Univ.) Parallel axiom and differentiability of Busemann functions 15

Summary: Busemann has introduced a function to develop the theory of parallels in G-spaces. The function is called a Busemann function after him. Busemann functions have been used in Riemannian and Finslarian geometry at infinity. We study the relation of Parallel Axiom to the 2-nd order differentiability of Busemann functions.

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

Kei Kondo (Yamaguchi Univ.) Non-smooth analysis and differentiable sphere theorems

Summary: We establish an approximation method for a Lipschitz map via diffeomorphisms using the notion of non-smooth analysis established by F. H. Clarke, and we apply our method to prove differentiable sphere theorems: As a main theorem, we prove that a Lipschitz map from a compact Riemannian manifold M into a Riemannian manifold N admits a smooth approximation via immersions if the map has no singular points on M in the sense of Clarke, where $\dim M \leq \dim N$. As its corollary, we have that if a bi-Lipschitz homeomorphism between compact manifolds and its inverse have no singular points in the same sense, respectively, then they are diffeomorphic. As applications of the main theorem, we have two differentiable sphere theorems for a pair of topological spheres admitting a single cut point of some point, in which that of exotic ones is included. Moreover, we have that if a compact n-manifold M satisfies certain two conditions for critical points of its distance function in the sense of Clarke, then M is a twisted sphere and there exists a bi-Lipschitz homeomorphism between M and the unit n-sphere $S^n(1)$ which is a diffeomorphism except for a single point. As corollaries from this result, we observe that if an exotic 4-sphere Σ^4 exists, then Σ^4 does not satisfy one of the two conditions in the result; furthermore we have that for any Grove–Shiohama type n-sphere X, there exists a bi-Lipschitz homeomorphism between X and $S^n(1)$ which is a diffeomorphism except for one of points that attain their diameters. This is joint work, arXiv:1408.6036, with Minoru Tanaka.

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

Nicola Gigli (SISSA) Nonsmooth differential geometry

Summary: Aim of the talk is to give an overview on some recent results of mine concerning the possibility of developing differential calculus both on abstract metric measure spaces and on spaces with Ricci curvature bounded from below.
Specifically, building on top of some ideas of Weaver, I shall describe in which sense general metric measure spaces possess a weak first order differential structure. The construction is based on the notion of L^2-normed L^∞-module: these are Banach spaces which are also modules over the ring of L^∞-function and which possess a 'pointwise norm', i.e. a map defined in them and taking values in L^2 compatible, in the appropriate sense, with both the Banach and the L^∞-module structure. The key example of such structure is the space of L^2 sections of a normed vector bundle on a manifold and the advantage of using this approach in the nonsmooth setting—reminiscent of Serre–Swan theorem—is that one can speak of (co)vector fields without having to specify the (co)tangent space at every point.
Such a general setup will then by applied in the setting of spaces with Ricci curvature bounded from below. Having a weak curvature bound reflects in the possibility of defining a second order calculus, thus allowing to speak about Hessians, covariant and exterior derivatives as well as a Ricci curvature tensor.

September 16th (Fri) Conference Room IX

9:30–10:00

Summary: We describe a construction of $Spin(7)$-instantons in on Joyce's examples of compact $Spin(7)$-manifolds. The examples we consider here are obtained by gluing ALE $Spin(7)$-manifolds to each singular point of a Calabi–Yau four-orbifold divided by an anti-holomorphic involution fixing only the singular points. We simultaneously glue certain Hermitian–Einstein connections divided by anti-holomorphic involutions on the underlying manifolds together to obtain $Spin(7)$-instantons on the compact $Spin(7)$-manifold.

Summary: In general, for a given A_∞-category (DG-category), we can construct a triangulated category from the original A_∞-category (DG-category). We consider a triangulated category from a DG-category consisting of holomorphic vector bundles on high dimensional complex tori, and we discuss exact triangles consisting of projectively flat vector bundles.

10:10–10:25 Presentation Ceremony for the 2016 MSJ Geometry Prize

10:30–11:30 Award Lecture for the 2016 MSJ Geometry Prize

Teruhiko Soma (Tokyo Metro. Univ.) Geometry and topology of irreducible 3-manifolds

Summary: In this talk, we will review some results concerning geometry and topology of irreducible 3-manifolds such as hyperbolic, geometric or Haken manifolds. The main topics discussed are (1) the simplicial volume of irreducible 3-manifolds and the 3-dimensional bounded cohomology of closed surfaces, (2) non-zero degree maps between irreducible 3-manifolds, (3) the proof of the Smale conjecture for $\widetilde{SL}_2$-manifolds, and (4) the classification of geometric limits of Kleinian surface groups, which implies an answer to Thurston's eighth problem.

13:00–14:00 Award Lecture for the 2016 MSJ Geometry Prize

Shigeharu Takayama (Univ. of Tokyo) Complex geometry of the canonical bundle

Summary: It is my belief that the canonical bundle $K_X = \det T^*_X$ of a complex manifold reflects numerous properties of the manifold. In the study of Riemann surfaces, the study of the canonical bundle corresponds to look at the genus and endow the Riemannian metric of constant curvature. We try to generalize the beautiful theory of Riemann surfaces and complex analytic surfaces to the higher dimensional case. The classification theory of algebraic varieties, the so-called minimal model program, would be a typical example of it. A better understanding of higher dimensional varieties is also important and useful to a better understanding of the moduli space of Riemann surfaces, for example.

In my talk, I will explain several fundamental results in the theory of complex manifolds in a sprit of the minimal model program, which can be described in terms of the canonical bundle. For example, I will explain that (i) when K_X is negative, the holomorph-convexity of a pseudo-convex manifold, and a structure theorem of a semi-positively curved complete Kähler manifold, (ii) when K_X is zero, degenerations of Calabi–Yau type manifolds / Ricci-flat Kähler–Einstein metrics, (iii) when K_X is positive, the boundedness of the pluricanonical map $\Phi_{|mK_X|}$. I will also explain a few technical basic tools in this field of research; singular Hermitian metrics, multiplier ideal sheaves, Nadel vanishing theorem, Ohsawa–Takegoshi's L^2-extension theorem.

September 17th (Sat) Conference Room IX

9:30–11:40

16 Saburou Saitoh * Division by zero z/0=0 in Euclidean spaces 15
(Gunma Univ.*/Inst. of Reproducing Kernels)
Hiroshi Michiwaki (NejiLaw Inc.)
Hiroshi Okumura (Yamato Univ.)

Summary: In this paper, we will show the division by zero z/0=0 in Euclidean spaces and the results will show that the division by zero is our elementary and fundamental mathematics.

Keywords: Division by zero, 1/0=0 , field, Y-field, point at infinity, infinity, gradient, curvature, area, volume, special relative theory, Einstein, Newton method, ratio.

17 Saburou Saitoh * (Gunma Univ.*/Inst. of Reproducing Kernels)
Tsutomu Matsuura (Gunma Univ.)
Matrices and division by zero z/0=0 15

Summary: In this paper, a new viewpoint of the division by zero z/0=0 in matrices is introduced and the results will show that the division by zero is our elementary and fundamental mathematics. New and practical meanigs for many mathematical and physical formulas for the denominator zero cases may be given. Furthermore, a new space idea for the point at infinity for the Eucleadian plane is also introduced.

18 Udo Hertrich-Jeromin * (Vienna Univ. of Tech.)
Atsufumi Honda (Miyakonojo Nat. Coll. of Tech.)
Minimal Darboux transformations 10

Summary: We derive a permutability theorem for the Christoffel, Goursat and Darboux transformations of isothermic surfaces. As a consequence we obtain a simple proof of a relation between Darboux pairs of minimal surfaces in Euclidean space, curved flats in the 2-sphere and flat fronts in hyperbolic space.

19 Yuta Ogata (Kobe Univ.)
Keisuke Teramoto (Kobe Univ.)
Duality between cuspidal butterflies and cuspidal S_1 singularities on maxfaces 15

Summary: We give criteria for cuspidal butterflies and cuspidal S_1^- singularities in terms of the Weierstrass data for maxfaces. Moreover, we show duality between these singularities.

20 Katsuhiro Moriya (Univ. of Tsukuba)
The Weierstrass representation for surfaces in Euclidean space of arbitrary dimension 15

Summary: The notion of holomorphic structures for a Clifford bundle is introduced. Conformal maps from a Riemann surface to Euclidean space of arbitrary dimension is characterized in terms of a holomorphic structure. The differential of a conformal map is written by a holomorphic section. These are an analogue of the quaternionic holomorphic geometry.

21 Kazuyuki Hasegawa (Kanazawa Univ.)
A quaternionic invariant for an inclusive immersion 10

Summary: We introduce a quaternionic invariant for an inclusive immersion in a quaternionic manifold, which is a quaternionic object corresponding to the Willmore functional. The lower bound of this invariant is given by topological one and the equality case can be characterized in terms of the natural twistor lift. When the ambient manifold is the quaternionic projective space and the natural twistor lift is holomorphic, we obtain a relation between the quaternionic invariant and the degree of the image of the natural twistor lift as an algebraic curve.

22 Kazuyuki Hasegawa (Kanazawa Univ.)
A quaternionic Willmore immersion 10

Summary: We consider stationary points of the quaternionic invariant of an inclusive surface, which are said to be quaternionic Willmore immersions in this talk. The first variation formula for the invariant is obtained. As an application of the formula, if the natural twistor lift is a harmonic section, then the surface is a stationary point under any variations such that the induced complex structures do not vary.

23 Kouhei Miura (Tokyo Univ. of Sci.) Superextremal spacelike surfaces in a pseudo-Riemannian space form and a characterization of Boruvka hyperbolic planes 10

Summary: We study superextremal spacelike surfaces in a pseudo-Riemannian space form. Some congruent theorems for such surfaces are given in this talk. Besides, we see that, if the Gaussian curvature K of the surface is constant, then the ambient index is determined by K. Moreover, we characterize Boruvka hyperbolic planes as superextremal spacelike surfaces in indefinite hyperbolic spaces.

24 Qing Song Shi (Nagoya Inst. of Tech.) * Comparison theorems on trajectory-harps 10
Toshiaki Adachi (Nagoya Inst. of Tech.)

Summary: Given a trajectory for a magnetic field, we take a variation of geodesics each of which joins the origin of and another point of this trajectory. A trajectoy harp hence shows difference and relationship between a trajectory and geodesics. By applying Rauch's comparison theorem, we give estimates of distances between two distinct points on a given trajectory for a Kähler magnetic field from below under a condition that sectional curvatures of the underlying Kähler manifold are bounded from above. We also discuss their estimates from above under a condition that sectional curvatures are bounded from below.

14:15–16:50

25 Yuichiro Taketomi (Hiroshima Univ.) On a Riemannian submanifold whose slice representation has no nonzero fixed point 15

Summary: In this talk, we introduce a new class of Riemannian submanifolds which we call arid submanifolds. A Riemannian submanifold is said to be arid if no nonzero normal vectors are fixed under the full slice representation. The notion of arid submanifolds is a generalization of the notion of weakly reflective submanifolds introduced by Ikawa, Sakai and Tasaki. On the other hand, any arid submanifold is a minimal submanifold. We also introduce an application of the idea of arid submanifolds to the study of left-invariant metrics on Lie groups. We obtained a sufficient condition for an arbitrary Riemannian Lie group to be a Ricci soliton.

26 Kotaro Kawai (Univ. of Tokyo) Frölicher–Nijenhuis bracket and geometry of G_2-and Spin(7)-manifolds 15
Hông Vân Lê (CAS)
Lorenz Schwachhöfer (TU Dortmund)

Summary: In complex geometry, it is well-known that an almost complex structure is integrable if and only if the Nijenhuis tensor vanishes. We extend this characterization to the cases of torsion-free G_2 and Spin(7) structures via the Frölicher–Nijenhuis bracket, which is a generalization of the Nijenhuis tensor. As an application, we define new cohomology invariants of torsion-free G_2-and Spin(7)-manifolds. This is a joint work with Hông Vân Lê and Lorenz Schwachhöfer.

27 Akira Kubo (Hiroshima Shudo Univ.) Totally geodesic complex curves in Hermitian symmetric spaces 15
Takayuki Okuda (Hiroshima Univ.)
Hiroshi Tamaru (Hiroshima Univ.)

Summary: We classify totally geodesic complex curves in Hermitian symmetric spaces. As a result, for any irreducible Hermitian symmetric space M, there exist exactly $\operatorname{rank} M$ totally geodesic complex curves, up to isometry.

Summary: In this talk, we construct biharmonic homogeneous hypersurfaces in compact Lie groups. These biharmonic hypersurfaces are given as regular orbits of group actions on compact Lie groups which are induced by commutative compact symmetric triads.

Summary: In two previous MSJ meetings we gave the classification of maximal antipodal subgroups of the quotient groups of classical compact Lie groups. Using this classification and canonical forms of elements in disconnected compact Lie groups we show the classification of maximal antipodal subgroups of the automorphism groups of classical compact Lie algebras.

Summary: By means of the concept of polars on compact Riemannian symmetric spaces originated by Chen–Nagano, we show that a maximal antipodal subgroup of the compact Lie group G_2 of exceptional type is unique up to conjugation. We realize it explicitly by the use of Yokota's concrete realization of the classical group $SO(4)$ as a subgroup of G_2.

Summary: We give a duality between semisimple pseudo-Riemannian symmetric pairs and compact symmetric triads. This is a generalization of the duality for Riemannian symmetric spaces.

Summary: In this talk, we give an alternative proof for semisimple pseudo-Riemannian symmetric pairs from a viewpoint of compact symmetric triads. Our method is based on the theory of symmetric triads with multiplicities.

Summary: This is joint work with Toshiyuki Kobayashi aimed to extend the results of his earlier paper with Birgit Speh studying properties of symmetry breaking operators of $O(n,1)$. Symmetry breaking operators (SBOs) are G'-intertwining operators between the degenerate principal series representations of $G := O(p+1,q+1)$ and its closed subgroup $G' := O(p,q+1)$ parametrized each by one complex parameter. Similarly to the original paper, one is able to classify the space of SBOs for every pair of parameters and to study their properties (residue formulae, functional equations, images) in quite a detail. I will list these results, briefly explain what difficulties one runs at when compared with the original $q = 0$ case and how these are resolved. If time permits, I'll also discuss the further directions.

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

Satoshi Ishiwata (Yamagata Univ.) Heat kernel estimates on connected sums

Summary: Connected sums of non-compact manifolds have been known as the manifolds which fails the Li–Yau type heat kernel estimates (matching two sided Gaussian estimates). In 2009, Grigor'yan and Saloff–Coste obtained matching two-sided heat kernel estimates on connected sums of non-parabolic ends (manifold on which the Brownian motion is transient). The mixed case (connected sum with non-parabolic end and parabolic end) can be treated in the same way by using Doob's h-transform with a nice harmonic function. In this talk, I will give the motivation of the study of the heat kernel on connected sums and the results for the heat kernel estimates on connected sums of parabolic ends which is proved recently by Grigor'yan, Saloff–Coste and the speaker.

Complex Analysis

September 15th (Thu) Conference Room VIII

9:00–11:45

1 Shigeyoshi Owa (Yamato Univ.)
Hari M. Srivastava (Univ. of Victoria)
Toshio Hayami (Setsunan Univ.)
Kazuo Kuroki
(Osaka Univ. of Health and Sport Sci.)

Summary: Let $\mathcal{A}$ be the class of functions $f(z)$ which are analytic in the open unit disk $\mathbb{U}$ with $f(0) = 0$ and $f'(0) = 1$. For the class $\mathcal{A}$, a new general class $\mathcal{A}_k$ is defined. With this general class $\mathcal{A}_k$, two interesting subclasses $\mathcal{S}_k^*(\alpha)$ and $\mathcal{K}_k(\alpha)$ concerning classes of starlike of order α in $\mathbb{U}$ and convex of order α in $\mathbb{U}$ are also considered. In the present talk, we discuss the coefficient inequalities for $\mathcal{S}_k^*(\alpha)$ and $\mathcal{K}_k(\alpha)$. Furthermore, we approach to properties and problems for these general classes.

2 Narufumi Tsuboi (JSOL Co.)

Summary: It is known that a power series convergent in the unit disk with Hadamard gaps whose coefficients do not converge to zero has no finite defective value. More recently, it was shown that a power series convergent in the unit disk with Hadamard gaps whose Nevanlinna characteristic is sufficiently large has no finite defective value. In this talk, we shall discuss the defects of Hadamrd gap series in the unit disk whose order is small.

3 Saburou Saitoh *
(Gunma Univ.*/Inst. of Reproducing Kernels)
L. P. Castro (Univ. of Aveiro)
A. Yamada (Tokyo Gakugei Univ.)

Summary: We consider a natural representation of solutions for the Tikhonov functional equation. This will be done by applying the theory of reproducing kernels to the approximate solutions of general bounded linear operator equations (when defined from reproducing kernel Hilbert spaces into general Hilbert spaces), by using the Hilbert–Schmidt property and tensor product of Hilbert spaces. As a concrete case, we shall consider generalized fractional functions formed by the quotient of Bergman functions by Szegö functions considered from the multiplication operators on the Szegö spaces.

4 Saburou Saitoh *
(Gunma Univ.*/Inst. of Reproducing Kernels)
Masako Takagi
(Inst. of Reproducing Kernels)

Summary: In this talk, we will show and examine the values of analytic functions at isolated singular points in the sense of the division by zero $z/0 = 0$ with the general situation of the division by zero:
Introduction, fundamental theorem, applications to solutions with analytic parameter, linear fractional functions, examples of values at singular points, basic meanings of hidden values of analytic functions, hidden values of domain functions, conclusion and others.

Summary: We study the composition operators with closed range on the weighted Bloch spaces, the weighted Dirichlet spaces, the Bergman spaces and the Hardy space.

Summary: Our aim in this talk is to deal with Sobolev's inequalities for Riesz potentials of functions in non-homogeneous central Herz–Morrey–Musielak–Orlicz spaces.

Summary: In this talk we are concerned with optimal estimates for the fractional Hardy operator.

Summary: We consider a Hilbert space of polyharmonic functions on half spaces together with iterated parabolic operators. In this talk, we first remark a relation of polyharmonic functions with solutions of parabolic equations, and next, we give the reproducing kernel explicitly by using the Poisson kernel.

Summary: We consider an exponential weight $w(x) = \exp(-Q(x))$ on $\mathbb{R} = (-\infty, \infty)$. where Q is an even and nonnegative function on $\mathbb{R}$. We always assume that w belongs to a relevant class $\mathcal{F}(C^2+)$.
Let $\{p_n\}$ be orthogonal polynomials for a weight w. For a function f on $\mathbb{R}$, $s_n(f)$ denote the $n-1$-th partial sum of Fourier series.
In this research, we discuss uniformly convergence of $s_n(f)$. In the proof of main theorem, Nikolsky's inequality and the de la Vallée Poussin mean of f play important roles.

Summary: We consider the polyharmonic Bergman space which is consisted of all real-valued square integrable polyharmonic functions on the unit ball. We give an estimate for the reporducing kernel of the polyharmonic Bergman space and discuss an operator from the harmonic Bergman space to the polyharmonic Bergman space.

14:15–16:55

11 Hiroki Sumi (Osaka Univ.) Finding roots of any polynomials by random relaxed Newton's methods 15

Summary: We develope the theory of random holomorphic dynamics. Applying it to finding roots of polynomials by random relaxed Newton's methods, we show that for any polynomial g, for any initial value $z \in \mathbb{C}$ which is not a root of g', the random orbit starting with z tends to a root of g almost surely, which is the virtue of the effect of the randomness.

12 Shizuo Nakane (Tokyo Polytechnic Univ.) Stretching rays for cubic polynomials 15

Summary: We investigate the landing properties of the stretching rays for cubic polynomials. In a certain class of critical portrait loci, stretching rays accumulate the parabolic locus. We show that, if the Boettcher vector is not an integer, the stretching rays accumulate but do not land. This extends the results of Komori–Nakane for real cubic polynomials. This is a joint work with Pascale Roesch.

13 Masanori Amano (Tokyo Tech) The estimation of the Teichmüller distance by the new coordinate 15

Summary: In this talk, we see some properties of the new coordinate of the Teichmüller space. The coordinate depends on flat structures of Riemann surfaces. In particular, by using this characterization, we obtain the upper and lower estimations of the Teichmüller distance between any two point.

14 Hideki Miyachi (Osaka Univ.) Extremal length and the period matrices of branched covering spaces for associated quadratic differentials 15

Summary: The extremal length is one of important conformal invariants in Teichmüller theory. The extremal length is represented as the L^1-norm of a holomorphic quadratic differential (the Hubbard–Masur differential). In this talk, I would like to discuss the relationship between the complex analytical invariants (∂-derivative, Levi forms, etc.) defined from the extremal length functions on Teichmüller space and the period matrices of branched double covering spaces for the square root of the associated Hubbard–Masur differential. Indeed, we will show that the Levi form is represented as the quadratic form of the imaginary part of the period matrix, up to multiple constant.

15 Masahiro Yanagishita (Yamaguchi Univ.) Curvatures of Weil–Petersson metric on square integrable Teichüller space 15

Summary: The square integrable Teichmüller space $T^2(R)$ of a Riemann surface R is a metric subspace of the Teichmüller space of $T(R)$ consisting of Teichmüller equivalence classes with a quasiconformal mapping whose Beltrami coefficient is square integrable with respect to the hyperbolic metric on R. For a compact Riemann surface R of genus $g > 1$, Ahlfors showed that $T(R)$ has a canonical Hermitian metric, which is called the Weil–Petersson metric, and that this metric has some negative curvatures. In this talk, we prove that the Weil–Petersson metric can be also defined on $T^2(R)$ for a Riemann surface R with Lehner's condition and that the holomorphic sectional curvature and Ricci curvature of this metric are negative on $T^2(R)$.

16 Hiroki Fujino (Nagoya Univ.) Quasisymmetric embedding of the integer set and its quasiconformal extension 15

Summary: From the study of Beurling–Ahlfors in 1956, Quasisymmetric mappings and its extensions are investigated by many mathematicians in connection with the Teichmüller theory, complex dynamics, and so on. In particular, Beurling and Ahlfors proved that every quasisymmetric homeomorphism of the real line admits a quasiconformal extension to the whole plane. In this study, we show that every quasisymmetric injection from the integer set into the real line admits a quasiconformal extension to the plane. Furthermore, to prove it, we characterize images of quasisymmetric mappings, and quasisymmetric automorphisms of the integer set by quite simple geometric conditions.

17 Katsusuke Nabeshima (Univ. of Tokushima), Shinichi Tajima (Univ. of Tsukuba) Computing μ^*-sequences of hypersurface isolated singularities via parametric local cohomology systems 15

Summary: Complex analytic invariants of hypersurface isolated singularities are considered in the context of symbolic computation. The motivations for this talk are computer calculations of μ^*-sequences that introduced by B. Teissier to study the Whitney equisingularity of deformations of complex hypersurfaces. A new algorithm that utilizes parametric local cohomology systems, is proposed to compute μ^*-sequences. Lists of μ^*-sequences of some typical cases are also given in this talk.

18 Katsusuke Nabeshima (Univ. of Tokushima), Shinichi Tajima (Univ. of Tsukuba) Parametric holonomic D-modules and b-functions of μ-constant deformations 15

Summary: A computation method of parametric b-functions, that utilizes comprehensive Gröbner systems, is given. The motivation of this talk is computer calculations of complete lists of b-functions of parametric polynomials. The method is proposed to compute stratifications of a parameter space associated with μ-constant deformations. Some results of μ-constant deformations are given in this talk.

19 Katsuyoshi Ohara (Kanazawa Univ.), Tajima Shinichi (Univ. of Tsukuba) An algorithm for computing Grothendieck local residues in the case of shape bases 15

Summary: An algorithm for computing Grothendieck local residues under certain condition are developed. Grothendieck local residue is interpreted as a distribution represented by a Noether differential operator. Our method returns Noether operators.

Let I be an ideal generated by n polynomials of complex n variables. It is supposed that I is 0-dimensional and has primary decomposition whose all primary ideals are expressed by shape bases. Under this condition our method computes the Noether operator for the cohomology class whose denominator is the product of given polynomials.

17:00–18:00 Talk Invited by Complex Analysis Section

Yu Kawakami (Kanazawa Univ.) Geometric interpretation of value-distribution-theoretic property for the Gauss map of complete minimal surfaces

Summary: In this talk, we give a geometric interpretation of value-distribution-theoretic property for the Gauss map of complete minimal surfaces in Euclidean 3-space and 4-space.

September 16th (Fri) Conference Room VIII

9:30–11:45

20 Masakazu Shiba (Hiroshima Univ.⋆)
Hiroshi Yamaguchi (Shiga Univ.⋆)

Conformal embeddings of an open Riemann surface into closed ones of the same genus —The range of the period matrices— · · · · · · · · · · · · · · · 15

Summary: Let R be an open Riemann surface of positive finite genus g and $\chi_R := \{A_j^R, B_j^R\}_{j=1}^g$ be a canonical homology basis of R modulo dividing cycles. A closing of the pair (R, χ_R) is, by definition, a triplet (S, χ_S, ι) consisting of a closed Riemann surface S of genus g, a canonical homology basis $\chi_S := \{A_j^S, B_j^S\}_{j=1}^g$, and a conformal mapping $\iota : R \to S$ such that $\iota(A_j^R)$ (resp. $\iota(B_j^R)$) is homologous to A_j^S (resp. B_j^S) for each $j\,(1 \le j \le g)$. Identify two triplets $(S_k, \chi_{S_k}, \iota_k)$, $k = 1, 2$ if there exists a conformal mapping $h : S_1 \to S_2$ with $h \circ \iota_1 = \iota_2$. Denote by $C(R, \chi_R)$ the set of closings of (R, χ_R). Let $T = T(S, \chi_S, \iota) := (\tau_{jk})_{j,k=1,2,\dots,g}$ be the Riemann's period matrix of $(S, \chi_S) \in C(R, \chi_R)$. One of our results is: Each diagonal element τ_{jj} of T describes a closed disk in the upper half plane. Non-diagonal elements of T will be also investigated.

21 Sachiko Hamano (Osaka City Univ.)
Masakazu Shiba (Hiroshima Univ.⋆)
Hiroshi Yamaguchi (Shiga Univ.⋆)

Variation of the moduli disk for an open Riemann surface of positive finite genus · 15

Summary: The pseudoconvex variation of open Riemann surfaces $R(t)$ of positive finite genus $g \ge 1$ with complex parameter t yields the subharmonicity of the Euclidean diameter of the moduli disks $\mathfrak{M}(t)$ with t.

22 Shigeki Matsutani (Sasebo Nat. Coll. of Tech.)
Jiryo Komeda (Kanagawa Inst. of Tech.)
Emma Previato (Boston Univ.)

Jacobi inversion formulae for a trigonal curve $y^3 = x^2k(x)$ · · · · · · · · · · · 15

Summary: In this talk, we give the Jacobi inversion formula for a curve defined in the affine plane by a "Weierstrass normal form" $y^3 = x^2k(x)$. Normalization yields a non-singular curve in three-dimensional affine space whose compactification by one point at infinity is also smooth and has Weierstrass gaps at infinity corresponding to a non-symmetric numerical semigroup. It is known that the Riemann constant normalized at a point is a half-period in the Jacobian if and only if the semigroup in symmetric. By introducing a shifted Riemann constant and corresponding Abel map, we deal with half periods and obtain an explicit expression for Jacobi's inversion.

23 Takashi Umeno (Kyushu Sangyo Univ.)

Two examples of arithmetic toroidal groups · 15

Summary: We give two examples of arithmetic toroidal groups. One is a quasi-abelian variety and the other is a toroidal group without non-constant meromorphic functions on it.

24 Takayuki Koike (Kyoto Univ.)*

Ueda theory for compact curves with nodes · 15

Summary: Let C be a compact complex curve included in a non-singular complex surface such that the normal bundle is topologically trivial. Ueda studied complex analytic properties of a neighborhood of C when C is non-singular or is a rational curve with a node. We propose an analogue of Ueda's theory for the case where C admits nodes. As an application, we study singular Hermitian metrics with semi-positive curvature on the anti-canonical bundle of the blow-up of the projective plane at nine points in arbitrary position.

25 Atsushi Atsuji (Keio Univ.) Default function and Liouville type theorems 15

Summary: We will report that we can use default functions, which appear in martingale theory, to obtain Liouville type theorems for integrable subharmonic functions and holomorphic maps.

26 Genki Hosono (Univ. of Tokyo) Converegnce along geodesics between toric plurisubharmonic functions 10

Summary: Our interest is the behavior of weak geodesics between two plurisubharmonic functions on pseudoconvex domains. We characterize the convergence condition along the geodesic between toric psh functions with a pole at origin on a unit ball in $\mathbb{C}^n$ by means of Lelong numbers.

27 Takeo Ohsawa (Nagoya Univ.)[b] Runge's theorem on pseudoconvex Kähler manifolds 15

Summary: Let X be a Kähler manifold of dimension n equipped with a smooth plurisubharmonic exhaustion function, say φ, and let E be a Nakano semipositive vector bundle over X. We shall show that, E-valued holomorphic n-forms on a sublevel set X_c of φ can be approximated by those on X locally uniformly on X_c.

13:00–14:00 Talk Invited by Complex Analysis Section

Shin-ichi Matsumura (Tohoku Univ.) On generalizations of the Kodaira vanishing theorem by transcendental methods

Summary: The injectivity theorem, which is a generalization of the Kodaira vanishing theorem, is a powerful tool to study higher dimensional complex geometry. After the pioneering work by Tankeev, Kollár established the celebrated injectivity theorem by using the Hodge theory. Enoki gave an analytic proof for Kollár's injectivity theorem and Fujino recently gave further generalizations.

In this talk, I will explain recent developments and my results on the injectivity theorem from the viewpoint of complex geometry. In particular, I would like to discuss injectivity theorems with multiplier ideal sheaves of singular hermitian metrics and injectivity theorems for log canonical pairs. The proof depends on transcendental methods based on the theory of harmonic integrals and the L^2-method for the dbar-equation. If time permits, I will explain applications to a vanishing theorem of Kawamata–Viehweg–Nadel type and an extension theorem for holomorphic sections. Part of this talk is based on a joint work with Yoshinori Gongyo and Osamu Fujino.

Functional Equations

September 15th (Thu) Conference Room II

9:15–12:00

1 Masafumi Yoshino (Hiroshima Univ.) Moving singularity and monodromy of some Hamiltonian system ····· 12

Summary: We study moving singularity and monodromy of Hamiltonian systems containing a generalized Emden–Fowler equation. We give the structure of moving singularities in terms of an elliptic function for a certain model equation. Then, by the global singular Birkoff transformation we reduce general equations to the model one and study the global singularity of the solution. We also compute the monodromy around branch points by virtue of the classical elliptic function.

2 Shogo Yamanaka (Kyoto Univ.)
Kazuyuki Yagasaki (Kyoto Univ.) Non-integrability of general differential equations with homo- and heteroclinic orbits ····· 12

Summary: We consider general differential equations possessing homo- or heteroclinic orbits. We adopt the definition of integrability due to Bogoyavlenski for general differential equations. We study the variational equations along the homo- and heteroclinic orbits, and give necessary conditions for integrability under some assumptions.

3 Mika Tanda (Kansai Med. Univ.)
Toshinori Takahashi (Kinki Univ.)
Takashi Aoki (Kinki Univ.) The relation between the confluent hypergeometric function and WKB solutions ····· 12

Summary: We consider the confluent hypergeometric differential equation with a large parameter from the viewpoint of the exact WKB analysis. We introduce a large parameter η in the parameters of the confluent hypergeometric equation as general linear forms of η. We define the Voros coefficient of the confluent hypergeometric differential equation with a large parameter for the origin. Explicit form of the Voros coefficient and the Borel sums of them in a Stokes region are given. Moreover, we investigate the relation between the confluent hypergeometric function and WKB solutions.

4 Naoto Yamaoka (Osaka Pref. Univ.) Oscillation criteria for linear dynamic equations on time scales ····· 10

Summary: The purpose of this talk is to give oscillation criteria for second-order linear dynamic equations on time scales of the form $x^{\Delta\Delta} + \frac{\lambda}{t\sigma(t)}x = 0$, $t \in \mathbb{T}$. Here $\lambda > 0$, $\mathbb{T}$ is a time scale, $\sigma(t)$ is a forward jump operator, x^{Δ} is Δ-derivative. Moreover, we give a pair of oscillation and non-oscillation theorems for second-order nonlinear dynamic equations on time scales.

Summary: We consider differential equations with unbounded variable state-dependent delays and study the well-posedness of initial value problems (IVPs) for non-seminormable initial value spaces. A simple example of such delays is $\rho(t,x) = t^2 + |x|$, where t is the time variable, and $x \in \mathbb{R}^n$ is the state variable. The expansive properties of the delay show that we need an initial history defined on $(-\infty, 0]$ for each initial time. It seems natural that we give the compact-open topology to the initial value space for that IVP. However, the previous axioms for infinite delay obtained by Hale & Kato (1978) does not cover this topology because the compact-open topology is not seminormable. In this talk, we give axioms for topological linear spaces and show the well-posedness under these axioms.

Summary: Asymptotic forms of slowly decaying solutions of a Lanchester-type model are determined.

Summary: The oscillation of all solutions of a linear autonomous difference system with two delays is studied. Explicit necessary and sufficient conditions in terms of the coefficient matrix and the delays are established, which are some extensions of the previous results.

Summary: Various cell polarization models are proposed by S. Ishihara, et al. (Phys. Rev. E 75 015203(R), 2007) and M. Otsuji, et al. (PLoS Compt. Biol. 3: e108, 2007).
We investigate global structure of stationary solutions to a cell polarization model proposed by Y. Mori, A. Jilkine and L. Edelstein-Keshet (SIAM J. Appl Math, 2011), which is closely related with results by them.
We study finite diffusion coefficient case by using infinite diffusion coefficient case. We show exact solution for finite diffusion coefficient case and numerical results.
This is a joint work with Professors K. Kuto (Univ. of Electro-Comm.), T. Tsujikawa (Univ. of Miyazaki) and Shoji Yotsutani (Ryukoku Univ.).

9 Kousuke Kuto (Univ. of Electro-Comm.)
Tatsuki Mori (East China Normal Univ.)
Tohru Tsujikawa (Univ. of Miyazaki)
Shoji Yotsunani (Ryukoku Univ.)
Secondary bifurcation and global solution structure for a one-dimensional stationary Allen–Cahn equation with nonlocal term 12

Summary: This talk is concerned with the Neumann problem of a 1D stationary Allen–Cahn equation with nonlocal term. Our main result shows that the nonlocal term induces a symmetry breaking bifurcation point on the branch of odd-symmetric solutions. This talk also mentions the uniqueness of such secondary bifurcation points and the global behavior of the bifurcation branch of asymmetric solutions.

10 Tetsutaro Shibata (Hiroshima Univ.)
Asymptotic length of bifurcation curves related to inverse bifurcation problems 12

Summary: We consider the asymptotic properties of bifurcation curves for nonlinear ordinary differential equations. Let $\lambda > 0$ be a bifurcation parameter and $L(g, \alpha)$ be the asymptotic length of the bifurcation curve $\lambda = \lambda(g, \alpha)$ $(\alpha = \|u_\lambda\|_\infty > 0)$ associated with the nonlinear term $g(u)$. By the asymptotic property of $L(g, \alpha)$ as $\alpha \to \infty$, we consider a new inverse bifurcation problem. Namely, let $g(u)$ be an unknown nonlinear term. Then we consider the problem whether we can distinguish $g(u)$ from $g_1(u) = (u/2)\sin u$ and $g_2(u) = u + (1/2)\sin u$ by the asymptotic formulas for $L(g, \alpha)$ and $L(g_i, \alpha)$ $(i = 1, 2)$ as $\alpha \to \infty$.

11 Kenji Kurogi (Hiroshima Univ.)
Counterexample to the 1-summability of a divergent formal solution to some linear partial differential equations 12

Summary: In 2013, Tahara–Yamazawa showed multisummability of formal solutions of some linear partial differential equation under a certain condition on the Newton polygon. We shall study the necessity of the condition on the Newton polygon. In this talk, we shall give an example such that every divergent formal power series solution is not multisummable in any direction when the condition on the Newton polygon by Tahara–Yamazawa does not hold.

12 Yoshihiko Mitsumatsu (Chuo Univ.)
Tomohiro Horiuchi (Chuo Univ.)
Schröder's equation on the half-line 12

Summary: We consider Schröder's eqation on the half-line $[0, \infty)$ for a pull-back operator φ^* where φ is an expanding C^∞ diffeomorphism. We give a complete description of (the space of) smooth solutions. The methods of proof are also explained.

14:15–16:15

13 Marco Squassina (Univ. of Verona)
Tatsuya Watanabe (Kyoto Sangyo Univ.)
Uniqueness of limit flow for quasi-linear parabolic equations 10

Summary: We investigate the issue of uniqueness of the limit flow for a relevant class of quasi-linear parabolic equations defined on the whole space. More precisely, we shall investigate conditions which guarantee that the global solutions decay at infinity uniformly in time and their entire trajectory approaches a single steady state as time goes to infinity.

Summary: We consider the orbital stability of standing waves for the nonlinear Schrödinger equation coupled with the Maxwell equation. First we show the uniqueness of ground states and a link between minimizers and ground states. Then we obtain the orbital stability for the quadratic nonlinearity.

Summary: In this lecture, we study the (p, q)-Laplace equation in a bounded domain under the Dirichlet boundary condition. Then we prove the existence of a sequence of solutions diverging to infinity or converging to zero. Moreover, we give a priori estimate of the C^1-norm of solution.

Summary: We consider a point-condensation phenomenon in solutions of a semilinear elliptic equation with variable coefficients. This means that distribution of a solution concentrates in very narrow regions around a finitely many points. In order to know where the concentration points are, we introduce a locator function composed of the coefficients involved in the equation, and prove that any concentration point must be a critical point of the locator function. Moreover, we construct a solution concentrating near a nondegenerate critical point of the locator function and show how to find the local maximum point of the solution.

Summary: In this talk, we show the uniqueness of positive solutions for a class of quasilinear elliptic equations. We convert quasilinear elliptic equations to semilinear elliptic equations by using the dual approach, and apply uniqueness results for semilinear elliptic equations. In previous works, some restriction on the parameter was required. However, we remove the restriction, and obtain uniqueness and non-degeneracy results.

Summary: We consider the existence, the non-existence, and the asymptotic behavior of the least-energy solutions of an elliptic equation with the Hardy–Sobolev critical exponent. In particular, we investigate the impact of the mean curvature at origin on the existence of the least-energy solutions in the boundary singularity case.

19 Takashi Suzuki (Osaka Univ.)
Yohei Toyota (Osaka Univ.)
Yūki Naito (Ehime Univ.)
A priori bounds for superlinear elliptic equations with semidefinite nonlinearity ····· 12

Summary: We derive a priori bounds for positive solutions of the superlinear elliptic problems $-\Delta u = a(x)u^p$ on a bounded domain Ω in $\mathbb{R}^N$, where $a(x)$ is Hölder continuous in Ω. Our main motivation is to study the case where $a(x) \geq 0$, $a(x) \not\equiv 0$ and $a(x)$ has some zero sets in Ω. We show that, in this case, the scaling arguments reduce the problem of a priori bounds to the Liouville-type results for the equation $-\Delta u = A(x')u^p$ in $\mathbb{R}^N$, where A is the continuous function defined on the subspace $\mathbb{R}^k$ with $1 \leq k \leq N$ and $x' \in \mathbb{R}^k$.

20 Shigeaki Koike (Tohoku Univ.)
Takahiro Kosugi (Tohoku Univ.)
Fully nonlinear elliptic equations with sublinear growth in Du ····· 12

Summary: It is obtained that there exist L^p-strong solutions of Pucci extremal equations with sublinear growth in Du and measurable ingredients. By using this existence result, it is shown that the ABP maximum principle and the weak Harnack inequality for L^p-viscosity solutions hold true.

21 Masaki Ohnuma (Univ. of Tokushima) *
Shigeru Sakaguchi (Tohoku Univ.)
A strong comparison principle for semicontinuous solutions of the prescribed mean curvature equation ····· 12

Summary: We prove a strong comparison principle for semicontinuous viscosity sub- and supersolutions of the prescribed mean curvature equation.

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

Tomoyuki Tanigawa (Kumamoto Univ.)
Regular variation and asymptotic behavior of solutions of differential equations

Summary: The theory of regularly varying functions has been shown very useful in some fields of qualitative theory of differential equations, see, in particular, the important monograph by Maric (Regular variation and differential equations, Lecture Notes in Mathematics 1726, Springer-Verlag, Berlin-Heidelberg-New York, 2000) summarizing themes in the research up to the year 2000. In this talk we will establish an accurate asymptotic formulas for regular varying solutions of a class of differential equations explicitly.

September 16th (Fri) Conference Room II

9:00–12:00

22 Yusuke Yamauchi (Hiroshima Inst. of Tech.)
Mitsuharu Ôtani (Waseda Univ.)
Tetsuya Koyama (Hiroshima Inst. of Tech.)
On a regularity theorem for rectangular domain ····· 10

Summary: The aim of this talk is to prove a regularity theorem for an elliptic boundary value problem on a rectangular domain Ω. We prove that weak solution of $u - \Delta u = G$ with boundary value $f \in H^2(\partial\Omega)$ belongs to $H^2(\Omega)$.

Summary: In this talk, we show partial regularity up to the boundary $\partial\Omega$ of a bounded open set Ω for minimizers u for $p(x)$-growth functionals of the following type

$$\mathcal{A}(u) = \int_\Omega (A_{ij}^{\alpha\beta}(x,u) D_\alpha u^i(x) D_\beta u^j(x))^{p(x)/2} dx,$$

assuming that $A_{ij}^{\alpha\beta}(x,u)$ are bounded uniformly continuous functions satisfying Legendre condition and that $p(x)$ is a Hölder continuous function with $p(x) > 1$.
When $A_{ij}^{\alpha\beta}(x,u)$ are given as $A_{ij}^{\alpha\beta}(x,u) = g^{\alpha\beta}(x) G_{ij}(x,u)$, we can also prove that minimizers have no singular points on the boundary.

Summary: Spherical harmonics on $\mathbb{S}^{n-1}$, which are used extensively in various fields, are harmonic homogeneous polynomials in $\mathbb{R}^n$ restricted to the unit sphere $\mathbb{S}^{n-1}$. We define spherical functions (vector fields) for the Lamé operator by restricting to $\mathbb{S}^{n-1}$ homogeneous polynomial solutions of the Lamé equation $\mu\Delta u + (\lambda+\mu)\nabla(\nabla\cdot u) = 0$ in $\mathbb{R}^n$. We show that those spherical functions span a dense subspace of the L^2-space on $\mathbb{S}^{n-1}$, which is a fundamental property of the spherical harmonics.

Summary: Let Ω be a bounded domain of $\mathbf{R^N}$ $(N \geq 1)$. In this talk, we shall study Kato's inequality when $\Delta_p u$ is a measure, where $\Delta_p u$ denotes a p-Laplace operator with $1 < p < \infty$. The classical Kato's inequality for a Laplacian asserts that given any function $u \in L^1_{\mathrm{loc}}(\Omega)$ such that $\Delta u \in L^1_{\mathrm{loc}}(\Omega)$, then Δu^+ is a Radon measure and the following holds: $\Delta u^+ \geq \chi_{[u\geq 0]} \Delta u$ in $D'(\Omega)$. Our main result extends Kato's inequality to the case where $\Delta_p u$ is a Radon measures on Ω. We also establish the inverse maximum principle for Δ_p.

Summary: Weak solutions u of boundary value problems for partial differential equations has singular points. Point p is a singular point if the restriction $u|_{U(p)}$ of u cannot be strong for any neighborhood $U(p)$ of p. Here we consider that the point on the boundary is singular. I will talk the method of shape optimization of singular points under the cost functional; energy, least square error and mean compliance.

Summary: We define a generalized fixed contact angle condition for n-varifold and establish a boundary monotonicity formula. The results are natural generalizations of those for the Neumann boundary condition considered by Grüter–Jost.

Summary: Lotka–Volterra system associated with skew-symmetric interaction is studied. We pick up a class provided with conserved quantities which makes all the solutions to be periodic-in-time except for the equilibrium. This class is explicitly given by algebraic condition for coefficients and has a sufficently large number of degrees of freedom.

Summary: We introduce a class of reaction diffusion systems of which weak solution exists global-in-time with compact orbit in L^1, that is, quasi-positive, dissipative, and quadratic growth. If the space dimension is less than or equal to two, this solution is classical and uniformly bounded. Under additional property in accordance with entropy structure, this weak solution is asymptotically spatially homogeneous in L^1.

Summary: In this lecture, we study the initial boundary value problem of the sublinear parabolic equation. We show that a unique positive and a unique negative stationary solutions are exponentially stable and give the exact exponent. We prove that small stationary solutions are unstable.

Summary: We consider the blow-up problem for systems of nonlinear parabolic inequalities and establish a criterion for the location of the blow-up set. Our criterion enables us to obtain sufficient conditions for the boundedness of the blow-up set and no boundary blow-up for type I blowing up solutions.

Summary: We prove the existence of solutions and the comparison principle for the heat equation with a nonlinear boundary condition with the initial function $\varphi(x) = O(e^{-\lambda d(x)^2})$ as $x \to \infty$ for some $\lambda \geq 0$. Here $d(x) = \mathrm{dist}\,(x, \partial\Omega)$.

Summary: I will talk about finite-time blow-up solutions of a semilinear heat equation with power nonlinearity in the whole space. A problem on blow-up rate is addressed. It is known that, as long as nonnegative radially symmetric solutions are concerned, every blow-up is of type I if the power is less than the Joseph–Lundgren exponent, whereas type II blow-up does occur if the power is greater than the Joseph–Lundgren exponent. As far as I know, it is not known whether or not type II blow-up solutions exist on the borderline case. I will report recent results on this problem.

34 Yasuhiro Fujita (Univ. of Toyama) On lower estimate of gradients of solutions to uniformly parabolic equations 12

Summary: Our aim is to provide a lower estimate of the gradients of solutions to uniformly parabolic equations. This is done by using a logarithmic Sobolev inequality.

35 Shigeru Sakaguchi (Tohoku Univ.) * Two-phase heat conductors with a stationary isothermic surface 12

Summary: We consider a two-phase heat conductor in $\mathbb{R}^N$ with $N \geq 2$ consisting of a core and a shell with different constant conductivities. Suppose that, initially, the conductor has temperature 0 and, at all times, its boundary is kept at temperature 1. It is shown that, if there is a stationary isothermic surface in the shell near the boundary, then the structure of the conductor must be spherical. When the medium outside the two-phase conductor has a possibly different conductivity, we also consider the Cauchy problem with $N \geq 3$ and the initial condition where the conductor has temperature 0 and the outside medium has temperature 1. Then we show that almost the same proposition holds true.

13:00–14:00 Talk Invited by Functional Equations Section

Toru Wakasa (Kyushu Inst. of Tech.) Linearized eigenvalue problems associated with 1 dimensional front/pulse type steady states

Summary: In the dynamical theory of semilinear parabolic PDEs, the stability of the steady states, have been studied by analyzing the corresponding linearized eigenvalue problems. A special case that the PDE admits a small (diffusion) coefficient, has been particularly investigated by many researchers. In this situation the behaviour of the solution to the evolutional problem is interesting in view of the pattern formation.
We are interested in the parameter dependence of eigenpairs, as the coefficitent (regarding it a small parameter), tends to zero. In the previous works by the author and S. Yotsutani, Allen–Cahn equation which the front type steady states appear, have been considered, and for the typical nonlinearies the asymptotic formulas of eigenvalues and eigenfunctions as the parameter tends to zero are obtained. It can be observed from the asymptotic formulas that all of eigenpairs are classified into the finite number of group, which is characterized by the associated limit problem.
In this talk we will briefly introduce the previous results on the bistable case and also will consider the case of the scalar field equations which the pulse type steady states appear. We will show us that the similar results are obtained for the eigenvalue and eigenfunctions associated with the pulse solutions.

September 17th (Sat) Conference Room II

9:15–12:00

36 Shuichi Jimbo (Hokkaido Univ.) * Yoshihiro Takazawa Y-shaped graph and a time entire solution to a semilinear parabolic equation 12

Summary: I deal with a semilinear parabolic equation in a Y shaped graph. I study an asymptotic behavior of solutions of an initial value problem and also discuss with existence of time entire solution.

37 Naoto Kajiwara (Univ. of Tokyo)
Yoshikazu Giga (Univ. of Tokyo)
Resolvent estimates for bidomain operators 12

Summary: We study bidomain equations that are commonly used as a model to represent electrophysiological wave propagation in the heart. We can transform into abstract parabolic evolution equation by using bidomain operators. This operator is formally harmonic mean of two elliptic operators. Our aim of this talk is to prove resolvent estimate for bidomain operators in L^p and L^∞ spaces. The method is based on blow-up argument in L^∞ space. We get L^p estimate by interpolating L^2 estimate and our L^∞ estimate and using duality argument.

38 Masaaki Mizukami (Tokyo Univ. of Sci.)
Tomomi Yokota (Tokyo Univ. of Sci.)
Asymptotic stability in a two-species chemotaxis system with any chemical diffusion 10

Summary: This talk is concerned with asymptotic stability of solutions to a two-species chemotaxis system. Negreanu and Tello established asymptotic stability in the system with "non"-diffusive chemoattractant in 2015. The main result of this talk asserts asymptotic stability of solutions to the system with "any" chemical diffusion.

39 Masaaki Mizukami (Tokyo Univ. of Sci.)
Tobias Black (Paderborn Univ.)
Johannes Lankeit (Paderborn Univ.)
Boundedness and asymptotic stability in a two-species chemotaxis-competition model of parabolic-parabolic-elliptic type 10

Summary: This talk is concerned with asymptotic bahavior of solutions to a two-species chemotaxis-competition model of parabolic-parabolic-elliptic type. This system describes a situation in which multi populations react on single chemoattractant. Moreover, we assume that both populations reproduce themselves, and mutually compete with the other, according to the classical Lotka–Volterra kinetics. Tello and Winkler proved global existence and asymptotic behavior in the system under some conditions in 2012. The main result of this talk asserts boundedness and asymptotic stability of solutions to the system under more sharp condition.

40 Toshikazu Kuniya (Kobe Univ.)
Jinliang Wang (Heilongjiang Univ.)
Construction of Lyapunov functions for an SIR epidemic model with diffusion terms and space-dependent coefficients 12

Summary: In this study, we consider an SIR epidemic model with diffusion terms and space-dependent coefficients. We consider two cases in which only either susceptible or infective individuals can diffuse. For both cases, we obtain the basic reproduction number and show that it determines the global asymptotic stability of each equilibrium. For the proof, we construct suitable Lyapunov functions and use the Green's first identity to show the non-positivity of their derivatives.

41 Yusuke Sugiyama (Tokyo Univ. of Sci.) Degeneracy in finite time of a parameterized quasilinear wave equation 12

Summary: We consider the large time behavior of solutions to the following nonlinear wave equation: $\partial_t^2 u = c(u)^2\partial_x^2 u + \lambda c(u)c'(u)(\partial_x u)^2$ with the parameter $\lambda \in [0,2]$. If $c(u(0,x))$ is bounded away from a positive constant, we can construct a local solution for smooth initial data. However, if $c(\cdot)$ has a zero point, then $c(u(t,x))$ can be going to zero in finite time. When $c(u(t,x))$ is going to zero in finite time, the equation degenerates. We give a sufficient condition that the equation with $0 \leq \lambda < 2$ degenerates in finite time.

42 Mamoru Okamoto (Shinshu Univ.)
Machihara Shuji (Saitama Univ.) Well-posedness and ill-posedness of the Cauchy problem for the dimensional reduced Chern–Simons–Dirac system 10

Summary: We consider the Cauchy problem for the dimensional reduced Chern–Simons–Dirac system. We show that the Cauchy problem is well-posed in $H^s(\mathbb{R}) \times H^r(\mathbb{R})$ if s and r satisfy ($s \geq 0$, $r > -1/2$, $s-1 \leq r \leq s$) or ($0 < s < 1/2$, $r = -1/2$) or ($s = 0$, $-1 \leq r \leq 0$). Moreover, we show that this result is optimal in the sense that the Cauchy problem is ill-posed in $H^s(\mathbb{R}) \times H^r(\mathbb{R})$ if s and r do not satisfy these conditions.

43 Isao Kato (Nagoya Univ.)* Well-posedness and scattering for the Cauchy problem of the Klein–Gordon–Zakharov system in four and more spatial dimensions 10

Summary: We study the Cauchy problem of the Klein–Gordon–Zakharov system in spatial dimension $d \geq 4$ with radial or non-radial initial datum $(u, \partial_t u, n, \partial_t n)|_{t=0} \in H^{s+1}(\mathbb{R}^d) \times H^s(\mathbb{R}^d) \times \dot{H}^s(\mathbb{R}^d) \times \dot{H}^{s-1}(\mathbb{R}^d)$. The critical value of s is $s_c = d/2 - 2$. By the radial Strichartz estimates and U^2, V^2 type spaces, we prove that the small data global well-posedness and scattering hold at $s = s_c$ in $d \geq 4$ for radial initial datum. For non-radial initial datum, we prove that the local well-posedness hold at $s = 1/4$ when $d = 4$ and $s = s_c + 1/(d+1)$ when $d \geq 5$.

44 Kunio Hidano (Mie Univ.)* Regularity and global existence of small solutions to systems of quasi-linear wave equations in $2D$ with multiple speeds 12

Summary: This talk is concerned with global existence of small solutions to systems of quasi-linear wave equations with cubic nonlinear terms and multiple speeds in $2D$ satisfying the null condition. By using the Klainerman–Sideris method together with the space-time weighted L^2 estimate for some "good derivatives" due to Alinhac, Lindblad–Rodnianski, and Lindbald–Nakamura–Sogge, we prove global existence in a Sobolev space of lower order. When the nonlinear term does not satisfy the null condition, we obtain almost global existence for small data in the Sobolev space whose order is the lowest among all the admissible integer-order Sobolev spaces. To study the multiple-speed wave equations with these low-order Sobolev spaces, we must overcome the difficulty caused by the lack of the H^1-L^p Klainerman–Sobolev type inequality. We use some trace-type inequalities as effective substitutes for this inequality.

45 Masahiro Ikeda (Kyoto Univ.) *
Takahisa Inui (Kyoto Univ.)
Yuta Wakasugi (Nagoya Univ.)
The Cauchy problem for the nonlinear damped wave equation with slowly decaying data 10

Summary: We study the Cauchy problem for the nonlinear damped wave equation with slowly decaying data, which means the data not belonging to L^1 in general. We establish the small data global well-posedness for the supercritical nonlinearity. We also prove that the asymptotic profile of the global solution is given by a solution of the corresponding parabolic problem.

46 Hiroyuki Takamura * (Future Univ.-Hakodate)
Kyouhei Wakasa (Muroran Inst. of Tech.)
Blow-up for semilinear wave equations with scale invariant damping and super Fujita exponent 10

Summary: The constant in the scale invariant damping may have a critical value classifying the situation for semilinear equations to "heat-like" or "wave-like". Introducing a new blow-up result for super Fujita exponent, We will discuss some conjecture on the constant.

47 Kyouhei Wakasa * (Muroran Inst. of Tech.)
Borislav Yordanov (Hokkaido Univ.)
Global regularity for supercritical nonlinear dissipative wave equations in 3D 10

Summary: The nonlinear wave equation $u_{tt} - \Delta u + |u_t|^{p-1}u_t = 0$ is shown to be globally well-posed in the Sobolev spaces of radially symmetric functions $H^k_{\mathrm{rad}}(\mathbf{R}^3) \times H^{k-1}_{\mathrm{rad}}(\mathbf{R}^3)$ for all $p \geq 3$ and $k \geq 3$. Moreover, global C^∞ solutions are obtained when the initial data are C^∞_0 and exponent p is an odd integer. The radial symmetry allows a reduction to the one-dimensional case where an important observation of A. Haraux(2009) can be applied, i.e., dissipative nonlinear wave equations contract initial data in $W^{k,q}(\mathbf{R}) \times W^{k-1,q}(\mathbf{R})$ for all $k \in [1, 2]$ and $q \in [1, \infty]$.

48 Itsuko Hashimoto * (Toyama Nat. Coll. of Tech.)
Hideo Kozono (Waseda Univ.)
Asymptotic behavior of radially symmetric solutions for quasilinear hypaerbolic fluid model 10

Summary: We consider a large time behavior of the radially symmetric solution to the equation of the quasilinear hyperbolic model in the exterior domain of a ball in general space dimensions. In the previous paper, we proved the asymptotic stability of the stationary wave of the Burgers equations in the same exterior domain when the solution is also radially symmetric. On the other hand, in the 1D-case, a similar asymptotic structure as above to the damped wave equation with a convection term has been established by Ueda–Kawashima. We shall prove that the stationary wave of our quasilinear hyperbolic model is asymptotically stable even in higher dimensions of exterior domains under the radially symmetric condition.

14:15–16:15

Summary: An inverse problem for the Maxwell system over a finite time interval in an exterior domain is considered. It is assumed that the solution of the system satisfies the so-called Leontovich boundary condition on the boundary of the domain. An application of the enclosure method to the inverse problem is given.

Summary: We consider the energy estimates for the Cauchy problem of Klein–Gordon type equation with time dependent potential $M(t) = \mu^2(1+t)^{-2} + \delta(t)$. The main purpose of our theorem is to give sufficient conditions to the perturbation $\delta(t)$ such that the same energy estimates hold as the case $\delta(t) = 0$, which have proved in the previous papers.

Summary: In this talk, we consider the Boltzmann equation without angular cutoff. Under perturbative setting, we show unique global existence of a non-negative solution in a certain Chemin–Lerner space, which is a time-velocity-space Besov space. We will mainly focus on how to construct the global solution. In order to estimate a nonlinear term of the equation, it is crucial to combine a non-isotropic norm with the Chemin–Lerner norm. Also, conservation laws of the equation gives another system of equations, which is essential for the estimate. Integrating these methods, we will have an apriori estimate of energy and dissipation terms.

Summary: We consider the asymptotic behavior of a solution to a linear thermoelastic equation in 3-dimension. Decomposing the elastic wave into irrotational and rotational components via the Helmholtz decomposition, we obtain that the solution behaves as a solution of heat equation and diffusive wave by eliminating the certain wave parts.

Summary: We consider a nonlinear version of the Timoshenko system with heat conduction of the Cattaneo law. The linear version of this system is of regularity-loss type. It is known that the regularity-loss property of the linear problem creates difficulties when dealing with the nonlinear problem. In this talk, we show the global existence result with the critical Sobolev space H^2 by using just an energy method without any negative weights. Besides, we also give the optimal decay result with the minimal regularity assumptions on the initial data. The proof is based on the refined time decay inequalities of L^p-L^q-L^r type.

Summary: We study spherically symmetric motions of a gseous star under the Euler–Poisson equations or the Einstein–Euler equations. If N is an even integer, where $N/(N-2)$ is the adiabatic exponent of the gas near the vacuum, the approximation by time-periodic linearized solutions and the time-local solvability of the Cauchy problem near equilibria with finite rasdii were established. Even if N is not an even integer, similar results can be proved, provided that $N > 108$.

Summary: We consider the two-dimensional Euler equations on domains with cusps. In this talk, we prove that for some domains with cusps, the Lipschitz estimate of the vorticity at the cusp is at most polynomial growth and the upper bound is sharp. Moreover we show that there exists a domains with cusps such that the Lipschitz estimate of the vorticity at the cusp is logarithmic growth.

Summary: In this talk we concern the large time behavior of solutions to the compressible Navier–Stokes equations in an infinite layer of $\mathbb{R}^2$ under slip boundary condition. It is shown that if the initial data is sufficiently small, the global solution uniquely exists and the large time behavior of the solution is described by a superposition of one-dimensional diffusion waves.

Summary: This talk is concerned with the stability of stationary solutions of the incompressible Navier–Stokes equation and the corresponding artifical compressible system. The latter system is obtained by adding the time derivative of the pressure with a small parameter to the continuity equation. Both systems have the same sets of stationary solutions and the incompresible system is obtained from the artificial compressible one in the zero small parameter limit which is a singular limit. It is shown that if a stationary solution is stable as a solution of the incompressible Navier–Stokes equation and satisfies some smallness condition, then the stationary solution is also stable as a solution of the artificial compressible system.

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

Atsuhide Ishida (Tokyo Univ. of Sci.) ♭ Direct and inverse problems of quantum scattering in time-dependent electric fields

Summary: In this talk, we consider the quantum scattering problems in time-dependent electric fields asymptotically constant in time. In the first section, I will report the result obtained by Adachi–Ishida (2011). We could show the asymptotic completeness for two-body quantum systems in an external electric field converging on non-zero constant. In addition, this result can be applied to a charge transfer model considered in Ishida (2010). In the second section, I will report the result of a multidimensional inverse scattering obtained by Adachi–Fujiwara–Ishida (2013). We could allow that the electric field converges on zero and show that the high velocity limit of the scattering operator determines uniquely the short-range part of the potential.

September 18th (Sun) Conference Room II

9:15–12:00

58 Noboru Chikami (Tohoku Univ.)
Raphaël Danchin (Univ. Paris-Est)
On the global existence and time decay estimates in critical spaces for the Navier–Stokes–Poisson system 12

Summary: We are concerned with the study of the Cauchy problem for the Navier–Stokes–Poisson system in the critical regularity framework. In the case of a repulsive potential, we first establish the unique global solvability in any dimension $n \geq 2$ for small perturbations of a linearly stable constant state. Next, under a suitable additional condition concerning only the low frequencies of the data and in the L^2-critical framework, we exhibit optimal decay estimates for the constructed global solutions, which are similar to those of the barotropic compressible Navier–Stokes system.

59 Hirokazu Saito (Waseda Univ.) Global solvability of the Navier–Stokes equations with a free surface in the maximal L_p-L_q regularity class 12

Summary: In this talk, we show the global solvability of the Navier–Stokes equations with a free surface in the maximal L_p-L_q regularity class. More precisely, the surface tension and the gravity force do not work, and the domain is bounded below by a solid surface and bounded above by a free surface. To show the global solvability, we combine the maximal L_p-L_q regularity of the linearized problem for suitable exponents p, q with the contraction mapping principle.

60 Hajime Koba (Osaka Univ.) On $L^{3,\infty}$ and L^∞-stability of the Navier–Stokes system on exterior domains 12

Summary: We consider the stability of a stationary solution of the Navier–Stokes system with a constant velocity at infinity in an exterior domain. More precisely, we study the stability of the Navier–Stokes system governing the stationary solution which belongs to the weak L^3-space $L^{3,\infty}$. Under the condition that the initial datum belongs to a solenoidal $L^{3,\infty}$-space, we prove that if both the $L^{3,\infty}$-norm of the initial datum and the $L^{3,\infty}$-norm of the stationary solution are sufficiently small then the system admits a unique global-in-time strong $L^{3,\infty}$-solution satisfying both $L^{3,\infty}$-asymptotic stability and L^∞-asymptotic stability.

Summary: We consider the initial-boundary value problem of the Navier–Stokes equations in an exterior domain, subject to the non-slip boundary condition. There is a large literature on the exterior problem for initial data decaying at space infinity. However, a few result is available for non-decaying data. We report some solvability result in a space of bounded functions.

Summary: We study the two-dimensional stationary Navier–Stokes equations describing the flows around a rotating obstacle. The unique existence of solutions and their asymptotic behavior at spatial infinity are established when the rotation speed of the obstacle and the given exterior force are sufficiently small.

Summary: We investigate the stability of boundary layer solutions of the two-dimensional incompressible Navier–Stokes equations. We show that if the initial boundary layer profile of shear type and is monotonic and concave then it is stable over some time interval under perturbations with Gevrey regularity in x and Sobolev regularity in y.

Summary: I will talk about the globally in time existence of solutions to the free boundary value problem for the Navier–Stokes equations in a bounded domain, taking the surface into account. I assume that the initial domain is closed to the ball and initial data are small and orthogonal to the rigid motion in the Euler coordinate. The velocity fields belongs to the maximal L_p-L_q regularity class. My proof is based on the maximal L_p-L_q regularity for the linearized problem and exponential stability for the Stokes semi-group with free boundary condition on the quotient space of the rigid motion.

Summary: I will talk about a free boundary problem for the Navier-Stokes equations in an exterior domain Ω in the N-dimensional Euclidean space ($N \geq 2$). The key is the unique existence of the weak Dirichlet problem. Combining my theorems concerning the maximal L_p-L_q result for the Stokes equations with free boundary condition in a general domain and the local well-posedness for the free boundary problem for the Navier-Stokes equations, I also report the corresponding results in the exterior domain case.

Summary: In this talk, we consider the wave operators for Schrödinger equation with variable coefficients. We prove the existence of the wave operators and characterize their ranges.

67 Haruya Mizutani (Osaka Univ.)
Jean-Marc Bouclet (Univ. Paul Sabatier)
Resolvent estimates for scaling-critical Schrödinger operators and applications 12

Summary: We discuss global dispersive properties for Schrödinger equations with potentials exhibiting scaling-critical singularities. Typical examples of potentials we have in mind are inverse-square type potentials. If the potential is subcritical in the sense that the corresponding Schrödinger operator is proportional to the positive Laplacian, then we show that both uniform resolvent estimates with a large class of weights and the full set of global-in-time Strichartz estimates hold. On the other hand, in the case with negative inverse-square potential involving the best constant in Hardy's inequality, usual endpoint Strichartz estimates can fail, while a weak-type endpoint estimate still holds.

68 Wataru Ichinose (Shinshu Univ.)
Takayoshi Aoki (Shinshu Univ.)
On the Cauchy problem for the Schrödinger equations with polynomially growing potentials in the spatial direction 10

Summary: We will study the Cauchy problem for the Schrödinger equations, in particular, with polynomially growing potentials in the spatial direction. Introducing weighted Sobolev spaces B^a and their dual spaces B^{-a}, we will show that the Cauchy problem for the Schrödinger equations is well defined in each $B^{\pm a}$ and so in $\mathcal{S}$ and $\mathcal{S}'$. The convergence of the Feynman path integral, which will be talked in the next talk, can be obtained by means of the results in this talk.

69 Wataru Ichinose (Shinshu Univ.)
The Feynman path integral for the Schrödinger equations with polynomially growing potentials in the spatial direction 10

Summary: We will show that the Feynman path integral for the Schrödinger equations is defined mathematically, in particular, with polynomially growing potentials in the spatial direction. We define the Feynman path integral in terms of piecewise linear paths, commonly used in physics. In more details, the Feynman path integral with any initial function $f \in L^2$ converges in the L^2 strong topology as the time-slicing width goes to 0. For example, in L^2 space we can define the Feynman path integral with $A_j = 0$ and $V(t,x) = |x|^{2l} +$ " a lower order term " $(l = 1, 2, ...)$.

14:15–16:15

70 Yutaka Kamimura (Tokyo Univ. of Marine Sci. and Tech.)
Inverse scattering method by an energy dependent Schrödinger equation 12

Summary: An inverse scattering method obeying an energy dependent Schrödinger equation is established in the case of refrectionless and one boundstate. This method is applied to a nonlinear evolution equation of an isospectral flow, and an exact solution of a Cauchy problem for the evolution equation is obtained.

Summary: We consider time global behavior of solutions to mass-subcritical nonlinear Schr̈odinger equation. To find a threshold solution between small scattering solutions and non-scattering solutions such as blowup solution or soliton like solutions, we introduce two minimization problems. Our aim here is to consider the above problems in the mass-subcritical setting. Weighted spaces are frequently used but it turns out that they are not so suitable to consider the above problems. So, we introduce a hat-Morrey space, which appears in refinement of Strichartz estimate. We first establish local well-posedness results. Then, we consider the two minimization problems. The main results is existence of a minimal blowup solution which has a compactness property so-called almost periodicity modulo symmetry.

Summary: We consider nonlinear Schrödinger equation with data in scale critical weighted space. Our aim here is to prove that boundedness of a solution in the critical weighted space implies that the solution scatters. This implies that the boundedness is equivalent to scattering. The proof is based on a concentration compactness argument and rigidity type argument. We first restate the problem in terms of a minimization problem. Then, we construct a minimizer by means of concentration compactness argument. Then, it turns out that the minimizer has a compactness property which is so-called almost periodicity modulo symmetry. Further, the solution must be of the self-similar type. In particular, the solution blows up at $t = 0$. Then, we show that an almost-periodic-modulo-symmetry solution of the self-similar type must belongs to L^2, which implies that the solution is global and that contradicts to blowup of the solution.

Summary: We study the orbital instability of solitary waves for a derivative nonlinear Schrödinger equation with a general nonlinearity. We treat a borderline case between stability and instability, which is left as an open problem by Liu, Simpson and Sulem (2013). We give a sufficient condition for instability of a two-parameter family of solitary waves in a degenerate case, and verify this condition for some cases.

Summary: We study strong instability of standing waves $e^{i\omega t}\phi_\omega(x)$ for nonlinear Schrödinger equations with L^2-supercritical nonlinearity and a harmonic potential, where ϕ_ω is a ground state of the corresponding stationary problem. We prove that $e^{i\omega t}\phi_\omega(x)$ is strongly unstable if $\partial_\lambda^2 E(\phi_\omega^\lambda)|_{\lambda=1} \le 0$, where E is the energy and $v^\lambda(x) = \lambda^{N/2}v(\lambda x)$ is the L^2-invariant scaling.

Summary: We consider the stability for line solitary waves of the two dimensional Zakharov–Kuznetsov equation on $\mathbb{R} \times \mathbb{T}$, where $\mathbb{T}$ is the torus with the 2π period. The orbital and asymptotic stability of the one soliton of Korteweg–de Vries equation on the energy space has been proved by Benjamin, Pego and Weinstein and Martel and Merle. We regard the one soliton of Korteweg–de Vries equation as a line solitary wave of Zakharov–Kuznetsov equation on $\mathbb{R} \times \mathbb{T}$. We show the stability of the line solitary waves of Zakharov–Kuznetsov equation. Moreover, we prove the asymptotic stability for line solitary waves of Zakharov–Kuznetsov equation by using the argument of Martel and Merle and a corrected virial type estimate.

Summary: We consider the focusing mass-supercritical and energy-subcritical nonlinear Schrödinger equation (NLS). We are interested in the global behavior of the solutions to (NLS) with group invariance. By the group invariance, we can determine the global behavior of the solutions above the ground state standing waves.

Summary: We consider third- and fourth-order nonlinear Schrödinger-type equations. Our aim is to study the limit problem from these equations to the standard nonlinear Schrödinger equation with cubic nonlinearity as the coefficients of the higher-order dispersion and derivative nonlinear terms tend to zero. The main part of the proof is to establish local well-posedness for the initial value problem associated with these equations which is independent of the smallness of the higher-order dispersion.

Summary: We consider a nonlinear Schrödinger equation with a non-vanishing condition at spatial infinity. A typical example is Gross–Pitaevskii equation (GP), which appears as a model equation in various physical phenomena. As for (GP), the nonlinearity decays to zero around the spatial infinity in the same rate as that a solution tends to a non-vanishing element. Since it would be expected that the decay rate of the nonlinearity governs global behavior of solutions, we introduce a nonlinear Schrödinger equation with a nonlinearity generalized with respect to the decay rate, to capture this phenomenon. In this talk, we show that if the decay rate is larger than a specific one, then the equation admits a global solution which scatters to the non-vanishing element for both time directions.

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

Masaya Maeda (Chiba Univ.) On orbital instability of excited states of nonlinear Schrödinger equations

Summary: In this talk, we consider the orbital stability/instability of bound states of nonlinear Schrödinger equations (NLS). For the case of ground states, which are real valued bound states with fixied sign, there is a simple criterion called Vakhitov–Kolokolov (VK) condition (or Grillakis–Shatah–Strauss condition) to show staiblity/instability. However, it is known that one cannot show stability/instability from VK condition for excited states, although they are expected to be unstable. Here, excited states are bound states which are not ground states. Further, it is known that some excited states are spectrally stable and one cannot show the instability of excited states from the study of the spectrum of linearized opeartors. In this talk, we show that under generic conditions similar to the assumptions of asymptotic stability theory of ground states of NLS, excited states are unstable. This is a joint work with Scipio Cuccagna (Trieste University).

Real Analysis

September 17th (Sat) Conference Room VI

9:30–11:45

1 Yoshifumi Ito (Univ. of Tokushima*) * Development of L^p-calculus 15

Summary: In this paper, we define the derivatives or the partial derivatives of L^p-functions and L^p_{loc}-functions in the sense of L^p-convergence and L^p_{loc}-convergence respectively. Then we study their fundamental properties.
Thereby, in the study of analysis of classical functions, we need not use the theory of distributions.

2 Yoshifumi Ito (Univ. of Tokushima*) * Fourier Transformation of L^p_{loc}-functions 15

Summary: In this paper, we study the Fourier transformation of L^p_{loc}-functions.
Thereby we prove the structure theorem of the space of Fourier transformations of L^p_{loc}-functions.

3 Yasuhiro Fujita (Univ. of Toyama) On the set where a generalized Takagi function takes its maximum
Yusuke Saito (Univ. of Toyama) 15

Summary: Our aim of the present talk is to investigate the set where a generalized Takagi function takes its maximum.

4 Shin-ya Matsushita (Akita Pref. Univ.) On convergence of the aternating direction method of multipliers 15
Li Xu (Akita Pref. Univ.)

Summary: In this talk, we consider the alternating direction method of multipliers (ADMM) for convex optimization problems. We investigate theoretical properties of ADMM by using fixed point theory.

5 Fumiaki Kohsaka (Tokai Univ.) Approximation of minimizers of convex functions in Hadamard spaces 15

Summary: We study the existence and approximation of minimizers of proper lower semicontinuous convex functions in Hadamard spaces by using the resolvents of such convex functions.

6 Koji Aoyama (Chiba Univ.) Approximation of zeros of accretive operators in a Banach space 15

Summary: In this talk, we consider the problem of finding a zero of an accretive operator in a Banach space. Then we prove strong convergence results for resolvents of the accretive operator.

7 Sachiko Atsushiba (Univ. of Yamanashi) Common acute points, fixed points and convergence theorems for nonlinear mappings 15

Summary: In this talk, we study the concepts of common acute points of families of nonlinear mappings by using the idea of common attractive points. We prove nonlinear ergodic theorems for nonlinear mappings. We also deal with Mann iterations and prove some convergence theorems for nonlinear mappings.

Summary: We will talk about Ćirić's and Bogin's fixed point theorems.

14:15–16:00

Summary: It is known as Pinsky phenomenon that, for the Fourier series of the indicator function of a d-dimensional ball with $d \geq 3$, the spherical partial sum diverges at the center of the ball. In 2010 Kuratsubo shows that, for the Fourier series of the indicator function of a d-dimensional ball with $d \geq 5$, the spherical partial sum diverges at all rational points. In this talk, we discuss the spherical partial sum of a certain radial function in four-dimension.

Summary: In this talk, we discuss the Fefferman–Stein inequality on Morrey spaces and give a sufficient and necessary condition for which the inequality holds. Further, we give an example of weights such that the Fefferman–Stein inequality on Morrey spaces fails.

Summary: Let μ be a locally finite Borel measure and $\mathcal{D}$ a family of measurable sets equipped with a certain dyadic structure. We introduce an α-dimensional Hausdorff content by means of μ and $\mathcal{D}$. In this talk we study the boundedness of the Hardy–Littlewood maximal operator $M_{\mathcal{D}}^{\mu}$ adapted to $\mathcal{D}$ and μ.

Summary: In this talk, we discuss the von Neumann–Jordan constant $C_{\mathrm{NJ}}(X)$ of concrete Banach spaces X. In particular, we treat Banaś–Frączek space $\mathbb{R}^2_\lambda$ which may be considered as a generalization of Day–James space ℓ_2-ℓ_1. We introduce a new class of two-dimensional normed spaces, which contains the space $\mathbb{R}^2_\lambda$. For such a space X, the constant $C_{\mathrm{NJ}}(X)$ is calculated by using the Banach–Mazur distance.

13 Aoi Honda (Kyushu Inst. of Tech.) Yoshiaki Okazaki (Fuzzy Logic Systems Inst.) Shilkret–Sugeno type integral for a subadditive monotone measure and its L_p space 15

Summary: We introduce the L_p-space $L_p[SS]$ for a subadditive monotone measure based on the fuzzy integral of Shilkret–Sugeno type: $(SS)\int f d\mu = \sup_{r\geq 0} r * \mu(f > r)$, where $*$ is a binary operation on $[0, \infty)$. The basic properties of $L_p[SS]$ and its dual are studied.

14 Jun Kawabe (Shinshu Univ.) Monotone convergence theorems for nonlinear integrals 15

Summary: The monotone convergence theorem for the abstract Lebesgue integral has played a fundamental role in the study of limit theorems of integral. In fact, it yields other basic theorems, such as the Fatou lemma, the dominated convergence theorem, and the bounded convergence theorem. The purpose of this talk is to present a unified approach to the monotone convergence theorem for nonlinear integrals such as the Choquet, the Šipoš, the Sugeno, and the Shilkret. The key tool is a perturbation of integral functional that manages not only the monotonicity of the functional but also the small change of the functional value arising as a result of adding small amounts to a measure and a function in the domain.

16:20–17:20 Talk Invited by Real Analysis Section

Akihiko Miyachi (Tokyo Woman's Christian Univ.) Hardy space estimates for multidimensional Hausdorff operators

Summary: In the one dimensional case, the Hausdorff operator is defined by taking average of dilations of a given function. A crude estimate of Hausdorff operators in Lebesgue spaces L^p, $p \geq 1$, is obtained by a simple application of Minkowski's inequality for L^p norms; we find that the Hausdorff operator is bounded in L^p, $p \geq 1$, if the average is taken with respect to an integrable weight function. The same holds for the estimate of Hausdorff operators in the Hardy space H^1. The situation changes if we consider estimates in Hardy spaces H^p, $p < 1$. The first nontrivial result for 1 dimensional Hausdorff operator was given by Yuichi Kanjin, who proved that Hausdorff operator is bounded in Hardy spaces H^p, $p < 1$, if the average is taken with respect to a sufficiently smooth weight function. In the lecture we shall consider extension of this result to higher dimension.

In the case of higher dimension, we define the Hausdorff operator as follows: given a function $f(x)$ of several real variables x, we make change of variables with nonsingular matrices A to get $f(Ax)$ and then take average of $f(Ax)$ over A's with respect to a fixed weight function. By some examples, we shall observe that only smoothness of the weight function of the average is not sufficient for the boundedness of the Hausdorff operator in Hardy spaces H^p, $p < 1$. We give a general theorem that the Hausdorff operator is bounded in Hardy spaces H^p, $p < 1$, if the average is taken, in a sense, for every directions.

This lecture is based on a joint work with Elijah Liflyand.

September 18th (Sun) Conference Room VI

9:30–12:00

15 Toshiyuki Suzuki (Kanagawa Univ.) Abstract semilinear Schrödinger equations with nonautonomous terms 15

Summary: To construct wave operators we consider the Cauchy problem for semilinear nonautonomous Schrödinger equations with inverse-square potentials.

$$i\frac{\partial u}{\partial t} = P_a u + \lambda t^{\gamma-1} u\,(|x|^{-\gamma} * |u|^2)$$

where $i = \sqrt{-1}$, $N \geq 3$, $a \geq -(N-2)^2/4$ and $P_a := -\Delta + a|x|^{-2}$. If we use the contraction methods, we need impose an unsatisfactory condition of a. Thus we need to establish a new method to solve the problem.

16 Takanori Kuroda (Waseda Univ.)
Mitsuharu Ôtani (Waseda Univ.) Solvability of complex Ginzburg–Landau equations with non-dissipative terms 15

Summary: In this talk we present a result on the existence of the unique local solutions for the complex Ginzburg–Landau equations (CGL) with non-dissipative terms. We also discuss a global continuation of the solution with small data. Our approach to (CGL) is to regard our equation as a parabolic equation of real 2-dim vectors with non-monotone perturbations and to apply abstract results of parabolic equations.

17 Shun Uchida (Waseda Univ.)
Mitsuharu Ôtani (Waseda Univ.) Right-differentiability for solution of some evolution equation with non-monotone perturbation 15

Summary: In 1973, H. Brézis characterized the right-differentiability for solution of evolution equation governed by maximal monotone operator. Apparently, it seems that it is difficult to apply the same proof to the case where a perturbation term is added to the equation. In this talk, we give a sufficient condition for perturbation so that the same characterization of right-differentiability given by H. Brézis holds true.

18 Kentarou Yoshii (Tokyo Univ. of Sci.)
Motohiro Sobajima (Tokyo Univ. of Sci.) An embedding estimate for the repulsive Hamiltonian in L^p 15

Summary: We consider the one-dimensional repulsive Hamiltonian with a class of perturbations, that is, $H := -\frac{d^2}{dx^2} - x^2 + V(x)$, $x \in \mathbb{R}$, where $V \in C(\mathbb{R})$ satisfies $V(x) \geq -a(1+x^2)$ for some constant $a \geq 0$ and $\int_{\mathbb{R}} |V(x)|(1+x^2)^{-1/2}\,dx < \infty$. The operator H describes the quantum particle affected by a strong repulsive force from the origin. Our aim of this talk is to show an embedding estimate for H.

19 Kota Kumazaki (Tomakomai Nat. Coll. of Tech.) On a mathematical model for moisture transport in porous media involving adsorption phenomenon 15

Summary: In this talk, we consider a mathematical model for moisture transport in concrete carbonation process. In this process, it is known that the relationship between the relative humidity and the degree of saturation is a hysteresis, and this is caused by adsorption and desorption phenomenon which occurs in each pores. Recently, a free boundary problem describing the adsorption and desorption process is proposed and analysed mathematically. In this talk, we propose a mathematical model for moisture transport consisting of a diffusion equation of the relative humidity and the above free boundary problem, and discuss the existence of a time local solution of this problem.

20 Akio Ito
Yusuke Murase (Meijo Univ.)
Existence of weak solutions for mathematical model of brewing process of Japanese Sake with stirring effect 15

Summary: In this talk, we discuss a existence of weak solutions for mathematical model of brewing process of Japanese Sake with stirring effect. Our model is a system which is formulated by 5 partial differential equations and a constraint condition. Strong solutions of auxiliary model bring about weak solutions of our original brewing model. we will show you the outline of a proof for existence of weak solutions.

21 Takeshi Fukao (Kyoto Univ. of Edu.)
Pierluigi Colli (Pavia Univ.)
Degenerate parabolic equations as asymptotic limits of Cahn–Hilliard equations 15

Summary: In this talk, an asymptotic limit of a class of Cahn–Hilliard equations is investigated to obtain a degenerate parabolic equation. The target equation may reproduce a number of well-known model equations: Stefan problem, porous media equation, Hele-Shaw profile, nonlinear diffusion of singular logarithmic type, nonlinear diffusion of Penrose–Fife type, fast diffusion equation and so on. Namely, by setting the suitable potential of the Cahn–Hilliard equations, all these problems can be obtained as limits of the Cahn–Hilliard related problems. Convergence results and error estimates are proved. The report is based on the result by Colli–Fukao, Journal of Differential Equations (2016).

22 Ryota Nakayashiki (Chiba Univ.)
Ken Shirakawa (Chiba Univ.)
Pierluigi Colli (Univ. Pavia)
Gianni Gilardi (Univ. Pavia)
Quasilinear parabolic variational inequalities subject to dynamic boundary condition 15

Summary: In this talk, we consider coupled systems of an Allen–Cahn type equation in a bounded spatial domain Ω, and another Allen–Cahn type equation on the smooth boundary $\partial\Omega$. The systems are denoted by $(\mathrm{ACE})_\varepsilon$ with arguments $\varepsilon \geq 0$, and the coupled two Allen–Cahn type equations are transmitted via the dynamic boundary conditions. In particular, the diffusion in Ω is provided by a quasiliniear from with singularity. The objective of the study is to build a mathematical method to analyze the systems $(\mathrm{ACE})_\varepsilon$ for $\varepsilon \geq 0$. On this basis, the results concerned with the well-posedness of $(\mathrm{ACE})_\varepsilon$ for each $\varepsilon \geq 0$, and the continuous dependence of solutions to $(\mathrm{ACE})_\varepsilon$ for the variations of $\varepsilon \geq 0$, are reported in forms of some Main Theorems.

23 Noriaki Yamazaki (Kanagawa Univ.)
Tomoyuki Suzuki (Kanagawa Univ.)
Keisuke Takasao (Univ. of Tokyo)
Stability criteria for numerical experiments of Allen–Cahn equations with constraint via Yosida approximation 15

Summary: We consider a two-dimensional Allen–Cahn equation with double-obstacle constraint, numerically. The constraint is provided by the subdifferential of the indicator function on the closed interval, which is the multivalued function. Therefore, it is very hard to perform a numerical simulation of our problem. In this talk we approximate the constraint by the Yosida approximation. Then, we give the stability criteria for the standard forward Euler method to provide the stable numerical experiments of the approximating equation.

14:15–15:15

24 Hiroshi Watanabe (Oita Univ.) Nonlocal strongly degenerate parabolic system with variable coefficients 15

Summary: We consider the initial value problem (CP) for nonlocal strongly degenerate parabolic system 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 equation has both properties of hyperbolic equations and those of parabolic equations. Nonlocal strongly degenerate parabolic system is a kind of system of strongly degenerate parabolic equations and describes various phenomena such as laser technology and crowd dynamics and so on. In this talk, we formulate BV-entropy solutions to (CP) and show the existence and uniqueness of the solutions.

25 Ken Shirakawa (Chiba Univ.)
Noriaki Yamazaki (Kanagawa Univ.) Optimal control problems involving one-dimensional models of grain boundary motions 15

Summary: In this talk, we consider optimal control problems involving state systems with no-uniqueness. In the context, the state systems are formulated by parabolic systems of degenerate types, which are based on mathematical models of grain boundary motions proposed in [Warren et al., Acta Materialia, 53 (2003), 6035–6058]. The objective in this talk is to obtain a control theory which is applicable for no-uniqueness situations in our state systems. Based on this, the mathematical results concerned with "the existence of optimal controls", "the constructions of approximating optimal control problems which involve state systems with uniqueness", and "the relationship between optimal controls in the original problem and those in the approximating problems", will be reported in forms of some main theorems.

26 Akio Ito Asymptotic behavior of a global-in-time solution to a tumor invasion model of Chaplain–Anderson type with quasi-variational structure ... 15

Summary: We treat 2D and 3D tumor invasion models with quasi-variational structures composed of two PDEs, one ODE and certain constraint conditions. Although the original model was proposed by M. R. A. Chaplain and A. R. A. Anderson in 2003, the difference between their original model and ours is that the constraint conditions for the distributions of tumor cells and the extracellular matrix are imposed in our model giving a quasi-variational structure. In this talk, we discuss the existence of global-in-time solutions and consider their large-time behaviors. Especially, for the large-time behaviors, we show that there exists at least one global-in-time solution such that it converges to a constant steady state in an appropriate function space as time goes to ∞

27 Toyohiko Aiki (Japan Women's Univ.)
Adrian Muntean (Karlstad Univ.) Large time behavior of solutions to the model 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. Here, we have already treated the Smoluchowski population balance equation as a reaction rate of generation of colloid particles on the domain. For this problem we showed the results concerned with existence, uniqueness and homogenization. In these results we consider the approximation of the nonlinear terms. The aim of this talk is to discuss the well-posedness for the same problem relaxing the approximation. Also, we establish the large time behavior of the solution. Precisely, the concentration of the colloids vanishes at large time.

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

Hiroshi Matsuzawa
(Numazu Nat. Coll. of Tech.)

Spreading speed and asymptotic profile of the free boundary problems of nonlinear diffusion equations

Summary: In this talk, we consider free boundary problems for nonlinear diffusion equations of the form $u_t = u_{xx} + f(u)$ for $t > 0$, $g(t) < x < h(t)$, where $x = g(t)$ and $x = h(t)$ are free boundaries. The behavior of the free boundaries are determined by the Stefan-like conditions.

For special $f(u)$ of the logistic type, the problem was introduced by Du and Lin (2010) as a population model describing the spreading of a new or invasive species, with the free boundaries representing the spreading fronts of the population whose density is expressed by $u(t, x)$.

Their results were extended in the paper by Du and Lou (2015) for quite general nonlinearities $f(u)$. In particular,they obtained that if $f(u)$ is monostable, bistable, or combustion type, then the problem has a unique solution which is defined for all $t > 0$. They also revealed sharp transition phenomena between spreading ($u \to 1$ as $t \to \infty$) and vanishing ($u \to 0$ as $t \to \infty$). Moreover they show that, when spreading happens, the asymptotic spreading speed of the fronts is uniquely determined and it is characterised by the corresponding so-called "semi-waves".

Motivated by the classical work of Fife and McLeod (1977), my recent researches concentrate on the asymptotic profile of the solution u to the free boundary problem for which spreading happens. In particular, I will present how the solution approaches the semi-wave when spreading happens. This research have extended to the problem with an advection term and problem in higher dimension with radially symmetric setting.

This talk is based on several joint works with Professor Yihong Du (University of New England), Professor Yuki Kaneko (Waseda University) and Dr. Maolin Zhou (University of New England).

Functional Analysis

September 15th (Thu) Conference Room IV

14:15–16:15

1 Hiroyuki Yamagishi (Tokyo Metropolitan Coll. of Indus. Tech.)
Yoshinori Kametaka (Osaka Univ.*)
The best constant of Sobolev inequality corresponding to Schrödinger operator with square-well potential 15

Summary: We consider boundary value problems for the one-dimensional Schrödinger operator with square-well potential. Green function $G(x, y)$ is calculated and the aspect as reproducing kernel is also investigated. As an application, the best constant of Sobolev inequality is expressed as the maximum of the diagonal value $G(y, y)$.

2 Akito Suzuki (Shinshu Univ.)
Toru Fuda (Hokkaido Univ.)
Daiju Funakawa (Hokkaido Univ.)
Localization of a one-dimensional split-step quantum walk 15

Summary: We consider a one-dimensional discrete-time quantum walk. A model of quantum walk is defined by unitary operator U which is the product of a shift operator and a coin operator. Supposing that the shift operator and coin operator are self-adjoint and unitary. We talk about the phenomenon called "localization" and above mentioned U has eigenvalues -1 or $+1$ with some sufficient conditions. This research is joint work with A. Suzuki and T. Fuda.

3 Hiromichi Ohno (Shinshu Univ.)
Unitary equivalence of one-dimensional quantum walks 15

Summary: This study investigates unitary equivalent classes of one-dimensional quantum walks. We prove that one-dimensional quantum walks are unitary equivalent to quantum walks of Ambainis type and that translation-invariant one-dimensional quantum walks are Szegedy walks. We also present a necessary and sufficient condition for a one-dimensional quantum walk to be a Szegedy walk.

4 Yoritaka Iwata ♭ (Tokyo Tech/Shibaura Inst. of Tech.)
Characterization of infinitesimal generators of invertible evolution families 15

Summary: We consider abstract evolution equations in Banach spaces. For non-autonomous cases, the detail property of infinitesimal generators is well known to highly affect the solvability of evolution equations. In this presentation, based on the logarithmic representation of infinitesimal generators, the classification of infinitesimal generator is provided in terms of the invertibility of evolution family. The unique existence of solutions for non-autonomous equations is presented for the related evolution equations by showing the possible application of the maximal regularity for evolution equations including the classified infinitesimal generators.

5 Yukihide Tadano (Univ. of Tokyo)
Long-range scattering for discrete Schrödinger operators 15

Summary: In this talk, we define time-independent modifiers to construct a long-range scattering theory for discrete schrödinger operators on the square lattice $\mathbb{Z}^N$. We prove the existence and completeness of modified wave operators in terms of the above mentioned time-independent modifiers.

6 Fumio Hiroshima (Kyushu Univ.) Spectrum of discrete Schrödinger operators on lattice ····· 10

Summary: Eigenvalue behaviors of Schrödinger operator defined on n-dimensional lattice with $n+1$ delta potentials is studied. It can be shown that lower threshold eigenvalue and lower threshold resonance are appeared for $n \geq 2$.

7 Fumio Hiroshima (Kyushu Univ.) Time operators associated with Schrödinger operators ····· 15

Summary: A weak time operator T associated with a self-adjoint operator H is a symmetric operator such that $(H\phi, T\psi) - (T\phi, H\psi) = -i(\phi, \psi)$ holds for $\phi, \psi \in D$ with some domain D which is, however, not dense in general, and T can be constructed only for special H. In this talk we define a time operator T_H as a densely defined symmetric quadratic form, and T_{H_V} associated with a Schrödinger operator of the form $H_V = -(1/2)\Delta + V$ is constructed. In particular a generalized time operator associated with the 3-dimensional hydrogen atom $-(1/2)\Delta - \frac{1}{|x|}$ is given.

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

Susumu Yamazaki (Nihon Univ.) Pseudodifferential operators of infinite order and symbols in the analytic category

Summary: We shall announce our recent results about a new cohomological representation and the corresponding symbol theory for pseudodifferential operators in the complex analytic category. Here the pseudodifferential operators mean integral operators with real holomorphic microfunction kernels. The notion of real holomorphic micro functions had been introduced by Sato, Kawai and Kashiwara by using sheaf cohomology theory. Symbol theory for those operators was partly developed by Kataoka and by Aoki and it has been effectively used in the analysis of operators of infinite order. However, there are the following two issues: (1) the consistency of the Leibniz–Hörmander rule and the cohomological definition of composition for operators (2) the relation between the action of operators by integration of kernel functions and canonical action through cohomological definition. We use a new isomorphism of cohomology groups, provide a cohomological foundation of the symbolic calculus of pseudodifferential operators, and solve (1) and (2) above. The contents of this talk are based on a joint work with Takashi Aoki (Kindai University) and Naofumi Honda (Hokkaido University).

September 16th (Fri) Conference Room IV

9:15–12:00

8 Imam Nugraha Albania (Chiba Univ.) The order of some functions related to their positive definiteness ····· 15
Kosuke Kanemitsu (Chiba Univ.)
Masaru Nagisa (Chiba Univ.)

Summary: We consider the order of the function $f_{a,b} = t^{(1-a+b)/2}\frac{b(t^a-1)}{a(t^b-1)}$ for $a, b \in \mathbb{R}$. We define the order of two functions by positive definiteness and using this order it related to the norm inequality of operators.

Summary: We consider operator monotonicity of a 2-parameter family of functions which is constructed by integration of the representing function of weighted power mean. We also think about operator monotonicity of $\exp\{f(x)\}$ for a continuous function $f(x)$ defined on $(0,1)$.

Summary: Let A and B be strictly positive operators on a Hilbert space. Fujii et al. pointed out that the relative operator entropy $S(A|B) = A^{\frac{1}{2}}\log(A^{\frac{-1}{2}}BA^{\frac{-1}{2}})A^{\frac{1}{2}}$ and Tsallis relative operator entropy $T_r(A|B) = \frac{A\natural_r B - A}{r}$ can be regarded as the velocities at $t=0$ of the paths $A\natural_t B = A^{\frac{1}{2}}(A^{\frac{-1}{2}}BA^{\frac{-1}{2}})^t A^{\frac{1}{2}}$ $(t\in\mathbb{R})$ and $A\sharp_{t,r}B = A^{\frac{1}{2}}\{(1-t)I + t(A^{\frac{-1}{2}}BA^{\frac{-1}{2}})^r\}^{\frac{1}{r}}A^{\frac{1}{2}}$ $(0\le t\le 1,\ -1\le r\le 1)$ respectively.
In this talk, based on their discussion, we consider $S_\alpha(A|B)$ and $S_{\alpha,r}(A|B)$ (generalizations of $S(A|B)$ and $T_r(A|B)$) as the velocities at $t=\alpha$ of the paths $A\natural_t B$ and $A\sharp_{t,r}B$ respectively. Moreover we introduce the accelerations of these paths and show their properties.

Summary: As generalizations of arithmetic and geometric means, for positive real numbers a and b, power difference mean $J_q(a,b) = \frac{q}{q+1}\frac{a^{q+1}-b^{q+1}}{a^q-b^q}$ and Heron mean $K_q(a,b) = (1-q)\sqrt{ab} + q\frac{a+b}{2}$ are well known. Many researchers investigate estimations of these means, and also they discuss related operator inequalities and matrix norm inequalities. In this talk, we obtain the greatest value $\alpha = \alpha(q)$ and the least value $\beta = \beta(q)$ such that the double inequality

$$K_\alpha(a,b) < J_q(a,b) < K_\beta(a,b)$$

holds for any $q\in\mathbb{R}$, which includes Xia, Hou, Wang and Chu's result. From this result, we can also obtain operator inequalities for bounded linear operators on a Hilbert space.

Summary: In this talk, by virtue of the generalized Kantorovich constant, we show counterparts to the information monotonicity of operator power means of order t for all $t\in(0,1]$.

13 Hiroyuki Osaka (Ritsumeikan Univ.)
Yukihiro Tsurumi (Ritsumeikan Univ.)
Shuhei Wada
(Kisarazu Nat. Coll. of Tech.)
Generalized reverse Cauchy inequality and applications to operator means 15

Summary: Let $0 \leq \nu \leq 1$ and ∇_ν be a weighted operator arithmetric mean. We introduce an operator inequality for an operator mean σ such that $\phi(A)\sigma\phi(B) \geq \phi(A\nabla_\nu B) - \phi(r|A-B|)$ $(r \geq 0)$ for a non-negative operator convex function ϕ on $[0,\infty)$ with $\phi(0) = 0$ and $\phi(1) = 1$ and all positive definite matrices A and B, and we show the characterization of σ to hold that $\sigma = \nabla_\nu$.

14 Junichi Fujii (Osaka Kyoiku Univ.)
Around Jones–Wenzl projections 15

Summary: As one of models of TQC, the spin network one is important. It is based on Temperley–Lieb algebra and the Jones–Wenzl projections. We obtain Jones–Wenzl projections not only from the skein computation but also from purely algebraic one. We refer also to the model of Fibonacci anyon in the spin networks.

15 Mitsuru Uchiyama (Ritsumeikan Univ.)
Positive linear maps on C*-algebras and rigid functions 15

Summary: Let a linear map Φ between two unital C^*-algebras be positive and preserve the identity. Kadison showed that if $f(t) = |t|$ and $\Phi(f(A)) = f(\Phi(A))$ for all selfadjoint operators $A \in \mathcal{A}$, then $\Phi(A^2) = \Phi(A)^2$ for all selfadjoint operators A, that is, Φ is a C^*-homomorphism. Choi proved this fact for an operator convex function f, and then conjectured that this fact would hold for a non-affine continuous function f. We shall prove a refinement of his conjecture.

16 Kei Ji Izuchi (Niigata Univ.)*
Yuko Izuchi
Shûichi Ohno (Nippon Inst. of Tech.)
Topological properties of path connected components in spaces of weighted composition operators into L^∞ 15

Summary: We will demonstrate the equivalence amongst the topological structures of path connected components in the spaces of weighted composition operators acting from L^∞, H^∞ and the disk algebra into L^∞ on the unit circle.

13:00–14:00 Talk Invited by Functional Analysis Section

Shuhei Wada
(Kisarazu Nat. Coll. of Tech.)
Topics in the theory of operator monotone functions

Summary: The theory of operator monotone functions was founded by K. Löwner (C. Loewner) and his pupils in the 1930s. In recent years, some researchers have re-evaluated the value of this theory through the emergence of the theory of operator means and quantum information. In this paper, we will discuss some recent topics about operator monotone functions and operator means.

September 17th (Sat) Conference Room IV

9:15–12:00

17 <u>Masatoshi Enomoto</u> Yasuo Watatani (Kyushu Univ.) Unbounded strongly irreducible operators and Hilbert representations of Kronecker quivers · · · 15

Summary: Kronecker studied Kronecker canonical form as a generalization of Jordan canonical form. We developed this direction into infinite dimensional frame work and we had a class of infinite dimensional transitive Hilbert representations of quivers. In our study we recognized that unbounded strongly irreducible operators are important. Furthermore, relations between unbounded strongly irreducible operators, operator quotients and Hilbert representations of Kronecker quivers are also crucially important. In this talk we report related results.

18 Takahiro Sudo (Univ. of Ryukyus) Classification of topological manifolds by the Euler characteristic and the K-theory ranks of C*-algebras · · · 15

Summary: We give a lecture about classification of topological manifolds by the Euler characteristic and the K-theory ranks of C*-algebras.

19 Yuhei Suzuki (Chiba Univ.) Elementary constructions of non-discrete C*-simple groups · · · 15

Summary: Recently Raum has given the first examples of locally compact non-discrete groups with simple reduced group C*-algebras, answering a question of de la Harpe. In this talk, we construct such groups, relying only on results in the discrete case.

20 Yuhei Suzuki (Chiba Univ.) Construction of minimal skew products of amenable minimal dynamical systems · · · 15

Summary: For an amenable minimal topologically free dynamical system α of a group on a compact metrizable space Z and for a compact metrizable space Y satisfying a mild condition, we construct a minimal skew product extension of α on $Z \times Y$. This generalizes a result of Glasner and Weiss. We also study the pure infiniteness of the crossed products of minimal dynamical systems arising from this result. In particular, we give a generalization of a result of Rordam and Sierakowski.

21 Takuya Takeishi (Kyoto Univ.) Primitive ideals and K-theoretic approach to Bost–Connes systems · · · 10

Summary: In this talk, we would like to deal with the classification problem of Bost–Connes systems. For a number field K, there is a C^*-dynamical system (C^*-algebra equipped with an $\mathbb{R}$-action) so called the Bost–Connes system for K. By KMS-classification theorem of Laca–Larsen–Neshveyev, the Dedekind zeta function is an invariant of Bost–Connes systems. However, this invariant turned out to be an invariant of Bost–Connes C^*-algebras, in fact. We would like to explain the history of the classification problem of Bost–Connes systems, and to give an outline of the proof of the main theorem.

22 Norio Nawata (Osaka Kyoiku Univ.) Examples of simple stably projectionless C*-algebras with non-zero pairings · · · · · 15

Summary: In this talk, we construct simple stably projectionless C*-algebras with non-zero pairings, arising as crossed products of simple unital C*-algebras by ℝ. This construction is based on the work of Kishimoto and Kumjian.

23 Tsuyoshi Kajiwara (Okayama Univ.) Yasuo Watatani (Kyushu Univ.) Ideals of the cores of the C*-algebras associated with self-similar maps with higher dimensional sets of branched points · · · · · 15

Summary: In this talk, we present analysis of the core of the C*-algebras associated with self-similar maps with higher dimensional sets of branched points. We mainly consider the case of the products of the one dimensional tent map. We present the matrix representation of the finite cores. We also do a complete classification of primitive ideals of the cores using a concrete description of the matrix representation of the finite cores.

24 Kengo Matsumoto * (Joetsu Univ. of Edu.) Strong Morita equivalence vs. strong shift equivalence · · · · · 15

Summary: We introduce a notion of strong Morita equivalence in the Cuntz–Krieger triplets $(\mathcal{O}_A, \mathcal{D}_A, \rho^A)$ the Cuntz–Krieger algebra $\mathcal{O}_A$,its canonical maximal abelian C^*-subalgebra $\mathcal{D}_A$ and its gauge action ρ^A, and prove that two Cuntz–Krieger triplets $(\mathcal{O}_A, \mathcal{D}_A, \rho^A)$ and $(\mathcal{D}_B, \mathcal{D}_B, \rho^B)$ are strong Morita equivalent if and only if the matrices A and B are strong shift equivalent. We also show that the generalized gauge actions on the stabilized Cuntz–Krieger algebras are cocycle conjugate if the underlying matrices are strong shift equivalent. By clarifying K-theoretic behavior of the cocycle conjugacy, we investigate a relationship between cocycle conjugacy of the gauge actions on the stabilized Cuntz–Krieger algebras and topological conjugacy of the underlying topological Markov shifts.

14:15–16:15

25 Shuhei Masumoto (Univ. of Tokyo) The Jiang–Su algebra and Fraïssé theory · · · · · 15

Summary: Fraïssé theory is a theory where a bijective correspondence between countable ultra-homogeneous structures and classes with certain properties of finitely generated structures is studied. It has been generalized to the setting of metric structures so that it can be applied to operator algebras. In this talk, I will present how the Jiang-Su algebra is understood in the context of Fraïssé theory.

26 Yusuke Isono (Kyoto Univ.) On fundamental groups of tensor product II_1 factors · · · · · 15

Summary: Let M be a II_1 factor and let $\mathcal{F}(M)$ denote the fundamental group of M. We study the following property of M: for arbitrary II_1 factor B, we have $\mathcal{F}(M \otimes B) = \mathcal{F}(M)\mathcal{F}(B)$. We particularly show that if $G, H \leq \mathbf{R}_+^*$ are realized as fundamental groups of II_1 factors (with separable predual), then so is the group generated by G and H.

Summary: A probability-measure-preserving action of a countable group is called stable if its transformation-groupoid absorbs the ergodic hyperfinite equivalence relation of type II_1 under direct product. Some conditions for groups to have a stable action involve inner amenability and property (T). Among other things, I will discuss a characterization of a central group-extension having a stable action.

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

Summary: Let G be an exponential solvable Lie group with Lie algebra $\mathfrak{g}$. We study a holomorphically induced representation of G from a real linear form f of $\mathfrak{g}$ and a complex subalgebra $\mathfrak{h}$ of $\mathfrak{g}_{\mathbb{C}}$ such that $f([\mathfrak{h},\mathfrak{h}]) = \{0\}$. We discuss some examples under a setting where the space $\mathfrak{h} + \overline{\mathfrak{h}}$ is not necessarily a Lie subalgebra of $\mathfrak{g}_{\mathbb{C}}$.

Summary: Let X be a homogeneous space of a real reductive group G. It was proved by Kobayashi and T. Oshima that the space of functions on X contains each G irreducible representation at most finitely many times if a minimal parabolic subgroup of G has an open orbit on X, or equivalently the number of P-orbit on X is finite. We discuss an analogous result for degenerate principal series representations. For non-minimal parabolic Q, we find an example that the space of functions on X contains the degenerate principal series representations infinitely many times even though the number of Q-orbits on X is finite.

Summary: Given a smooth manifold X and its submanifold Y, consider linear maps from the space $\mathcal{E}^i(X)$ of differential i-forms on X to the space $\mathcal{E}^j(Y)$ of differential j-forms on Y, that satisfies certain covariance. For instance, the differential d commutes with diffeomorphisms. The codifferential d^* and (when the codimension of Y is 1) interior multiplication $\iota_{N(Y)}$ by the normal vector field to Y also have some covariance with respect to conformal transformations.

The object of this talk is conformally covariant differential operators $\mathcal{E}^i(X) \to \mathcal{E}^j(Y)$ for Riemannian manifold X. If such differential operators can be constructed uniformly, then they should exist for the case $(X, Y) = (S^n, S^{n-1})$ whose conformal groups are "large". In this talk we report that we completely classified the conformally covariant differential operators from $\mathcal{E}^i(S^n)$ to $\mathcal{E}^j(S^{n-1})$ with explicit formulæ.

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

Yoshiki Oshima (Univ. of Tokyo) * Unitary representations of real reductive Lie groups and orbit method

Summary: The orbit method was introduced by Kirillov in the 1960s and relates the representations of Lie groups and symplectic geometry. For nilpotent groups it establishes an exact correspondence between the unitary representations and the coadjoint orbits. Although such correspondence is not so perfect for reductive groups, it still provides a general principle for the study of unitary representations.
In this talk we will see some results on characters, inductions and restrictions of representations of real reductive groups, especially singular representations from the viewpoint of orbit geometry.

Statistics and Probability

September 15th (Thu) Conference Room VII

9:15–12:00

1 Mamoru Tanaka (Tohoku Univ.) A percolation on directed graphs 10

Summary: Suppose each site independently and randomly chooses some sites around it. If a site chooses another site, then we say they are weakly connected, if they are choosed each other, then we say they are strongly connected. When the weak (strong) connected cluster is infinite? We investigate a percolation model for this problem, which is a generalization of site percolation. We give a relation between the probability of the number of chosen sites around a site and the size of clusters.

2 Akira Sakai (Hokkaido Univ.) The lace expansion for the nearest-neighbor models on the BCC lattice 15

Summary: The lace expansion has been a powerful tool to rigorously prove mean-field (MF) results for various statistical-mechanical models in high dimensions. Recently, van der Hofstad and Fitzner managed to prove MF results for nearest-neighbor percolation on $\mathbb{Z}^{d\geq 11}$ by using the so-called NoBLE (Non-Backtracking Lace Expansion). However, the method is too heavy to digest and there still remains a gap from the expected upper-critical dimension $d_c = 6$.
In this talk, we show that the MF results may be proven for the nearest-neighbor models on the BCC (Body-Centered Cube) lattice in dimensions much closer to the model-dependent d_c, in a much simpler and accessible way.

3 Jean-Dominique Deuschel (Tech. Univ. Berlin)
Ryoki Fukushima (Kyoto Univ.) Quenched tail estimate for the random walk in random scenery 10

Summary: We discuss the quenched tail estimates for the random walk in random scenery. The random walk is the symmetric nearest neighbor walk and the random scenery is assumed to be independent and identically distributed, non-negative, and has a power law tail. We identify the long time aymptotics of the upper deviation probability of the random walk in quenched random scenery, depending on the tail of scenery distribution and the amount of the deviation.

4 Yosuke Kawamoto (Kyushu Univ.) Density preservation of infinite-dimensional interacting Brownian motions 15

Summary: We prove that unlabeled diffusion processes with infinitely many particles preserve density in the time evolution of the process at the capacity level. This result can be applied to show the strong uniqueness of a solution of some type of infinite dimensional stochastic differential equation, for example, infinite dimensional Dyson's Brownian motion with multiple tails.

Summary: In a recent paper by Gorin and Shkolnikov (2016), they have found, as a corollary to their result relevant to random matrix theory, that the area below a normalized Brownian excursion minus one half of the integral of the square of its total local time, is identical in law with a centered Gaussian random variable with variance 1/12. In this talk, we give a pathwise interpretation to their identity; Jeulin's identity connecting normalized Brownian excursion and its local time plays an essential role in the exposition.

Summary: We consider driftless SDEs with monotonically increasing or decreasing diffusion coefficients on the positive interval $I = (0, \infty)$. Firstly, we show a necessary condition that pathwise uniqueness holds for nondegenerated diffusion coefficients on I. Then, we study stability problems of SDEs with degenerated and nondegenerated diffusion coefficients. As a concrete example, the Cantor diffusions is introduced and the bounded rate is given.

Summary: In this talk, we consider the strong rate of convergence for the Euler–Maruyama scheme of a class of stochastic differential equations whose diffusion coefficient is discontinuous.

Summary: Let C be the set of smooth curves $\mathsf{c} : \mathbb{R} \to \mathbb{R}^2$. Let $G = SU(n)$, and $\mathfrak{g} = \mathfrak{su}(n)$, the Lie algebra of G. Let Ω^1 denote the space of $\mathfrak{g}$-valued smooth 1-forms on $\mathbb{R}^2$. For $A \in \Omega^1$, let $h_{\mathsf{c},A}(t) \in G$ $(t \in \mathbb{R})$ denote the parallel transport along $\mathsf{c} \in \mathsf{C}$. Consider the following problem: Construct a sequence of Ω^1-valued random variables $A^{(j)}$ $(j \in \mathbb{N})$, and a complete metric space $(\mathcal{G}, d)$ with $\mathcal{G} \subset C(\mathbb{R}, G)$ such that (1) $h_{\mathsf{c}} := \lim_{j\to\infty} h_{\mathsf{c},A^{(j)}}$ exists in $\mathcal{G}$ for all $\mathsf{c} \in \mathsf{C}$, a.s., (2) The set of random variables $\{h_{\mathsf{c}} : \mathsf{c} \in \mathsf{C},\ \mathsf{c}$ is a loop$\}$ obeys the law of the Wilson loops of Yang–Mills theory on $\mathbb{R}^2$. We give a partial result on this problem. Our approach is based on the results of Gubinelli's theory of controlled rough paths. We also use an estimation on the supremum of Gaussian variables due to Hytönen and Veraar.

Summary: This study is an alternative approach to the fundamental theory of rough paths on the basis of fractional calculus. In this talk, using fractional derivative operators, we will introduce an explicit expression of the integral of controlled rough paths, which was introduced by M. Gubinelli in 2004. The expression provides an extension of the integration introduced by Y. Hu and D. Nualart in 2009. It is also regarded as an extension of the integration introduced in the speaker's previous works.

10 Kiyoiki Hoshino (Osaka Pref. Univ.) Tetsuya Kazumi (Osaka Pref. Univ.) Identification of noncausal Wiener functionals from SFC ····· 10

Summary: We identify the stochastic derivatives of noncausal Wiener functionals from Skorokhod type SFC on the space of square integrable Wiener functionals. Moreover, we identify them from Ogawa type SFC by applying our previous results.

11 Shigeyoshi Ogawa (Ritsumeikan Univ.) Hideaki Uemura (Aichi Univ. of Edu.) On a reconstruction of random function from its SFCs ····· 5

Summary: We consider the reconstruction problem of a random function from the system of its stochastic Fourier coefficients (SFC in abbr.). We employ the system of trigonometric functions and Ogawa integral to construct SFCs. We obtained an affirmative answer to the reconstruction problem with the aid of discrete white noise under some conditions on a random function.

14:15–15:00

12 Masaaki Tsuchiya (Kanazawa Univ.*) * On a characterization of the temporal homogeneity of additive processes ····· 10

Summary: Let us consider a stochastically continuous d-dimensional càdlàg process starting from the origin at the initial time. We show that if the process has the independent increments property in strong sense, then it has the temporal homogeneity (that is, it is a Lévy process), provided the process is immediately random.

13 Masaki Wada (Tohoku Univ.) Limit theorems for fundamental solutions of Schrödinger operators ··· 15

Summary: Let $\{X_t\}_{t\geq 0}$ be the symmetric α-stable process with generator $\mathcal{L} = -(-\Delta)^{\alpha/2}$ for $0 < \alpha \leq 2$ and μ be a positive Radon measure in a certain class. We define the Schrödinger operator $\mathcal{L}^{\mu} = \mathcal{L} + \mu$ and consider the fundamental solution of the equation $\partial u/\partial t = \mathcal{L}^{\mu} u$. If μ is critical, the behavior of the fundamental solution is different from that of the transition density function of $\{X_t\}_{t\geq 0}$. In this talk, we give some limit theorems for fundamental solutions of critical Schrödinger operators.

14 Shunsuke Kaji (Kyushu Sangyo Univ.) First passage problems over increasing boundaries for Lévy processes with exponentially decayed Lévy measures ····· 15

Summary: In this note, we study a first passage problem for Lévy processes over one-side moving boundaries. Our main theorem states that the tail behaviour of the crossing time over the boundary $f(t)$ is asymptotically polynomial of order $-\frac{1}{\alpha}$, where $1 < \alpha \leq 2$ if and only if $|f(t)|t^{-\frac{1}{\alpha}-1}$ is integrable on $[1, \infty)$.

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

Xiang-Dong Li (AMSS, Chinese Acad. of Sci.) W-entropy formulas on super Ricci flows and Langevin deformation on Wasserstein space over Riemannian manifolds

Summary: Inspired by Perelman's work for the resolution to Poincaré's conjecture, we prove an analogue of Perelman's W-entropy formula for the heat equation of the time dependent Witten Laplacian on manifolds equipped with a family of super Ricci flows, and prove the W-entropy formula for the geodesic flow on the Wasserstein space over compact and complete Riemanniann manifolds. Our work recaptures Lott–Villani's theorem on the displacement convexity of the Boltzmann entropy on the Wasserstein space over Riemannian manifolds with non-negative Ricci curvature. To better understand above results, we introduce the Langevin deformation of geometric flows on the Wasserstein space, which interpolates the heat equation on manifolds and the geodesic flow on the Wasserstein space, and can be considered as the potential flow of the compressible Euler equation with damping on Riemannian manifolds. The W-entropy formula will be extended to the Langevin deformation of flows and the rigidity model is proposed. Joint work with Songzi Li (Beijing Normal University).

16:30–17:30 Talk Invited by Statistics and Probability Section

Naoki Kubota (Nihon Univ.) Large deviation principle for random walks in random environments and Lyapunov exponents

Summary: In this talk, the speaker will give an overview of the large deviation principle for random walks in random environments. In particular, the focus of this talk is a relation between the rate function and the so-called Lyapunov exponent, which is defined as the limit (in a sense) of the cost paid by random walks for traveling from the origin to a remote location. We can find such kind of the Lyapunov exponent in the related models. Recently, the speaker has studied the first-passage percolation and the simple random walk in random potentials in view of an application to the large deviation principle for random walks in random environments. This talk also includes results for concentration inequalities in the above two related models.

September 16th (Fri) Conference Room VII

9:00–11:40

15 Ryo Shimizu (Hiroshima Univ.), Akihiko Inoue (Hiroshima Univ.), Yukio Kasahara (Hokkaido Univ.) A Baxter-type inequality for stationary processes and its application to bootstrap 15

Summary: We prove a Baxter-type inequality for stationary processes. We apply it to the bootstrap of the processes.

16 Yusuke Nakamura (Hiroshima Univ.), Akihiko Inoue (Hiroshima Univ.) Semimartingale representation of moving-average type stationary-increment processes by innovation processes 15

Summary: We consider a class of continuous-time stationary-increment processes with moving-average representation. We derive explicit semimartingale representations for them using the innovation processes.

17 Yumiharu Nakano (Tokyo Tech) Approximating nonlinear filter by radial basis functions ····· 15

Summary: We are concerned with numerical methods for nonlinear filtering where the system is a diffusion process and with continuous observations. It is well known that under suitable conditions, the optimal filter is described by the solution of Zakai equation, a stochastic partial differential equation. We propose an approximation method for the solution of Zakai equation and the optimal filter by a meshfree collocation method with radial basis functions. Then we report an estimation result of the mean squared error for Zakai equation, with respect to an appropriate probability measure. This yields that the proposed filter converges to the optimal filter in probability under mild conditions.

18 Tomoki Inoue (Ehime Univ.) Invariant measures of random maps and the first return maps ····· 15

Summary: We consider a family of transformations with a random parameter and study a random dynamical system in which one transformation is randomly selected from the family and applied on each iteration. We study the first return map of the random map. Further, we study how to make an invariant measure of the original random map from the invariant measure of the first return map.

19 Johannes Jaerisch (Shimane Univ.)
Marc Kesseböhmer (Univ. Bremen)
Sara Munday (Univ. di Bologna)
Cusp-winding process for some hyperbolic surfaces with cusps ····· 15

Summary: We introduce the cusp-winding process for the geodesic flow on a hyperbolic surface with cusps. We investigate the number of windings around a cusp compared to the total geodesic length. We determine the fluctuation of these two quantities by employing methods from the thermodynamic formalism in ergodic theory.

20 Hiroki Takahashi (Keio Univ.) On the removal of freezing phase transition of the Chebyshev quadratic maps ····· 15

Summary: It is well-known that the geometric pressure function $P(t) = \inf_\mu\{h(\mu) - t\int \log|DT_2(x)|\mu(x)\}$ of the Chebyshev quadratic map $T_2(x) = 1 - 2x^2$ is not differentiable at $t = -1$. We show that this phase transition can be "removed", by an arbitrarily small singular perturbation of the map T_2 into Hénon-like diffeomorphisms. A proof of this result relies on an elaboration of the well-known inducing techniques adapted to Hénon-like dynamics near the first bifurcation.

21 Naoto Shimaru (Okayama Univ. of Sci.)
Yoshiyuki Mori (Okayama Univ. of Sci.)
Keizo Takashima
(Okayama Univ. of Sci.)
On the leading digit of a^n ····· 10

Summary: We investigate irrational rotations with isolated large partial quotients from the point of view of the distribution of the leading digit of a^n. We prove some mathematical formulae explaining the unusual behavior of the χ^2 statistic of the leading digits of a^n, where $log_{10}a$ has a single isolated large partial quotient in its continued fraction expansion. We also report that hills appear infinitely often in the graphs of χ^2 statistics and that there are many different types of shapes of hills.

Summary: We study the behaviors of rational rotations to give an exact formula which determines the position of each point of rational rotation. We apply our results to the studies of behaviors of irrational rotations to give exact formulae of the position of point of irrational rotation. We use only Ostrowski expansion and basic well-known relations on continued faction expansions.

Summary: Setokuchi and Takashima and Setokuchi give refinements of estimates for discrepancies by using Schoissengeier's exact formula. Mori and Takashima discuss the distributions of leading digits of an, where they use approximations of irrational rotation by rational rotation. We apply their methods to estimation of discrepancy. We give much more accurate estimates for discrepancies, by direct and simple calculation without using Schoissengeier's formula. We show that the first slope of the graphs of discrepancies of irrational rotations with single isolated large partial quotient is linearly decreasing, when we observe discrepancies with adequate step. Moreover we prove that large hills, caused by single isolated large partial quotient, will appear infinitely often.

Summary: It is known that the discrepancy $D_N\{kx\}$ of the sequence $\{kx\}$ satisfies $ND_N\{kx\} = O\big((\log N)(\log\log N)^{1+\varepsilon}\big)$ a.e. for all $\varepsilon > 0$, but not for $\varepsilon = 0$. For $n_k = \theta^k$, $\theta > 1$ we have $ND_N\{n_kx\} \le (\Sigma_\theta + \varepsilon)(2N\log\log N)^{1/2}$ a.e. for some $0 < \Sigma_\theta < \infty$ and $N \ge N_0$ if $\varepsilon > 0$, but not for $\varepsilon < 0$. In this paper we prove, extending results of Aistleitner–Larcher, that for any sufficiently smooth intermediate speed $\Psi(N)$ between $(\log N)(\log\log N)^{1+\varepsilon}$ and $(N\log\log N)^{1/2}$ and for any $\Sigma > 0$, there exists a sequence $\{n_k\}$ of positive integers such that $ND_N\{n_kx\} \le (\Sigma + \varepsilon)\Psi(N)$ eventually holds a.e. for $\varepsilon > 0$, but not for $\varepsilon < 0$. We also consider a similar problem on the growth of trigonometric sums.

Summary: We study the behavior of the capital process of a continuous Bayesian mixture of fixed proportion betting strategies in the one-sided unbounded forecasting game in game-theoretic probability. We establish the relation between the rate of convergence of the strong law of large numbers in the self-normalized form and the rate of divergence to infinity of the prior density around the origin. In particular we present prior densities ensuring the validity of Erdős–Feller–Kolmogorov–Petrowsky law of the iterated logarithm.

11:40–12:10 Research Section Assembly

September 17th (Sat) Conference Room VII

9:15–12:00

26 Masayuki Horiguchi (Kanagawa Univ.) A prior detection procedure on a sequential sampling problem ····· 15

Summary: In this talk, we consider a statistical problem of sequential sampling and make the control chart which is constructed by calculating a probability of a state of the system being regarded as defective and a threshold probability setted by the decision maker before starting the sampling. By using interval Bayesian method (cf. Horiguchi, Iki, Yasuda and Kurano 2009), the chart consists of three disjoint regions those which are devided by two limit lines (acceptance line and prior detection line of defective).

27 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.)
Characteristics of balanced third-order designs of resolution $\mathrm{R}^*(\{10, 01\})$ with $N < \nu(m)$ and $\mathrm{NSV}_2 = 0$ for 3^m factorials ····· 15

Summary: We consider the third-order linear model based on a fractional factorial design with m factor each at three levels, which is derived from a simple array (SA), where $m \geq 6$. Then the non-negligible factorial effects are the general mean, the linear and the quadratic components of the main effect, the linear by linear and the linear by quadratic components of the two-factor-interaction, and the linear by linear by linear components of the three-factor interaction. Under this model, if all the main effects are estimable, and furthermore the remaining non-negligible factorial effects may or may not be estimable, then a design is said to be of resolution $\mathrm{R}^*(\{10, 01\})$. In this talk, we give a necessary and sufficient condition for an SA to be of resolution $\mathrm{R}^*(\{10, 01\})$, where the number of assemblies is less than the number of non-negligible factorial effects and $\mathrm{NSV}_2 = \#\{(x, y) \,|\, 1 \leq x, y \leq m-2,\ x+y \leq m-1\} = 0$.

28 Kazuki Matsubara (ChuoGakuin Univ.)
Sanpei Kageyama (Tokyo Univ. of Sci.)
Cyclically near-resolvable splitting-balanced block designs ····· 15

Summary: The concept of splitting-balanced block designs $(v, u \times k, \lambda)$-SBBD has been defined with some applications for authentication codes in Ogata et al. (2004). In this talk, we focus on the two properties, i.e., a cyclic automorphism and near-resolvability, of $(v, 2 \times 2, \lambda)$-SBBD. Some direct and recursive constructions of cyclically near-resolvable $(v, 2 \times 2, \lambda)$-SBBD are provided. Finally, the existence of a cyclically near-resolvable $(PQ^2, 2 \times 2, 2)$-SBBD is shown, where P is any product of primes p with each $p \equiv 1 \pmod 4$ and Q is any product of primes q with each $q \equiv 3 \pmod 4$.

29 Kiyoshi Inoue (Seikei Univ.)
Sigeo Aki (Kansai Univ.)
On sooner and later waiting time distributions associated with simple patterns in a sequence of bivariate trials ····· 10

Summary: We study the sooner/later waiting time problems for simple patterns in a sequence of bivariate trials. The double generating functions of the sooner/later waiting times for the simple patterns are expressed in terms of the double generating functions of the numbers of occurrences of the simple patterns. The effective computational tools are developed for the evaluation of the waiting time distributions along with some examples. Finally, some examples are given in order to illustrate how our theoretical results are employed for the investigation of the waiting time problems for simple patterns.

Summary: The overlap coefficient (OVL) is defined by the area under the minimum of two probability density functions, which is used as a similarity measure between two distributions. In order to approximate OVL, the kernel density estimation has often been used. Here, we propose a novel algorithm named mixed decision tree using the misclassification error impurity measure (MDTerr), which can calculate OVL of various probability distributions. In this presentation, we will focus on the theoretical properties of the MDTerr.

Summary: For a T-variate density function, this presentation defines the double-symmetry, quasi-double-symmetry of order k ($< T$) and the marginal double-symmetry of order k, and gives the theorem that the density function is T-variate double-symmetric if and only if it is quasi-double-symmetric and marginal double-symmetric of order k.

Summary: For two-way contingency tables, Tahata and Tomizawa (2015) considered the ordinal quasi point-symmetry model. For multi-way contingency tables, we shall propose the extended ordinal quasi point-symmetry model. Also we shall give the decomposition of the point-symmetry for cell probabilities using the proposed model.

Summary: In this talk, we propose robust Bayesian estimation using the posterior distribution based on γ-divergence (γ-psoterior). We show some asymptotic properties of the Bayes estimatior using γ-posterior. We perform numerical study for investigating the performance of our estimator.

Summary: We present limit results about the total number of components of the Ewens partition when the parameter gets large together with a sample size. Based on the results, we derive asymptotic properties of the maximum likelihood estimator of the parameter. Moreover, we show their applications to some problems in genetics.

35 Yoshihiko Maesono (Kyushu Univ.)
Taku Moriyama (Kyushu Univ.)
Kernel type estimators of a conditional density and its application to regression 10

Summary: In this talk, we propose a direct kernel type estimator of a conditional density and its application to regression. We obtain asymptotic mean squared errors and compare them with a natural estimator, which is constituted of two kernel type estimators of density and joint density functions. Applying this estimator to regression, we propose a new estimator which is a competitor of the Nadaraya–Watson estimator. We also compare these estimators by the mean squared errors.

12:10–12:30 Presentation Ceremony for the 2016 MSJ Analysis Prize

14:15–15:00

36 Masashi Hyodo (Osaka Pref. Univ.)
Takahiro Nishiyama (Senshu Univ.)
Simultaneous testing of the mean vector and the covariance matrix for high-dimensional data 15

Summary: In this talk, we propose L^2-norm based test for simultaneous testing of the mean vector and the covariance matrix under high-dimensional non-normal populations. To construct this, we derive asymptotic distribution of test statistc based on both the differences mean vectors and covariance matrices. We also investigate asymptotic sizes and powers of proposed tests using this result. Finally, we study the finite sample and dimension performance of this test via Monte Carlo simulations.

37 Hirokazu Yanagihara (Hiroshima Univ.)
A convergence rate of a probability of selecting the true model by a consistent C_p-type criterion in multivariate linear regression models .. 15

Summary: This paper deals with a variable selection procedure in a multivariate linear regression model with normality assumption, which is called a normal multivariate linear regression model, by minimizing a C_p-type criterion. Yanagihara (2016) proposed a high-dimensionality-adjusted consistent generalized C_p ($HCGC_p$) criterion, which is a consistent generalized C_p criterion evaluated from asymptotic framework such that $n \to \infty$ and $p/n \to c_0 \in [0, 1]$, where n is the sample size and p is the dimension of response variable vector. The purpose of this paper is to derive a convergence rate of a probability of selecting the true model by a $HCGC_p$.

38 Yasunori Fujikoshi (Hiroshima Univ.*)
Strong consistency of estimation criteria AIC and BIC for dimensionality in high-dimensional principal component analysis 15

Summary: In this paper we study the problem of estimating the number of significant components in principal component analysis which corresponds to the number of dominant eigenvalues of the covariance matrix of p variables. Our purpose is to examine the consistency of the estimation criteria AIC and BIC based on the model selection criteria under a high-dimensional asymptotic framework. Using random matrix theory, we derive sufficient conditions for the criteria to be strongly consistent for the case when the dominant population eigenvalues are bounded, and the case when the dominant eigenvalues tend to infinity.

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

Nobumichi Shutoh (Kobe Univ.) Linear discriminant analysis and some tests based on monotone missing data

Summary: We consider the linear discriminant analysis and some tests on the basis of missing data. In this case, the estimators of the mean vector and the covariance matrices generally do not have the explicit forms and their exact distributions are very complicated. However, by Kanda and Fujikoshi (1998), the distributions of the maximum likelihood estimators were derived for the case of k-step monotone missing data, where k is the number of the missing data patterns. With making use of their results, we derive the asymptotic expansions for the distributions of the statistics, which give better approximations to the misclassification probability for the linear discrimination and the upper percentiles of some test statistics. Finally, for the selected parameters, we conduct Monte Carlo simulation in order to evaluate our results.

16:30–17:30 Talk Invited by Statistics and Probability Section

Teppei Ogihara (Inst. of Stat. Math. / JST PRESTO) Statistical analysis for diffusion processes with noisy, nonsynchronous observations

Summary: We study statistical inference for diffusion processes with noisy, nonsynchronous observations. These problems appear when we consider statistical analysis of stock prices behaviors with high-frequency financial data.

Let $X = \{X_t\}_{0\leq t\leq T}$ be a two-dimensional diffusion process satisfying

$$dX_t = \mu(t, X_t, \sigma_*)dt + b(t, X_t, \sigma_*)dW_t, \quad t \in [0, T],$$

where $\{W_t\}_{0\leq t\leq T}$ is a two-dimensional standard Wiener process, μ is an $\mathbb{R}^2$-valued Borel function (known), b is a 2×2 matrix-valued Borel function (known), and $\sigma_* \in \mathbb{R}^d$ is an unknown parameter.

Let $\{S_i^{n,p}\}_i \subset [0, T]$ be random observation times of X^p, and $\epsilon_i^{n,p}$ be i.i.d. noise with $E[\epsilon_0^{n,p}] = 0$, $E[(\epsilon_0^{n,p})^2] = v_{p,*}$ for some unknown $v_{p,*} > 0$. We consider statistical inference of the unknown parameter σ_* with noisy, nonsynchronous observations $Y_i^{n,p} = X^p_{S_i^{n,p}} + \epsilon_i^{n,p}$.

We will see a short survey of statistical inference in this topic, and study maximum-likelihood-type estimation. We also study the local asymptotic mixed normality property and optimality of estimators (asymptotic efficiency).

September 18th (Sun) Conference Room VII

9:15–12:00

39 Hideaki Nagahata (Waseda Univ.) Numerical results of analysis of variance for multivariate time series
Masanobu Taniguchi (Waseda Univ.) 10

Summary: For independent observations, analysis of variance (ANOVA) has been enoughly tailored. Recently there has been much demand for ANOVA of dependent observations in many fields. For example it is important to analyze differences among industry averages of financial data. However ANOVA for dependent observations has been immature. In this paper, we study ANOVA for dependent observations. Specifically, we show the asymptotics of classical tests proposed for independent observations and give a sufficient condition for them to be asymptotically χ^2 distributed. If the sufficient condition is not satisfied, we suggest a likelihood ratio test based on Whittle likelihood and derive an asymptotic χ^2 distribution of our test. Some numerical examples for simulated and real financial data are given as applications of these results. This paper opens a new aspect for the analysis of variance for time series.

Summary: For a weakly stationary process $\{X_t, t \in Z\}$ with mean 0 and spectral distribution function $F(\lambda)$, the linear extrapolation problem can be transferred into a problem to get the distance from 1 to a completion of the linear hull of the set $\{e^{ij\omega}; j \in S\}$ where S is a subset of integers. When $S = \{..., -2, -1, 1, 2, ...\}$, in the L^2 space, the optimal interpolator is well known. In this talk, We mainly discuss the case of L^p where $p \geq 1$. It is shown that the closed form of the optimal interpolator can be given when $p > 1$, and that when $p = 1$, we can only get value of minimum interpolation error. Also, the minimax problem when F is partially known is discussed.

Summary: Recently, in many fields involving electrical and genome engineering, high-dimensional and low sample size data are often observed, and the various methods have been investigated to deal with such data appropriately. The most of classical results were proved in the situation where the model has Gaussianity and the sample is independent and identically distributed. However, it is often sever to assume Gaussianity for real time series data and the methods are required to be extended. In this paper, we develop the asymptotic theory for Whittle functional of high-dimensional non-Gaussian dependent observations. In particular, thresholded-periodogram matrix is proposed, and asymptotic normality of the proposed for the functional is shown.

Summary: For second order stationary processes, the spectral distribution function is uniquely determined by the autocovariance functions of the processes. We define the quantiles of the spectral distribution function and propose two estimators for the quantiles. Asymptotic properties of both estimators are elucidated and the difference from the quantile estimators in time domain is also indicated. We construct a testing procedure of quantile tests from the asymptotic distribution of the estimators and strong statistical power is shown in our numerical studies.

Summary: The Dantzig selector for the proportional hazards model proposed by D. R. Cox is studied in a high-dimensional and sparse setting. We prove the l_q consistency for all $q \geq 1$ of some estimators based on the compatibility factor, the weak cone invertibility factor, and the restricted eigenvalue for certain deterministic matrix which approximates the Hessian matrix of log partial likelihood. Our matrix conditions for these three factors are weaker than those of previous researches.

Summary: This talk considers L_1-based empirical likelihood approach for testing problems of linear hypothesis. The model concerned is allowed to have a singular design matrix and infinite variance. The proposed framework can grasp various important applications such as one-way layout analysis of variance. The null distribution of the proposed test converges to the standard chi-square distribution, and therefore any additional estimations are not required to construct the testing procedure. We also derive the limit distribution of the proposed test statistic under local contiguous alternatives. Moreover, the finite sample performance of the proposed test is investigated via some simulation experiments, and the empirical likelihood approach is shown to have various desired properties in practical situations theoretically and experimentally.

Summary: In this talk, we consider classifiers for high-dimensional data under two disjoint models: the strongly spiked eigenvalue (SSE) model and the non-SSE (NSSE) model. We first consider the distance-based discriminant analysis (DBDA) given by Aoshima and Yata (2014). We verify that it is asymptotically distributed as a normal distribution under the NSSE model. Next, we investigate DBDA under the SSE model by considering strongly spiked eigenvalues and their eigenvectors. We show that the asymptotic normality does not hold under the SSE model. We propose a new classifier by the estimation of eigenstructures for the SSE model. We verify that the proposed classifier is asymptotically distributed as a normal distribution under the SSE model. We also show that it gives preferable performances for the SSE model.

Summary: In this talk, we consider two-sample tests for high-dimensional data under the strongly spiked eigenvalue (SSE) model proposed by Aoshima and Yata (2016, arXiv:1602.02491). Ishii et al. (2016, JSPI) discussed asymptotic properties of the first principal component by using the noise-reduction (NR) methodology and gave a one-sample test under the SSE model. In addition, Ishii (2016) considered a two-sample test by using the NR method. In this talk, we discuss asymptotic properties of the first principal component by using the cross-data-matrix (CDM) methodology. Also, we give a new two-sample test and compare it with the previous ones.

Summary: We consider the likelihood ratio test (LRT) for testing of covariance matrix for one-sample problem when the data have a monotone pattern of missing observations. For non-missing and multivariate normality, an asymptotic expansion for the null distribution of the LRT statistic with unbiasedness and the modified LRT statistic with the Bartlett correction factor were discussed by many authors. We give the LRT statistic with k-step monotone missing data and propose a new modified LRT statistic and derive the modified LRT statistic with the Bartlett correction factor. Finally, we investigate the accuracy and asymptotic behavior of the approximation for chi-squared distribution by Monte Carlo simulation.

Summary: We consider the problem of testing homogeneity of regression coefficient vectors under synchronized order restrictions when the covariance matrix is unknown. For this problem, Hu and Banerjee (2012) proposed some test statistics and studied their distributions. Sasabuti and Kulatunga (2016) derived strict inequalities among their powers. In this presentation, we show some properties of these test statistics and compare them.

Applied Mathematics

September 15th (Thu) Conference Room V

10:00–12:00

1 Iwao Sato (Oyama Nat. Coll. of Tech.)
Hideo Mitsuhashi (Utsunomiya Univ.)
Hideaki Morita (Muroran Inst. of Tech.)
A matrix-weighted zeta function of a graph ····· 15

Summary: We define a matrix-weighted L-function of a graph G, and give a determinant expression of it. As a corollary, we present a decomposition formula for the matrix-weighted zeta function of a regular covering of G by a product of matrix-weighted L-functions of G.

2 Shunichi Maezawa
(Shibaura Inst. of Tech.)
Ryota Matsubara
(Shibaura Inst. of Tech.)
Haruhide Matsuda
(Shibaura Inst. of Tech.)
Fan-type condition for a graph to be a k-leaf-connected ····· 15

Summary: We consider finite undirected graphs without loops nor multiple edges. A graph G said to be k-leaf-connected if $|G| > k$ and for each subset S of $V(G)$ with $|S| = k$, G has a spanning tree T with precisely S as the set of vertices of degree one. We obtain a Fan-type condition for a graph to be k-leaf-connected. We will explain the background of this research and the sharpness of our result.

3 Zhi Xian Zhao (Tokyo Univ. of Sci.)
Forbidden triples generating a finite set of 4-connected graphs ····· 10

Summary: For a graph G and a set $\mathcal{F}$ of connected graphs, G is said be $\mathcal{F}$-free if G does not contain any member of $\mathcal{F}$ as an induced subgraph. We let $\mathcal{G}_4(\mathcal{F})$ denote the set of all 4-connected $|\mathcal{F}|$-free graphs. This talk is concerned with sets $\mathcal{F}$ of connected graphs such that $|\mathcal{F}| = 3$ and $\mathcal{G}_4(\mathcal{F})$ is finite. We show that if $|\mathcal{F}| = 3$ and $\mathcal{G}_4(\mathcal{F})$ is finite and $|\mathcal{F}|$ does not contain a star, then $\mathcal{F}$ belongs to one of five specified families.

4 Raiji Mukae
(Miyakonojo Nat. Coll. of Tech.)
Terukazu Sano
(Kisarazu Nat. Coll. of Tech.)
On tree-tree quadrangulations ····· 15

Summary: A triangulation of the sphere is a *tree-tree triangulation* if the vertices can be partitioned into two parts such that each part induces a tree. It is known that a triangulation on the sphere G is tree-tree if and only if the dual map of G is Hamiltonian. In this talk, we consider the case of quadrangulations on surfaces.

5 Kazuhide Hirohata
(Ibaraki Nat. Coll. of Tech.)
Ronald J. Gould (Emory Univ.)
Megan Cream (Spelman Coll.)
Chorded pancyclic graphs ····· 15

Summary: A graph G of order $n \geq 4$ is called *chorded pancyclic* if G contains chorded cycles of all lengths from 4 to n. We will show the result on chorded pancyclic.

6 Shohei Satake (Nagoya Univ.) A construction of N-e.c. tournaments ····· 15

Summary: In 1963, Erdős and Rényi showed that Erdős–Rényi random graphs almost surely satisfy the adjacency property called N-existentially closedness (N-e.c.) for all $N \in \mathbb{N}$. Remark that this property also can be considered in the case of tournaments. After their work, some constructions of N-e.c. graphs and tournaments were investigated. Especially, it is well-known that Paley graphs and Paley tournaments are N-e.c.
In this talk, we define some "Paley-like" tournaments and we show that these tournaments are N-e.c. If possible, we also discuss about some related topics.

7 Akihiro Higashitani (Kyoto Sangyo Univ.)
Johannes Hofscheier (Otto-von-Guericke-Univ. Magdeburg) Classification of lattice simplices with small degrees ····· 15

Summary: We will give a complete classification of the lattice simplices with degree 2 which are not lattice pyramids.

8 Kenta Ozeki (Nat. Inst. of Information / JST ERATO)
Arthur Hoffmann-Ostenhof (Technical Univ. of Vienna) On HISTs in cubic graphs ····· 15

Summary: A HIST of a connected graph is a spanning tree without vertices of degree two. We provide a necessary condition for the existence of a HIST in cubic graphs. As one consequence, we answer affirmatively an open question on HISTs by Albertson, Berman, Hutchinson and Thomassen.

14:15–15:30

9 Kaname Matsue (Inst. of Stat. Math.)
Osamu Ogurisu (Kanazawa Univ.)
Etsuo Segawa (Tohoku Univ.) On eigenpairs of quantum walk models ····· 15

Summary: We discuss the description of eigenspace of a quantum walk model U with an associating linear operator T in abstract settings of quantum walk including the Szegedy walk on graphs. In particular, we provide the spectral mapping theorem of U without the spectral decomposition of T. Arguments in this direction reveal the eigenspaces of U characterized by the generalized kernels of linear operators given by T.

10 Etsuo Segawa (Tohoku Univ.)
Hideaki Obuse (Hokkaido Univ.) Sensitivity of quantum walks to edge ····· 15

Summary: How dose a quantum walk recognize the edge of a given graph? As a first step to answer this question, we focus on $\mathbb{Z}^2$ cutting on the $x = 0$ line as a simple case. Using a spectral analysis of the orthogonal polynomials on the unit circle of the complex plane, we obtain a spectral property corresponding to the dispersion relation providing the existence of so called edge state of the topological insulator. We also obtain limit theorems which partially provide how the aspect of the dispersion relation is reflected by the behavior of the quantum walk on $x = 0$ line of this infinite graph.

11 Takashi Komatsu (Yokohama Nat. Univ.)
Takako Endo (Monash Univ./Ochanomizu Univ.)
Hikari Kawai (Yokohama Nat. Univ.)
Norio Konno (Yokohama Nat. Univ.)
Seiya Yoshida (Yokohama Nat. Univ.)
One-dimensional three-state Fourier walk 15

Summary: We study three-state quantum walks in one-dimensional lattices. In this talk, we present results on the stationary measures of one-dimensional three-state Fourier walks. After that, we discuss the difference between properties of the Fourier and Grover walks.

12 Takashi Komatsu (Yokohama Nat. Univ.)
Norio Konno (Yokohama Nat. Univ.)
Fourier walk on the two-dimensional torus 10

Summary: We investigate the Fourier walk on the two-dimensional torus. The quantum walk was introduced as a quantum analogue of the random walk. Recently, quantum walks have been intensively studied in connection with quantum computing and quantum physics. In this talk, we consider the behavior of the Fourier walk for some class of the initial states.

16:30–17:30 Talk Invited by Applied Mathematics Section

Chie Nara (Meiji Univ.) Kelvin's conjecture and space-fillers with minimal surface area — Unfolding of doubly covered polyhedra and soap film experiments—

Summary: How can space be divided into cells of equal volume so as to minimize the surface area of the boundary? L. Kelvin, in 1887, conjectured that the partition made by a tiling (packing) of congruent copies of the truncated octahedron with slightly curved faces is the solution. More than one hundred years later, in 1994, D. Phelan and R. Waire showed counterexample to Kelvin's conjecture, whose tiling consists of two kinds of cells with curved faces. The problem is still open. We study the orthic version of Kelvin's conjecture: the truncated octahedron has the minimum surface area among all polyhedral space-fillers, where a polyhedron is called a space-filler if its congruent copies fill space with no gaps and no overlaps. We emply the notion of doubly covered polyhedra and their unfoldings, which is relevant to Kelvin's conjecture and soap-film expriments. Finally, we also discuss some related topics, e.g. "transformability" among polyhedra.

September 16th (Fri) Conference Room V

10:00–11:30

13 Kazuhiko Ushio
Balanced C_3-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_3-foil designs and related designs.

14 Kohei Yamada (Nagoya Univ.)
Miwako Mishima (Gifu Univ.)
Junya Satoh (Nagoya Univ.)
Masakazu Jimbo (Chubu Univ.)
On λ-fold factorizations of cyclic groups 15

Summary: Let G be a cyclic group. For multisets A, B of G, the pair (A, B) is said to be a λ-fold factorization of G if each element of G occurs λ times in the multiset $A + B := \{a + b \mid a \in A, b \in B\}$. In this talk, we give a necessary and sufficient condition for the existense of a λ-fold factorization of a cyclic group with a given factor, and discuss the structure of a factor of λ-fold factorization of the set of integers $\mathbb{Z}$. (This talk is based on a joint work with Miwako Mishima, Junya Satoh, and Masakazu Jimbo.)

15 Shoko Chisaki (Tokyo Univ. of Sci.)
Nobuko Miyamoto (Tokyo Univ. of Sci.)
Computational results for optimal difference systems of sets 10

Summary: Difference systems of sets (DSS) are combinatorial structures introduced by Levenshtein in 1971, which are a generalization of cyclic difference sets and arise in connection with code synchronization. A DSS is a collection of t disjoint subsets $Q_i, 0 \leq i \leq t-1$, of any finite abelian group G of order $q = ef + 1$ such that every element of $G\backslash\{0\}$ appears at least ρ times in the multiset $\{a-b|a \in Q_i, b \in Q_j, 0 \leq i \neq j \leq t-1\}$. In this talk, we will talk about some computational results for DSSs with block sizes $\lfloor e/2 \rfloor$ and $\lfloor e/3 \rfloor$, whose parameter ρ attains or comes close to the Levenshtein bound.

16 Tomoko Adachi (Toho Univ.)
A cyclic labeling of bipartite graph 10

Summary: The design of large disk array architectures leads to interesting combinatorial probrems. Minimizing the number of disk operations leads to cluttered orderings. Using the special bipartite graph H(h;t), Mueller et al.(2005) gave label in the case h=1,2. In this talk, we give a new label in general H(h;t).

17 Norihiro Nakashima (Tokyo Denki Univ.)
Hajime Matsui (Toyota Tech. Inst.)
A reduction of the computational complexity of the algebraic geometry codes defined by Garcia and Stichtenoth 15

Summary: Garcia and Stichtenoth explicitly constructed a tower of smooth projective curves which reaches the Drinfeld–Vladut bound. It is known an error correction algorithm and a systematic encoding algorithm for algebraic geometry codes via the Berlekamp–Massey–Sakata algorithm and the discrete Fourier transform. In this talk, we modify the discrete Fourier transform for curves defined by Garcia and Stichtenoth, and then the computational complexity of the error correction algorithm is reduced.

13:15–14:00

18 Shinya Fujita (Yokohama City Univ.)
Some results on properly colored cycles in edge-colored graphs II 10

Summary: Some recent results on properly colored cycles in edge-colored graphs will be reviewed.

19 Morimasa Tsuchiya (Tokai Univ.)
Shinichiro Tashiro (Tokai Univ.)
Kazutaka Ikeda (Tokai Univ.)
On strict-double-bound numbers of graphs with cut vertices ····· 10

Summary: For a poset P, the strict-double-bound graph (sDB-graph sDB(P)) is the graph on V(P) for which vertices u and v of sDB(P) are adjacent if and only if there exist strict lower bound x and strict upper bound y in V(P) of u and v. The strict-double-bound number of a graph G is defined as min(n ; the union of G and Nn is a strict-double-bound graph). We obtain some upper bounds of strict-double-bound numbers of graphs with cut vertices in terms of subgraphs.

20 Akira Saito (Nihon Univ.)
Michael D. Plummer (Vanderbilt Univ.)
Toughness, binding number and restricted matching extension ····· 15

Summary: In this talk, we study the existence of a perfect matching containing and avoiding prescribed sets of independent edges. A graph G of order at least $2(m+n+1)$ is said to satisfy $E(m,n)$ if G contains a perfect matching and for every pair of sets of independent edges M, N with $|M| = m$, $|N| = n$ and $M \cap N = \emptyset$, there exists a perfect matching F with $M \subset F$ and $N \cap F = \emptyset$. We give sufficient conditions for a graph G to satisfy $E(m,n)$ in terms of toughness and binding number, and compare them with the existing conditions.

September 17th (Sat) Conference Room V

10:00–11:35

21 Yushi Nakaya
(Kwansei Gakuin High School)
Ryohei Miyadera
(Kwansei Gakuin High School)
Grundy numbers of impartial three dimensional chocolate bar games ····· 15

Summary: We investigate step chocolate bars whose widths are determined by a fixed function of the horizontal distance from the bitter square. Step chocolate games that are variants of game of Nim. In the last conference we presented a necessary and sufficient condition for chocolate bars to have the Grundy number that is equal to $(m-1) \oplus (n-1)$, where m is the largest width of the chocolate and n is the longest horizontal distance from the bitter part. This time we generalize this result, and get a theorem for 3 dimensional chocolate bar.

22 Masaji Watanabe (Okayama Univ.)
Fusako Kawai (Kyoto Inst. Tech.)
Numerical techniques for inverse analysis in study of microbial depolymerization processes ····· 15

Summary: A mathematical model for microbial depolymerization processes is described. Inverse problems for a molecular factor and a time factor of degradation rate are formulated. Numerical techniques for the inverse problems are illustrated. Experimental results are introduced into inverse analyses, and numerical results are introduced. Once the molecular factor and the time factor of degradation rate are obtained, a microbial depolymerization process is simulated.

23 Aoi Honda (Kyushu Inst. of Tech.)
Yoshiaki Okazaki (Fuzzy Logic Systems Inst.)
Inclusion-exclusion integral and t-norm based data analysis model construction 15

Summary: A data analysis model using the inclusion-exclusion integral and a new construction method of a model utilizing t-norms are proposed. This model is based on the integral with respect to the nonadditive measure and is constructed in three steps of specifications of monotone functions, t-norm and monotone measures. The model has good description ability and can be applied flexibly to real problems.

24 Takeshi Gotoda (Kyoto Univ.)
Global solvability of regularized 2D Euler equations in Radon measure space 15

Summary: It is expected that the enstrophy dissipating solutions in 2D incompressible Euler equations might describe 2D turbulent flows. Since smooth solutions conserve the enstrophy, we need to consider the less regular initial vorticity such as Radon measure. However the global existence of solutions for initial vorticity in Radon measure has not been established in 2D Euler equations. Then, we consider the regularized 2D Euler equations which have the global solutions for Radon measure vorticity and try to construct the dissipative weak solutions with solutions of those equations. We prove the global existence of unique weak solutions for Radon measure initial vorticity in the regularized 2D Euler equations. Moreover, solutions of these regularized equations converge to those of 2D Euler equations.

25 Koichi Anada (Waseda Univ. Senior High School)
Tetsuya Ishiwata (Shibaura Inst. of Tech.)
Backward self similar solutions for a quasi-linear parabolic equations 15

Summary: We consider properties of backward self similar solutions for a quasi-linear parabolic equations $v_t = v^\delta(v_{xx} + v)$. The properties is very important to investigate asymptotic behavior of solutions to this parabolic equation, especially, the blow-up sets and rates.

14:15–15:30

26 Syunsuke Kobayashi (Meiji Univ.)
Takashi Sakamoto (Meiji Univ.)
Hopf and Hopf–Pitchfork bifurcation in an integro-differential reaction-diffusion system 15

Summary: We study the local bifurcation structures of an integro-differential reaction-diffusion system. The system provides doubly degenerate points with 0:n mode interaction. As a result, the system has small amplitude time-periodic solutions for each 0:n degenerate point. We also consider the bifurcation around triply degenerate points in the system. The dynamics around the such degenerate point is locally topologically equivalent to the "Hopf–Pitchfork normal form". Moreover, we can find a Heteroclinic loop (which could be induce the chaos) in an integro-differential reaction-diffusion system.

27 Kazuyuki Yagasaki (Kyoto Univ.)
Shotaro Yamazoe (Kyoto Univ.)
Pitchfork bifurcation and linear stability of solitary waves for coupled nonlinear Schrödinger equations 10

Summary: We consider the linear stability of solitary waves for coupled nonlinear Schrödinger equations. By applying bifurcation theory of homoclinic orbits, the pitchfork bifurcation of solitary waves can be detected. In this talk, we give some criteria for linear stability of these bifurcated solitary waves. The proof is based on Evans function technique, which is a powerful method to solve some eigenvalue problems.

28 Kazuyuki Yagasaki (Kyoto Univ.) Heteroclinic motions in periodic perturbations of conservative systems 15

Summary: We consider periodic perturbations of conservative systems. We extend Melnikov's method to give a condition under which the stable and unstable manifolds of locally invariant manifolds intersect transversely. Moreover, when the locally invariant manifolds consist of families of periodic orbits, we show that there can exist heteroclinic orbits connecting periodic orbits near the unperturbed equilibria on distinct level sets. We illustrate our theory for rotational motions of a periodically forced rigid body. Numerical computations to support the theoretical results are also given.

29 Hideto Asashiba (Shizuoka Univ.)
Emerson G. Escolar (Tohoku Univ.)
Yasuaki Hiraoka (Tohoku Univ.)
Hiroshi Takeuchi (Tohoku Univ.)
Matrix method for persistence modules on commutative ladders of finite type 15

Summary: The theory of persistence modules of the commutative ladder quivers $CL(\tau_n)$ provides an extension of persistent homology. This extension is well-motivated by applications, but an efficient algorithm to compute the generalized persistence diagrams is still lacking. We show an equivalence between the category of persistence modules over the commutative ladder quivers and a category of arrows in $\mathrm{rep}(\mathrm{A}_n)$. We express the arrows in block matrix form, on which row and column operations may be performed. Only certain row and column operations are permissible, and these are determined by the structure of the Auslander–Reiten quiver of $\mathrm{rep}(\mathrm{A}_n)$. This point of view provides an easier way to compute the indecomposable decompositions of the persistence modules over $CL(\tau_n)$ of finite type, from which we can compute persistence diagrams.

15:50–16:50 Talk Invited by Applied Mathematics Section

Ichiro Hasuo (Univ. of Tokyo) Modern abstract mathematics at work: Category theory and logic disentangling complex structures in computer systems

Summary: Mathematics is useful—and "modern" mathematics, with its principal focus on abstract structures, is no exception. In this talk I will exhibit some instances of application of category theory and logic—characteristic languages of "modern" mathematics—in the field of theoretical computer science. Typically a problem there is to find bugs in systems or to prove their absence; and these problems are complex, mirroring the literally cosmological complexities of those systems. I will demonstrate how the descriptive power of the mathematical languages (category theory and logic) can be exploited in disentangling the complexities, reducing the problems to structurally simpler ones (such as satisfiability of Boolean formulas, mathematical optimization and statistical learning, for which effective solution methods are studied well).

September 18th (Sun) Conference Room V

10:00–12:00

30 Shunzi Horiguchi (Niigata Sangyo Univ.) Extended complex Newton's method and the formulas to compare the convergences 10

Summary: We give the extension of complex Newton's method and the formulas to compare the convergences.

Summary: We give the numerical calculations to compare the convergences of the extended complex Newton's method.

Summary: A computational algorithm using the bisection method is applied to a stationary point in nonlinear dynamical systems.

Summary: In this study, an application of 1-norm minimization is proposed for the reduction of computational quantity required in an integer-type algorithm. This algorithm can solve higher-order linear ODEs with rational coefficient functions only by four arithmetic operations among integers. Originally, this algorithm utilizes quasi-orthogonalization of integer vectors for the removal of extra solutions. However, substitution of the 1-norm minimization for the quasi-orthogonalization reduces to a great extent the computational quantity required in this algorithm. Some numerical examples are shown where a considerable reduction is successful.

Summary: We consider the boundary-value problem of the biharmonic equation in disk, and its numerical solution by the method of fundamental solutions using the Almansi-type decomposition. Particularly, we prove that under some condition there uniquely exists an approximate solution by the method of fundamental solutions, and its error decays exponentially when the boundary data are analytic.

Summary: This talk presents some constructive error estimates of two-dimensional bi-harmonic equations by using verified computational techniques. These error estimations are expected to provide invaluable information for computer-assisted proofs of nonlinear bi-harmonic problems. Several numerical examples which confirm the effectiveness are presented.

36 Kaname Matsue (Inst. of Stat. Math.) Rigorous numerics of tubular neighborhoods of slow manifolds ····· 15

Summary: We provide a rigorous numerical computation method to validate tubular neighborhoods of normally hyperbolic slow manifolds with the explicit width for the fast-slow system $x' = f(x, y, \epsilon),\ y' = \epsilon g(x, y, \epsilon)$.
Our main focus is the validation of the continuous family of eigenpairs $\{\lambda^\epsilon(y), u^\epsilon(y)\}_{i=1}^n$ of $f_x(h^\epsilon(y), y, \epsilon)$ over the slow manifold $S_\epsilon = \{x = h^\epsilon(y)\}$. In order to obtain such a family, we apply the interval Newton-like method with rigorous numerics to eigenvalue problems depending on parameters. Validated family of eigenvectors generates a vector bundle over S_ϵ, which enables us to construct a tubular neighborhood of slow manifolds with an explicit width.

14:15–16:05

37 Tomoya Kemmochi (Univ. of Tokyo)
Norikazu Saito (Univ. of Tokyo)
Error analysis for the finite element approximation of parabolic equations via maximal regularity and fractional powers of operators ····· 15

Summary: Maximal regularity is a fundamental concept in the theory of partial differential equations. For example, the Laplace operator and the Stokes operator have maximal regularity have maximal regularity, and these properties are applied to analysis of quasilinear parabolic equations and the Navier–Stokes equations. Thus we are concerned with discretization of maximal regularity, and our goal is apply discrete maximal regularity to numerical analysis of above equations.
In this talk, we consider a semilinear heat equation and discretize it by the finite element method for the spatial variables, and semi-implicit Euler scheme for the time variable. With the aid of discrete version of maximal regularity and fractional powers of discrete minus Laplacian, we can establish an optimal l^p-L^q-error estimate for this approximation scheme. We will present the sketch of its proof.

38 Takuya Tsuchiya (Ehime Univ.)
Kenta Kobayashi (Hitotsubashi Univ.)
Error analysis of Lagrange interpolation on tetrahedrons ····· 15

Summary: In this talk, we describes the analysis of Lagrange interpolation errors on tetrahedrons. In many textbooks, the error analysis of Lagrange interpolation is conducted under geometric assumptions such as shape regularity or the (generalized) maximum angle condition. In this talk, we present a new estimation in which the error is bounded in terms of the diameter and projected circumradius of the tetrahedron. It should be emphasized that we do not impose any geometric restrictions on the tetrahedron itself.

39 Shinya Uchiumi (Waseda Univ.)
Masahisa Tabata (Waseda Univ.)
A Lagrange–Galerkin scheme with the grad-div stabilization and a locally linearized velocity for the Oseen problem ····· 15

Summary: We consider a Lagrange–Galerkin scheme with the grad-div stabilization and a locally linearized velocity for the Oseen problem. The Lagrange–Galerkin scheme is a powerful numerical method for flow problems. Thanks to introduction of the locally linearized velocity it is possible to implement the scheme exactly without numerical quadrature. Meanwhile, it is known that the grad-div term increases the stability for the small viscosity. We combine the two methods. We show convergence independent of the viscosity and numerical examples which reflect the result.

40 Yoshiki Sugitani (Univ. of Tokyo) A remark on the mathematical formulation for the immersed boundary method 15
Norikazu Saito (Univ. of Tokyo)

Summary: The immersed boundary method was first introduced by Peskin in 1977 and has evolved into a generally useful method for problems of fluid-structure interaction. Its mathematical formulation is characterized by the Dirac delta function to capture the interaction between a dynamically evolving elastic membrane and the incompressible fluid in which it is immersed. The numerical scheme also introduced by Peskin is nothing but the combination of the regularized Dirac delta function and the finite difference method. However, there are some issues to apply the idea of immersed boundary to other numerical methods. In this talk, I discuss an issue about the IB method and in order to avoid it, propose another method using a characteristic function with some numerical experiments.

41 Guanyu Zhou (Univ. of Tokyo) The conservative finite volume scheme on Voronoi mesh for the chemotaxis model 15

Summary: We consider the finite volume scheme on Voronoi mesh for the Keller–Segel system modelling chemotaxis. The conservation laws of mass and positivity are verified for the numerical solution. The discrete Lyapunov functionals are investigated. To study the error analysis, we introduce a mass-lumping operator on Voronoi mesh, and a projection operator from the finite volume-element method. Then, using the discrete semigroup theories of a discrete elliptic operator, we deduce the optimal error estimate O(h). The theoretical results are confirmed by numerical experiments.

42 Hiroshi Fujiwara (Kyoto Univ.) Numerical analysis of the 2D stationary radiative transport equation by a semi-discrete upwind finite volume method 15
Nobuyuki Higashimori (Kyoto Univ.)

Summary: We show numerical analysis of a semi-discrete finite volume method for the stationary radiative transport equation in two dimensions. The radiative transport equation is a mathematical model of near infrared light propagation in tissue, and its analysis enables us to develop a reliable noninvasive monitoring method of our brain activities. The radiative transport equation is an integro-differential equation, and it contains the first order differentiation with respect to position, to which an upwind approximation with the finite volume method is applied in our discretization. We obtain unique existence of the solution to the discretization problem, and show its error estimates in the L^2 sense. We also show some numerical examples.

16:30–17:30 Talk Invited by Applied Mathematics Section

Takahito Kashiwabara (Univ. of Tokyo) On L^∞-type error estimates and discrete Green's functions in the finite element method

Summary: When error estimation is considered in the finite element method, it is usually shown in the H^1 or L^2 norms (for the case of second-order elliptic equations). It is also desirable, for several reasons, to have error analysis in terms of the $W^{1,\infty}$ or L^∞ norms. Many researchers, e.g. Nitsche, Scott, Schatz, Thomée, and Wahlbin, already addressed this issue and established (quasi-)optimal error estimates in which the use of a Green's function, together with its discrete version, is essential. It seems, however, that some questions, e.g. whether the convexity assumption when a smooth domain is approximated by polygonal ones could be omitted or not, remain unanswered. In this talk we highlight such questions and report recent results on them, especially focusing on the roles that discrete Green's functions play in error analysis.

Topology

September 15th (Thu) Conference Room Ⅲ

9:50–12:00

1 Genki Omori (Tokyo Tech) A normal generating set for the handlebody subgroup of the Torelli group 15

Summary: We prove that the handlebody subgroup of the Torelli group of an orientable surface is generated by genus one BP-maps. As an application, we give a normal generating set for the handlebody subgroup of the level d mapping class group of an orientable surface.

2 Takahiro Yamamoto (Kyushu Sangyo Univ.) Number of singularities of stable maps on surfaces 15

Summary: Let N denote the plane $\mathbb{R}^2$ or the 2-sphere S^2. In this talk, we determine the 5-tuples of integers (g, d, i, c, n) such that there exists a degree d stable map $\Sigma_g \to N$ whose singular point set consists of i connected components, c cusps and n nodes, where Σ_g is the standard genus g surface.

3 Ryoma Kobayashi (Ishikawa Nat. Coll. of Tech.) On a normal generating set for the Torelli group of a compact non-orientable surface 15

Summary: For a compact non-orientable surface N, the Torelli group $\mathcal{I}(N)$ of N is defined as the group consisting of isotopy classes of diffeomorphisms of N acting trivially on the integral first homology group $H_1(N;\mathbb{Z})$ of N. In this work, we obtained a normal generating set for $\mathcal{I}(N)$.

4 Takuya Sakasai (Univ. of Tokyo)
Masaaki Suzuki (Meiji Univ.)
Shigeyuki Morita (Univ. of Tokyo*/Tokyo Tech*) An abelian quotient of the symplectic derivation Lie algebra of the free Lie algebra 15

Summary: We construct an abelian quotient of the symplectic derivation Lie algebra of the free Lie algebra.

5 Shunsuke Ichiki (Yokohama Nat. Univ.)
Takashi Nishimura (Yokohama Nat. Univ.) Generalized distance-squared mappings of $\mathbb{R}^{n+1}$ into $\mathbb{R}^{2n+1}$ 15

Summary: We classify generalized distance-squared mappings of $\mathbb{R}^{n+1}$ into $\mathbb{R}^{2n+1}$ having generic central points. We also investigate that generic central points must depend on given matrices A, namely, there does not exist a universal bad set in the case of this dimension-pair.

6 Huhe Han (Yokohama Nat. Univ.)
Takashi Nishimura (Yokohama Nat. Univ.) Self-dual Wulff shapes and spherical convex bodies of constant width $\pi/2$ 15

Summary: For any Wulff shape, its dual Wulff shape is naturally defined. A self-dual Wulff shape is a Wulff shape equaling its dual Wulff shape exactly. In this talk, it is shown that a Wulff shape is self-dual if and only if the spherical convex body induced by it is of constant width $\pi/2$.

7 Motoo Tange (Univ. of Tsukuba) Infinite order corks 15

Summary: It is well-known that if X, X' are exotic oriented smooth closed simply-connected 4-manifolds, then X' is a cork twist of X with order 2. We prove a non-existence theorem for infinite families of 4-manifolds with infinite OS-invariants. This non-existence theorem is proved in a localized situation. Also, we construct a $\mathbb{Z}^k$-cork and $\mathbb{Z}^k$-effective embedding in a closed 4-manifold. Finally, we prove that the twisted double of Gompf's C is a log transform of standard S^4.

8 Hokuto Konno (Univ. of Tokyo) High-dimensional wall crossing and gluing in Seiberg–Witten theory 15

Summary: For a given 4-manifold with a spin c structure, we study an abstract simplicial complex consisting of all embedded surfaces with self-intersection number zero which violate the adjunction inequalities. We will explain that the homology group of the simplicial complex is non-trivial under certain assumptions. This result implies the adjunction inequalities hold for some 4-manifolds whose Seiberg–Witten invariants vanish.

14:15–15:15 Talk Invited by Topology Section

Hisaaki Endo (Tokyo Tech) Topology of Lefschetz fibrations

Summary: In this talk, I would like to review recent progress of the topology of Lefschetz fibrations, in particular, several researches of myself.

15:30–17:20

9 Hiraku Nozawa (Ritsumeikan Univ.) Independent variation of secondary characteristic classes of Riemannian foliations 15

Summary: Secondary characteristic classes of Riemannian foliations with framed normal bundle were cobordism invariants obtained by generalizing Chern–Simons invariant of framed Riemannian manifolds. It was introduced by Lazarov–Pasternack and Morita. We show that all derivable classes vary independently, which implies that the integral homology of the classifying space of Riemannian foliations with framed normal bundle surjects onto a real vector space. This generalizes results of Hurder and Morita. We also show the injectivity of the universal homomorphism and that some homotopy group of the classifying space surjects onto a real vector space.

10 Takahiro Oba (Tokyo Tech) Higher dimensional contact manifolds with infinitely many Stein fillings 15

Summary: There are many contact 3-manifolds that admit infinitely many Stein fillings. These were yielded by Lefschetz fibrations, especially mapping class groups of surfaces. However, in the higher dimensional case such a contact manifold was not constructed. One of the reasons is that it is difficult to generalize combinatorial group-theoretic techniques of mapping class groups of surfaces. In this talk, I will present how to deal with mapping class groups of higher dimensional manifolds and construct contact $(4n-1)$-manifolds each of which admits infinitely many pairwise non-homotopic Stein fillings by using higher dimensional Lefschetz fibrations.

Summary: We almost completely determine the group of automorphims of a Reeb component with complex leaves of $\dim_{\mathbb{C}} 1$. The detemination is done by solving Schröder's functional equation on the half-line. Some applications and future problems concerning Levi-flats are raised.

Summary: It is known that compact Stein 4-manifolds give contact 5-manifolds via open books with the identity monodromy. We show that a certain class of contact 5-manifolds can 'coarsely' distinguish smooth structures on compact Stein 4-manifolds via open books. We also give a simple sufficient condition for an infinite family of Stein 4-manifolds to have an infinite subfamily of pairwise non-diffeomorphic Stein 4-manifolds. The proofs rely on the adjunction inequality.

Summary: We determine explicitly the dual structure of the loop (co)products on the loop homology of the classifying space of a Lie group. A key device for the computation is the module derivation on the cohomology of the classifying space.

Summary: Félix and Thomas extended the loop products and coproducts to simply-connected Gorenstein spaces. We explicitly describe these operations with rational coefficients in terms of Sullivan models. Moreover, by this description, we prove some results on triviality of these operations. They include a variant of the result of Tamanoi, and generalizations of that of Félix and Thomas and that of Naito.

Summary: Let G be a finite group, $S(G)$ the subgroup category of G, and M a Mackey functor on G. For a full subcategory F of $S(G)$, we have the direct limit $M_*(F)$ and the inverse limit $M^*(F)$ of M. We discuss the canonical homomorphisms $ind : M_*(F) \to M(G)$ and $res : M(G) \to M^*(F)$. This is concerned with an obstruction group to obtaining a G-map from a family of H-maps ($H \in F$).

September 16th (Fri) Conference Room IX

10:10–10:25 Presentation Ceremony for the 2016 MSJ Geometry Prize

10:30–11:30 Award Lecture for the 2016 MSJ Geometry Prize

Teruhiko Soma (Tokyo Metro. Univ.) Geometry and topology of irreducible 3-manifolds

Summary: In this talk, we will review some results concerning geometry and topology of irreducible 3-manifolds such as hyperbolic, geometric or Haken manifolds. The main topics discussed are (1) the simplicial volume of irreducible 3-manifolds and the 3-dimensional bounded cohomology of closed surfaces, (2) non-zero degree maps between irreducible 3-manifolds, (3) the proof of the Smale conjecture for $\widetilde{SL_2}$-manifolds, and (4) the classification of geometric limits of Kleinian surface groups, which implies an answer to Thurston's eighth problem.

13:00–14:00 Award Lecture for the 2016 MSJ Geometry Prize

Shigeharu Takayama (Univ. of Tokyo) Complex geometry of the canonical bundle

Summary: It is my belief that the canonical bundle $K_X = \det T^*_X$ of a complex manifold reflects numerous properties of the manifold. In the study of Riemann surfaces, the study of the canonical bundle corresponds to look at the genus and endow the Riemannian metric of constant curvature. We try to generalize the beautiful theory of Riemann surfaces and complex analytic surfaces to the higher dimensional case. The classification theory of algebraic varieties, the so-called minimal model program, would be a typical example of it. A better understanding of higher dimensional varieties is also important and useful to a better understanding of the moduli space of Riemann surfaces, for example.
In my talk, I will explain several fundamental results in the theory of complex manifolds in a sprit of the minimal model program, which can be described in terms of the canonical bundle. For example, I will explain that (i) when K_X is negative, the holomorph-convexity of a pseudo-convex manifold, and a structure theorem of a semi-positively curved complete Kähler manifold, (ii) when K_X is zero, degenerations of Calabi–Yau type manifolds / Ricci-flat Kähler–Einstein metrics, (iii) when K_X is positive, the boundedness of the pluricanonical map $\Phi_{|mK_X|}$. I will also explain a few technical basic tools in this field of research; singular Hermitian metrics, multiplier ideal sheaves, Nadel vanishing theorem, Ohsawa–Takegoshi's L^2-extension theorem.

September 17th (Sat) Conference Room III

9:50–12:00

16 Mitsunobu Tsutaya (Kyushu Univ.) * Finiteness of A_n-equivalence types of gauge groups 15

Summary: There are many works on the homotopy types of gauge groups or their classifying spaces. From a Stasheff's A_n point of view, they are the studies on the A_1-types and the A_∞-types. In fact, the certain finiteness result for the A_1-types and the infiniteness result for the A_∞-types are known. Then, how about the A_n-types for $1 < n < \infty$? The main result states that the finiteness holds for the A_n-types when $1 < n < \infty$. We also describe the classification of the A_n-types of the gauge groups of $SU(2)$-bundles over S^4.

17 Tatsuya Arai (Tsukuba Univ. of Tech.) * The structure of dendrites constructed by pointwise P-expansive maps on the unit interval 10

Summary: Let f be a continuous map from the unit interval to itself. In this talk, we investigate the structure of space Z which is constructed corresponding to the behaviors of f and a periodic orbit P of f. Under some restriction of f, we get necessary and sufficient conditions for Z being the universal dendrite. Furthermore Z is classified into five types especially when it is a tree.

18 Yukinobu Yajima (Kanagawa Univ.) C^*-embedding implies P-embedding in certain products 10
Yasushi Hirata (Kanagawa Univ.)

Summary: Introducing a new concept of generalized zero-sets, we show that every generalized zero-set is P-embedded in the products of a monotonically normal space and a compact T_2-space if it is C^*-embedded. Moreover, it is proved that every closed subset is P-embedded in the products of two subspaces of an ordinal if it is C^*-embedded.

19 Takashi Shimomura (Nagoya Univ. of Economics) Bratteli–Vershik representations on zero-dimensional homeomorphisms 10

Summary: A compact minimal homeomorphic Cantor systems has Bratteli–Vershik representations. This fact was described by Herman, Putnam and Skau. Accordingly, many studies have been done, in the relation with C* algebra, ergodic theory and so on. We have found that every zero-dimensional homeomorphic system has Bratteli–Vershik representations that are not trivial.

20 Takashi Shimomura (Nagoya Univ. of Economics) Expansiveness on finite rank Bratteli–Vershik homeomorphisms 10

Summary: It is well known if a minimal Bratteli–Vershik system has finite topological rank $K > 1$, then it is expansive. This fact has been extended to non-minimal cases without periodic orbits. We show that all finite rank Bratteli–Vershik homeomorphisms are expansive, if they do not contain infinite odometers.

21 Shosuke Omori (Waseda Univ.) A product space of {0,1} and an abstract polycrystal 15
Tomoyuki Yamamoto (Waseda Univ.)
Akihiko Kitada (Waseda Univ.)

Summary: Let $(X, \tau) = (\{0,1\}^{\Lambda}, \tau_0^{\Lambda})$, $Card\Lambda \succ \aleph_0$ be the $\Lambda-$product space of $(\{0,1\}, \tau_0)$ where τ_0 is a discrete topology for $\{0,1\}$. The topological space (X, τ) needs not to be metrizable, that is, the relation $Card\Lambda \succ \aleph$ may hold. In the present report, assuming the lattice point of crystal to be a map $x : \Lambda \to \{0,1\}$ (for example, $\Lambda = \mathbf{N}, \mathbf{R}, ...$), we will mathematically confirm the existence of a partition $\{X_1, ..., X_n\}$ of X, $X_i \in (\tau \cap \Im) - \{\phi\}$, a decomposition space of each element X_i of which is self-similar. The partition of X can be regarded as a kind of polycrystal in an abstract sense each abstract singlecrystal $X_i = (X_i, \tau_{X_i})$ of which is characterized by its self-similar decomposition space. Namely, all points in X_i are classified into equivalence classes and then the equivalence classes coalesce to form a self-similar structure.

22 Shintaro Kuroki (Okayama Univ. of Sci.)
Dong Youp Suh (KAIST)
Cohomological non-rigidity of eight-dimensional complex projective towers 15

Summary: A complex projective tower, or simply CP-tower, is an iterated complex projective fibration starting from a point. In this talk, we introduce a classification of some class of 8-dimensional CP-towers up to diffeomorphism. As a consequence, we show that cohomological rigidity is not satisfied by the collection of 8-dimensional CP-towers: there are two distinct 8-dimensional CP-towers that have the same cohomology rings.

23 Hirokazu Nishinobu (Kochi Univ.)
Toshihiro Yamaguchi (Kochi Univ.)
Rational cohomologies of classifying spaces for homogeneous spaces of small rank 10

Summary: Let X be a simply connected homogeneous space with (2,3)-type. Then we compute the Sullivan minimal model of the Dold–Lashof classifying space $Baut_1X$ and observe whether or not its rational cohomology is a polynomial algebra.

24 Tadayuki Haraguchi (Oita Nat. Coll. of Tech.)
A model structure of the category of diffeological spaces 15

Summary: We construct on the category of diffeological spaces a model structure having smooth weak homotopy equivalences as the class of weak equivalences. It is shown that our model structure on the category of diffeological spaces is Quillen equivalent to the standard Quillen model structure on the category of topological spaces, with weak homotopy equivalences as the class of weak equivalences.

25 Naoya Suzuki (Nat. Inst. of Tech., Akita Coll.)
The equivariant cohomology on a simplicial manifold 10

Summary: When a simplicial Lie group acts on a simplicial manifold $\{X_*\}$, we can construct a bisimplicial manifold and the de Rham complex on it. This complex is quasi-isomorphic to the equivariant simplicial de Rham complex on $\{X_*\}$ and its cohomology group is isomorphic to the cohomology group of the fat realization of the bisimplicial manifold.

14:15–15:15 Talk Invited by Topology Section

John Parker (Univ. of Duhram) Non-arithmetic lattices

Summary: In this talk I will discuss arithmetic and non-arithmetic lattices and I will give a history of the problem of finding non-arithmetic lattices. I will also briefly describe the construction of new non-arithmetic lattices in SU(2,1) found in my joint work with Martin Deraux and Julien Paupert.

15:30–17:15

26 Teruaki Kitano (Soka Univ.) $SL(2;\mathbb{R})$-representations of a Brieskorn homology 3-sphere 10
Yoshikazu Yamaguchi (Akita Univ.)

Summary: We classify $SL(2;\mathbb{C})$-representations of a Brieskorn homology 3-sphere. We show any irreducible representation into $SL(2;\mathbb{C})$ is conjugate to that into either $SU(2)$ or $SL(2;\mathbb{R})$. We also give a construction of $SL(2;\mathbb{R})$-representations for a Brieskorn homology 3-sphere from $PSL(2;\mathbb{R})$-representations of the base orbifold fundamental group.

27 Masaaki Suzuki (Meiji Univ.) Epimorphisms between 2-bridge knot groups ans their crossing numbers 10

Summary: Suppose that there exists an epimorphism from the knot group of a 2-bridge knot K onto that of another knot K'. In this talk, we study the relationship between their crossing numbers $c(K)$ and $c(K')$.

28 Takefumi Nosaka (Kyushu Univ.) On the fundamental relative 3-classes of knot group representations 15

Summary: This paper focuses on the fundamental (relative) 3-classes of knots (or hyperbolic links), and provide diagrammatic descriptions of the push-forwards with respect to every link-group representation. The point is an observation of a bridge between the relative group homology and quandle homology from the viewpoints of Inoue–Kabaya map. Furthermore, we give an algorithm to algebraically describe the fundamental 3-class of any hyperbolic knot.

29 Ken'ichi Yoshida (Univ. of Tokyo) Union of 3-punctured spheres in a hyperbolic 3-manifold 15

Summary: We classify the topological types for components of union of the totally geodesic 3-punctured spheres in an orientable hyperbolic 3-manifold of finite volume.

30 Anh T. Tran (Univ. of Texas at Dallas) Asymptotic behavior of Reidmeister torsion for toroidal surgeries along
Yoshikazu Yamaguchi (Akita Univ.) twist knots 10

Summary: We have observed the asymptotic behavior of the Reidemeister torsion for graph manifolds obtained by 4-surgeries along hyperbolic twist knots. We will talk about the order of growth and the explicit values of the limit of leading coefficient in the asymptotic behavior of Reidemeister torsion. We will also talk about a relationship between metabelian SL(2,C)-representations and degenerate hyperbolic structures of hyperbolic knot complements.

31 Takuya Katayama (Hiroshima Univ.) RAAGs in knot groups 15

Summary: In 2003, Crisp–Wiest considered embeddings from surface groups into right-angled Artin groups (RAAGs) and proved that most surface groups can be embedded in RAAGs. Recently, Agol, Liu, Przytycki, Wise et al. considered "virtual" embeddings from the fundamental groups of compact aspherical 3-manifolds into RAAGs and obtained deep theorems such as Virtual Haken Conjecture for 3-manifolds. In this talk, we consider embeddings from RAAGs into knot groups, and we give a complete classification of RAAGs which admit embeddings into the knot group of K for each knot K in S^3. If time permits, I would like to explain some applications of our main result.

32 Yoshihiro Takeuchi (Aichi Univ. of Edu.)
Misako Yokoyama (Shizuoka Univ.)
The w-Čech cohomology of orbifolds 10

Summary: We construct the w-Čech cohomology of orbifolds.

September 18th (Sun) Conference Room III

9:50–12:00

33 Kodai Wada (Waseda Univ.) A note on Milnor's link-homotopy invariants 10

Summary: J. Milnor defined two kinds of link-homotopy invariants $\overline{\mu}$ and μ^*. By definition it would seem that the μ^*-invariant is weaker than the $\overline{\mu}$-invariant. We show that this is indeed the case by giving an example of length greater than 4 where the values of $\overline{\mu}$ and μ^* are distinct. For sequences of length not greater than 4, Milnor has shown that $\overline{\mu} = \mu^*$.

34 Kodai Wada (Waseda Univ.)
Natsuka Kobayashi (Tokyo Metropolitan Fujimori High School)
Akira Yasuhara (Tsuda Coll.)
Milnor invariants of covering links 10

Summary: We consider Milnor invariants for certain covering links as a generalization of covering linkage invariants formulated by R. Hartley and K. Murasugi. A set of Milnor invariants for covering links is a link-cobordism invariant of a link, and that this invariant can distinguish some links for which the ordinary Milnor invariants coincide. Moreover, for a Brunnian link L, the first non-vanishing Milnor invariants of L is modulo-2 congruent to a sum of Milnor invariants of covering links. As a consequence, a sum of linking numbers of iterated covering links gives the first non-vanishing Milnor invariant of L modulo 2.

35 Yuka Kotorii (Univ. of Tokyo)
Atsuhiko Mizusawa
Milnor invariant for handlebody-links 10

Summary: A handlebody-link is a disjoint union of handlebodies embedded in S^3 and HL-homotopy is an equivalence relation on handlebody-links generated by self-crossing changes. A. Mizusawa and R. Nikkuni classified the set of HL-homotopy classes of 2-component handlebody-links completely using the linking numbers for handlebody-links. In this talk, by using Milnor's link-homotopy invariants, we construct an invariant for handlebody-links and give a bijection between the set of HL-homotopy classes of n-component handlebody-links with some assumption and a quotient of the action of the general linear group on a tensor product of modules.

36 Nao Imoto (Nara Women's Univ.) On an estimation of flat plumbing basket number of knots 10

Summary: For a knot K, Hirose and Nakashima introduced a numerical invariant called flat plumbing basket number, denoted $fpbk(K)$, which is the minimal number of annuli to obtain a flat plumbing basket of K. They gave two estimations of $fpbk(K)$ using the degree of the Alexander polynomial of K. In this talk, we show that one of the estimations of given by Hirose and Nakashima is exact.

Summary: A 2-dimensional braid over an oriented surface-knot F is a surface in the form of a simple branched covering over F. A 2-dimensional braid is presented by a certain graph called a chart on a surface diagram of F. We consider 2-dimensional braids obtained by an addition of 1-handles equipped with chart loops. We show that an addition of 1-handles with chart loops is an unbraiding operation.

Summary: A region crossing change is a local move on a link diagram. In this talk, we introduce a subspecies of region crossing change, named region freeze crossing change. We study similarity and difference between region crossing change and region freeze crossing change.

Summary: A knot shadow is a diagram with all crossing information missing. We cannot determine the original knot from a knot shadow in general. In this paper, we investigate properties (unknotting number, genus, braid index, etc.) of the original knot from a knot shadow.

Summary: A knot projection is the image of an immersion from a circle to a 2-sphere whose singular points are only finitely many transverse double points. A chord diagram is a configuration of paired points on a circle. Traditionally, two paired points are connected by a chord. A triple chord is a sub-chord diagram consisting of three pairs where each pair of the two chords intersects with each other. The main result is that if a chord diagram of a non-trivial knot projection contains no triple chord as a sub-chord diagram, then, the knot projection has at least one 1-gon or strong 2-gon where a strong 2-gon is a 2-gon that can be oriented by orienting the knot projection.

Summary: In this talk, we obtain a framework to produce (possibly infinitely many) new topological invariants of spherical curves under some Reidemeister moves. They are obtained by chord diagrams, each of which is a configuration of paired points on a circle.

Summary: For a link with zero determinants, a $\mathbb{Z}$-coloring is defined as a generalization of Fox coloring. We call a link having a diagram which admits a non-trivial $\mathbb{Z}$-coloring a *$\mathbb{Z}$-colorable link*. The *minimal coloring number* of a $\mathbb{Z}$-colorable link is the minimal number of colors for non-trivial $\mathbb{Z}$-colorings on diagrams of the link. We give sufficient conditions for non-splittable $\mathbb{Z}$-colorable links to have the least minimal coloring number.

Summary: For an effectively n-colorable knot K, $\mathrm{C}_n^*(K)$ stands for the minimum number of distinct colors used over all effective n-colorings of K. It is known that $\mathrm{C}_n^*(K) \geq \lfloor \log_2 n \rfloor + 2$ for any effectively n-colorable knot K. For $n = 3, 5, 7, 9, 11, 13$, any effectively n-colorable knot K satisfies $\mathrm{C}_n^*(K) = \lfloor \log_2 n \rfloor + 2$. In general, however, it is not known whether there is an effectively n-colorable knot K with $\mathrm{C}_n^*(K) = \lfloor \log_2 n \rfloor + 2$. In this talk, we show that for any $n \geq 3$ an effectively n-colorable torus knot T satisfies $\mathrm{C}_n^*(T) = \lfloor \log_2 n \rfloor + 2$.

Infinite Analysis

September 15th (Thu) Conference Room VI

10:15–12:00

1 Masahiko Ito (Tokyo Denki Univ.)
Masatoshi Noumi (Kobe Univ.)
An elliptic generalization of the Gustafson–Rakha summation formula 15

Summary: We will talk about an elliptic generalization of the Gustafson–Rakha summation formula, which was conjectured by Spiridonov. We will explain a way to prove this elliptic summation formula from the viewpoints of the q-difference de Rham theory and the interpolation functions.

2 Azusa Ikeda (Aoyama Gakuin Univ.)
Tetsu Masuda (Aoyama Gakuin Univ.)
q-Painlevé systems of type A and their generalization 15

Summary: A q-deformation of discrete dynamical systems associated with the Weyl group of type A is proposed. This is a natural generalization of the birational Weyl group action for the q-Painlevé equation of type $A_4^{(1)}$. A determinant formula of Jacobi–Trudi type for a family of Laurent polynomials arising from the action of the Weyl group is also presented.

3 Tetsu Masuda (Aoyama Gakuin Univ.)
Hypergeometric solutions to the q-Painlevé system of type $A_2^{(1)}$ and $A_3^{(1)}$ 15

Summary: We construct hypergeometric solutions to the q-Painlevé system of type $A_2^{(1)}$ and $A_3^{(1)}$.

4 Ryo Kamiya (Univ. of Tokyo)
Masataka Kanki (Kansai Univ.)
Tetsuji Tokihiro (Univ. of Tokyo)
Takafumi Mase (Univ. of Tokyo)
Quasi-integrable generalization of the two-dimensional discrete Toda equation 15

Summary: We introduce a discrete equation defined over the three-dimensional lattice. The equation is a generalization of the two-dimensional discrete Toda equation and is quasi-integrable, i.e., passes the singularity confinement test, and has exponential growth of the degrees of its iterates.

5 Saburo Kakei (Rikkyo Univ.)
Shuhei Kamioka (Kyoto Univ.)
Yosuke Katayama (Rikkyo Univ.)
Yasuhiro Ohta (Kobe Univ.)
Jeu de taquin slide and discrete 2-dimensional Toda equation 15

Summary: Difference equations that describe jeu de taquin slide are proposed, and their relation to discrete 2-dimensional Toda equation is investigated.

6 Hideshi Yamane (Kwansei Gakuin Univ.)
Long-time asymptotics for the focusing integrable discrete nonlinear Schrödinger equation 15

Summary: We investigate the long-time asymptotics for the focusing integrable discrete nonlinear Schrödinger equation by using the nonlinear steepest descent method. The leading term is a multi-soliton.

14:15–15:15

Summary: A direct connection between two sequences of points, one of which is generated by seed mutations of the cluster algebra of type $A_1^{(1)}$ and the other by time evolutions of the periodic discrete Toda lattice, is explicitly given.

Summary: Let g be an affine Lie algebra with the index set $I = \{0, 1, 2, \ldots, n\}$ and g^L be its Langlands dual. It is conjectured in [KNO] that for each $k \in I \setminus \{0\}$ the affine Lie algebra g has a positive geometric crystal whose ultra-discretization is isomorphic to the limit of coherent family of certain perfect crystals for g^L. We give a positive answer to the conjecture for $g = A_n^{(1)}$ and any $k \in I \setminus \{0\}$.

Summary: We establish a bijection between the set of rigged configurations and the set of tensor products of Kirillov–Reshetikhin crystals of type $D_n^{(1)}$ in full generality. We prove the invariance of rigged configurations under the action of the combinatorial R-matrix on tensor products and show that the bijection preserves certain statistics (cocharge and energy). As a result, we establish the fermionic formula for type $D_n^{(1)}$.

Summary: We show that the quantum R matrix for symmetric tensor representations of $U_q(A_n^{(1)})$ satisfies the sum rule required for its stochastic interpretation under a suitable gauge. Its matrix elements at a special point of the spectral parameter are found to factorize into the form that naturally extends Povolotsky's local transition rate in the q-Hahn process for $n = 1$. Based on these results we formulate new discrete and continuous time integrable Markov processes on a one-dimensional chain in terms of n species of particles obeying asymmetric stochastic dynamics.

15:30–16:30 Talk Invited by Infinite Analysis Special Session

Kohei Motegi (Tokyo Univ. of Marine Sci. and Tech.) — Partition functions of integrable lattice models and symmetric polynomials

Summary: We review recent developments on the combinatorial representation theory of symmetric polynomials by realizing them as partition functions of integrable lattice models. Partition functions, which are central objects in mathematical physics, are global quantities constructed from the local L-operators and determined by the boundary conditions for the case of integrable lattice models.

We first explain that symmetric polynomials such as the Schur, Grothendieck, Hall-Littlewood polynomials and their generalizations, variations can be represented as wavefunctions, which is a special class of partition functions.

By this integrable lattice model representation of symmetric polynomials, one can naturally derive algebraic identities for the symmetric polynomials such as the Cauchy and dual Cauchy identities by analyzing other important classes of partition functions called the scalar products and the domain wall boundary partition functions. Even studying the wavefunction itself can lead one to find new combinatorial formulae for the symmetric polynomials.

We illustrate these topics mainly by the six-vertex model of the XXZ type and the q-deformation of the Grothendieck polynomials, and its degeneration. Derivations of orthogonality relations from the Bethe ansatz equations, relation with objects in Schubert calculus etc will also be explained if time permitted.

September 16th (Fri) Conference Room VI

10:15–11:45

11 Taichiro Takagi (Nat. Defense Acad. of Japan), Takuma Yoshikawa (Nat. Defense Acad. of Japan) — Generalized Wick theorems in conformal field theory and the Borcherds identity · · · · · 15

Summary: We consider the well-known generalized Wick theorem for interacting fields in two dimensional CFT, and present a new formula for the operator product expansion of a normally ordered operator and a single operator on its right hand. Quite similar to the original Wick theorem for the opposite order operator product, it expresses the singular part of the operator product expansion as a contour integral of only two terms. We discuss the relationship between these formulas and the Borcherds identity satisfied by the quantum fields associated with the theory of vertex algebras.

12 Kanehisa Takasaki (Kinki Univ.), Toshio Nakatsu (Setsunan Univ.) — Quantum mirror curve of closed topological vertex and Kac–Schwarz operator of q-difference type · · · · · 15

Summary: We show that the quantum mirror curve of closed topological vertex may be thought of as a Kac–Schwarz operator of the q-difference type. A similar interpretation holds for open string amplitudes of topological string theory on strip geometry as well.

13 Ryosuke Kodera (Kyoto Univ.)* Cherednik algebras and quantized Coulomb branches ····· 15
Hiraku Nakajima (Kyoto Univ.)

Summary: We prove that the quantized Coulomb branches associated with framed quiver gauge theory of Jordan type are isomorphic to spherical Cherednik algebras.

14 Takeshi Ikeda (Okayama Univ. of Sci.) Pieri rule for the K-theoretic P-functions ····· 15

Summary: We study the K-theory of algebraic vector bundles over the maximal orthogonal Grassmannian OG. The classes of structure sheaves of the Schubert varieties form a basis of the ring. We want to describe the multiplicative structure constants for this basis. Naruse–Ikeda 2013 introduced K-theoretic P-functions which are identified with the Schubert basis of K-theory of OG. Combinatorial descriptions for these Schubert structure constants are given by Clifford, Thomas, and Yong, and more recently by Pechenik and Yong. We give a conjecture for the structure constants in terms of combinatorial object called set-valued reverse decomposition tableaux. Non-set-valued version of these objects are introduced by Serrano, and used by Cho to give a new combinatorial description of P-functions. We prove a special case of our conjecture called Pieri rule, which was originally proved by Buch and Ravikumar.

15 Ivan Ip (Kyoto Univ.) Positive representations of split real quantum groups ····· 15

Summary: The notion of Positive Representations is a new research program devoted to the representation theory of split real quantum groups, initiated in a joint work with Igor Frenkel. Many structures are parallel to the finite dimensional representation theory of compact quantum groups, but at the same time also serves some new properties that is not available in the compact case. In this talk I will survey the recent developments and describe some of its relations to other areas of mathematics.

13:00–14:00 Talk Invited by Infinite Analysis Special Session

Tatsuyuki Hikita (Kyoto Univ.)♭ On the cohomology of conical symplectic resolutions

Summary: DeConcini–Procesi and Tanisaki proved that the cohomology ring of a Springer fiber of type A is isomorphic to the coordinate ring of the scheme-theoretic intersection of some nilpotent orbit closure and a Cartan subalgebra. Since Springer fibers are homotopic to Slodowy varieties which are examples of conical symplectic resolutions, this result can be considered as a description of the cohomology ring of Slodowy varieties of type A by the coordinate ring of some scheme. In this talk, I'd like to formulate some conjectures generalizing this kind of isomorphisms to other conical symplectic resolutions. In the formulation, we use a duality between conical symplectic resolutions, called symplectic duality, introduced by Braden–Licata–Proudfoot–Webster.