

 The Mathematical Society of Japan

2026 Annual Meeting

Titles and Short Summaries of the Talks

March, 2026

at Tokyo University of Science

2026 The Mathematical Society of Japan

ANNUAL MEETING

Dates: March 23rd (Mon)–26th (Thu), 2026

Venue: Kagurazaka Campus, Tokyo University of Science
1-3 Kagurazaka, Shinjuku-ku, Tokyo 162-8601, Japan

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The Mathematical Society of Japan

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Plenary Talks

March 24th (Tue) 624, 2F, Building no. 6

Award Lecture for the 2026 MSJ Spring Prize

Spring Prize Winner (15:15–16:15)

Senjo Shimizu (Kyoto Univ.) Free boundary problems for fluids based on the maximal regularity theorem (16:30–17:30)

Summary: Free boundary problems for the Navier–Stokes equations have been studied since the pioneering work of Solonnikov in 1977. In such problems, the Navier–Stokes equations are often treated as quasilinear equations by transforming the free boundary problem into a fixed boundary problem. Over the past three decades, maximal L^p -regularity has been established as one of the most powerful methods for solving quasilinear parabolic equations. Nevertheless, the well-posedness of free boundary problems for the Navier–Stokes equations in scale-invariant spaces has not been established.

In this talk, we discuss the global well-posedness of free boundary problems for the Navier–Stokes equations in scaling-critical Besov spaces. Our approach is based on a newly established maximal L^1 -regularity theorem for the corresponding Stokes system, which is not covered by the existing theoretical framework.

Featured Invited Talks

March 23rd (Mon)

Conference Room I

Kenshi Miyabe (Meiji Univ.) Algorithmic randomness: its theory and connection with analysis (13:00–14:00)

Summary: Algorithmic randomness provides a refined framework for understanding information, complexity, and prediction by incorporating the notion of computability into classical probability theory. In this talk, I will introduce the basic ideas and motivations behind algorithmic randomness, highlighting how the concept captures random behavior from the viewpoint of computation. I will then discuss several connections with analysis, including links to differentiability, ergodic theorems, fractal geometry, and computable aspects of measure theory. By viewing these phenomena through the lens of computation, we gain a new perspective on typical behavior, one shaped by Kolmogorov complexity. Finally, I will briefly discuss recent developments related to learning theory, illustrating how algorithmic randomness offers a unifying perspective across learning and prediction.

Conference Room II

Guest Talk from the Japan Society for Industrial and Applied Mathematics

Takayasu Matsuo (Univ. of Tokyo) Structure-preserving numerical methods and their applications (13:00–14:00)

Summary: This lecture surveys structure-preserving numerical methods for differential equations, focusing on algorithms that retain geometric or energetic structures of the underlying continuous systems. After introducing the historical development and major classes of such methods—symplectic integrators, discrete gradient methods, and variational and multisymplectic schemes—the talk highlights discrete gradient methods as a representative framework, explaining their theoretical foundations and qualitative properties such as energy dissipation and asymptotic behavior. The application of continuous optimization is discussed, illustrating how numerical analysis can contribute beyond simulation to the theoretical understanding of algorithms. If time allows, some recent research progress is also mentioned.

Conference Room III

Tatsuhiko Yagasaki (Kyoto Inst. Tech.*) On topologies of homeomorphism groups and diffeomorphism groups of noncompact manifolds (13:00–14:00)

Summary: In this survey talk, we revisit standard topologies on groups of homeomorphisms and diffeomorphisms of manifolds; (i) compact-open topology, (ii) (very) strong Whitney topology, (iii) uniform topology and (iv) direct limit topology. For compact manifolds, all of these topologies coincide and are well-behaved for many purposes. However, for noncompact manifolds each of them has its own defect deviating from our intuition. In the first half of this talk, we discuss on this issue. In the latter half, we review our works on homeomorphism groups and diffeomorphism groups of noncompact manifolds; (1) Compact-open topology: (i) Homotopy types and topological types of groups of homeomorphisms (diffeomorphisms) of noncompact 2-manifolds, (ii) Group of measure-preserving homeomorphisms (volume-preserving diffeomorphisms) of noncompact manifolds and mass flow toward ends, (2) Uniform topology: Deformation of uniform homeomorphisms on noncompact metric manifolds, (3) very strong Whitney topology: Local topological types of groups of homeomorphisms (diffeomorphisms) (with compact support).

March 25th (Wed)

Conference Room X

Yoshihisa Saito (Rikkyo Univ.)^b Elliptic root systems and thier applications to representation theory (13:00–14:00)

Summary: In the middle of 1980’s, K. Saito introduced the notion of “elliptic root systems”, motivated by study of singularity theory. They are generalizations of affine root systems which have two null directions. As well known, if a root system is given, then associated algebraic structures are also given. (For example, the Weyl group, the Hecke algebras, or the Lie algebras, etc.) In this talk, we will explain what kind of algebraic structures appear in association with elliptic root systems, and certain applications to representation theory.

Conference Room XI

Noriaki Yamazaki (Kanagawa Univ.) The topology of the space of convex functions and its applications (13:00–14:00)

Summary: In this talk, we first introduce the definition and properties of the topology of the space of convex functions. Next, by using the topology of the space of convex functions, we discuss the solvability and the stability of solutions to abstract nonlinear evolution equations governed by time-dependent subdifferentials. Finally, we consider the generalization of optimal convex function control problems by using the concept of the local gap of two control convex functions. In addition, we apply our general results to some model problems.

March 26th (Thu)

Conference Room X

Seiya Negami (Yokohama Nat. Univ.*) Topological graph theory, its birth to the future (13:00–14:00)

Summary: Topological graph theory is a field amalgamating topology and graph theory. The author developed a theory on embeddings of graphs on closed surfaces in 1980’s and has been known as the pioneer of this field in Japan. Moreover, he produced many results, such as a theory of diagonal flips in triangulations on closed surfaces and Ramsey theorem of spacial graphs, by various groundbreaking ideas. In particular, “Planar Cover Conjecture” he proposed in 1986 is worldwide famous as one of unsolved open problems in topological graph theory. In this lecture, he will outline these research themes that he himself proposed and present future prospects for topological graph theory.

Conference Room XI

Takehiko Yasuda (Univ. of Osaka) Singularities in Diophantine geometry (13:00–14:00)

Summary: In Diophantine geometry, problems concerning rational and integer solutions to equations are said to be governed by the geometry of the algebraic variety defined by those equations. This talk will focus on the question: What role do singularities of algebraic varieties play in Diophantine geometry? The motto is: “The more singular a variety is, the more rational points it has.” Quantifying the degree of singularity and the abundance of rational points leads to intriguing assertions and conjectures. Furthermore, viewing “Diophantine geometry” and “singularities” in a broad sense provides new perspectives on a wider range of subjects. In this talk, I wish to introduce several phenomena related to this theme from my personal viewpoint.

Foundation of Mathematics and History of Mathematics

March 23rd (Mon) Conference Room VI

9:00–11:25

- 1 Masato Fujita (Japan Coast Guard Acad.) Weakly o-minimal structures possessing exactly m dimension functions 15

Summary: For every positive integer m , we construct a weakly o-minimal theory whose models have exactly m dimension functions possessing the van den Dries property.

- 2 Koichiro Ikeda (Hosei Univ.) On theories with the strong tree property 15

Summary: A non-isolated type $p \in S(T)$ is said to have the strong tree property (STP), if there are $a, b, c \models p$ such that $tp(bc/a)$ is non-algebraic, isolated, and b, c are independent. In my talk, I will explain the relationship between theories with STP and the number of countable models.

- 3 Akito Tsuboi (Univ. of Tsukuba*) Chromatic properties of U-rank one graphs 10

Summary: We show the following result: Let G be a graph whose theory has U-rank one, meaning that every element in the monster model has U-rank at most 1. Assume $\chi(G) \geq \omega$. Then G must contain an infinite clique.

- 4 Koki Okura (Univ. of Tsukuba) On distal expansions 15

Summary: Distal theories are NIP theories regarded as purely unstable in a suitable sense. This talk concerns the question of when an expansion of a distal theory remain distal. We first present a criterion for distality based on a form of quantifier elimination and separation of terms. Then, we introduce our main result: $(\mathbb{Z}; <, +, R)$, $(\mathbb{Q}_p; +, \cdot, p^{\mathbb{Z}})$, and $(\mathbb{Q}_p; +, \cdot, p^{\mathbb{Z}}, p^R)$ are distal, where R is an almost sparse sequence in \mathbb{Z} .

- 5 Hiroataka Kikyo (Kobe Univ.) On Hrushovski's construction and chromatic number 15

Summary: Let M be a generic graph obtained by Hrushovski construction using a predimension function with a coefficient α . We have already reported (with Tsuboi) that the chromatic number of M is always finite. We have shown that the chromatic number of M can be arbitrarily large: For any integer $k > 0$ there is a real number $\varepsilon > 0$ such that if $0 < \alpha < \varepsilon$ then the chromatic number of M is greater than k .

- 6 Toshio Suzuki (Tokyo Metro. Univ.) The field generated by left c.e. reals below a weakly computable real
Masahiro Kumabe (Open Univ. of Japan) 15
Kenshi Miyabe (Meiji Univ.)

Summary: Extending Miller's work (2017), we study a subfield of the real numbers generated by left c.e. real numbers below a weakly computable real number with respect to Solovay reducibility. We discuss, from algorithmic randomness perspective, the relationship between the following two operations on a weakly computable real number; (i) operation of taking field extension by adding the weakly computable real to the field of computable real numbers, and (ii) operation of taking the lower Solovay cone. This talk is based on the talk of the same name given at Asian Logic Conference 2025, Kyoto, September 2025.

7 Kohtaro Tadaki (Chubu Univ.) The Wigner–Deutsch collaboration 15

Summary: In our former works, based on the toolkit of algorithmic randomness, we presented an operational refinement of the Born rule, called the principle of typicality, for specifying the property of the results of quantum measurements in an operational way. The Wigner’s friend paradox is a Gedankenexperiment regarding when and where the reduction of the state vector occurs in a chain of the measurements by several observers. Deutsch’s thought experiment is a variant of it, which can, in principle, verify the effect of the consciousness of observer on the reduction of the state vector. In this talk, we introduce a combination of the Wigner’s friend paradox and Deutsch’s thought experiment, and make an analysis of it in our framework of quantum mechanics based on the principle of typicality.

8 Makoto Fujiwara (Tokyo Univ. of Sci.) Goodman’s theorem and Markov’s principle 15
Benno van den Berg
(Univ. of Amsterdam)

Summary: Goodman’s theorem states that intuitionistic finite-type arithmetic HA^ω augmented with the axiom schema of choice AC is conservative over intuitionistic first-order arithmetic HA. However, the situation dramatically changes already when we add a weak logical axiom (with function parameters) to the theory in the premise. In fact, for each natural number n , there exists a HA-sentence Φ such that Φ is provable in $\text{HA}^\omega + \text{AC}$ augmented with Markov’s principle MP (with function parameters) but not provable even in HA augmented with the law-of-excluded-middle schema restricted to Σ_n -formulas. On the other hand, for any HA-sentence Φ constructed from Σ_{n+1}^0 -formulas using only \wedge , \rightarrow and \forall , if Φ is provable in $\text{HA}^\omega + \text{AC} + \text{MP}$, then it is provable in HA augmented with the double-negation-elimination schema restricted to Σ_{n+1} -formulas.

9 Yuzuki Kaneko (Tohoku Univ.) Quasi-metric spaces in reverse mathematics 15
Keita Yokoyama (Tohoku Univ.)

Summary: We introduced a representation of quasi-metric spaces within second-order arithmetic. It is known that every T_0 countably based space is isometric to a separable quasi-metric space, and specifically, it is a Π_2^0 subspace of $\mathcal{P}(\mathbb{N})$ as the product of the Sierpinski space if it is complete (quasi-Polish). Hence our representation enables us to deal with more topological spaces in the setting of reverse mathematics. We also see that a quasi-Polish space is homeomorphic to a UF space, a variant of a poset space, and formalize this idea in second-order arithmetic. We then consider which subsystem of second-order arithmetic is needed to prove theorems for quasi-metric spaces in reverse mathematics.

11:40–11:55 Research Section Assembly**14:15–15:15 Talk Invited by Section on Foundation and History of Mathematics**

Makoto Tamura (Osaka Sangyo Univ.) On the arithmetic books in the Qin Bamboo Slips housed at the Peking University

Summary: The Qin Bamboo Slips housed at the Peking University were donated to the university in 2009. After the publication of the report books with photographs of the slips in 2023, the research on them has been progressed widely. Although the excavation circumstances of the slips are unknown, they contain 761 bamboo slips, 21 wooden slips, 6 wooden tablets, 1 non-rectangular wooden card, 1 wooden die, and 61 bamboo counting rods as well as fragments of the bamboo container that held them. The presence of counting rods suggests that the contents were largely arithmetic-related. The arithmetic texts comprise five books: the Math Books (Type A: 235 slips, Type B: 37 slips, and Type C: 71 slips), “Chengtian” (22 slips), and “Tianshu” (50 slips), along with a wooden tablet inscribed with a multiplication table. The latest possible date for these texts is 216 BCE, based on a reference to “the thirty-first year of Emperor Qin Shi Huang” found in the “Zhiri”. This fact indicates that they are the oldest known arithmetic books in China. This paper will provide an overview of the content of the arithmetic books of the Qin Bamboo Slips housed at the Peking University and compare them with other ancient arithmetic books of the Qin-Han periods.

15:30–17:30

- 10 Katsushi Waki (Yamagata Univ.)^b Extraction of geometric areas from Wasan books using NDL Classical Books OCR-Lite 15

Summary: In the previous presentation, I extracted candidate graphic regions through layout analysis using NDL_Layout, but many non-graphic regions were also extracted as graphic regions. This time, I attempted to narrow down the candidate graphic regions using NDL Classical Books OCR-Lite.

- 11 Noriko Tanaka (Naragakuen Univ.) A comparison of mathematical expressions in schools during the Edo period 15

Summary: During the Edo period (1603–1867) in Japan, both samurai and commoners studied mathematics. Schools sprang up across the country, and Sangaku (mathematical tablets) were dedicated at shrines and temples. It is known that the methods of mathematical expression differed between schools. We compare the mathematical expressions of several schools: the Seki school, which was the largest; the Takuma school, a Kansai-based school; the Shisei Sanka school; the Saijyo school; and the Miike school. The Saijyo School and the Shisei Sanka school had similar expressions with the Seki School, but the Takuma School and the Miike School can be said to possess their own unique methods of expression.

- 12 Koichi Hirata Renjutsu and their solutions with rational number as radii 15
(Matsuyama Univ./Ehime Univ.*)

Summary: Ajima Naonobu's Renjutsu is known as a method for calculating the radius of each circle in a circle chain. Some problems in Japanese mathematics are designed so that all the diameters of the circles in the circle chain are rational numbers. In this study, we explore the conditions under which all the diameters of the circles in the circle chain are rational numbers, and consider how to construct the initial four circles of such a circular chain.

- 13 Tsukane Ogawa (Yokkaichi Univ.) *Jinkouki* as an abacus book 15
Noriko Tanaka (Naragakuen Univ.)

Summary: It goes without saying that the *Jinkouki* is an abacus book, but modern researchers do not necessarily read it as such. This talk discusses the knowledge gained from actually operating an abacus, including fingering, the difficulty of manipulation, positioning (decimal) points, special ways of calculating quotients, and comparisons with the *Sanyouki*.

- 14 Hideyuki Majima (Ochanomizu Univ.*^a) On the publication of Katsuyousanpou 15

Summary: On the publication of Katsuyousanpou We discuss on reasons why there are several versions of Katsuyousanpou.

- 15 Michiyo Nakane The emergence of the Hamilton–Jacobi theory in the calculus of variations 15

Summary: In his examination of the three-body problem in 1836, Jacobi encountered a dynamical system in which the force function explicitly depended on time. Building on this insight, Jacobi extended Hamilton's achievements in dynamics from 1834–35 to encompass such systems. As a result, inspired by Hamilton's approach of solving mechanical problems by reducing them to partial differential equations, Jacobi conceived this idea in 1837 and went on to construct a theory of the calculus of variations in his lectures on dynamics delivered in 1842–43.

- 16 Ken Saito Making vocabulary of ancient Greek to read Greek mathematical works 15
(Osaka Pref. Univ.*^a/Yokkaichi Univ.)

Summary: Greek mathematical works are very simple from the linguistic point of view, but they contain conjugations that are rare in normal writing, unusual words, and usages that are specific to mathematical arguments. Our goal is to create a specific vocabulary book for Greek mathematics, for readers who want to read Greek mathematics in the original language. We present a prototype version for the first six Books of Euclid's *Elements*.

17:45–18:00 Mathematics History Team Meeting

March 24th (Tue) Conference Room VI

9:00–11:45

- 17 Yusuke Hayashi (Kobe Univ.) Stationary list colorings 15

Summary: In this talk, we introduce stationary list coloring for infinite graphs. This is a variant of list coloring in which each vertex is assigned an arbitrary stationary subset of a regular cardinal κ as its list of colors, and we ask whether the graph has a good coloring obtained by choosing each vertex's color from its list. We compare stationary list colorability with the usual list colorability and Komjáth's restricted list colorability. Moreover, we obtain an analogue of a result of Komjáth regarding restricted list coloring. Finally, by a forcing construction, we obtain a consistency result showing that stationary and restricted list colorability does not have the monotonicities in the cardinal parameter.

- 18 Kenta Tsukura (Nat. Fisheries Univ.) Coloring triples of uncountable sets 15

Summary: We show that, if there is a $<\kappa$ -non-reflecting stationary subsets of $E_{<\kappa}^\lambda$ then $\mathcal{P}_\kappa\lambda \not\rightarrow [I_{\kappa\lambda}^+]_\lambda^3$.

- 19 Toshimasa Tanno (Kobe Univ.) Perfect set dichotomy theorem in generalized Solovay model 15

Summary: The perfect dichotomy theorem for an equivalence relation E on \mathbb{R} asserts that either \mathbb{R}/E is well-orderable or there exists a perfect set of pairwise E -inequivalent reals. We show that in the Solovay model, the perfect set dichotomy holds for any equivalence relation. Furthermore, we consider a generalization of the Solovay model for an uncountable regular cardinal μ , and show the perfect set dichotomy theorem for μ^μ also holds in that model. In this talk, we present these results together with some combinatorial consequences and related propositions. This is a joint work with Hiroshi Sakai.

- 20 Hiroaki Minami (Aichi Gakuin Univ.) The splitting and reaping number for mad families 15

Summary: We study cardinal invariants of the quotient Boolean algebra $\mathcal{P}(\omega)/\mathcal{I}(\mathcal{A})$ where $\mathcal{I}(\mathcal{A})$ is the ideal generated by a mad family \mathcal{A} . Using a matrix iteration of ccc posets we obtain the consistency of $\mathfrak{b} = \mathfrak{a} = \mathfrak{s}(\mathcal{A}) < \mathfrak{s}$ and the consistency of $\mathfrak{r}(\mathcal{A}) > \mathfrak{r}$. This is joint work with Jörg Brendle.

- 21 Yasuo Yoshinobu (Nagoya Univ.) More on convex sets and the axiom of choice 15

Summary: For a cardinal κ , let $\text{MCV}(\kappa)$ denote the statement that every subset of the \mathbb{R} -vector space of dimension κ has a maximal convex subset. Under ZF, we show that $\text{MCV}(3)$ is equivalent to the axiom of uniformization, a fragment of the axiom of choice. We also observe consequences of $\text{MCV}(2^\omega)$ and $\text{MCV}(\omega_1)$. This work is a continuation of the study on which the speaker presented at the 2024 spring meeting of the MSJ.

- 22 Ken-etsu Fujita (Tokyo Denki Univ.) Girard's paradox and T-algebras 15
Toshihiko Kurata (Hosei Univ.)

Summary: Sorensen and Urzyczyn provided a proof of the so-called Girard's paradox in the system of lambda U-. They expounded the powerful universe A as kind polymorphism in terms of an inductive kind. In this talk, we show that a type isomorphic to A can be introduced in the form of a weakly initial T-algebra under some functor. Moreover, we give a dual one, i.e., a weakly final T-coalgebra that can constitute a framework to establish Girard's paradox as well.

- 23 Yoshihito Tanaka (Sci. Tokyo/Kyushu Sangyo Univ.) Neighborhood models for predicate modal logics with ω -rules 15

Summary: This paper investigates neighborhood models for predicate modal logics with ω -rules, including non-normal cases. We prove that each of these logics is characterized by a neighborhood model with constant domains. Related results for normal modal logics with ω -rules were obtained by Tanaka, while similar results for non-normal modal logics without ω -rules were presented by Arló-Costa and Pacuit and by Tanaka. The result presented here extends these works. As applications, we show that a predicate extension of GL is sound and complete with respect to a class of neighborhood frames with constant domains, and that a predicate common knowledge logic is Kripke incomplete but neighborhood complete.

- 24 Takahiro Seki (Niigata Univ.) Classification of non-associative substructural logics with contraposition 15

Summary: Substructural logics are obtained by removing structural rules, such as exchange, weakening or contraction, from standard sequent calculi. Recent studies have also investigated extensions of non-associative substructural logics. A central issue is contraposition, which links implication and negation. When exchange is absent, two implication operators and two corresponding negations are required. In the Full Lambek calculus, contraposition is closely tied to associativity; however, in non-associative settings, several alternative forms arise. This paper examines these variations by adding contraposition axioms to non-associative substructural logics, classifying the resulting systems according to their strength.

- 25 Taishi Kurahashi (Kobe Univ.) Derivability conditions **E** and **C** and the second incompleteness theorem 15

Summary: We show that several weak principles inspired by non-normal modal logic suffice to derive various refined forms of the second incompleteness theorem. Among the main results, we show that the set $\{\mathbf{E}, \mathbf{C}, \mathbf{D3}\}$ suffices to establish the unprovability of the consistency statement $\neg \text{Pr}_T(\ulcorner 0 = 1 \urcorner)$. We also prove that the set $\{\mathbf{E}^U, \mathbf{CB}_\exists\}$ yields formalized Σ_1 -completeness.

- 26 Haruka Kogure (Kobe Univ.) Arithmetical completeness based on neighborhood semantics 15

Summary: We study provability predicates $\text{Pr}_T(x)$ satisfying the following condition **E** from a modal logical perspective:

E : if $T \vdash \varphi \leftrightarrow \psi$, then $T \vdash \text{Pr}_T(\ulcorner \varphi \urcorner) \leftrightarrow \text{Pr}_T(\ulcorner \psi \urcorner)$.

For this purpose, we develop a new method of embedding models based on neighborhood semantics into arithmetic. Our method broadens the scope of arithmetical completeness proofs. In particular, we prove the arithmetical completeness theorems for the non-normal modal logics EN, ECN, ENP, END, and ECNP.

13:00–14:00 Talk Invited by Section on Foundation and History of Mathematics

Shota Motoura (Otemon Gakuin Univ.) A general framework and inverse action operators for dynamic epistemic logic

Summary: Dynamic Epistemic Logic (DEL) is a branch of modal logic for reasoning about dynamics of epistemic states, such as knowledge change or belief revision, caused by communication. In this talk, we first give a brief introduction to DEL. We then present our previous research contributions: (i) a unified framework for DEL, which employs two-layered Kripke models, referred to as model transition systems (MTSs), to represent transitions of epistemic states, (ii) modal correspondences between axioms and semantic properties of epistemic actions, where each property is represented as a set of MTSs, and (iii) an extension of DEL with inverse action operators, whose semantics is defined in a natural way using MTSs. In the final part of the talk, we provide a brief overview of ongoing research related to these topics.

Algebra

March 23rd (Mon) Conference Room I

9:30–12:00

- 1 John Ashley Navarro Capellan (Nagoya Univ.) Towards the McKay correspondence for dimer models: The arrow contraction algorithm and the consistency condition 13

Summary: The McKay correspondence for finite Abelian subgroups of $SL(3, \mathbb{C})$ has been well established. There is a generalization of the Abelian case via the McKay quiver to the case of algebras associated to dimer models. The arrow contraction operation contracts an arrow in the quiver corresponding to the dimer model. In this paper, we show that after the arrow contraction algorithm under the assumption that the removed cones comprise a convex region, the consistency condition is preserved. This is one of the essential ingredients towards the construction of the McKay correspondence.

- 2 Kotaro Kawatani (Wakayama Med. Univ.) Infinitesimal deformation of algebraic curves and Bridgeland stability condition 13

Summary: Let D be a triangulated category and $\text{Stab}(D)$ the space of stability conditions on D . Suppose that D is the bounded derived category of an infinitesimal deformation X of a smooth projective curve X_0 over a field. We show that $\text{Stab}(D)$ is naturally isomorphic to the space of stability conditions on the original curve X_0 .

- 3 Hisato Matsukawa (Hokkaido Univ.) Equivalences between derived categories of non-proper varieties 13

Summary: I will discuss equivalences between derived categories of algebraic varieties that are not necessarily proper. For projective varieties, many results on derived equivalences are known, including theorems of Bondal–Orlov, Huybrechts, and Kawamata. Favero extended the Bondal–Orlov reconstruction theorem to certain non-proper varieties. In contrast, little is known when the canonical or anticanonical bundle is not ample. In this talk, I will present results on derived categories of open subsets of abelian varieties, proving finiteness and lifting conjectures in this setting. I will also explain a geometric description of equivalences via Matsui’s triangular spectrum, which provides a universal framework for realizing and classifying such equivalences.

- 4 Yuki Tochitani (Tokyo Metro. Univ.) Autoequivalences of derived categories of bielliptic surfaces 13

Summary: In studying the derived category of coherent sheaves on an algebraic variety X , two natural themes arise. The first is to investigate algebraic varieties that are derived equivalent to X , and the second is to analyze the structure of the group of autoequivalences of the derived category. In this work, we focus on bielliptic surfaces defined over an algebraically closed field of arbitrary characteristic. We prove that the only algebraic variety derived equivalent to X is X itself. Moreover, we determine generators for the group of autoequivalences of the derived category of X .

- 5 Atsushi Ito (Univ. of Tsukuba) An example of derived equivalence across a geometric transition 13
Shinnosuke Okawa (Univ. of Osaka)
Makoto Miura (Univ. of Osaka)

Summary: We study whether a derived equivalence between Calabi–Yau threefolds can remain compatible with geometric transitions. Focusing on one of Inoue’s examples of a derived-equivalent but non-birational pair (X^2, Y^2) with Picard number 2, we show that X^2 admits a geometric transition to a Picard-number-1 Calabi–Yau threefold X^1 , identified with Kanazawa’s degree-5 Pfaffian threefold. Using homological projective duality (HPD) for the Grassmannian–Veronese join and its blow-up variant, we establish a twisted derived equivalence between X^1 and the noncommutative Calabi–Yau threefold $Y_{n.c.}^1$. Also, we discuss a mirror-symmetric interpretation of the geometric transition, expressing the fundamental periods as Hadamard products of periods of elliptic curves.

- 6 Makoto Sakurai (Kaichi Gakuen) Redefinition of chiral algebra theory by ind-coherent sheaves and toric degenerations 13

Summary: The chiral algebra theory of Beilinson–Drinfeld (AMS, 2004) is applicable without modifications until now in principle, although there are some new recent investigations by the theory of operator algebras. The author once studied the $\beta\gamma$ -CFTs which are “compactified” to del Pezzo surfaces in 2007. This study can be regarded as an “interpretation of Witten’s index theorem by quantum anomaly theory” by applying the Deligne–Riemann–Roch theorem to (free loop spaces of) “curved space-time”. In this talk, I will try to interpret the Operator-Product-Expansions (OPEs) for the Beilinson–Drinfeld’s chiral algebra theory by toric degenerations and Gaitsgory’s ind-coherent sheaves.

- 7 Yuki Kato (Kurume Nat. Coll. of Tech.) The stable model category of mixed motives from the excisive approximation of the category of non-unital algebras 13

Summary: The triangulated category of mixed motives was constructed to have the universal property for various cohomology theories, which have common properties. We construct the stable ∞ -category of mixed motives from the ∞ -category of non-unital algebras, which is pointed and locally finitely presentable. The excisive approximation, which is the Goodwillie approximation of degree one, has the universal property by Heuts’ theory: Goodwillie approximation of ∞ -categories. By using this advantage, we establish the theory of mixed motives and prove the comparison theorem to Voevodsky’s construction.

- 8 Hideya Kuwata (Kindai Univ. Tech. Coll.) Explicit coefficients in the product $c_k c_{n-k}$ of Chern classes on the permutohedral variety of type A_n 13

Summary: For the root system of type A_n , we consider the permutohedral variety X_{A_n} . Using purely combinatorial methods, we obtain an explicit formula expressing the product of Chern classes $c_k c_{n-k}$ as a multiple of the top Chern class c_n in the rational cohomology ring $H^*(X_{A_n}; \mathbb{Q})$, where the coefficient depends only on k and n and is given by a closed-form expression. As an application, we compute the Chern number $\langle c_k c_{n-k}, [X_{A_n}] \rangle$.

- 9 Ryunosuke Nakano (Hokkaido Univ.) Keiji Matsumoto (Hokkaido Univ.) Algebraic-geometric aspects of the iterative limit theorem for a quaternary of means of four terms 13

Summary: J. M. Borwein and P. B. Borwein (1991) express the iterative limit of a pair of means of two terms by the Gauss hypergeometric series by using an analogue of Jacobi’s period formula. T. Kato and K. Matsumoto (2009) extend this pair to a quaternary of means of four terms, and express its iterative limit by the Lauricella hypergeometric series F_D in three variables. We study this limit theorem by the period map per for a family of algebraic curves of genus 6 to the 3-dimensional complex ball \mathbb{B}_3 . We present a multi-variable version of Jacobi’s period formula, and introduce four modular forms on \mathbb{B}_3 expressing per^{-1} and a unitary transformation R on \mathbb{B}_3 such that the four means appear as the actions of R on the four modular forms. By these results, we obtain an alternative proof of this limit theorem.

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

Makoto Enokizono (Univ. of Tokyo) Normal stable degenerations of Horikawa surfaces

Summary: Horikawa surfaces are algebraic surfaces of general type satisfying the equality of the Noether inequality. In the 1970s, Horikawa conducted a detailed study of smooth Horikawa surfaces, providing a classification of these surfaces and describing their moduli spaces. In this talk, I will present an explicit classification of normal stable degenerations of Horikawa surfaces. Specifically, I will discuss the following results: (1) Classification of Horikawa surfaces with \mathbb{Q} -Gorenstein smoothable log canonical singularities. (2) Criterion for determining the (global) \mathbb{Q} -Gorenstein smoothability of the surfaces described in (1). (3) Description of the KSBA moduli spaces for \mathbb{Q} -Gorenstein smoothable normal stable Horikawa surfaces. This is joint work with Hiroto Akaike, Masafumi Hattori and Yuki Koto.

15:30–18:00

- 10 Tomohiro Iwami (Kyushu Inst. of Tech.) Triple covers of certain irregular three-folds with small c_1^3 or c_1c_2 , Part I 13

Summary: For 3-dimensional extremal neighborhood $(X, C) \subset \mathbb{C}^4$ with reduced irreducible extremal curve C , as infinitesimal deformations of C , i) extensions of $S^2(\text{gr}_C^1 \Omega_X^1)$ to ω_X and ii) 0-, or 1-dimensional supports of Du Val members of $| -K_X |$, under abundance property, work for the existence of flips of type k1A or k2A ([S.Mori,1988]). Based on them, the author had presented ([I.2018-2024]): a) 3-dimensional Miyaoka–Yau type inequality with c_3 , abbreviated as $(MY)_{3,c_3}$, via ii), and for reducible $C(=: C_s)$, b) 3-dimensional Miyaoka–Yau type inequality with c_3 , driven by associated symmetric 2-forms, abbreviated as $(MY)_{3,c_3,S^2}$, by cofibered products of C_s via i), and moreover, c) homological property for both of $(MY)_{3,c_3}$ and $(MY)_{3,c_3,S^2}$ by (tri-)diagonals in such cofibered products as infinitesimals of C_s , via ii). As succeeding to them, the author show: for $(X, C_s) \subset \mathbb{C}^4$ with non-trivial extension of $S^2(\text{gr}_{C_s}^1 \Omega_X^1)$, by \exists (locally) triple cover $f : X \rightarrow Y$ associated to $S^2\mathcal{E} \rightarrow \wedge^2\mathcal{E}$ with subsheaves $\exists \mathcal{E} \subset \Omega_X^1$ ([Miranda,1985]) via a) and b), 1) homological equivalent deformation for Chern classes in related total Chern polynomials via c), 2) alternatives of [Miyaoka,1977;Theorem 3] by 1), and 3) related 3-folds of general type which slightly become a counter-part of [Horikawa,1991;Section 6].

- 11 Lucas Hiroyuki Ragni Hamada (Sci. Tokyo) Classification of torsion subgroups of elliptic curves with rational j -invariant 13

Summary: In 1997, B. Mazur completed the classification, up to isomorphism, of the torsion subgroups of elliptic curves defined over the rational number field \mathbb{Q} . Since then, many analogous results have been obtained for several families of elliptic curves defined over several families of number fields. In this talk, after giving a brief overview of some of these previous results, I will discuss the classification, up to isomorphism, of torsion subgroups of elliptic curves with rational j -invariant. I will then present results for two specific families: elliptic curves defined over the maximal elementary abelian 2-extension of \mathbb{Q} , and elliptic curves defined over quartic number fields, both under the assumption of a rational j -invariant.

- 12 Yuya Yamamoto (Yokohama Nat. Univ.) The multiplicity-one theorem for the superspeciality of hyperelliptic curves 13

Summary: The multiplicity-one theorem for the simultaneous equations determining the superspeciality of hyperelliptic curves was proved by Igusa in 1958 for the genus-one case, and by Harashita–Yamamoto in 2026 for the genus-two case. In this paper, we generalize this result to arbitrary genus. Our approach uses the Lauricella system (of type D) of hypergeometric series in $2g + 1$ variables, whose truncations form the entries of a Cartier–Manin matrix, and we study partial differential equations involving these entries. On this basis, we establish the multiplicity-one theorem.

- 13 Satoru Fukasawa (Yamagata Univ.) New examples of tangentially degenerate curves 13

Summary: An irreducible space curve is said to be tangentially degenerate if a general tangent line meets the curve again at another point. In the case of positive characteristic, in 1994, Esteves and Homma presented the first example of a tangentially degenerate curve such that the Gauss map is birational onto its image. For a long time, there has been no another example. In this talk, focusing on “non-classical” automorphisms, I present a method of constructing tangentially degenerate curves admitting a birational Gauss map.

- 14 Ken Sato (Sci. Tokyo) On symplectic action on $(2,1)$ -cycles on K3 surfaces 13

Summary: In this talk, I propose a conjecture that symplectic automorphisms of a K3 surface X act trivially on the indecomposable part $\text{CH}^2(X, 1)_{\text{ind}} \otimes \mathbb{Q}$ of Bloch’s higher Chow group. This is a higher Chow analogue of Huybrechts’ conjecture on the symplectic action on 0-cycles. We give several partial results verifying our conjecture, some conditional and some unconditional. Our unconditional results include the full proofs for Picard-general Kummer surfaces of Jacobian type and product type, and K3 surfaces of finite automorphism groups.

- 15 Masayuki Hirokado (Hiroshima City Univ.) Classification of two-dimensional rational triple points in positive characteristic 13

Summary: Dual graphs which can arise from the minimal resolution of a two-dimensional rational triple point were classified by Artin in 1966. Tjurina proved in 1968 that any complex rational triple point is taut, i.e., its local structure is determined uniquely by dual graph, to solve the classification problem. Extending her result to characteristic $p > 0$ is still incomplete. In this talk, i) I give a criterion for a rational triple point to be taut, which completes the classification of taut rational triple points in $p > 0$. ii) I present a candidate for the classification table of rational triple points. It no longer seems to be true in $p = 2$ that there are only a finite number of isomorphism classes for each dual graph. iii) I give a peculiar equisingular family in view of a question imposed by Wahl.

- 16 Tatsuki Yamaguchi (Sci. Tokyo) Uniform positivity of F-signature and F-alpha invariant 13

Summary: The F-signature is an invariant defined for Noetherian local rings of positive characteristic, which detects strong F-regularity. Since strong F-regularity is a positive-characteristic analogue of klt singularities, it is natural to expect that the limit F-signature should be positive when the ring has klt singularities. In this talk, we confirm this conjecture for the case of reductive quotient singularities. Key ingredient of the proof is the notion of the F-alpha invariant, introduced by Pande, as a positive-characteristic analogue of the classical alpha-invariant. This talk is based on joint work with Shunsuke Takagi.

- 17 Takuya Nemoto (Waseda Univ.) Globally generated vector bundles on the del Pezzo threefold of degree 6 with Picard number 2 13

Summary: Globally generated vector bundles on projective varieties are fundamental objects in algebraic geometry, but their classification for small first Chern classes has only been studied fairly recently. In this talk, we provide such a classification for the del Pezzo threefold of degree 6 with Picard number 2, the general hyperplane section of the Segre embedding of $\mathbb{P}^2 \times \mathbb{P}^2$.

- 18 Yuta Takahashi (Chuo Univ.) Weak Fano bundles of rank 2 over hyperquadrics Q^n of dimension $n \geq 5$ 13

Summary: A vector bundle whose projectivization becomes a weak Fano variety is called a weak Fano bundle. We present classification results for rank 2 weak Fano bundles on higher-dimensional quadrics Q^n of dimension $n \geq 5$.

- 19 Yuki Kondo (Univ. of Osaka) Degree of Verschiebung: A combinatorial perspective via higher level dormant opers 13
Yasuhiro Wakabayashi (Univ. of Osaka)

Summary: In positive characteristic, the relative Frobenius morphism induces the generalized Verschiebung, a rational map on the moduli spaces of stable vector bundles on smooth projective curves. For genus 2, Osserman (2006) computed the generic degree of this map. In this talk, we present a uniform, combinatorial description of its generic degree for arbitrary genus g . Our approach uses the theory of higher-level dormant opers developed by Y. Wakabayashi.

March 24th (Tue) Conference Room I

9:00–12:00

- 20 Haruki Domoto (Yamaguchi Univ.) A problem on a -kernel of an integer 10
Tadaaki Igawa
Makoto Minamide (Yamaguchi Univ.)
Yoshio Tanigawa

Summary: We consider a problem on a certain kernel of an integer. Let $a \geq 0$ be a fixed integer. For any natural number n , we define $k_a(1) = 1$ and $k_a(n) = \prod_{p|n, p \geq a} (p - a)$ if $n > 1$. We set $k_a(n) = 1$ if the product is empty. When $a = 0$, $k_0(n)$ is called the kernel of n . We investigate the average of $k_a(n)$ for $n \leq x$. This is a generalization of a problem by Ramaré.

- 21 Haruka Sakai (Yamaguchi Univ.) On a theorem of Turán 10
 Makoto Minamide (Yamaguchi Univ.)
 Yoshio Tanigawa

Summary: We consider a generalization of Turán's theorem. Let $\omega(n)$ denote the number of distinct prime divisors p of n . In 1934, Turán showed that $\sum_{n \leq x} (\omega(n) - \log \log x)^2 = O(x \log \log x)$. Concerning this problem, Granville and Soundararajan showed a generalization. We show a new estimate on this their proposition for odd power moments.

- 22 Keita Nakai (Nagoya Univ.) Effective estimates of universality for Hurwitz zeta-functions with rational parameters 13

Summary: In 1975, Voronin proved the universality theorem for the Riemann zeta-function. Roughly speaking, universality for the Riemann zeta-function states that any non-vanishing holomorphic function can be approximated by the Riemann zeta-function shifted by $+i\tau$, and the set of such τ has a positive lower density. In 2003, Garunkštis obtained a non-trivial lower bound for the lower density in the universality theorem for the Riemann zeta-function. In this talk, we generalize Garunkštis's result to universality for Hurwitz zeta-functions with rational parameters.

- 23 Takashi Miyagawa On the mean values of the Barnes multiple zeta function 13
 (Onomichi City Univ.)
 Hideki Murahara (Univ. of Kitakyushu)

Summary: In this talk, I will present the results on the mean square values for the Barnes multiple zeta function $\zeta_r(s, a, \mathbf{w})$, together with an outline of the proof. The obtained results differ in the three cases $r - 1/2 < \sigma < r$, $\sigma = r - 1/2$ and $r - 1 < \sigma < r - 1/2$, respectively, and these results are analogous to those for the mean square values of the Riemann zeta function $\zeta(s)$.

- 24 Genki Shibukawa Generating functions of multiple zeta values at non-positive integers
 (Kitami Inst. of Tech.) 13

Summary: We give some generating functions of special values of the multiple zeta functions at non-positive integer points by Akiyama–Tanigawa.

- 25 Mahiro Yokomizo (Tohoku Univ.) Modular iterated integrals and multiple L -functions 13

Summary: It is well known that modular L -functions admit both series and integral representations. Manin focused on the integral representation and introduced iterated integrals of cusp forms. Subsequently, Choie and Ihara revealed the relationship between such iterated integrals and multiple modular L -functions. More recently, Brown proved that the iterated integrals of a broad class of functions, including modular forms, are in fact rational functions. In this talk, I will report on a generalization of the work of Choie and Ihara to arbitrary modular forms. If time permits, I will also mention the application to multiple zeta values.

- 26 Hayato Kanno (Tohoku Univ.) Family of linear relations among multiple Eisenstein series 13

Summary: Multiple Eisenstein series are holomorphic functions on the upper half-plane introduced by Gangl, Kaneko and Zagier, which are iterated multiple sum generalizations of the classical Eisenstein series. They are also regarded as q -analogues of multiple zeta values. Bachmann and Kühn formulated a dimension conjecture for the \mathbb{Q} -linear space spanned by all multiple Eisenstein series. Although this conjecture suggests that there exist many linear relations among multiple Eisenstein series, no conjectural family of relations is previously known to generate all such relations. In this talk, we introduce a conjectural family of relations that is expected to give all linear relations among multiple Eisenstein series. This talk is based on a joint work with Henrik Bachmann (Nagoya University).

- 27 Tomoko Kikuchi (Sophia Univ.) The explicit formula for multi-indexed poly-Bernoulli numbers of general indices. 13
Maki Nakasuji
 (Sophia Univ./Tohoku Univ.)

Summary: It is known that the classical Bernoulli numbers can be expressed by Stirling numbers of the second kind. We call it the explicit formula. As a generalization of the classical Bernoulli numbers, poly-Bernoulli numbers (resp. multi-indexed poly-Bernoulli numbers) are defined using polylogarithmic function (resp. multiple polylogarithmic function). In this research, we obtain the explicit formula for multi-indexed poly-Bernoulli numbers of general indices. Note that the case of double-indexed poly-Bernoulli numbers were obtained by Baba–Nakasui–Sakata in 2025. The result of this talk is the generalization of their result.

- 28 Ryotaro Harada (Tokyo Univ. of Sci.) Linear relations among algebraic points on tensor powers of the Carlitz
Yen-Tsung Chen module 13
 (Pennsylvania State Univ.)

Summary: In this talk, we introduce our result on linear equations on tensor powers of the Carlitz module using the theory of Anderson dual t -motives and a detailed analysis of a specific Frobenius difference equation. As an application, we present sufficient conditions for the linear independence of Carlitz polylogarithms at algebraic points, simultaneously in the ∞ -adic and v -adic settings. This is joint work with Yen-Tsung Chen in Pennsylvania State University.

- 29 Kazuki Yamada (Gakushuin Univ.) Homotopy exact sequences and Hyodo–Kato isomorphism for log rigid
 fundamental groups 13

Summary: Let k be a field of positive characteristic $p > 0$. For a log scheme over the log point k^0 , one can define a category of (log overconvergent) isocrystals depending on the choice of a base ring and a log structure on it. In particular, by considering the trivial, hollow, and canonical log structures on the base ring, we obtain three distinct categories of isocrystals. As comparison results among them, I will present three kinds of homotopy exact sequences and the Hyodo–Kato isomorphism between the corresponding tannakian fundamental groups.

- 30 Kazuki Yamada (Gakushuin Univ.) Description of p -adic polylogarithms via semistable reduction 13

Summary: Let U be the complement in \mathbb{P}^1 of the p -adic open unit disks around 0, 1, and ∞ . An interpretation of p -adic polylogarithms as a mixed p -adic sheaf on U was given by Bannai. Furthermore, for elements of the K -group of a number field arising from points in U , their images under the p -adic regulator map are described by the p -adic polylogarithm functions, as shown by Gros–Kurihara, Somekawa, and Besser–de Jeu. In this talk, I will extend these results to the natural setting obtained by replacing U with $\mathbb{P}^1 \setminus \{0, 1, \infty\}$. As a byproduct of this research, we also obtain an alternative expression of the p -adic zeta values in terms of ordinary iterated integrals, without using Coleman integration.

- 31 Daichi Tanaka (Tohoku Univ.) Maass forms associated with Hecke characters of real quadratic fields
 and an analogy of Stark (1975) 13

Summary: Maass (1949) explicitly constructed Maass forms in the case of real quadratic fields with narrow class number one. In this talk, I extend his construction to arbitrary real quadratic fields. Furthermore, I explicitly compute the Petersson inner product of the constructed Maass forms and show that the resulting formula provides a natural analogy to Stark’s (1975) result for modular forms.

- 32 Yuichi Sakai (Kurume Inst. of Tech.) The Schwarzian derivative of the KZ equation and its applications . . . 13
Hiroyuki Tsutsumi
 (Osaka Univ. of Health and Sport Sci.)

Summary: For an ordinary linear differential equations given by Kaneko and Zagier, which is called KZ-equation, it is generally unknown whether solutions for KZ-equation of rational weights possess the modularity except for the already known results. In this talk, we will give some observations whether modular-form solutions exist for those cases.

12:50–14:00

- 33 Kohei Fujita (Hokkaido Univ.) An analogue of Ogus’s theorem for certain hypergeometric curves 13

Summary: For a family whose Picard–Fuchs equation is given by a certain hypergeometric differential equation, we express the Frobenius action on the de Rham cohomology as products of p -adic gamma values. Such an expression is known in specific cases, Fermat curves and CM elliptic curves, but remains unknown in general. In this talk, I will present new examples. The idea of the proof is to reduce the statement to CM elliptic curve case according to a transformation formula of hypergeometric functions.

- 34 Chihiro Ando (Yokohama Nat. Univ.) The Lang–Trotter conjecture on average for genus-2 curves with Klein-4
Shushi Harashita or S_3 reduced automorphism group 13
(Yokohama Nat. Univ.)

Summary: For an elliptic curve E over \mathbb{Q} without complex multiplication, Lang and Trotter conjectured that the number of primes $p < X$ at which E has a supersingular reduction is asymptotically equal to $c\sqrt{X}/\log X$, where $c > 0$ is a constant depending only on E . Fouvry and Murty obtained an average estimation related to the Lang–Trotter conjecture, called the Lang–Trotter conjecture on average. In this talk we extend the Lang–Trotter conjecture on average to genus-2 curves. More precisely, we study genus-2 curves with a reduced automorphism group containing the Klein 4-group or symmetric group S_3 and obtain analogous results for each case.

- 35 Ki Sen (Yokohama Nat. Univ.) Explicit bounds for the norms of ideals of central simple algebras over
number fields 13

Summary: Classically, there is a well-known bound, called the Minkowski bound, for the norms of ideals in number fields. In this talk, we show explicit bounds of the norms of locally principal integral right ideals in right ideal classes of orders in central division algebras over number fields. Moreover, we also show explicit bounds for maximal orders in central simple algebras over number fields.

- 36 Daisuke Shiomi (Yamagata Univ.) On the divisibility of the relative class number of cyclotomic function
fields 10

Summary: For a prime p and a positive integer r , we set $q = p^r$. For a monic $N \in \mathbb{F}_q[T]$, we denote by h_N^- the relative class number of the N -th cyclotomic function field. In previous work, the author gave a complete criterion for the p -divisibility of h_N^- when $r \geq 2$ and $\deg N = 2$. In this talk, we generalize these results and determine the p -divisibility of h_N^- when $r \geq 2$ and $N = (T - a)^d - b$ with $a, b \in \mathbb{F}_q$.

- 37 Shigeru Iitaka On perfect numbers 2.0 10
(Open Univ. of Japan/Gakushuin Univ.*)

Summary: Using $\sigma^2(a) = \sigma(\sigma(a))$ we define new perfect numbers to be a such that $\sigma^2(a) - 2a = -m$ where m is a given integer.

For a perfect number k , define perfect numbers 2.0 a to be positive integers satisfying $\sigma^2(a) - 2a = 2 + 2k$

March 25th (Wed) Conference Room I

9:00–12:00

- 38 Shota Maehara (Kyushu Univ.) Chambers of line arrangements and their algebraic aspects 13

Summary: When we arrange a finite set of lines in a two-dimensional real vector space, the complement of the lines can be regarded as a division of the plane. Let us call the maximal connected components chambers. It is well known that the number of chambers becomes maximal when all intersection points are double points. However, determining the arrangement that gives the minimal number is much more difficult. A very famous theorem in the theory of hyperplane arrangements, called Yoshinaga’s criterion, provides a lower bound for the number of chambers in an algebraic way. We study the relationship between the chamber structures of line arrangements in \mathbb{R}^2 and algebraic structures called logarithmic derivation modules.

- 39 Ryo Uchiyumi (Univ. of Osaka) Equivariant version of characteristic quasi-polynomials for hyperplane arrangements 13

Summary: In this talk, we introduce an equivariant version of the characteristic quasi-polynomials as the permutation characters on the complement of mod q hyperplane arrangements. We show that its character is a quasi-polynomial in q and can be expressed as a sum of the induced characters of an equivariant version of the Ehrhart quasi-polynomials. In addition, we present the results for the Coxeter arrangements with Weyl group actions.

- 40 Toshio Oshima (Univ. of Tokyo*) Stable hyperplane arrangements 13

Summary: We classify hyperplane arrangements \mathcal{A} in \mathbb{C}^n whose intersection posets $L(\mathcal{A})$ satisfy $L(\mathcal{A}) = \pi_i^{-1} \circ \pi_i(L(\mathcal{A}))$ for $i = 1, \dots, n$. Here π_i denotes the projection from \mathbb{C}^n onto \mathbb{C}^{n-1} defined by forgetting the coordinate x_i of $(x_1, \dots, x_n) \in \mathbb{C}^n$, and $\pi_i(L(\mathcal{A})) = \{\pi_i(S) \mid S \in L(\mathcal{A})\}$. We show that such arrangements \mathcal{A} arise as pullbacks of the mirror hyperplanes of complex reflection groups of type A or B .

- 41 Takafumi Kouno (Waseda Univ.) The quantum K -theoretic Whitney relation for the flag manifold of type C 13

Summary: We give the Whitney-type relations in the quantum K -ring of the flag manifold of type C . We denote by $\lambda_y(\mathcal{E})$ the (Hirzebruch) λ_y -class of the vector bundle \mathcal{E} over the flag manifold in the sense of the K -ring. Then, for each short exact sequence $0 \rightarrow \mathcal{E}_1 \rightarrow \mathcal{E}_2 \rightarrow \mathcal{E}_3 \rightarrow 0$ of vector bundles, we have $\lambda_y(\mathcal{E}_1) \cdot \lambda_y(\mathcal{E}_3) = \lambda_y(\mathcal{E}_2)$. This identity is known as the K -theoretic Whitney relation. We compute the quantum K -theoretic analog of such Whitney relation in type C ; that is, we compute a product of two λ_y -classes, associated to the tautological sequence of the trivial bundle \mathbb{C}^{2n} , in the quantum K -ring of the flag manifold of type C .

- 42 Toshitaka Aoki (Kobe Univ.) Preservation of interval resolutions for persistence modules 13
Shunsuke Tada (Tohoku Univ.)

Summary: Persistence modules (i.e. representations of posets) have attracted attention due to the success and recent developments of persistent homology. We study persistence modules via a Galois connection (an adjoint pair of posets) whose left adjoint is the inclusion of a full subposet and the right adjoint is its floor function. Such a full subposet is called an interior system. We call the left Kan extension along this floor function the contraction functor, which is left adjoint to the induction functor. In this talk, we introduce a subclass of interior systems which we call aligned interior systems. For this subclass, we show that both induction and contraction functors send interval modules to interval modules. Then, we use them to study interval covers and resolutions. This work is based on [1] (arXiv:2506.21227).

- 43 Toshiya Yurikusa (Osaka Metro. Univ.) Finiteness of Jacobian algebras 13

Summary: Jacobian algebras play a central role in the categorification of cluster algebras. In this talk, we study those associated with non-degenerate quivers with potentials and show that several finiteness conditions, such as representation-finiteness, τ -tilting finiteness, g -finiteness, and E -finiteness, are equivalent in this setting. This unifies different notions of finiteness in the study of Jacobian algebras.

- 44 Zelin Jia (Nagoya Univ.) Tropicalization and cluster asymptotic phenomenon of generalized Markov equations 13

Summary: The generalized Markov equations are deeply connected with the generalized cluster algebras of Markov type. We construct a deformed Fock–Goncharov tropicalization for the generalized Markov equations and prove that their tropicalized tree structure is essentially the same as that of the classical Euclid tree. We then define the generalized Euclid tree and prove that it converges to the classical Euclid tree up to a scalar multiple. Moreover, by means of cluster mutations, we exhibit an asymptotic phenomenon, up to some limit q , between the logarithmic generalized Markov tree and the classical Euclid tree. A rationality conjecture of q is then put forward. We also propose a generalized Markov uniqueness conjecture for the generalized Markov equations, which illustrates an application of the asymptotic phenomenon.

- 45 Naoki Fujita (Kumamoto Univ.) Marked chain-order polytopes and polyptych lattices 13
 Akihiro Higashitani (Univ. of Osaka)

Summary: The theory of polyptych lattices is a framework to obtain a family of toric degenerations whose polytopes are related by piecewise-linear transformations. It can be regarded as a generalization of toric degenerations arising from cluster algebras. In this talk, we study polyptych lattices consisting of transfer maps for marked chain-order polytopes, and obtain a family of toric degenerations to marked chain-order polytopes for the Gelfand–Tsetlin poset.

- 46 Yuto Nogata (Hirosaki Univ.) Group zeta functions and subgroup lattice isomorphism in semidirect products 13

Summary: We consider the group zeta function that counts subgroups of a finite group. The function was introduced by Yumiko Hironaka. For finite abelian groups, equality of zeta functions determines the isomorphism class. Once nonabelian groups are included, the statement fails in general. There exist counterexamples given by an abelian p -group and a nonabelian p -group that share the same zeta function. The conditions under which nonisomorphic groups have equal zeta functions remain open. This talk focuses on semidirect p -groups, beginning with metacyclic p -groups, and determine the answer to the problem. We also discuss the relation to isomorphism of subgroup lattices.

- 47 Hayaki Kudo (Hirosaki Univ.) An upper bound for cyclotomic numbers and their associated matroids 13
Koichi Betsumiya (Hirosaki Univ.)
Wei-Liang Sun
 (Nat. Kaohsiung Normal Univ.)

Summary: We would like to obtain some good upper bounds for a given cyclotomic number $(a, b)_e$. We improve upper bounds for $(a, b)_e$ by using matroid theory, especially some complexes of their linear matroid over the matrix associated with $(a, b)_e$. Complexes of the linear matroid $M[C^{(a,b)}]$ associated with $(a, b)_e$ have a relationship between their reduced Euler characteristic and rank of $C^{(a,b)}$. We introduce the upper bound for $(a, b)_e$ come from invariants of their matroids.

- 48 Yuto Kawase (Kyoto Univ.) On the iterated analogue of the fundamental theorem of homomorphisms 13
Hayato Nasu (Dalhousie Univ.)

Summary: The fundamental theorem of homomorphisms plays a central role in abstract algebra, which states that for every homomorphism, the quotient algebra modulo its kernel is isomorphic to its image, a subalgebra of its codomain. In category theory, the theorem can be reformulated as a decomposition of a morphism into a regular epimorphism (= quotient) followed by a monomorphism (= subalgebra). However, as the notion of algebras is generalized, a longer sequence of regular epimorphisms can be required for such a decomposition. For example, in the category of (small) categories, we require two regular epifunctors to factorize a functor through a subcategory. In this talk, I will present several examples of calculating the supremum length of such decompositions.

14:15–14:30 Presentation Ceremony for the 2026 MSJ Algebra Prize**14:40–15:40 Award Lecture for the 2026 MSJ Algebra Prize**

Shigeo Koshitani (Chiba Univ.*) Research on modular representation theory of finite groups

Summary: We will discuss modular representation theory of finite groups. More precisely, what has been going on since Richard Brauer (1901–1977), who was one of students of I. Schur. Namely, in 1963 Brauer gave a survey talk on the subject. In fact, he announced then 40 problems, some/several of which are/have been called Brauer’s conjectures (or problems). As usual some of them have been solved and some of the others are still open. We will not discuss all of them but focus on certain problems/conjectures such as Alperin’s weight conjecture (AWC for short) (due to Jonathan L. Alperin) announced in 1986, Dade’s conjecture (due to E.C. Dade) announced right after AWC, and then Broue’s abelian defect group conjecture (due to M. Broue) announced around 1990. We might discuss also McKay’s conjecture due to John McKay announced in 1971, which has been solved positively just a couple years ago by M. Cabanes and B. Späth for any prime number p . If we would have still time to talk, we could discuss Donovan’s conjecture (due to P. Donovan) and also Puig’s finiteness conjecture (due to L. Puig).

16:00–17:00 Award Lecture for the 2026 MSJ Algebra Prize

Shunsuke Yamana (Osaka Metro. Univ.) Automorphic forms and L-functions

Summary: The purpose of this talk is to overview investigations by the speaker in automorphic forms and L-functions.

The first topic is the definition of L-functions of automorphic representations of classical groups. The speaker generalized the local theory of L-factors from $GL(n)$ to other classical groups, using the integral representation discovered by Piatetski-Shapiro and Rallis.

The second topic is the construction of Hilbert–Siegel cusp forms. This is a joint work with Tamotsu Ikeda. Ikeda constructed a lifting associating to an elliptic cusp form a Siegel cusp form in 2001. We generalized it to Hilbert cusp forms by a different method.

The third topic is constructions of p-adic L-functions. The speaker has recently constructed p-adic L-functions for $PGSp(4)$, $GL(2) \times GL(2) \times GL(2)$, $U(3) \times U(2)$, $U(2,1) \times U(1,1)$. These are joint works with Ming-Lun Hsieh and Michael Harris.

In this talk other works by the speaker will also be mentioned.

March 26th (Thu) Conference Room I

9:30–12:00

- 49 Kyosuke Maeda (Nihon Univ.) Classification on nearly Gorenstein rational surface singularities with
Tomohiro Okuma (Yamagata Univ.) almost reduced fundamental cycle 13
 Kei-ichi Watanabe
 (Nihon Univ./Meiji Univ.)
 Ken-ichi Yoshida (Nihon Univ.)

Summary: In this talk, we classify all nearly Gorenstein rational surface singularities with almost reduced fundamental cycle in terms of resolution graph, which generalizes a classification theorem on Gorenstein rational surface singularities.

- 50 Tomohiro Okuma (Yamagata Univ.) The canonical trace ideal of elliptic surface singularities 13
 Ken-ichi Yoshida (Nihon Univ.)
 Kei-ichi Watanabe
 (Nihon Univ./Meiji Univ.)

Summary: In this talk, we describe the canonical trace ideal of two-dimensional normal surface singularities in terms of cycles on a resolution. As an application, we provide a criterion for an elliptic singularity to be nearly Gorenstein.

- 51 Kei-ichi Watanabe (Nihon Univ.) Nearly Gorenstein normal graded rings 13
 Tomohiro Okuma (Yamagata Univ.)
 Ken-ichi Yoshida (Nihon Univ.)

Summary: Let R be a normal graded domain over a field. We discuss “nearly Gorenstein” property of such rings using the inverse of the canonical module K_R . The graded structure of K_R and its inverse, Demazure’s construction of R using ample Q divisor on $X = \text{Proj}(R)$ are fully investigated.

- 52 Taiga Ozaki (Sci. Tokyo) On higher-dimensional Teter rings via the canonical trace ideal 13
 Sora Miyashita (Univ. of Osaka)

Summary: We study Puthenpurakal’s higher-dimensional Teter rings via the canonical trace ideal. We give a sufficient criterion for Teterness and show that, in the standard graded case, it is also necessary, yielding a characterization. Consequently, several nearly Gorenstein families are Teter; moreover, under certain hypotheses, the Cohen–Macaulay type of nearly Gorenstein rings is bounded by the projective dimension.

- 53 Sora Miyashita (Univ. of Osaka) Canonical traces of graded fiber products: applications to disconnected
 Shinya Kumashiro Stanley–Reisner rings 13
 (Osaka Inst. of Tech.)

Summary: This talk is based on joint research with Shinya Kumashiro. Recent work by the speaker and Varbaro classified the canonical traces of Stanley–Reisner rings that are Gorenstein on the punctured spectrum, under the Cohen–Macaulay assumption. We aim to generalize the result to the non-Cohen–Macaulay case. First, we establish an explicit formula for the canonical trace of graded fiber products of Noetherian rings and apply it to Stanley–Reisner rings of disconnected simplicial complexes. This allows us to reduce the problem to the case of connected simplicial complexes. In that case, we succeed in weakening the Cohen–Macaulay assumption in their result to the Serre’s condition (S_2) , obtaining a similar classification. Finally, by combining these results, we provide a description of the canonical trace of a Stanley–Reisner ring satisfying (S_2) .

- 54 Kohsuke Shibata The grading of a polynomial ring associated with a simplicial poset,
 (Yonago Nat. Coll. of Tech.) and injective envelopes 13
 Kohji Yanagawa (Kansai Univ.)

Summary: From a combinatorial motivation, Stanley assigned the ideal I_P in a polynomial ring S to a simplicial poset P . The ideal I_P is graded with respect to a somewhat unusual grading of S . As a first step toward studying the local cohomology modules $H_{I_P}^i(S)$, we examine injective envelopes in this grading and the morphisms between them.

- 55 Naoki Endo (Meiji Univ.) Normality of Rees algebras of integrally closed monomial ideals 13

Summary: Let (R, \mathfrak{m}) be a regular local ring with $d = \dim R \geq 2$, and let I be an integrally closed \mathfrak{m} -primary ideal of R . In this talk, we address the question of when the Rees algebra $\mathcal{R}(I) = \bigoplus_{n \geq 0} I^n$ becomes a Cohen–Macaulay normal domain. The speaker provided a positive answer to the case where I is generated by $d + 2$ elements at the MSJ Autumn Meeting 2024. In the present talk, we take a further step and establish a similar affirmative result for monomial ideals I generated by $d + 3$ elements in a polynomial ring $k[X_1, X_2, \dots, X_d]$ over a field k of characteristic zero. The results to be presented are based on joint work with B. Ulrich and J. Hong.

- 56 Koji Matsushita (Univ. of Tokyo) Gorensteinness of Ehrhart rings of matching polytopes 13

Summary: The matching polytope of a graph G is the convex hull of the indicator vectors of the matchings on G . In this talk, we give a characterization when the Ehrhart rings of matching polytopes are Gorenstein. Moreover, we show that matching polytopes whose Ehrhart rings are Gorenstein have the integer decomposition property.

- 57 Ken-ichi Yoshida (Nihon Univ.) A conjecture on Hilbert–Kunz multiplicities and Ehrhart theory 13
 Akihiro Higashitani (Univ. of Osaka)

Summary: In this talk, we prove that the Hilbert–Kunz multiplicity $e_{HK}(A_{p,d})$ of the quadric hypersurface $A_{p,d}$ can be written by Ehrhart polynomial of a Fibonacci polytope. Moreover, we show several applications.

- 58 Akihiro Higashitani (Univ. of Osaka) On the h -polynomials of cyclotomic standard graded commutative al-
 Kenta Ueyama (Shinshu Univ.) gebras 13

Summary: We call a standard graded commutative \mathbb{k} -algebra cyclotomic if its h -polynomial has all its roots on the unit circle in the complex plane. Complete intersections provide typical examples of cyclotomic algebras, since the h -polynomial of any standard graded complete intersection is a product of polynomials of the form $1 + t + \cdots + t^{m-1}$. We refer to such polynomials as being of type CI. A natural question is whether there exists a cyclotomic standard graded \mathbb{k} -algebra whose h -polynomial is not of type CI. In this talk, we give a partial answer to this question.

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

Akiyoshi Tsuchiya (Toho Univ.) Interactions between commutative algebra and graph coloring theory

Summary: Toric ideals and toric varieties are important objects in commutative algebra and algebraic geometry, and they allow one to apply combinatorial methods to study algebraic structures. Conversely, by considering toric ideals and toric varieties arising from discrete structures such as graphs, one can investigate those discrete structures through algebraic and geometric techniques. In this talk, we discuss connections between commutative algebra and graph coloring theory. Given a graph, one can define an algebraic object called the stable set ideal, which is a toric ideal. The question of when this ideal is generated by quadratic binomials is linked to the classical graph-theoretical concept of Kempe equivalence. Using this correspondence, we present an algebraic method to examine Kempe equivalence. Moreover, we propose an algebraic analogue of the perfectly contractile graph conjecture.

15:30–17:15

- 59 Kaito Kimura (Nagoya Univ.) On conductors, test ideals, and parameter ideals 13

Summary: When the ring is Gorenstein and local, the question of whether the conductor of a reduced ring or the (parameter) test ideal of a ring of positive characteristic can be contained in a parameter ideal is related to the validity of the monomial conjecture. In this talk, we consider whether such containment holds in a more general setting.

- 60 Yuya Otake (Nagoya Univ.) An approach to the invariant of Auslander and Martsinkovsky 13

Summary: The Auslander–Buchweitz theory ensures that every finitely generated module over a Gorenstein local ring admits a Cohen–Macaulay approximation. Auslander introduced the δ -invariant of a module via its minimal Cohen–Macaulay approximation, and later Martsinkovsky extended the theory to arbitrary noetherian local rings by defining the ξ -invariant, which coincides with the δ -invariant in the Gorenstein case. In this talk, we study an increasing sequence converging to the ξ -invariant and describe each term through Auslander’s approximation theory.

- 61 Yuki Mifune (Nagoya Univ.) On the generation of the singularity category and the annihilator ideals
 Souvik Dey (Arkansas Univ.) of Ext modules 13
 Jian Liu (Central China Normal Univ.)
 Yuya Otake (Nagoya Univ.)

Summary: Let R be a commutative noetherian ring. The singularity category, introduced by Buchweitz, is a triangulated category that reflects the singularity of R . The concepts of (strong) generation in triangulated categories, developed by Bondal, Rouquier, and Van den Bergh, are fundamental to studying its structure. Iyengar and Takahashi characterized the existence of generators in the derived and singularity categories through the openness of the regular locus. Following this, Dey, Lank, and Takahashi established a connection between the strong generation of the bounded derived category and the nonvanishing of the cohomology annihilator. In this talk, we introduce a new form of cohomology annihilator and characterize the existence of a generator in the singularity category in terms of its nonvanishing.

- 62 Kazuki Hayashi (Sci. Tokyo) An application of Fontaine's monoidal map to perfectoid towers 13
 Shinnosuke Ishiro
 (Gunma Nat. Coll. of Tech.)
 Kazuma Shimomoto (Sci. Tokyo)

Summary: In Scholze's theory of perfectoid spaces, the *tilting* operation plays a crucial role. *Fontaine's monoidal map* is particularly useful for comparing certain ring-theoretic properties such as being (completely) integrally closed under tilting. However, it behaves well only for non-Noetherian rings. To overcome this difficulty, the notion of *perfectoid towers* was introduced as a class of sequences of (Noetherian) rings that approximate perfectoid rings. In this context, we apply Fontaine's monoidal map to perfectoid towers and obtain a stability result in this framework. Furthermore, we present a new construction of perfectoid towers arising from ramification theory. This talk is based on a joint work with Shinnosuke Ishiro and Kazuma Shimomoto.

- 63 Haigang Hu Noncommutative affine pencils of conics 13
 (Univ. of Sci. Tech. of China)
 Izuru Mori (Shizuoka Univ.)
 Koki Takeda (Shizuoka Univ.)
Wenchao Wu (Shizuoka Univ.)

Summary: This paper is one of the series of papers which are dedicated to the complete classification of noncommutative conics. In this paper, we define and study noncommutative affine pencils of conics, and give a complete classification result. We also fully classify 4-dimensional Frobenius algebras. It turns out that the classification of noncommutative affine pencils of conics is the same as the classification of 4-dimensional Frobenius algebras.

- 64 Daisuke Tambara (Hirosaki Univ.*) The space A^2 for a certain four-dimensional division algebra A over \mathbf{F}_2
 10

Summary: We consider a certain four-dimensional nonassociative division algebra A over \mathbf{F}_2 . For any vectors (x, y) and (x', y') in A^2 we decide when the subspaces $A(x, y)$ and $A(x', y')$ of A^2 coincide.

- 65 Keima Akasaka (Chiba Univ.) (Op)lax twisted arrow (∞, n) -categories and their dualizability 13

Summary: We introduce (op)lax twisted arrow constructions for (∞, n) -categories. Building on work of Johnson-Freyd and Scheimbauer, who defined (op)lax arrow (∞, n) -categories, we propose twisted variants of their constructions, which also recover the classical twisted arrow $(\infty, 1)$ -category of Lurie and others in the case $n = 1$. Moreover, we establish a relationship between full dualizability in a given (∞, n) -category and full dualizability in the three associated twisted arrow (∞, n) -categories.

Geometry

March 23rd (Mon) Conference Room IV

9:30–11:30

- 1 Hidemasa Suzuki (Chiba Univ.) More on explicit correspondences between gradient trees in \mathbb{R} and holomorphic convex quadrilaterals in $T^*\mathbb{R}$ 15

Summary: Fukaya and Oh studied the correspondence between pseudoholomorphic disks in T^*M which are bounded by Lagrangian sections $\{L_i^\epsilon\}$ and gradient trees in M which consist of gradient curves of $\{f_i - f_j\}$. Here, L_i^ϵ is defined by $L_i^\epsilon = \text{graph}(\epsilon df_i)$. When $M = \mathbb{R}$ and Lagrangian sections are affine, pseudoholomorphic disks w_ϵ can be constructed explicitly, and the image of w_ϵ is a polygon. We proved that pseudoholomorphic disks w_ϵ converge to the gradient tree in the limit $\epsilon \rightarrow +0$ when the image of w_ϵ is a generic convex quadrilateral which has no parallel sides and whose diagonal lines are not orthogonal to horizontal line. In this talk, we study the convergence of pseudoholomorphic disks whose images are non-generic quadrilaterals.

- 2 Jun O'Hara (Chiba Univ.) Identification of generic polygonal domains by integral geometric functions 15

Summary: We study a problem of identification of spaces by integral geometric functions, such as Riesz energy functions and interpoint distance distributions, and show that they can identify “generic” planar polygonal domains.

- 3 Keita Takahashi (Sci. Tokyo) Completeness conditions in Lorentzian geometry 15

Summary: The celebrated Hopf–Rinow theorem shows the equivalence of several completeness notions on Riemannian manifolds, but a similar statement fails in Lorentzian geometry. Beem introduced Lorentzian analogues of completeness conditions —finite compactness, timelike Cauchy completeness, and Condition A— and proved their equivalence on globally hyperbolic C^2 -spacetimes. In this talk, we extend Beem’s notions to the metric framework of Lorentzian length spaces and clarify their implications, namely that finite compactness implies timelike Cauchy completeness and that timelike Cauchy completeness implies Condition A for globally hyperbolic Lorentzian length spaces. Moreover, for globally hyperbolic C^1 -spacetimes, we establish the equivalence of the three conditions under assumptions that guarantee good causal geodesic behavior. These results constitute a Hopf–Rinow-type theorem for low-regularity Lorentzian geometry.

- 4 Subaru Nomoto (Ritsumeikan Univ.) Generalized Bishop frames of regular timelike curves in 4-dimensional Lorentz space L^4 10

Summary: This study generalizes the notion of Bishop frames from curves in 4-dimensional Euclidean space to timelike regular curves in the 4-dimensional Lorentz space. We show that, up to reordering the frame vectors while keeping the tangent fixed, there are four possible types of generalized Bishop frames for such curves. Moreover, these frames admit a hierarchical structure analogous to the Euclidean case. Building on this hierarchy, we propose a new classification of timelike curves in L^4 .

- 5 Isami Koga (Kyushu Int. Univ.) A classification of equivariant harmonic maps between spheres ····· 15
 Yasuyuki Nagatomo (Meiji Univ.)
 Masaro Takahashi
 (Kurume Nat. Coll. of Tech.)

Summary: At the last spring meeting, we talked about classification results for equivariant harmonic maps between spheres with respect to the special unitary groups and the symplectic groups. This talk is a continuation of that presentation. We consider subgroups of the special orthogonal group which act transitively on the standard sphere except the special unitary groups and the symplectic groups. (For example, such groups are described in Besse's book.) When the subgroup is the exceptional Lie group G_2 or the spin group $Spin(7)$, we obtain rigidity results. In the other cases, we describe the moduli spaces of equivariant harmonic maps up to image equivalence. Finally, we introduce identity theorems for certain equivariant harmonic maps.

- 6 Shin Nayatani (Nagoya Univ.) Generalizing the variance maximization problem for maps to that for smoothing operators ····· 15

Summary: We generalize the variance maximization problem for smooth maps into a Hilbert space to one for smoothing operators. We report the result that the strong duality holds for the new problem and the first eigenvalue maximization problem, where the first eigenvalue is that of the Bakry–Émery Laplacian.

14:15–16:15

- 7 Hikaru Kubota (Univ. of Osaka) Timelike Hausdorff measure and its volume comparison ····· 15

Summary: Recently, synthetic Lorentzian geometry has been studied intensively. In this talk, the speaker will summarize definitions of Lorentzian pre-length space (LpLS) and the timelike Hausdorff measure. LpLS is a corresponding notion to a metric space for Riemannian manifolds, and the timelike Hausdorff measure is the corresponding notion to the standard Hausdorff measure. The speaker will propose a volume comparison inequality with respect to the timelike Hausdorff measure using timelike Lipschitz maps.

- 8 Toshiaki Miyamoto (Tohoku Univ.) Direct sums and decompositions of Gromov's pyramids ····· 15

Summary: Gromov studied the concentration topology on the set of all isomorphism classes of metric measure spaces, called mm-spaces, and introduced a pyramid, which is a kind of directed family of mm-spaces. The theory of the concentration topology and pyramids has been mainly studied with respect to the convergence of a sequence of mm-spaces whose dimensions diverge to infinity. In this talk, we define the direct sum of pyramids and show that it naturally appears as a limit of a sequence of mm-spaces whose measures concentrate on several mutually separated regions. Furthermore, we present the direct sum decomposition of a pyramid of infinite observable diameter.

- 9 Asuka Takatsu (Univ. of Tokyo)^b Law of large numbers for q -exponential families ····· 15
 Hiroshi Matsuzoe
 (Nagoya Inst. of Tech.)

Summary: We extend the law of large numbers from the framework of exponential families to that of q -exponential families, where the independence of random variables is not assumed.

- 10 Yoshiki Jikumaru (Toyo Univ.) On the governing equations of membrane O surfaces ····· 15

Summary: It is known that a shell membrane in equilibrium where a constant purely normal load acts on the membrane, and where the principal curvature lines coincide with the principal stress lines, forms an integrable system called a membrane O surface. This paper formulates the governing equations for membrane O surfaces of the 1st and 2nd kind, which are analogues to Guichard surfaces of the 1st and 2nd kind introduced by Calapso. Furthermore, under this formulation, we show that membrane O surfaces are a subclass of Demoulin's Ω surfaces, and that the Bäcklund transformation for membrane O surfaces preserves membrane O surfaces of the 1st and 2nd kind, respectively.

- 11 Shintaro Akamine (Nihon Univ.) Geometric properties invariant under the decomposition of zero mean
Joseph Cho (Handong Global Univ.) curvature surfaces 15
Masaya Hara
(Nat. Inst. of Tech., Anan Coll.)
Yuta Ogata (Kyoto Sangyo Univ.)

Summary: It has recently been recognized that zero mean curvature surfaces in the three-dimensional Euclidean space, the Lorentz space, and the isotropic space are closely related to each other through certain correspondences given by decomposition theorems. In this talk, we show the uniqueness of these decomposition theorems by means of the Weierstrass-Enneper type representation formula, and also present the fact that such decompositions preserve various geometric properties.

- 12 Shintaro Akamine (Nihon Univ.) Singularities on timelike minimal surfaces in the three-dimensional
Hirotaka Kiyohara Heisenberg group 15
(Osaka Kyoiku Univ.)

Summary: Surfaces with zero mean curvature are among the major topics in the study of the Heisenberg group. Under suitable settings, such surfaces can be constructed from harmonic maps, and they induce constant mean curvature surfaces in semi-Euclidean spaces. It has recently been found that zero mean curvature surfaces in the Heisenberg group with a Lorentzian metric can naturally admit singularities. In this talk, we present criteria for some singularities on timelike minimal surfaces in the Heisenberg group equipped with a certain Lorentzian metric, and provide some examples via the duality with constant mean curvature surfaces in the semi-Euclidean space.

16:30–17:30 Talk Invited by Geometry Section

- Shintaro Akamine (Nihon Univ.) Constant mean curvature surfaces in certain spaces with degenerate
metrics

Summary: The geometry of submanifolds is usually studied in pseudo-Riemannian manifolds equipped with non-degenerate metrics. However, in certain situations, spaces with degenerate metrics arise naturally as ambient spaces. For example, any minimal surface in the three-dimensional Euclidean space \mathbb{E}^3 can be locally deformed into a maximal surface in the three-dimensional Minkowski space \mathbb{L}^3 while preserving the mean curvature, by continuously varying the ambient space. During this deformation, one encounters zero mean curvature surfaces in a space with a degenerate metric, called the isotropic space \mathbb{I}^3 . Studying such surfaces in \mathbb{I}^3 thus directly contributes to the understanding of the original minimal surfaces.

In this talk, we will present local and global properties of zero or constant mean curvature surfaces in the isotropic space and constant mean curvature surfaces in the light cone, both of which appear in correspondence with minimal surfaces in \mathbb{E}^3 and maximal surfaces in \mathbb{L}^3 .

March 24th (Tue) Conference Room IV

9:30–11:00

- 13 Yoshinori Hashimoto Magnitude for metric measure spaces by means of an analogue of path
(Osaka Metro. Univ.) integrals 10

Summary: The magnitude of finite metric spaces is an invariant discovered by Leinster. Its definition depends on the similarity matrix which can only be defined for finite metric spaces. In this talk, by performing an analogue of path integrals over the space of geodesics, we define the magnitude for a general length space with a Borel measure. This definition extends the original one for finite metric spaces.

- 14 Yoshinori Hashimoto Rigidity of isotropic harmonic maps from elliptic curves to projective spaces 10
 (Osaka Metro. Univ.)
 Bruno Mera
 (Univ. de Lisboa/Tohoku Univ.)
 Tomoki Ozawa (Tohoku Univ.)

Summary: It is known that any harmonic map of positive degree from an elliptic curve to a projective space is constructed in a specific manner, called isotropic, by a theorem of Eells–Wood. In this talk, we prove that if two isotropic harmonic maps are isometric, then one can be obtained from the other by means of the unitary linear action on the projective space.

- 15 Yoshinori Hashimoto Geometric invariant theory and complex structure of $SU(3)$ 10
 (Osaka Metro. Univ.)
 Hiroaki Ishida (Osaka Metro. Univ.)
 Hisashi Kasuya (Nagoya Univ.)

Summary: The quotient space $M = SL(3, \mathbb{C})/U$ of $SL(3, \mathbb{C})$ by its maximal unipotent subgroup U admits an action of $(\mathbb{C}^*)^2$ from both sides. In this talk, we give a necessary and sufficient condition for M to agree with the stable locus in terms of geometric invariant theory. Combining this result with the previous result due to Ishida–Kasuya, we give a sufficient condition for the existence of double-sided invariant complex structure of $SU(3)$ in terms of geometric invariant theory.

- 16 Natsuki Imada (Waseda Univ.) Higher Killing spinors on 3-dimensional manifolds 15
Yasushi Homma (Waseda Univ.)
Soma Ohno (Waseda Univ.)

Summary: Killing spinors are one of the important objects in spin geometry. The existence of a Killing spinor imposes strong restrictions on the geometry of the underlying manifold. In this talk, we extend the concept of Killing spinors to the spin- $j/2$ bundle and discuss their properties. In particular, we will focus on spin- $j/2$ Killing spinors on 3-dimensional manifolds. Furthermore, we give a construction of higher Killing spinors on the 3-sphere. This is joint work with Yasushi Homma and Soma Ohno.

- 17 Doman Takata (Niigata Univ.) Topology and noncommutative geometry of Hilbert manifolds 15

Summary: For an oriented non-compact manifold M , there exists a map $H_p(M) \rightarrow H_c^{\dim(M)-p}(M)$. In the K -theory version of this map, the target group $K_c^{\dim(M)-p}(M)$ is a noncommutative geometric invariant, because it is isomorphic to the operator K -theory of the continuous function algebra of M by the Serre–Swan theorem.

In this talk, we formulate an infinite-dimensional version of this map. For the left-hand side of the map, we use the Baum–Douglas geometric K -homology. For the right-hand side of the map, we use the operator K -theory of the “ C^* -algebras of Hilbert manifolds”. This construction gives a K -theory element of this C^* -algebra.

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

- Tadayuki Watanabe (Kyoto Univ.) Graph complexes and diffeomorphism groups

Summary: The graph complexes, introduced by Kontsevich, are huge combinatorial objects related to several important problems in geometry and topology. In this talk, I will discuss about a topological realization of the graph complexes in the moduli spaces of smooth higher-dimensional disks, and its related results on the spaces of automorphisms of manifolds. This talk is partially based on a joint work with Boris Botvinnik.

March 25th (Wed) Conference Room IV

9:30–11:30

- 18 Satoshi Jimmouchi (Univ. of Osaka) On the Kobayashi–Hitchin correspondence for big classes 15

Summary: Given a Kähler class on a compact complex manifold, one can define the classical notions of slope stability and Hermitian–Yang–Mills metrics for holomorphic vector bundles. The Kobayashi–Hitchin correspondence asserts that a holomorphic vector bundle over a compact Kähler manifold is slope polystable if and only if it admits a Hermitian–Yang–Mills metric. Big cohomology classes provide a current-theoretic generalization of Kähler classes. In this talk, we introduce the concepts of slope stability and Hermitian–Yang–Mills metrics in the setting of big classes, and establish a version of the Kobayashi–Hitchin correspondence for big classes in certain special cases.

- 19 Kazushi Kobayashi (Univ. of Teacher Edu. Fukuoka) On a noncommutative deformation of holomorphic line bundles on complex tori and the SYZ transform 15

Summary: By regarding a given n -dimensional complex torus X^n as the trivial torus fibration $X^n \rightarrow \mathbb{R}^n/\mathbb{Z}^n$, we can obtain a mirror dual complexified symplectic torus \check{X}^n based on the SYZ construction. In the middle 2000s, Kajiwara studied the noncommutative deformation X_θ^n of X^n associated to the (real) deformation quantization of $X^n \rightarrow \mathbb{R}^n/\mathbb{Z}^n$ by a Poisson bivector θ defined along the fibers. In particular, he constructed the noncommutative deformations $L_\theta \rightarrow X_\theta^n$ of holomorphic line bundles on X^n associated to the deformation from X^n to X_θ^n . The purpose of this talk is to explain how to construct a mirror partner \check{X}_θ^n of X_θ^n (\check{X}_θ^n is also a deformation of \check{X}^n) and the objects defined on \check{X}_θ^n which are mirror dual to noncommutative objects $L_\theta \rightarrow X_\theta^n$.

- 20 Naoto Yotsutani (Shizuoka Univ.) Toric Fano manifolds that do not admit extremal Kähler metrics 15
DongSeon Hwang
(IBS Center for Complex Geometry)
Hiroshi Sato (Fukuoka Univ.)

Summary: We show that there exists a 10-dimensional toric Fano manifold that does not admit any extremal Kähler metric in its first Chern class, thereby answering a question posed by Mabuchi in 2011. Moreover, by taking the product with a suitable toric Fano manifold, we construct toric Fano manifolds of arbitrary dimension $n \geq 11$ that likewise admit no extremal Kähler metrics in their first Chern class.

- 21 Naoto Yotsutani (Shizuoka Univ.) On the blow-up formula of Chow weights for polarized toric manifolds
King Leung Lee (Univ. of Montpellier) and its application 15

Summary: Let X be a smooth projective toric variety, and let \tilde{X} denote the blow-up of X at finitely many distinct torus-invariant points. We derive an explicit combinatorial formula for the Chow weight of \tilde{X} in terms of the base toric manifold X and the symplectic cuts of its associated Delzant polytope. As an application, we compute this formula for the projective plane and compare the Chow stability of toric blow-ups with that of blow-ups at general points.

- 22 Shotaro Murayama Mabuchi constants and Mabuchi solitons on Fano admissible manifolds
(Tokyo Univ. of Sci.) 15
Yasufumi Nitta (Tokyo Univ. of Sci.)

Summary: A Mabuchi soliton is a canonical Kähler metric on a Fano manifold introduced by Toshiki Mabuchi, regarded as a generalization of the Kähler–Einstein metric. While every Kähler–Einstein metric is a Mabuchi soliton, the converse does not hold in general. Moreover, there exist Fano manifolds that admit a Mabuchi soliton but no Kähler–Einstein metric. An obstruction to the existence of Mabuchi solitons is given by the so-called Mabuchi constant, and a necessary condition for a Fano manifold to admit a Mabuchi soliton is that this constant is strictly less than one. In this talk, we will present explicit formulas for the Mabuchi constant in the class of Fano admissible manifolds, and discuss the existence problem of Mabuchi solitons on such manifolds fibered over complex projective spaces.

- 23 Masaya Kawamura On the Calabi flow on quasi-Kähler manifolds 15
(Sugiyama Jogakuen Univ.)

Summary: In this talk, we introduce the Calabi flow on a compact quasi-Kähler manifold and provide a priori estimates along the flow under the assumption of a uniform bound on the Chern scalar curvature of the evolving metric. Using these estimates, we show that if the Chern scalar curvature is uniformly bounded for all time, then the flow converges smoothly to the unique Chern–Ricci-flat metric in almost Hermitian geometry.

14:15–16:15

- 24 Hiroshi Sawai The fundamental 2-form on a non-Vaisman LCK solvmanifold 15
(Numazu Nat. Coll. of Tech.)

Summary: On a locally conformal Kähler (LCK, for short) structure, it is said to be Vaisman if the Lee form is parallel with respect to Levi–Civita connection, and the fundamental 2-form of a Vaisman structure is given by Lee form and the complex structure. In this talk, we investigate the fundamental 2-form of a non-Vaisman LCK structure on a solvmanifold, and prove that the solvable Lie algebra has a unimodular subalgebra with a Kähler structure.

- 25 Ken Kuwata The number of elliptic curves and Gromov–Witten invariants for four-
(Nat. Inst. of Tech., Kagawa Coll.) dimensional Fano hypersurfaces 15
Masao Jinzenji (Okayama Univ.)

Summary: We propose a conjectural formula relating the number of elliptic curves of degree d and the Gromov–Witten invariants for four-dimensional Fano hypersurfaces. In this talk, we introduce this conjecture.

- 26 Taito Shimoji (Univ. of Osaka) Bigraded Lie algebras and the nilpotent fundamental groups of quasi-
projective varieties 15

Summary: Let X be a smooth quasi-projective variety. Assume that the topological fundamental group $\pi_1(X, x)$ is torsion-free nilpotent. We prove that if the first Betti number $b_1(X) \leq 3$, then $\pi_1(X, x)$ is isomorphic to either \mathbb{Z}^n for $n = 1, 2, 3$, a lattice in the Heisenberg group $H_3(\mathbb{R})$, or a lattice in $\mathbb{R} \times H_3(\mathbb{R})$. Furthermore, if the rank is at most seven, then $\pi_1(X, x)$ is abelian or 2-step nilpotent. More precisely, we determine the real nilpotent Lie groups that admit such lattices up to ranks six and seven, respectively. Our results give a partial affirmative answer to a question of Aguilar–Campana on nilpotent (quasi-)Kähler groups.

- 27 Tsukasa Takeuchi (Meteorological Coll.) Haantjes operators on 4-dimensional phase spaces 15
 Kei-ichi Kiku-chi (Tokyo Univ. of Sci.)

Summary: We construct a 4-dimensional phase space using the orbit space by S^1 -action in hyperbolic 3-space and the Lagrangian by the Hsiang–Lawson metric. We then consider certain integrable systems as Hamiltonian systems on the phase space, and we give a Haantjes operator on the 4-dimensional phase space and construct a concrete symplectic-Haantjes manifold. In particular, we construct this manifold using a rewritten conditional formulation of the definition formula given by Tempesta and Tondo.

- 28 Daichi Arimatsu (Sci. Tokyo) ^b The mixed Hodge structure on the fundamental group of the Collino surface 15

Summary: Collino prove that the fundamental group of a Zariski open set of the symmetric square of a hyperelliptic curve is isomorphic to the integral Heisenberg group. We compute the mixed Hodge structure on this fundamental group, and show that the second extension class is expressed by the Abel-Jacobi invariant of the canonical class and the marked points of the hyperelliptic curve.

- 29 Tadashi Udagawa (Waseda Univ.) Construction of the tt^* -equation with ADE-type Stokes data 15

Summary: The tt^* -equation was introduced by S. Cecotti and C. Vafa in physics. In mathematics, B. Dubrovin formulated the tt^* -equation as a flatness condition (tt^* -structure) and described the tt^* -structure as an isomonodromic deformation of a certain linear differential equation. In this talk, we review Dubrovin's formulation in the case of tt^* -structure over \mathbb{C}^* and characterize the tt^* -equation by an upper uni-triangular matrices (Stokes matrix). We also discuss the ambiguity of the resulting Stokes matrices. Furthermore, we construct the tt^* -equation from the ADE Cartan matrices by solving a Riemann–Hilbert problem. This method was used by M. Guest, A. Its and C. Lin to solve the tt^* -Toda equation and we generalized their approach to more general tt^* -equations.

March 26th (Thu) Conference Room IV

9:30–10:45

- 30 Osamu Ikawa (Kyoto Inst. Tech.) Sum of Betti numbers of intersections of real flag manifolds 15
Hiroyuki Tasaki
 (Tokyo Metro. Univ./Univ. of Tsukuba)

Summary: We show that the sum of Betti numbers of intersections of real flag manifolds in a complex flag manifold is equal to that of the real flag manifold.

- 31 Naoki Kato (Chukyo Univ.) Infinitely many left-symmetric structures on nilpotent Lie algebras ... 15

Summary: Dekimpe and Ongenaë constructed infinitely many pairwise non-isomorphic complete left-symmetric structures on \mathbb{R}^n for $n \geq 6$. In this talk, we construct a family of complete left-symmetric structures on the cotangent Lie algebra $T^*\mathfrak{g}$ of a certain n -dimensional almost abelian nilpotent Lie algebra \mathfrak{g} and give a condition under which two left-symmetric structures in this family are isomorphic. As a consequence, we obtain infinitely many pairwise non-isomorphic left-symmetric structures on $T^*\mathfrak{g}$. Moreover, as an application of this construction, we obtain infinitely many symplectic structures on $T^*\mathfrak{g}$ which are pairwise non-symplectomorphic up to homothety.

- 32 Genki Ishikawa (Ritsumeikan Univ.) Stability analysis for the pseudo-Riemannian geodesic flows of step-two
 Daisuke Tarama (Ritsumeikan Univ.) nilpotent Lie groups 15

Summary: This talk deals with the geodesic flows of step-two nilpotent Lie groups equipped with a left-invariant pseudo-Riemannian metric. The left-invariant geodesic flow of a Lie group can be formulated as the Lie–Poisson equation on the dual space of its Lie algebra. In particular, in the case of step-two nilpotent Lie groups, the Lie–Poisson equation can be described in terms of the so-called j -mapping, a linear operator associated to the step-two nilpotent Lie algebras equipped with the induced scalar product. In this talk, the stability of equilibrium points for the Hamilton equation is determined in terms of their Williamson types. This talk is based on a joint work with Daisuke Tarama (Ritsumeikan Univ.).

11:00–12:00 Talk Invited by Geometry Section

Hiroshi Tamaru (Osaka Metro. Univ.) Quandles and symmetric spaces

Summary: The notion of quandles, which originated in knot theory, is now playing an important role in many branches of mathematics. Among various areas of study, quandles can be regarded as a generalization of symmetric spaces. We are studying quandles from the perspective of symmetric spaces, and in this talk, we will introduce some recent developments.

In the theory of symmetric spaces, the Chen–Nagano theory focuses on point symmetry, which aligns well with the study of quandles. One aspect of our work aims to discretize the Chen–Nagano theory or transfer it to quandles.

Complex Analysis

March 23rd (Mon) Conference Room V

9:30–11:00

- 1 Hideki Miyachi (Kanazawa Univ.) Towards a dynamical perspective on the mapping class group 15

Summary: In this talk, I will discuss a dynamical perspective on the mapping class group by analogy with the theory of Kleinian groups.

- 2 Takuya Hosokawa Hyperbolic derivative via composition operators 15
Shûichi Ohno

Summary: We here pose a new problem for composition operators on Bloch and little Bloch spaces. Could a compact composition operator with an analytic symbol imply the compactness of composition operator with product of it and any analytic self-map of the open unit disk? We will investigate the hyperbolic derivative of products of analytic self-maps of the unit disk and so provide explicit and new examples of products that induce compact composition operators on Bloch and little Bloch spaces.

- 3 Masahiro Yanagishita On an elementary example of Loewner chains of universal covering
 (Yamaguchi Univ.) mappings 15

Summary: A Loewner chain is originally defined as a one-parameter family of univalent functions $\{f_t\}_{t \in I}$ on the unit disk such that f_s is subordinate to f_t whenever $s, t \in I$ with $s < t$. Recently, Yanagihara has extended this concept to one-parameter families of universal covering mappings on the unit disk. In this talk, we introduce an example of such extended Loewner chains using only elementary functions.

- 4 Erika Sakurai (Waseda Univ.) On quadrilateral groups which are index finite subgroups of arithmetic
Keisuke Souma (Waseda Univ.) triangle groups 15
Yohei Komori (Waseda Univ.)

Summary: We classify non cocompact quadrilateral groups which are index finite subgroups of arithmetic triangle groups.

- 5 Shun Kumagai Self-affinity, Möbius geometry and Schwarzian-pre-Schwarzian deriva-
 (Hachinohe Inst. of Tech.) tive 15
Kenji Kajiwara (Kyushu Univ.)

Summary: Self-affinity is a symmetry of planar curves and is regarded as playing a crucial role in characterizing log-aesthetic curves (LACs), which have been studied as reference curves for designing aesthetic shapes in CAD systems. Inoguchi et al. showed a variational principle and an integrable deformation of LACs in similarity geometry, as well as its application to geometric shape generation. In this talk, we present results showing that the self-affinity can be reformulated as a differential equation using Schwarzian and pre-Schwarzian derivatives, which induces constant-curvature curves in Möbius geometry.

14:20–15:20 Talk Invited by Complex Analysis Section

- Masayo Fujimura Geometric properties of finite Blaschke products
 (Nat. Defense Acad. of Japan)

Summary: For a Blaschke product B of degree d , we introduce the interior curve and the exterior curve associated with B . We also discuss the geometric properties of these curves and their connection to some classical geometric theorems.

March 24th (Tue) Conference Room V

9:30–11:30

- 6 Takeo Ohsawa (Nagoya Univ.)^b Extending holomorphic functions from analytic complements of complete Kähler domains 15

Summary: Let M be a complex manifold and let X be a complex analytic subset of M . In the situation where $M \setminus X$ admits a complete Kähler metric, a condition is given for a holomorphic function on X to be extendable holomorphically to M .

- 7 Takanori Ayano (Osaka Metro. Univ.) Sigma function associated with a hyperelliptic curve with two points at infinity 15
Victor M. Buchstaber (Steklov Math. Inst.)

Summary: The Riemann theta function associated with a compact Riemann surface is a quasi-periodic entire function, which depends on a canonical homology basis. F. Klein posed the following problem. Construct a quasi-periodic entire function which does not depend on a canonical homology basis. This problem was solved by Korotkin, Shramchenko, and Nakayashiki for any compact Riemann surface. On the other hand, Buchstaber, Enolski, and Leykin posed the following problem. In the case where a defining equation of an algebraic curve is given, construct a quasi-periodic entire function whose power series expansion is determined only by the coefficients of the defining equation of the curve algebraically. In this talk, we will solve this problem for hyperelliptic curves with two points at infinity.

- 8 Shaolin Chen (Guangxi Normal Univ.) Hardy spaces on bounded symmetric domains I 15
Hidetaka Hamada (Kyushu Sangyo Univ.)

Summary: In this talk, we give the completeness of the pluriharmonic Hardy space and establish a Littlewood–Paley type theorem of holomorphic functions in bounded symmetric domains. Next, we provide a close relationship between the integral means of pluriharmonic (holomorphic) functions and those of their derivatives in bounded symmetric domains.

- 9 Shaolin Chen (Guangxi Normal Univ.) Hardy spaces on bounded symmetric domains II 10
Hidetaka Hamada (Kyushu Sangyo Univ.)

Summary: In this talk, using the weights and a new characterization of pluriharmonic Hardy space (the Littlewood–Paley type theorem), the composition operators from the planar harmonic Bloch type spaces to pluriharmonic Hardy spaces in bounded symmetric domains will be discussed. The obtained results provide the improvements and extensions of the corresponding known results.

- 10 Hidetaka Hamada Roper–Suffridge type extension operators for univalent mappings revisited 15
(Kyushu Sangyo Univ.)
Gabriela Kohr (Babeş-Bolyai Univ.)
Mirela Kohr (Babeş-Bolyai Univ.)

Summary: In this talk, we give a closed domain D in \mathbb{R}^2 such that for $(\alpha, \beta) \in D$ and the Roper–Suffridge type extension operator $\Psi_{\alpha, \beta}$, $\Psi_{\alpha, \beta}(f)$ can be embedded as the initial element of a normal Loewner chain on B for any $f \in S$. Note that D contains points $(\alpha, \beta) \in \mathbb{R}^2$ such that $\alpha < 0$ and/or $\beta < 0$. For the proof, we use a new method which is different from those used in the previous works. As a corollary, we obtain that for $(\alpha, \beta) \in D$, $\Psi_{\alpha, \beta}$ preserves starlikeness. We also show that if $(\alpha, \beta) \in \mathbb{R}^2 \setminus \{(0, 1/2)\}$, then the operator $\Psi_{\alpha, \beta}$ does not preserve convexity.

- 11 Hidetaka Hamada Koebe one-quarter theorem in infinite dimensions 15
 (Kyushu Sangyo Univ.)
 Gabriela Kohr (Babeş-Bolyai Univ.)
 Mirela Kohr (Babeş-Bolyai Univ.)

Summary: In this talk, we give a covering theorem for biholomorphic mappings on bounded domains in a complex Banach space. Next, as an application of this covering theorem, we give the Koebe one-quarter theorem for normal Loewner chains on the unit ball of a complex Banach space. We give also several applications of this result. Finally, as another application of the above covering theorem, we give a covering theorem for nonlinear resolvents on the unit ball of a complex Banach space.

- 12 Masakazu Takakura On the weighted L^2 approximation problems 15
 (Tokyo Metro. Univ.)

Summary: We study an increasing sequence of plurisubharmonic functions $\{\phi_n\}$ on a complex manifold X , converging to a psh function ϕ . Our focus is the stability of the weighted Bergman spaces $H^2(X, \phi_n) = \{f \in \mathcal{O}(X) \mid \int_X |f|^2 e^{-\phi_n} < \infty\}$. The question is whether any element of the limit space $H^2(X, \phi)$ can be approximated by elements of $H^2(X, \phi_n)$. This problem has two aspects: geometric conditions on X , and analytic conditions on the sequence $\{\phi_n\}$. We discuss both viewpoints and present situations in which such approximation becomes possible.

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

Yuya Takeuchi (Univ. of Tsukuba) CR Paneitz operator and embeddability

Summary: The CR Paneitz operator, a CR invariant fourth-order linear differential operator, plays a crucial role in three-dimensional CR geometry. It is deeply connected with global embeddability, the CR positive mass theorem, and the logarithmic singularity of the Szegő kernel. In this talk, I will present recent progress on the spectrum of the CR Paneitz operator, focusing in particular on how its nature differs between the embeddable and non-embeddable cases.

Functional Equations

March 23rd (Mon) Conference Room II

9:30–12:00

- 1 Yoshiaki Goto The Riemann–Wirtinger integral on the product of two one-dimensional
(Otaru Univ. of Commerce) complex tori 12

Summary: The Riemann–Wirtinger integral is an analogue of the hypergeometric integral, which is defined on a one-dimensional complex torus. As an example of its generalization, we define the Riemann–Wirtinger integral on the product of two one-dimensional complex tori. We study the structure of the twisted cohomology group associated with the Riemann–Wirtinger integral, and derive a system of differential equations satisfied by this integral.

- 2 Sunao Ōuchi (Sophia Univ.*) Another elementary approach to WKB analysis 12

Summary: We treat a singular perturbation problem called WKB equation

$$(Eq) \quad h^2 u(x, h) - Q(x)u(x, h) = 0, \quad h > 0 \text{ is a small parameter.}$$

Investigation of (Eq) has long history. Recently it has developed by a new method named “Exact WKB Analysis” based on Borel resummation method and new analytic results. We study (Eq) by another elementary method. We only apply advanced calculus, elementary theories of complex functions and differential equations to (Eq). We neither assume turning points are simple nor there is no Stokes curve that connects two turning points.

- 3 Tomoyuki Tanigawa Amplitude and zero distribution of oscillatory solutions of half-linear
(Osaka Metro. Univ.) differential equations 12
Takaši Kusano (Hiroshima Univ.*)
Jaroslav Jaroš (Comenius Univ.)
Hiroyuki Usami (Gifu Univ.*)

Summary: In this talk, since results on the amplitude and zero distribution of oscillatory solutions for linear differential equations, namely those of Sturm–Liouville type, have already been established, we attempt to extend these results obtained for linear differential equations to the nonlinear case of half-linear differential equations.

- 4 Mingzhu Qu (Hulunbair Univ.) Asymptotic stability of linear differential equation with two distributed
Wei Zheng (Heilongjiang Univ.) delays 12
Hideaki Matsunaga
(Osaka Metro. Univ.)

Summary: The purpose of this study is to establish explicit necessary and sufficient conditions for the asymptotic stability of the zero solution to a scalar linear differential equation with two distributed delays. The stability conditions are derived by the careful root analysis of the associated characteristic equation.

- 5 Hiroyuki Usami (Gifu Univ.*) Necessary conditions for half-linear ordinary differential equations in
Manabu Naito (Ehime Univ.*) order that they have solutions behaving exponentially II 12

Summary: We consider asymptotic behavior of solutions of a class of half-linear ordinary differential equations. We give a necessary condition for such equations to have solutions behaving exponentially near ∞ .

- 6 Masakazu Onitsuka (Okayama Univ. of Sci.) Conditional Ulam stability for a discrete logistic model 12

Summary: This study investigates the conditional Ulam stability for the discrete logistic model, also known as the Beverton–Holt model. This research is a joint work with D. R. Anderson. We compare our results with existing results for continuous and discrete logistic models. We show that our results align with the continuous case when the step size is small, and, significantly, they provide a better estimate than previous discrete results when the step size is unity.

- 7 Hiroyuki Yamagishi (Tokyo Metropolitan Coll. of Indus. Tech.) Kohtaro Watanabe (Nat. Defense Acad. of Japan) Atsushi Nagai (Tsuda Coll.) The best constant of the m -th Sobolev inequality ($m = 0, 1, 2$) corresponding to the clamped boundary value problem for $(-1)^M(d/dx)^{2M}$ 10

Summary: For $M = 1, 2, 3, \dots$ and $m = 1, 2$, the best constant $C(M, m)$ of the m -th Sobolev inequality

$$\left(\sup_{|y| \leq L} |u^{(m)}(y)| \right)^2 \leq C \int_{-L}^L |u^{(M)}(x)|^2 dx$$

has obtained. The function $u(x)$ satisfy the clamped boundary condition $u^{(i)}(\pm L) = 0$ ($0 \leq i \leq M - 1$). In the background, there is $2M$ -th order ordinary differential equation $(-1)^M u^{(2M)} = f(x)$ on an interval $(-L, L)$ with clamped boundary condition $u^{(i)}(\pm L) = 0$ ($0 \leq i \leq M - 1$). The solution u is given by the Green function $G(x, y)$. The best constant of Sobolev inequality is expressed by using Green function.

- 8 Tetsutaro Shibata (Hiroshima Univ.*) Exact solutions and bifurcation curves of nonlocal elliptic equations with convolutional Kirchhoff functions 12

Summary: We consider the one-dimensional nonlocal elliptic equations of Kirchhoff type with convolutional Kirchhoff functions. We obtain the exact solutions u_λ and global bifurcation curves $\lambda(\alpha)$. Here, $\alpha := \|u_\lambda\|_\infty$ represents the maximum norm of the solution u_λ .

- 9 Satoshi Tanaka (Tohoku Univ.) Kanako Manabe (JG Corporation) Morse index and global bifurcation of positive solutions to the one-dimensional Liouville type equation with a step function weight 12

Summary: We consider a boundary value problem involving a step function weight. We precisely compute the Morse index of the positive even solutions. Furthermore, applying global bifurcation theory, we establish the existence of an unbounded connected set of positive non-even solutions that bifurcates from a symmetry-breaking point.

- 10 Akira Toyoshima (Tohoku Univ.) Norisuke Ioku (Tohoku Univ.) The separation property of radial solutions to Hénon type equation on the hyperbolic space 12

Summary: We consider Hénon type equation $\Delta_{\mathbb{H}^n} u + (\sinh r)^\sigma |u|^{p-1} u = 0$ in the hyperbolic space with $n \geq 2, \sigma > 0, p > 1$, and classify the separation property of radial solutions which remained open in pioneering works by Hasegawa (2017). Main technical tool is a transformation, which enable us to work on the Euclidean space. As a byproduct, we reveal that Hasegawa’s exponen p_c can be written explicitly by using the Joseph–Lundgren type exponent p_{JL} .

14:15–16:45

- 11 Takashi Suzuki (Osaka Univ.) Yohei Toyota (Nat. Inst. of Tech., Nara Coll.) Boudedness of the variational functionals associated with point vortices with multi-intensities 5

Summary: We study the boundedness attainability of the variational functional associated with point vortices with multi-intensities. Three categories are considered: discrete, one-sided, and two-sided. Sufficient conditions for the boundedness in these cases are given.

- 12 Naoki Hamamoto (Osaka Metro. Univ.) Poincaré constant for vector fields on the ball with tangential boundary condition 12

Summary: This lecture deals with the optimal constant of the Poincaré inequality

$$\int_B |\nabla \mathbf{u}|^2 dx \geq C_N \int_B |\mathbf{u}|^2 dx$$

for vector fields $\mathbf{u} = \mathbf{u}(\mathbf{x}) : B \rightarrow \mathbb{R}^N$ on the $N(\geq 2)$ -dimensional unit ball $B \subset \mathbb{R}^N$. We compute the best constant C_N under the tangential boundary condition $u_\nu = 0$ which is slightly weaker than the full Dirichlet boundary condition $\mathbf{u} = \mathbf{0}$ on the unit sphere $\partial B = \mathbb{S}^{N-1}$.

- 13 Ryuji Kajikiya (Osaka Electro-Comm. Univ.) Asymmetry of solutions for the Hénon equation in unbounded domains 12

Summary: We study the Hénon equation in unbounded domains Ω which are G invariant, where G is a closed subgroup of the orthogonal group. Ω (or $u(x)$) is called G invariant if $g(\Omega) = \Omega$ (or $u(gx) = u(x)$) for any $g \in G$. We call $u(x)$ a least energy solution if it is a minimizer of the Rayleigh quotient. We prove that no least energy solution is G invariant.

- 14 Kotaro Motegi (Sci. Tokyo) A regularity theorem for weak solutions to mean curvature flow with forcing term 12

Summary: The Brakke flow is a weak notion of mean curvature flow that allows singularities. While the $C^{1,\alpha}$ -regularity for Brakke flows with forcing term has been established, the second-order regularity had previously been obtained only under additional assumptions. In this talk, we show that graphical Brakke flows with forcing term are solutions to the forced mean curvature flow equation, without imposing any further assumptions.

- 15 Shuhei Kitano (Univ. of Tokyo) ABP maximum principle for 1-Laplace type equations 12

Summary: In our talk, we present an upper bound of viscosity solutions to 1-Laplace type fully nonlinear equations in terms of the L^{n-1} -norm of inhomogeneous terms. A key ingredient in the proof is the geometric structure of the quasi-concave envelope of solutions, which plays a role analogous to that of the concave envelope in the classical ABP estimate. Unlike in the classical theory, however, we must handle both singularity and degeneracy in the equations. To overcome these difficulties, we introduce a new regularization scheme together with new sup-convolution techniques.

- 16 Shuntaro Tsubouchi (Univ. of Tokyo) Gradient continuity for the parabolic $(1, p)$ -Laplace system with an external force term 12

Summary: In this talk, the speaker would like to report an interior regularity result for a certain singular parabolic system involving both the one-Laplacian and the p -Laplacian with $1 < p < \infty$. The main result is that a weak solution to this system has a continuous spatial derivative. An external force term is also treated in parabolic Lebesgue spaces under an optimal condition.

- 17 Shigeru Sakaguchi (Tohoku Univ.*) Serrin's overdetermined problem on the three-dimensional sphere and Clifford tori 12
Andrea Bisterzo (Scuola Normale Superiore)

Summary: We consider Serrin's overdetermined torsion problem on the three-dimensional sphere. Domains admitting a solution to the problem are called Serrin domains. By introducing an isoparametric foliation with Clifford tori and using the Crandall–Rabinowitz bifurcation theorem, we construct two distinct types of sequences of Serrin domains, respectively of small and large volume, each of whose boundary is connected and is neither isometric to a geodesic sphere nor to a Clifford torus.

- 18 Toru Nakajima (Shizuoka Univ.) On isolated singular points of stable-stationary harmonic maps 10

Summary: Stable-stationary harmonic maps from a three dimensional Euclidean domain to a compact Riemannian manifold may have a singular point. We discuss their behavior around their isolated singular points.

- 19 Kiichi Tashiro (Sci. Tokyo) On singular limit of the free boundary Allen–Cahn energy 12
 Jingeon An (Univ. of Basel)

Summary: The free boundary Allen–Cahn equation has recently attracted considerable attention because, while significantly more tractable, it retains the essential features of the usual Allen–Cahn equation. In this talk, I will discuss the free boundary analogue of the seminal Hutchinson–Tonegawa theory, developing the varifold convergence framework for solutions of the free boundary Allen–Cahn equation to minimal surfaces.

- 20 Daowen Lin Liouville theorem for a semi-linear sub-elliptic equation on the quater-
 (Okinawa Inst. of Sci. and Tech. Grad. Univ.) nionic Heisenberg group 12
 Yang Zhou
 (Univ. of Sci. Tech. of China)

Summary: We prove that the subcritical semi-linear sub-elliptic equation on the quaternionic Heisenberg group admits no positive solution using the vector field method.

17:00–18:00 Award Lecture for the 2025 MSJ Analysis Prize

- Masaharu Taniguchi (Okayama Univ.) Traveling front solutions of dimension $n + 1$ generate entire solutions of
 dimension n in reaction-diffusion equations

Summary: In reaction-diffusion equations, multidimensional traveling front solutions (35C07) and entire solutions (35B08) have been studied independently so far. To study the relationship between them we deal with bistable reaction-diffusion equations, for an imbalanced case and for a balanced case. We show that the limit of $(n + 1)$ -dimensional multidimensional traveling front solutions as the speeds go to infinity generates an entire solution of the same reaction-diffusion equation in the n -dimensional space.

For an imbalanced case, we prove the existence of an n -dimensional polyhedral entire solution as the speeds of $(n + 1)$ -dimensional pyramidal traveling front solutions go to infinity. Conversely, as the time goes to $-\infty$, an n -dimensional polyhedral entire solution gives n -dimensional pyramidal traveling front solutions. For a balanced case, we prove the existence of an n -dimensional radially symmetric or asymmetric entire solution as the speed of an $(n + 1)$ -dimensional axially symmetric or asymmetric traveling front goes to infinity.

March 24th (Tue) Conference Room II

9:00–12:00

- 21 Kimie Nakashima Eigenvalues of spike cluster solutions of inhomogeneous scalar field
 (Tokyo Univ. of Marine Sci. and Tech./Tohoku Univ.) equations 12
 Yasuhito Miyamoto (Univ. of Tokyo)

Summary: We construct a spike cluster solution that has $n(\geq 2)$ spikes of the Neumann problem

$$\epsilon^2 u'' + h(x)^2(-u + u^p) = 0 \quad \text{for } 0 < x < 1, \quad u'(0) = u'(1) = 0,$$

where $p > 1$ and $\epsilon > 0$ is small. We determine all the negative eigenvalues of the linearization problem. Specifically, the first n eigenvalues λ_j , $j = 0, \dots, n - 1$, converge to $-(p + 3)(p - 1)h(x_0)^2/4$ as $\epsilon \rightarrow 0$, the next n eigenvalues λ_j , $j = n, \dots, 2n - 1$, are negative and they converge to 0. Moreover, we show that $\lambda_{2n-1} < 0 < \lambda_{2n}$ for small $\epsilon > 0$ and hence it is nondegenerate and the Morse index is $2n$. In the proof we construct three approximate eigenfunctions associated to λ_0 , λ_n and λ_{2n} by gluing local approximate eigenfunctions near spikes and between two successive spikes to obtain lower bounds of these eigenvalues.

- 22 Kouichi Takemura (Ochanomizu Univ.) The Lamé equation on a circle and applications to singular limit eigenvalue problems 10
Yasuhito Miyamoto (Univ. of Tokyo)
Tohru Wakasa (Kyushu Inst. of Tech.)

Summary: Let $n \in \{1, 2, \dots\}$, $\ell \in \{1, 2\}$ and $0 < k < 1$. We are concerned with the eigenvalues of the Lamé equation of the form

$$-\phi'' + \ell(\ell + 1) \{e_3 + k^2 \operatorname{sn}^2(x, k)\} \phi = \lambda \phi \text{ for } x \in \mathbb{R}/2nK(k)\mathbb{Z},$$

where $e_3 := -(1 + k^2)/3$ is a constant. We obtain exact expressions of all eigenvalues and establish asymptotic formulas for all eigenvalues as $k \rightarrow 1$. It is known that the Lamé equation appears as a linearized eigenvalue problem of important semilinear elliptic equations including the Allen–Cahn equation, a scalar field equation and the sine-Poisson equation. We also establish asymptotic formulas for the eigenvalues of the linearization of various boundary value problems of semilinear elliptic equations.

- 23 Kotaro Hisa (Fukuoka Univ.) Threshold property of a singular stationary solution for semilinear heat equations with exponential growth 10
Yasuhito Miyamoto (Univ. of Tokyo)

Summary: Let $N \geq 3$. We are concerned with a Cauchy problem of the semilinear heat equation

$$\begin{cases} \partial_t u - \Delta u = f(u), & x \in \mathbb{R}^N, t > 0, \\ u(x, 0) = u_0(x), & x \in \mathbb{R}^N, \end{cases}$$

where f satisfies certain assumptions. We establish a positive radial singular stationary solution u^* such that $u^*(x) \rightarrow \infty$ as $|x| \rightarrow 0$. Then, we prove the following: The problem has a nonnegative global-in-time solution if $0 \leq u_0 \leq u^*$ and $u_0 \not\equiv u^*$, while the problem has no nonnegative local-in-time solutions u such that $u \geq u^*$ if $u_0 \geq u^*$ and $u_0 \not\equiv u^*$.

- 24 Kotaro Hisa (Fukuoka Univ.) On blow-up rate for the Hénon parabolic equation with Sobolev supercritical nonlinearity 10
Yukihiro Seki (Tokyo Metro. Univ.)

Summary: We consider nonnegative radially symmetric solutions of the Hénon type parabolic equation $\partial_t u = \Delta u + |x|^\sigma u^p$ in a finite ball under the Dirichlet boundary condition, where $p > 1$ and $\sigma > 0$. We assume that the exponent p is supercritical in the Sobolev sense. Since the spatial potential term $|x|^\sigma$ vanishes at the origin, there is no reaction effect there, and solutions seem less likely to blow up at the origin. Our aim is to construct a solution that blows up at the origin. We also carry out an analysis of blow-up rate of solutions that blow up at the origin.

- 25 Hideyuki Miura (Sci. Tokyo) Blow-up rate for the subcritical semilinear heat equation in non-convex domains 12
Jin Takahashi (Sci. Tokyo)
Erbol Zhanpeisov (Tohoku Univ.)

Summary: We consider the semilinear heat equation in possibly non-convex and unbounded domains. Our main result shows the nonexistence of type II blow-up for possibly sign-changing solutions in the energy subcritical range, and it also implies the blow-up of the scaling critical norm.

- 26 Yohei Sato (Saitama Univ.) On the existence and nonexistence of solutions to the 1D nonlinear Schrödinger equation with a Dirac-type potential 12

Summary: We study the one-dimensional nonlinear Schrödinger equation in $-u'' + (\lambda^2 + b(x))u = f(u)$ in \mathbb{R} , $u(x) \rightarrow 0$ as $|x| \rightarrow \infty$, where $\lambda > 0$, $b(x)$ satisfies $m_1 \mu e^{-\mu|x|} \leq |b(x)| \leq m_2 \mu e^{-\mu|x|}$, and f is a locally Lipschitz function with $f(0) = 0$, under assumptions as general as possible. From f , we explicitly determine a constant $\gamma \geq \lambda$ and our main results are as follows. If $m_1 > \gamma$, then there exist no non-trivial solutions for large μ . If $m_2 < \lambda$, then there exists at least a positive solution for large μ . If $\gamma < m_1 < m_2 < \lambda$ and $b(-x) = b(x)$, then there exist at least two positive solutions for large μ . Our approach is based on a shooting method initiated from $\pm\infty$.

- 27 Yu Su (Anhui Univ. of Sci. Tech.) Ground state solutions for critical nonlocal elliptic equations with doping profile 12
Tatsuya Watanabe
(Kyoto Sangyo Univ.)

Summary: We consider the existence of ground state solutions for the Schrödinger–Poisson system with a doping profile and the Sobolev critical exponent. We remark that our system exhibits a “double” lack of compactness because of the unboundedness of the domain and the critical growth of the nonlinear term. Due to the appearance of the doping profile, the corresponding energy functional is not invariant under the translation, which causes a difficulty of obtaining the compactness of minimizing sequences and the uniqueness of a maximum point of a fibering map. We overcome this difficulty by the combination of Lions’ compactness lemma and analytical techniques.

- 28 Rikuya Kakinuma (Tohoku Univ.) Existence of L^2 normalized solutions to scalar field equations with absorptions 12

Summary: This talk is concerned with nonlinear scalar field equations with power-type absorption terms under L^2 constraints. The main result establishes the existence of nontrivial solutions to the L^2 -constrained problem under certain assumptions, which are closer to the so-called Berestycki–Lions condition than those in previous works, and in some aspects may even go beyond it.

- 29 Yutaro Chiyo (Tokyo Univ. of Sci.) Boundedness and finite-time blow-up in a quasilinear fully parabolic attraction-repulsion chemotaxis system 12
Kazuki Hasegawa (Tokyo Univ. of Sci.)
Takeshi Uemura (Tokyo Univ. of Sci.)
Tomomi Yokota (Tokyo Univ. of Sci.)

Summary: This talk deals with a special case of a quasilinear fully parabolic attraction-repulsion chemotaxis system. The purpose of this talk is to show boundedness by applying energy methods and to show finite-time blow-up by using a Lyapunov type functional in this system.

- 30 Shohei Kohatsu (Tokyo Univ. of Sci.) Stability of radial steady states to a chemotaxis system with supercritical flux-dependent sensitivity 12
Takasi Senba (Kanagawa Univ.)

Summary: We consider a chemotaxis system with supercritical flux-dependent sensitivity, and show stability of radial steady states, which generalizes the one for the classical chemotaxis system. The proof is based on establishing a layer structure of the family of radial steady states, which is useful to construct suitable subsolutions and supersolutions.

- 31 Mario Fuest (Leibniz Univ. Hannover) Blow-up in a fully parabolic chemotaxis-growth system 12
Johannes Lankeit
(Leibniz Univ. Hannover)
Masaaki Mizukami
(Kyoto Univ. of Edu.)

Summary: In the study of chemotaxis-growth systems existence of blow-up solutions is known to be a difficult problem. In the previous results, the results on existence of blow-up solution are only for some simplified problem, and there do not seem to be any results concerning fully parabolic systems. The purpose of this work is to show existence of blow-up solutions and their properties.

- 32 Kosuke Shibata (Univ. of Osaka) Existence of axis-symmetric blow-up solutions with multiple peak aggregations for the 2- D Keller-Segel system coupled with a bipolar source-sink flow 12
Yoshie Sugiyama (Univ. of Osaka)
Yukihiro Seki (Tokyo Metro. Univ.)

Summary: We consider the two-dimensional Keller–Segel system coupled with a bipolar source–sink flow. Under an axis-symmetric but non-radial configuration, we establish finite-time blow-up for initial data with total mass exceeding 16π . In sharp contrast to the classical radial case, where blow-up occurs only at the origin, multiple blow-up points arise in symmetric pairs along the x_1 -axis. A crucial ingredient is a sharp ε -regularity theorem, originally due to Luckhaus–Sugiyama–Vel’azquez and reformulated here for the flow setting. It ensures uniform boundedness in suitable space–time cylinders whenever the local mass is sufficiently small, enabling us to identify the finitely many blow-up points and to characterize their symmetric arrangement.

13:00–14:00 Award Lecture for the 2025 MSJ Analysis Prize

- Goro Akagi (Tohoku Univ.) Asymptotic analysis of solutions to nonlinear diffusion equations based on quantitative gradient inequalities

Summary: This talk is concerned with the asymptotic behavior of energy solutions to the Cauchy–Dirichlet problem for the fast diffusion equation posed on bounded domains. In particular, we will overview recent developments in the quantitative analysis of the convergence of energy solutions to asymptotic profiles, based on “quantitative” gradient inequalities.

March 25th (Wed) Conference Room II

9:00–12:00

- 33 Yusuke Oka (Univ. of Tokyo) On the solvability of fractional semilinear heat equations with distributional inhomogeneous terms 12

Summary: We consider the solvability of the Cauchy problem for the fractional semilinear heat equation with distributional inhomogeneous terms. In terms of Besov-type spaces, we provide necessary conditions and sufficient conditions on inhomogeneous terms for the existence of local-in-time mild solutions belonging to Lorentz spaces.

- 34 Sho Katayama (Univ. of Tokyo) Fundamental solution to the heat equation with a dynamical boundary condition 12
Kazuhiro Ishige (Univ. of Tokyo)
Tatsuki Kawakami (Ryukoku Univ.)

Summary: We give an explicit representation of the fundamental solution to the heat equation on a half-space of \mathbb{R}^N with the homogeneous dynamical boundary condition, and obtain upper and lower estimates of the fundamental solution. These enable us to obtain sharp decay estimates of solutions to the heat equation with the homogeneous dynamical boundary condition.

- 35 Md. Rabiul Haque (Rajshahi Univ.) Global well-posedness of initial value problems for systems of convection-diffusion equations in uniformly local Lebesgue spaces 12
Takayoshi Ogawa (Waseda Univ.)
Atsuko Okada (Kitasato Univ.)

Summary: We show the global well-posedness of a system of convection-diffusion equations in the scaling critical uniformly local Lebesgue space. The class of solutions includes almost periodic solutions in space or spatially non-decaying solutions as x tends to infinity. For the local well-posedness, we apply the uniformly local L_p - L_q estimate and a fixed-point argument of Banach–Caccioppoli type. For the global well-posedness, we employ the Bernstein-type argument via the Caccioppoli-type estimate to obtain an a priori estimate for the solution.

- 36 Kosuke Shibuya (Tohoku Univ.)^b Global solvability for small initial data in critical Besov spaces for the Takayoshi Ogawa (Waseda Univ.) convection-diffusion equation with fractional dissipation 12

Summary: In this talk, we consider the global well-posedness of the convection-diffusion equation with the critical fractional dissipation in critical Besov spaces. Miao–Wu (2009) and Ru–Chen (2017) established well-posedness in the critical Besov space $\dot{B}_{q,1}^{n/q}$, $n \leq q < \infty$ using the Chemin–Lerner spaces. In this talk, we consider the global well-posedness for small initial data in the critical Besov space in the endpoint case $\dot{B}_{q,1}^{n/q}$, $q = \infty$.

- 37 Ayuki Sekisaka (Meiji Univ.) Instability mechanism for a nonlocal reaction-diffusion equation 12
Hiroko Sekisaka-Yamamoto (RIKEN)

Summary: We study a nonlocal evolution equation with a convolution-type interaction kernel J and its approximation by a generalized reaction-diffusion system obtained via reaction-diffusion approximation. Under suitable assumptions we justify this approximation and describe how the spectral properties of the linearization depend on the symmetry of J . For an Allen–Cahn nonlinearity and a specific asymmetric kernel we show, via a convective Turing bifurcation, the existence of stable traveling wave trains in the approximating system.

- 38 Ryo Ito (Kanagawa Univ.) Existence and nonexistence of unbounded traveling wave solutions for Hirokazu Ninomiya (Meiji Univ.) reaction-diffusion equations 12

Summary: We investigate the existence problem of unbounded traveling wave solutions for one-dimensional reaction-diffusion equations. For bounded traveling wave solutions, it is well known that the range of admissible wave speeds depends on the type of nonlinearity. Specifically, in the monostable case, there exists a threshold speed, referred to as the minimal speed, that separates the existence and nonexistence of traveling wave solutions, while in the bistable case, a traveling wave solution exists only for a unique speed. In our previous study, we establish, for unbounded traveling wave solutions, the existence of the minimal speed under mild technical assumptions on the nonlinearity, even in the bistable case. In this talk, we describe the corresponding existence and nonexistence conditions for unbounded traveling wave solutions at the minimal speed.

- 39 Kazuhiro Oeda (Kyushu Sangyo Univ.) Nonlinear diffusion limit and bifurcation structure in a prey-predator Kousuke Kuto (Waseda Univ.) system with a protection zone 12

Summary: We study a predator-prey model with a protection zone, where prey can inhabit but predators cannot. The model incorporates nonlinear cross-diffusion describing the predators' tendency to move toward regions of high prey density. Previous results established the existence and bifurcation of positive steady states and their dependence on the diffusion parameter. We further analyze the nonlinear diffusion limit and reveal a global bifurcation branch of positive solutions in the limiting system. The branch bifurcates from the semi-trivial state, remains uniformly bounded in one component, and becomes unbounded in the other, reflecting a rich spatial interaction structure.

- 40 Masahiko Shimojo Convergence to traveling waves for reaction-diffusion systems using
(Tokyo Metro. Univ.) Lyapunov type arguments 12
Arnaud Ducrot
(Univ. Le Havre Normandie)

Summary: In this talk, we discuss the convergence of solutions of reaction-diffusion systems toward traveling wave solutions. By employing Lyapunov-type methods, we establish that when the initial data is sufficiently close to a wave profile at infinity, the corresponding solution converges to this traveling wave as time goes to infinity. As an application, we analyze predator-prey systems and demonstrate the stability of traveling waves, thereby providing new insights into the dynamics of non-cooperative systems.

- 41 Hiroko Sekisaka-Yamamoto (RIKEN) Reaction-diffusion approximation for nonlocal evolution equations 12
Ayuki Sekisaka (Meiji Univ.)

Summary: We study nonlocal evolution equations with arbitrary integral kernels. We show that an advection-reaction-diffusion system can effectively approximate such nonlocal equations. Moreover, if time permits during the talk, we will introduce another reaction-diffusion system that approximates the nonlocal equations.

- 42 Ikkei Shimizu (Kyoto Univ.) Time decay estimate for localized perturbation around helical state for the Landau–Lifshitz–Gilbert equation 12

Summary: We consider global-in-time dynamics of the Landau–Lifshitz–Gilbert (LLG) equation in 2D and 3D cases. If the energy consists of the Dirichlet and DMI terms, LLG has an explicit stationary solution which periodically depends on spatial variables, called the helical state. We prove that the helical state is dynamically stable under localized perturbation.

- 43 Takumi Kanai (Tokyo Univ. of Sci.) Characterization of the wave front set of solutions to the fractional Schrödinger equation with potentials 12
Ryo Muramatsu (Tokyo Univ. of Sci.)
Yuusuke Sugiyama (Tokyo Univ. of Sci.)

Summary: In this talk, we present a theorem characterizing the wave front set $\text{WF}(u(t))$ of the solution $u(t)$ to the fractional Schrödinger equation $i\partial_t u = (-\Delta)^{\theta/2}u + V(x)u$, $0 < \theta < 2$ with a potential $V(x)$. Depending on the value of θ , we investigate the growth rate of the potential $V(x)$ that allows the propagation of singularities. The proof is based on the wave packet transform and the characterization theorem of wave front sets via the wave packet transform.

- 44 Ryo Muramatsu (Tokyo Univ. of Sci.) Well-posedness on modulation spaces for Schrödinger equations with long-range magnetic fields 12

Summary: Inspired by the work of E. Cordero, F. Nicola and L. Rodino, we have obtained a well-posedness result in modulation spaces for the Schrödinger equation in a long-range magnetic field. This type of result for the magnetic Schrödinger equation was not covered in the previous paper and could not be achieved without modifying the approach taken there. In this talk, we show that such an extension is possible by carrying out a detailed analysis of the associated classical trajectories.

- 45 Shun Takizawa (Tokyo Univ. of Sci.) Strichartz estimates in Wiener amalgam spaces for Schrödinger equations with at most quadratic potentials 12

Summary: For Schrödinger equations with potentials which grow at most quadratically at spatial infinity, we prove Strichartz estimates in Wiener amalgam spaces. These estimates provide a stronger recovery of local-in-space regularity than the classical estimates in Lebesgue spaces. Our result is a generalization of the results by Cordero and Nicola, which are stated for the potentials $V(x) = 0, \pm|x|^2/2$.

14:15–16:45

- 46 Koichi Komada (Ritsumeikan Univ.) Large data scattering for the defocusing generalized Boussinesq equation 12

Summary: We consider the defocusing generalized Boussinesq equation for spatial dimensions $d \geq 3$ and nonlinear exponent $1 + 4/d \leq p \leq 1 + 4/(d - 2)$. We show that for all initial data in energy space, the corresponding solutions globally exist and scatter. Our result is an extension of the previous result by Chen–Guo–Shao (2023) for the radial case to the non-radial case.

- 47 Yu Zhou (Hokkaido Univ.) Nonlinear wave equations on the half-line with nonlinear boundary condition 12
Hideo Kubo (Hokkaido Univ.)

Summary: The lifespan of solutions to wave equations on the half-line with both an interior nonlinearity $|u_t|^p|u|^q$ and a nonlinear boundary condition $|u(0, t)|^r$ is analyzed. For small initial data, we show that the interior and boundary nonlinearities can jointly produce a “combined effect.”

- 48 Tomoyuki Tanaka (Yokohama Nat. Univ.) Improved refined bilinear estimates and well-posedness for generalized KdV type equations 12
 Luc Molinet (Univ. of Tours)

Summary: We study the Cauchy problem for one-dimensional dispersive equations posed on \mathbb{R} , under the hypothesis that the dispersive operator behaves as a Fourier multiplier by $i|\xi|^\alpha \xi$ with $1 \leq \alpha \leq 2$. We prove the unconditional local well-posedness of the Cauchy problem in $H^s(\mathbb{R})$ for $s \geq \frac{5-2\alpha}{4}$ whenever $1 \leq \alpha < \frac{3}{2}$, and for $s > \frac{1}{2}$ whenever $\alpha \in [\frac{3}{2}, 2]$. The main novelty of this work is an improvement of the refined bilinear estimates on \mathbb{R} .

- 49 Kaito Kokubu (Tokyo Univ. of Sci.) Classification of unstable travelling wave solutions to KdV type equations 12

Summary: We study travelling wave solutions to Korteweg–de Vries type equations which have double power nonlinearities with integer indices, such as the Gardner equation, and fractional dispersion. Whether these equations have ground state solutions depends on signatures of nonlinearities and parity combinations of the two indices. The aim of this study is to give the classification of phenomena of travelling wave solutions from the perspective of the signatures and parities of the indices. In this talk, we focus on unstable travelling wave solutions.

- 50 Takuma Yoshizumi (Univ. of Osaka) Blow-up for nonlinear Klein–Gordon equations in contracting cosmological backgrounds 12
 Kimitoshi Tsutaya (Hirosaki Univ.)
 Yuta Wakasugi (Hiroshima Univ.)
 Makoto Nakamura (Univ. of Osaka)

Summary: We consider the Cauchy problem for nonlinear Klein–Gordon equations in Friedmann–Lemaître–Robertson–Walker spacetimes (FLRW spacetimes for short). The equation involves time-dependent coefficients in the scale factor $a(t)$, damping term $b(t)$, and mass term $m(t)$. In this talk, we introduce blow-up phenomena for small initial data and upper bounds on the lifespan estimates. As a concrete example, we focus on the exponentially contracting case $a(t) = e^{-Ht}$ with $H > 0$, which corresponds to the Klein–Gordon or wave equations in a contracting universe. The obtained lifespan is quite short as estimated by logarithmic order in the smallness parameter in some cases.

- 51 Naoyasu Kita (Kumamoto Univ.) Time decay of solutions to nonlinear Schrödinger equations with attractive-dissipative nonlinearity 12
Hayato Miyazaki (Kagawa Univ.)
 Takuya Sato (Ehime Univ.)

Summary: We discuss L^2 -decay estimates for solutions to nonlinear Schrödinger equations with power-type dissipative nonlinearities. Our equation does not possess an L^2 -conservation law, and the L^2 -norm of solutions decreases monotonically over time. In particular, it is known that the L^2 -norm decays over time if the power of the nonlinearity is less than or equal to the Barab–Ozawa exponent; otherwise, it does not. In this talk, we focus on the case where the power is below the Barab–Ozawa exponent, and present results on the decay rate of the L^2 -norm under the attractive dissipative condition, where solutions may exhibit local concentration.

- 52 Hayato Miyazaki (Kagawa Univ.) Nonexistence of scattering states for nonlinear Schrödinger equations without gauge invariance 12
 Motohiro Sobajima (Tokyo Univ. of Sci.)

Summary: In this talk, we discuss a threshold phenomenon for the existence of scattering states in nonlinear Schrödinger equations. The nonlinearity under consideration includes a non-oscillatory power-type term with an exponent strictly below the Strauss exponent. We prove that no scattering states exist in certain weighted Sobolev spaces, even when the initial data are smooth and compactly supported. Our result highlights the role of the Strauss exponent as a sharp threshold that determines whether scattering occurs in the weighted setting.

- 53 Toshiki Kondo (Univ. of Osaka) Non-existence of solutions to the Cauchy problem for semi-linear Schrödinger
Mamoru Okamoto (Hiroshima Univ.) equation on the torus 12

Summary: We consider the Cauchy problem for semilinear Schrödinger equations on the torus. Using an ODE approach, we prove the non-existence of solutions to these equations.

- 54 Toshiki Kondo (Univ. of Osaka) Well-posedness of the Cauchy problem for derivative fractional nonlinear
Takamori Kato (Saga Univ.) Schrödinger equations on torus 12
Mamoru Okamoto (Hiroshima Univ.)

Summary: We consider the Cauchy problem for fractional Schrödinger equations on the torus. Using a modified energy method, we establish a sufficient condition on the nonlinearity for the Cauchy problem to be well-posed in the Sobolev space.

- 55 Satoshi Masaki (Hokkaido Univ.) On non-polynomial conserved quantity for a class of cubic ODE system
Jun-ichi Segata (Kyushu Univ.) 12
Kota Uriya (Okayama Univ. of Sci.)

Summary: This talk concerns a class of coupled cubic ordinary differential equation systems that appear in the study of nonlinear Schrödinger systems. We investigate the existence of non-polynomial conserved quantities, which are characterized by the eigenstructure of a real matrix naturally associated with the system. These quantities generalize the notion of polynomial conservation laws and provide an effective tool for controlling the long-time behavior of solutions. We show that, under certain spectral conditions, the systems possess global-in-time solutions whose amplitudes remain uniformly bounded. Two representative examples are presented, together with a discussion of the classification of systems satisfying these conditions.

- 56 Satoshi Masaki (Hokkaido Univ.) Global existence of solutions to a system of cubic nonlinear Schrödinger
Jun-ichi Segata (Kyushu Univ.) equations in one dimension 12
Kota Uriya (Okayama Univ. of Sci.)

Summary: In this talk, we study the asymptotic behavior of small solutions to the initial value problem for a system of cubic nonlinear Schrödinger equations in one spatial dimension. We identify a new class of NLS systems for which the global boundedness and asymptotic profiles of small solutions can be established, even in the absence of any effective conserved quantity. The key idea of our analysis is to exploit conserved quantities associated with a system of ordinary differential equations derived from the original NLS system. Previously, S. Masaki investigated conserved quantities represented by quartic polynomials. In contrast, the conserved quantities considered in this talk are of a different nature and are not necessarily polynomial.

17:00–18:00 Talk Invited by Functional Equations Section

Kunio Hidano (Tokyo City Univ.) Global existence and combined effect for systems of nonlinear wave equations without the null condition

Summary: We consider global existence of small solutions to the Cauchy problem for certain systems of nonlinear wave equations in three space dimensions. As is well known from the work of John, in finite time, singularity generally occurs in solutions to the Cauchy problem for the scalar wave equation $\partial_t^2 u - \Delta u = (\partial_t u)^2$ even for small and smooth initial data. We first start with the null condition of Klainerman which is a sufficient condition, concerning the form of quadratic nonlinear terms, for global existence of small solutions. Paying attention on the feature that this condition creates some gain of time decay together with a kind of loss of derivatives, we go over the proof of his global existence theorem.

We should note that the null condition is not a necessary condition for global existence. With their new weighted space-time L^2 estimates of certain special derivatives, Alinhac and Lindblad–Rodnianski independently gave an alternate proof of the theorem of Klainerman, achieving remarkable improvement concerning uniform in time bound on the highest-order energy. On the basis of their insight, we then discuss the problem of existence of global solutions to a class of systems without the null condition.

Finally, we turn our attention to non-trivial effects of the super Strauss-critical term $|u|^q$ ($q > 1 + \sqrt{2}$) on the lifespan of small solutions, to observe that, for a class of systems, “combined effect” occurs and combined terms yield solutions with much shorter lifespan. This talk is based on joint work with YOKOYAMA Kazuyoshi (Hokkaido University of Science).

March 26th (Thu) Conference Room II

9:30–12:00

- 57 Masahiro Takayama (Keio Univ.) The motion of an inextensible closed string 12
Tatsuo Iguchi (Keio Univ.)

Summary: We consider the motion of an inextensible closed string in non-gravitational field. The motion of the string is governed by nonlinear and nonlocal hyperbolic equations. We show that the initial value problem to the equations of motion is well-posed locally in time in the Sobolev spaces. To prove this, we need to show a strict positivity of the tension, and for this, it is crucial to derive a precise lower bound of the Green’s function for the corresponding Sturm–Liouville problem.

- 58 Yoshinori Furuto (Tohoku Univ.) Higher order derivative estimates of the parabolic Lamé system 12
Tsukasa Iwabuchi (Tohoku Univ.)

Summary: We consider the parabolic Lamé system on a bounded domain. This system derives from a linearized model of the compressible Navier–Stokes equations. We focus on two types of inequalities for higher-order derivatives of solutions. The first is related to an L^p - L^p estimate locally in time in the Lebesgue space setting, which includes the endpoint cases $p = 1$ and $p = \infty$. The second concerns the equivalence between the $L_t^q L_x^p$ norm of the solution and the Besov norm of the initial data.

- 59 Shozo Ogino (Tohoku Univ.)^b On the quasi-neutral limit of the compressible Navier–Stokes–Poisson equations in the scaling critical spaces 12

Summary: We study the quasi-neutral limit of the compressible Navier–Stokes–Poisson equations with initial data near a constant equilibrium state in the whole space. We deal with the two physical parameters which come from the effect of pressure and electric potential. We show that the compressible Navier–Stokes–Poisson equations converge to the incompressible flow strongly in the critical Besov spaces. It turned out that whether it oscillate or converge vary depending on the regularity imposed on the functional spaces.

- 60 Itsuko Hashimoto (Univ. of Osaka/Osaka Metro. Univ.) Existence of radially symmetric stationary solutions for viscous and heat-conductive ideal Gas 12
 Akitaka Matsumura (Osaka Univ.*)

Summary: We consider the existence of radially symmetric stationary solutions of the compressible viscous and heat-conductive polytropic ideal fluid on the unbounded exterior domain of a sphere where the boundary and far-field conditions are prescribed. The unique existence of the stationary solution is shown for both inflow and outflow problems in a suitably small neighborhood of the far-field state. Estimates of the algebraic decay rate toward the far field state are also obtained.

- 61 Masaya Kageura (Kobe Univ.) Stability of the composite wave for the scalar viscous conservation law
 Yoshihiro Ueda (Kobe Univ.) 12

Summary: In this talk, we consider the asymptotic behavior of solutions to the initial value problem for a scalar viscous conservation law. In particular, we focus on the case where the flux function is non-convex. When the corresponding Riemann problem admits a solution consisting of an Oleinik shock and a rarefaction wave, we will show the asymptotic stability of the composite wave composed of the viscous Oleinik shock and the rarefaction wave.

- 62 Yucong Huang (Sci. Tokyo) Asymptotic stability of the spherically symmetric stationary solution to
 Shinya Nishibata (Sci. Tokyo) outflow problem for compressible viscous fluid 12

Summary: In this talk, we study the asymptotic stability of multi-dimensional spherically symmetric stationary solution to the out-flowing compressible Navier–Stokes equations in the unbounded exterior domain. On the boundary of the domain, the fluid is flowing out at a constant speed. We show that for large spherically symmetric initial perturbations in certain suitable weighted Sobolev space, the stationary solution is stable asymptotically in time.

- 63 Yucong Huang (Sci. Tokyo) Asymptotic stability of the stationary state for out-flowing viscous gas
 Shinya Nishibata (Sci. Tokyo) under non-spherically symmetric initial perturbations 12

Summary: In this presentation, I will discuss the time-asymptotic stability of a 3-dimensional spherically symmetric out-flowing stationary solution to the compressible Navier–Stokes equations. More specifically, the fluid under consideration occupies an exterior domain of the unit ball. At the surface of the ball, the fluid is flowing out at a constant speed in the normal direction to the sphere. The main aim of the talk is to illustrate that stationary solution to this outflow problem is stable asymptotically in time under general, possibly non-spherically symmetric, small initial perturbation in the H^3 Sobolev space.

- 64 Shunsuke Fujita (Waseda Univ.) Global existence and long-time behavior of solutions to the stochastic
 Reika Fukuizumi (Waseda Univ.) gCLMG equation 12
 Takashi Sakajo (Kyoto Univ.)

Summary: We provide a mathematical analysis of a one-dimensional model of turbulence based on a stochastic generalized Constantin–Lax–Majda–DeGregorio (gCLMG) equation. In this model, the parameter a governs the strength of the advection term. We focus on the specific case $a = -2$, which allows some effective energy estimates. These estimates enable us to prove the global well-posedness of solutions in the mean-zero Sobolev space on the one-dimensional torus and the existence of an invariant measure. The uniqueness of the invariant measure is proved under a sufficiently large viscosity condition. This is a joint work with Reika Fukuizumi (Waseda University) and Takashi Sakajo (Kyoto University).

- 65 Tsukasa Iwabuchi (Tohoku Univ.) Local solutions for the inviscid SQG in a bounded domain 12

Summary: We study the inviscid surface quasi-geostrophic equation in a bounded domain of the two dimensional space with a smooth boundary, considering the Dirichlet boundary condition. Our focus is on the critical Besov space, which is a subspace of C^1 . We establish the existence of local solutions in the critical setting.

- 66 Mitsuo Higaki (Kobe Univ.) Lagrangian controllability in perforated domains 10
Jiajiang Liao (Beihang Univ.)
Franck Sueur (Univ. of Luxembourg)

Summary: Lagrangian controllability is the question of whether a patch of fluid particles governed by fluid equations can be transported to a target location within a given time interval by means of remote action (control). In this talk, we investigate the Navier–Stokes equations with the no-slip boundary condition in a perforated domain Ω^ε , and we report on Lagrangian controllability in the parameter regime of Euler homogenization.

14:15–16:45

- 67 Tsuyoshi Yoneda (Hitotsubashi Univ.) On the locality of vortex breakdown dynamics based on the three-dimensional incompressible Euler equations 12

Summary: We consider the 3D incompressible Euler equations under the following situation: a vortex being transported by a certain Lagrangian flow. Then we figure out that the vortex breakdown time is completely determined by the transport dynamics. The key idea is not using any kind of singular integral expression of the pressure term, instead, constructing an effective Lagrangian coordinate so that the Lie bracket is identically zero. This idea enables us to investigate the locality of the pressure term.

- 68 Motofumi Aoki (Kyoto Univ.) On energy conservation law for incompressible Euler equations in
Tsukasa Iwabuchi (Tohoku Univ.) bounded domains 12

Summary: In this talk, we consider a sufficient condition such that a weak solution of the incompressible Euler equations in a bounded domain satisfies the energy conservation law. Constantin, E, and Titi proved the energy conservation law for weak solutions that are smoother than order $1/3$ in the whole space. Cheskidov et al. also proved energy conservation in the whole space under a condition with the $1/3$ -fractional derivative. For the bounded domain case, Bardos and Titi proved the energy conservation law for weak solutions that are smoother than order $1/3$, corresponding to the result of Constantin–E–Titi. We show the energy conservation law under the condition corresponding to that of Cheskidov et al., with approximations satisfying the slip boundary condition.

- 69 Mikihiro Fujii (Nagoya City Univ.) Analyticity in space and time for global solutions to the anisotropic
Yang Li (Anhui Univ.) Navier–Stokes equations 12

Summary: We consider the real analyticity of the global solutions to the 3D incompressible anisotropic Navier–Stokes equations. We show that if only the horizontal component of initial velocity is small and analytic in x_3 , then there exists a unique global solution which is analytic in $t > 0$ and $x \in \mathbb{R}^3$. Our functional framework lies in some anisotropic Besov spaces based on $L^p(\mathbb{R}^3)$. To our best knowledge, our result is the first contribution to the well-posedness of the anisotropic Navier–Stokes equations in function spaces of the Besov type based on the full $L^p(\mathbb{R}^3)$ setting.

- 70 Mikihiro Fujii (Nagoya City Univ.) Asymptotic instability for the forced Navier–Stokes equations 12
Hiroyuki Tsurumi (Tokushima Univ.)

Summary: In \mathbb{R}^n with $n \geq 3$, it is easily proved by the standard argument that if the given small external force decays at temporal infinity, then the small forced Navier–Stokes flow also strongly converges to zero as time tends to infinity in the framework of the critical Besov spaces $\dot{B}_{p,q}^{n/p-1}(\mathbb{R}^n)$ with $1 \leq p < n$ and $1 \leq q < \infty$. We show that this asymptotic stability *fails* for $p \geq n$ with $n \geq 3$ and $1 \leq p \leq \infty$ with $n = 2$ in the sense that there exist arbitrary small external forces whose critical Besov norm decays in large time, whereas the corresponding Navier–Stokes flows oscillate and do not strongly converge as $t \rightarrow \infty$ in the framework of the critical Besov spaces $\dot{B}_{p,q}^{n/p-1}(\mathbb{R}^n)$.

- 71 Kei Noda (Kyoto Univ.) Periodic solutions of the 3D MHD equations in bounded domains with
 Hideo Kozono (Waseda Univ./Tohoku Univ.) arbitrary geometry 12
 Senjo Shimizu (Kyoto Univ.)

Summary: We prove existence and uniqueness of time periodic strong solutions to the three dimensional MHD equations in bounded domains without geometric restrictions. The analysis uses L^r theory for the magnetic Laplace operator by Kozono–Shimizu–Yanagisawa (2025) and adapts the fixed point framework of Kozono–Nakao (1996). For small periodic forces we construct global mild solutions and then show the regularity of the solutions when the given data are sufficiently smooth.

- 72 Kazuyuki Tsuda Time periodic problem of the Navier–Stokes equations in an exterior
 (Kyushu Sangyo Univ.) domain with periodically moving boundary 12
 Reinhard Farwig (TU Darmstadt)

Summary: In this talk we consider the Navier–Stokes equations in exterior domains of \mathbb{R}^n , $n \geq 3$, with moving boundary $\partial\Omega(t)$ periodically in time and with a periodic external force. For this case we prove the existence of a locally unique mild time periodic solution in weighted function spaces with radially symmetric Muckenhoupt weights. The solutions split into a stationary part controlled by potential theoretic estimates and a purely oscillatory part constructed as mild solution via analytic semigroup theory. To deal with perturbation terms of even second order —coming from a coordinate transform and the moving boundary— in weighted, homogeneous Sobolev spaces a maximal L^1 type regularity estimate is used in weighted Lorentz spaces. To control the convective term an \mathcal{H}^∞ -calculus in weighted spaces of the Stokes operator is established used to control fractional powers of the Stokes operator.

- 73 Miho Murata (Shizuoka Univ.) Global solvability of the Q-tensor model for nematic liquid crystals in
 Daniele Barbera (Politecnico di Torino) the half-space 10
 Yoshihiro Shibata (Waseda Univ.*)

Summary: In this talk, we consider the Q-tensor model of nematic liquid crystals, which couple the Navier–Stokes equations with a parabolic-type equation describing the evolution of the directions of the anisotropic molecules, in the half-space. The aim of this talk is to prove the global solvability for the Q-tensor model in the L_p - L_q framework. Our proof is based on Banach fixed point argument. To control the higher-order terms of the solutions, we prove the weighted estimates of the solutions for the linearized problem by the maximal L_p - L_q regularity. On the other hand, the estimates for the lower-order terms are obtained by the analytic semigroup theory.

- 74 Hirokazu Saito On the dispersive effect of internal gravity waves for the two-phase
 (Univ. of Electro-Comm.) Stokes semigroup 12
 Xin Zhang (Tongji Univ.)

Summary: In this talk, we consider the two-phase Stokes equations in the N -dimensional Euclidean space for $N \geq 2$ under the uniform gravitational field acting vertically downward. Our aim is to show the dispersive effect of internal gravity waves for the two-phase Stokes semigroup, associated with the two-phase Stokes equations, in terms of L_p - L_q decay estimates.

- 75 Takahiro Okabe (Yokohama Nat. Univ.) Domain dependence of the Helmholtz–Weyl decomposition on time
 Erika Ushikoshi (Yokohama Nat. Univ.) dependent domains 12

Summary: In this talk, we analyze the domain dependence of the each component in the Helmholtz–Weyl decomposition when the domain moves along to time. In our previous result, we established the domain dependence of components in case that the harmonic vector field has value to the normal direction on the boundary. In this talk, we consider the case that the harmonic vector field has a value to the tangential direction, which has a difficulty to deal with directly.

17:00–18:00 Talk Invited by Functional Equations Section

Tatsu-Hiko Miura (Hirosaki Univ.) Difference estimate for weak solutions to the Navier–Stokes equations in a thin spherical shell and on the unit sphere

Summary: We consider the Navier–Stokes equations in a three-dimensional thin spherical shell and on the two-dimensional unit sphere, and estimate the difference of weak solutions on the thin spherical shell and the unit sphere. Assuming that the weak solution on the thin spherical shell is a Leray–Hopf weak solution satisfying the energy inequality, we derive difference estimates for the two weak solutions by the weak-strong uniqueness argument. The main idea is to extend the weak solution on the unit sphere properly to an approximate solution on the thin spherical shell, and to use the extension as a strong solution in the weak-strong uniqueness argument.

Real Analysis

March 25th (Wed) Conference Room V

9:30–11:45

- 1 Soichi Ikeda (Kochi Univ. of Tech.) On certain composite functional equations associated with the Dirichlet function 15

Summary: In this talk, we study two composite functional equations

$$f(x) = xf(1 - x + f(x))$$

and

$$f(x + f(y)) = (x + f(y))f(1 - x + f(x)),$$

where $f : \mathbb{R} \rightarrow \mathbb{R}$. These functional equations are associated with the Dirichlet function. We study many general properties of these functional equations. In addition, we study monotonic solutions of these equations.

- 2 Toshiharu Kawasaki Some properties of the extended integral, IV 15
(Nat. Inst. of Tech., Kisarazu Coll.)

Summary: We would like to consider a case where the indefinite integral takes an infinite value. For that purpose, we extend the concept of integrals. In this talk, we discuss some properties of the extended integral.

- 3 Jun Kawabe (Shinshu Univ.) Characterization of the Choquet, Shilkret, and Sugeno integrals as integral functionals 15

Summary: In this presentation, we characterize the Choquet, Shilkret, and Sugeno integrals as integral functionals on function spaces. These integrals are particularly important concepts of integration under nonadditive measures. The features of our setting and the results obtained are as follows:

- (1) They are applicable even when the function space is a proper subspace of measurable functions, such as the family of continuous functions.
- (2) The domain of the representing measure does not require assumptions about structures such as lattices, rings, or fields.
- (3) Existing results for the case where X is a finite set are extended to general sets.
- (4) They include known results for the characterization of the Shilkret and Sugeno integrals.

- 4 Aoi Honda (Kyushu Inst. of Tech.) Uniform structures in Sugeno-type $\mathcal{L}_1(Su)$ spaces 15
Ryoji Fukuda (Oita Univ.)
Yoshiaki Okazaki
(Kyushu Inst. of Tech.*)

Summary: We investigate the uniform structure of the Sugeno-type function space $\mathcal{L}_1(Su)$. Using the translation-invariant functional $I(f, g)$ and building on the (p.g.p.)-condition for non-additive measures, we characterize when the associated family of entourages defines a genuine uniformity. Under quasimonotonicity, this occurs exactly when the underlying measure μ is uniform. We also identify the condition on μ under which $\mathcal{L}_1(Su)$ becomes an additive topological group.

- 5 Yukino Tomizawa The triangle inequality and geodesic convex quadrilaterals in complete Busemann spaces 15
(Niigata Inst. of Tech.)

Summary: This report examines whether the extension formula of a refinement of the triangle inequality for three vectors in a Banach space can be generalized to geodesic convex quadrilaterals, which are defined as the geodesic convex hulls of four points, in complete Busemann spaces.

- 6 Sachiko Atsushiba (Tokyo Woman's Christian Univ.) Approximation of fixed points of some generalized nonexpansive mappings 15

Summary: In this talk, we study approximation of fixed points of mean nonexpansive mappings by new iterative methods. We prove weak and strong convergence theorems for these mappings. Further, we prove convergence theorems for some generalized nonexpansive mappings.

- 7 Shunya Hashimoto (Kyoto Univ.) The weakest condition for a Kannan-type contraction mapping on a complete metric space 15
 Misako Kikkawa (Saitama Univ.)
 Shuji Machihara (Saitama Univ.)
 Aqib Saghir (Saitama Univ.)

Summary: In this talk, we investigate the weakest possible conditions for fixed point theorems concerning Kannan mapping. We employ the so-called CJM condition, which has been successfully applied to the classical Banach-type mappings by Ćirić. We show that the CJM condition is nearly the weakest possible to have a fixed point even for Kannan mapping, and that a slight modification yields the weakest condition.

14:15–15:30

- 8 Takeshi Iida (Fukushima Nat. Coll. of Tech.) Composition of the Orlicz fractional maximal operators 15

Summary: This talk explores the structure of Orlicz-fractional maximal operators. More precisely, we demonstrate that when a set of Young functions (Φ_1, Φ_2, Φ_3) meets a particular condition, the Orlicz fractional maximal operator $M_{\Phi_3, \alpha_1 + \alpha_2}$ provides pointwise control of the composition $M_{\Phi_1, \alpha_1} \circ M_{\Phi_2, \alpha_2}$. Using this theoretical context, we establish the boundedness of the fractional integral operator with homogeneous kernels within Orlicz–Morrey spaces.

- 9 Katsuo Matsuoka (Toho Univ.) New “weak” estimates of some sublinear operators on Herz spaces with variable exponent $\dot{K}_{q(\cdot)}^{\alpha, p}(\mathbb{R}^n)$ 15

Summary: In the investigation of the weak boundedness of some sublinear operators for the Herz spaces $\dot{K}_q^{\alpha, p}(\mathbb{R}^n)$, in order to obtain more precise estimates than the usual weak estimates, the author and the other (2008) introduced the new “weak” Herz spaces $\widetilde{W}\dot{K}_q^{\alpha, p}(\mathbb{R}^n)$ and showed the new “weak” boundedness on $\dot{K}_1^{\alpha, p}(\mathbb{R}^n)$. In this talk, we will extend the above new “weak” estimates to the sublinear operators satisfying another size condition, and further to one’s on the Herz spaces with variable exponent $\dot{K}_{q(\cdot)}^{\alpha, p}(\mathbb{R}^n)$.

- 10 Naoya Hatano (Univ. of Osaka) Weighted generalization of the Poincaré–Sobolev inequality 15

Summary: In this talk, we introduce a weighted generalization of the Poincaré–Sobolev inequality and, as an application, provide a refinement of Sobolev’s embedding theorem. Here, we use Morrey and Bourgain–Morrey spaces as the classes of weights.

- 11 Yoshihiro Sawano (Chuo Univ.) Moment-wise decomposition factorization property and ultradifferential operators 15
 Lenny Neyt (Univ. of Vienna)

Summary: We introduce the notion of moment-wise decomposition factorization property (MDFP). We establish the existence of MDFP by the use of the ultradifferential operators. As application, we characterize the bounded sets in a function space describing the smoothness of infinite order.

15:45–16:45 Talk Invited by Real Analysis Section

Ryoji Fukuda (Oita Univ.) Möbius transform and related developments

Summary: In this talk, I will discuss aspects of the Möbius transform for non-additive set functions. Originally, the Möbius transform is defined for set functions on finite sets, where it yields a one-to-one correspondence through its inverse transform. Using this representation, the Choquet integral can be expressed as a linear combination whose coefficients are the Möbius parameters, viewed as a finite set of unknowns. This enables us to identify the set function via linear regression. Moreover, when k -additivity is assumed, the number of parameters can be reduced, and this plays an important role in the practical handling of set functions in applications.

For infinite sets, various approaches have been proposed. In our research, we began by generalizing the notion of k -additivity. Using this framework, we investigated convergence theorems for a certain type of integrals and explored connections with strong null additivity. The Möbius transform can naturally be regarded as a finitely additive set function, and several researchers have developed σ -additive extensions of the Möbius representation. In our work, we have also studied σ -additive extensions from a slightly different perspective. This leads to a natural problem of extending a finitely additive set function to a σ -additive one in a general context.

I will present results obtained through joint research with Prof. Emeritus Y. Okazaki (Kyushu Institute of Technology) and Prof. A. Honda (Kyushu Institute of Technology), focusing on the topics described above.

March 26th (Thu) Conference Room V

9:00–12:00

- 12 Takeshi Fukao (Ryukoku Univ.) Asymptotic analysis of transmission problems with parameter-dependent Robin conditions 15

Summary: We study a transmission problem of Neumann–Robin type involving a parameter and perform an asymptotic analysis with respect to this parameter. The limits as the parameter goes to zero and to infinity correspond respectively to complete decoupling and full unification of the problem, and we obtain rates of convergence for both regimes. We also clarify the relationship between the asymptotic analysis with respect to this parameter and the asymptotics of the system in connection with the convergence of convex functionals known as Mosco convergence.

- 13 Osuke Shibata (Tokyo Univ. of Sci.) Global weak solvability of degenerate chemotaxis systems with threshold density 15
Tomomi Yokota (Tokyo Univ. of Sci.)

Summary: We study degenerate chemotaxis systems with threshold density. The purpose of this talk is to show global existence and uniqueness of weak solutions.

- 14 Daisuke Kubota (Chiba Univ.) Large-time behavior for inhomogeneous pseudo-parabolic total variation
Daiki Mizuno (Chiba Univ.) flows with time-dependent coefficients 15
Naotaka Ukai (Chiba Univ.)
Ken Shirakawa (Chiba Univ.)

Summary: In this study, we study the large-time behavior of solutions to an inhomogeneous pseudo-parabolic total variation flow with time-dependent coefficients. The problem extends previous results by incorporating the external forcing and the time-dependence of damping coefficients. Under suitable assumptions, we establish the existence and uniqueness of time-global solution and characterize their asymptotic properties as time tends to infinity. The limiting profiles are expected to be closely related to the solutions of the corresponding elliptic steady-state problem, which may admit nonsmooth solutions in the space of BV-functions. This work aims to provide a mathematical foundation for regular pseudo-parabolic approximating processes toward the nonsmooth BV-asymptotics, with potential applications to image processing and related optimization problems.

- 15 Hana Kakiuchi (Japan Women's Univ.) On behavior of free boundaries to two-phase Stefan problems with time dependent latent heat term 15
Toyohiko Aiki (Japan Women's Univ.)

Summary: In this talk we consider the one-dimensional free boundary problem describing a bread baking process. For the problem, the domain is assumed to be occupied by the bread consists of crumb, crust and the evaporation front, and unknown functions are the position of the front, the temperature field, and the water mass distribution. We have previously established uniqueness and global existence of solutions under the high regularity condition for initial data. Now, we aim to show that the crust region never vanishes by constructing stationary solutions and applying the comparison principle. In the proof, we improve a proof the comparison principle in order to overcome the difficulty arising from the time-dependence of the latent heat term.

- 16 Yoshiho Akagawa (Kyoto Univ. of Edu.) On the well-posedness of nonlinear strain kinematic hardening law models 15
Kazunori Matsui (Tokyo Univ. of Marine Sci. and Tech.)

Summary: This paper discusses a quasi-variational inequality in a plasticity model with nonlinear kinematic hardening law. From a physical perspective, it is natural that the yield surface depends on unknown variables. This model is designed to describe plastic deformation through nonlinear translation of the convex constraint characterized by time-nonlocal dependence of the unknown function, which differs from perfect plasticity models and generalizes the linear translation treated in previous studies to the nonlinear case. To establish the existence of a solution for this plasticity model with nonlinear kinematic hardening, we apply the Banach fixed point theorem to the solution operator, as in the linear case. The key point is that contractivity is obtained by appropriately setting the domain of the solution operator through a priori estimates of the solution.

- 17 Chiharu Kosugi (Yamaguchi Univ.) A class of energy conservation systems representing stretching and shrinking motions of the elastic closed curve with the compressible stress function 15

Summary: We consider initial and boundary value problems for the beam equation as the dynamical model for the elastic closed curves on the plane. Our aim of this talk is to prove existence and uniqueness of the problem under the generalized assumption to stress functions having the singularity in the energy conservation system. Keys of this proof are uniform estimates for the solution in the energy dissipative system and the lower bounded for the strain. We have already proved the solvability of the problem in the energy dissipative system. In this talk, we also show the error estimate between the solutions of the energy dissipative system and the energy conservation system.

- 18 Kota Kumazaki (Kyoto Univ. of Edu.) Construction of a strong solution to a system consisting of partial differential equations and free boundary problems 15

Summary: In this talk, we study a coupled system consisting of a parabolic equation describing moisture diffusion in a macroscopic domain and a free-boundary problem representing microscopic swelling in individual pores. The macroscopic domain is a bounded three-dimensional region, while each pore is modeled as a one-dimensional half-line attached to it. In our previous work, we established the existence and uniqueness of a weak solution. Here, we prove the existence and uniqueness of a strong solution. The proof relies on uniform estimates for solutions to an appropriately constructed approximation problem and on continuous dependence results. Using these, we construct a locally-in-time strong solution through a limiting procedure with respect to the approximation parameter.

- 19 Naotaka Ukai (Chiba Univ.) A parabolic energy gradient system with variable dependent coefficients
Daiki Mizuno (Chiba Univ.) 15
Ken Shirakawa (Chiba Univ.)
Harbir Antil (George Mason Univ.)

Summary: In this talk, we study a parabolic gradient system that integrates two models: the free-energy functional for anisotropic and orientation-adaptive image processing (cf. [Berkels et al., CAM Report 06-42 (2006)]; and the phase-field model of grain-boundary motion (cf. [Kobayashi et al., Physica D, 140 (2000)]). In the previous MSJ meeting, we studied a pseudo-parabolic version of this gradient system. In this talk, building on the time-discretization method for the pseudo-parabolic system, we proceed to the mathematical analysis of the corresponding parabolic system. In view of these, we now aim to clarify the well-posedness conditions for the parabolic system, and to develop an energy-dissipating time-discrete scheme that reduces the cost associated with higher-order derivatives.

- 20 Motoharu Hyodo (Niigata Univ.) Uniqueness and existence of entropy solutions to the Cauchy problem
Takanori Ebata (Niigata Univ.) for general balance laws 15
Hiroki Ohwa (Niigata Univ.)

Summary: In this talk, we study the uniqueness and existence of entropy solutions to the Cauchy problem for general balance laws. The uniqueness and existence of entropy solutions to this problem have been established by Kruřkov and others under certain regularity assumptions, such as the smoothness of the flux and source functions. We prove the uniqueness and existence of entropy solutions to the Cauchy problem without assuming such regularity conditions.

- 21 Takanori Ebata (Niigata Univ.) Well-posedness of entropy solutions to the Cauchy problem with con-
Sho Watabe (Niigata Univ.) tinuous flux functions 15
Hiroki Ohwa (Niigata Univ.)

Summary: In this talk, we consider the Cauchy problem for conservation laws with continuous flux functions and bounded, integrable initial data. We establish the well-posedness of entropy solutions to the Cauchy problem.

- 22 Sho Watabe (Niigata Univ.) L^1 contractive solutions for conservation laws whose flux functions are
Takahiro Kikuchi (Niigata Univ.) of locally bounded variation 15
Hiroki Ohwa (Niigata Univ.)

Summary: In this talk, we consider the Cauchy problem for conservation laws whose flux functions are of locally bounded variation. We show the existence of L^1 contractive solutions to the Cauchy problem.

14:15–16:40

- 23 Tobias Black (Paderborn Univ.) Global solvability and asymptotic behavior in a doubly degenerate
Shohei Kohatsu (Tokyo Univ. of Sci.) chemotaxis-consumption system 15
Duan Wu (Paderborn Univ.)

Summary: We consider global existence and asymptotic behavior of weak solutions to a doubly degenerate chemotaxis-consumption system. When the system has a usual consumption, previous results showed existence of global weak solutions only in the one-dimensional case, or the two-dimensional case with a convexity assumption. First, we use a new energy functional to establish existence results for the system with general consumption in higher dimensions without convexity assumptions. Second, we reveal large-time behavior of solutions, and show that the first component of solutions converges to a non-constant function, which is indeed characterized by weak solutions to the Neumann problem of a porous medium type equation.

- 24 Yutaro Chiyo (Tokyo Univ. of Sci.) Boundedness of radial solutions to a quasilinear parabolic-elliptic-elliptic attraction-repulsion chemotaxis system with flux limitation ··· 15
Kazuki Hasegawa (Tokyo Univ. of Sci.)
Tomomi Yokota (Tokyo Univ. of Sci.)

Summary: This talk deals with a quasilinear attraction-repulsion chemotaxis system with flux limitation. Boundedness of solutions to this system is known only in the one-dimensional case under some conditions on the parameters and initial data. However, there is no information about the question whether boundedness can be obtained in the higher-dimensional case. The purpose of this paper is to give an answer to this question in the higher-dimensional case.

- 25 Yoshihiro Sawano (Chuo Univ.)^b Maximal regularity in homogeneous Besov–Morrey spaces and applications to the Keller–Segel system ··········· 15
Toru Nogayama (Tokyo Univ. of Sci.)

Summary: We recall the definition of Besov–Morrey spaces and give some equivalent characterization. We propose an application to the Keller–Segel system.

- 26 Shunsuke Kurima (Tokyo Univ. of Sci.) A general nonisothermal and conserved phase field system with inertial term ··········· 15

Summary: There are some studies on conserved phase field systems. For example, Grasselli–Petzeltová–Schimperna (2007) and Colli–K. (2025) have studied nonisothermal and conserved phase field systems with inertial term. Gilardi–Rocca (2007) and Colli–K. (2020) have studied conserved phase field systems deduced from the entropy balance without inertial term. Ito–Kenmochi–Kubo (2003) have studied a conserved Penrose–Fife phase field system without inertial term. In this talk we prove existence of weak solutions to a general nonisothermal and conserved phase field system with inertial term.

- 27 Yoshihito Nakajima (Tohoku Univ.) Solvability of time-fractional abstract evolution equations involving time-dependent m -accretive operators and its applications ········· 15

Summary: This talk deals with abstract time-fractional evolution equations in real Banach spaces whose dual spaces are uniformly convex. The main results concern the existence of strong solutions to abstract evolution equations governed by time-dependent m -accretive operators involving time-fractional derivatives. The abstract results are also applied to certain time-fractional partial differential equations.

- 28 Shun Uchida (Oita Univ.)^b Doubly nonlinear parabolic equation with perturbation term ······· 15

Summary: In this talk, we consider the initial boundary value problem for a doubly nonlinear parabolic equation with nonlinear perturbation, subject to homogeneous Dirichlet boundary conditions. Our main goal is to relax the growth condition on the nonlinear term and to reduce the constraints on the exponent range, allowing the results to cover both singular and degenerate cases. The proof relies on an L^∞ -estimate for a time-discrete problem, obtained in earlier work, combined with the L^∞ -energy method.

- 29 Akio Ito Quasi-variational evolution inclusions on real Hilbert spaces with conservative quantities ········· 15

Summary: We consider a Cauchy problem of a quasi-variational evolution inclusion with a conservative quantity on a real Hilbert space. Actually, we construct a certain real Hilbert space in which the conservative quantity is taken into consideration. By doing so, we can apply the general theories for quasi-variational evolution inclusions and show the existence of strong local-in-time solutions which is established in the paper. Perturbation theory of evolution inclusions on real Hilbert spaces with quasi-variational structures for inner products, *Rend. Mat. Appl.*, 43 (2022), no. 3, 173–249.

- 30 Ken Shirakawa (Chiba Univ.) 1D optimal control problem with state and control constraints motivated by grain boundary motion 15
 Hiroshi Watanabe (Oita Univ.)
 J. Salvador Moll (Univ. Valencia)

Summary: In this talk, we study a 1D (one-dimensional) optimal control problem motivated by grain-boundary motion. The state system is a simplified 1D version of the phase-field model. On this basis, the optimal control problem is formulated under a state constraint imposed on the range of the state variable and a control constraint on the domain of the cost functional. The objective of this study is to develop an optimal control framework, building upon the recent uniqueness result for the 1D state system. Under suitable assumptions, the main focus will be on the existence of optimal controls and the necessary optimality conditions.

- 31 Daiki Mizuno (Chiba Univ.) H^2 -regularity of solutions to anisotropic singular diffusion equation
 Ken Shirakawa (Chiba Univ.) under periodic boundary condition 15

Summary: In this talk, we consider an anisotropic singular diffusion equation under periodic boundary condition, which is associated with mathematical models such as grain boundary motion and image denoising process. While its solvability is known from the theory of abstract evolution equations, this study focuses on the regularity theory of its solutions. To guarantee the H^2 -regularity for the solutions, previous studies relied on isotropic diffusions to estimate boundary integrals. However, under the periodic boundary condition, such boundary terms do not appear, which enables an extension of preceding results to anisotropic cases. Based on these, we set our goal to discuss the sufficient conditions for the H^2 -regularity, the uniqueness of solutions, and the fine properties under special settings.

16:50–17:50 Talk Invited by Real Analysis Section

Takahito Kashiwabara (Univ. of Tokyo) H^2 -regularity for variational inequalities of Navier–Stokes type

Summary: We consider strong solvability of parabolic variational inequalities (VIs) of Navier–Stokes type. H. Brezis (1972) proved existence and uniqueness of a strong solution in the Kiselev–Ladyzhenskaya class, assuming a two-dimensional spatial domain and the cancelation property for the convection term (which often reads $B(u, u, u) = 0$ using a trilinear form). However, its H^2 -regularity in space was unknown. In this talk, we construct a (local-in-time) strong solution having the H^2 -regularity to the Navier–Stokes VI in the maximal L^2 -regularity class and in the Kiselev–Ladyzhenskaya class for the three-dimensional domain, under the additional assumption that the stationary Stokes version of the VI has an H^2 -regularity structure. Our construction is based on a semi-implicit discretization in time (Rothe’s method) and does not use the cancelation property, thus allowing for Neumann-type boundary conditions in the normal direction. Regarding the regularity assumption for the stationary Stokes version of the VI, we show that Bingham models for visco-plastic fluids satisfy it if the perfect slip boundary condition is imposed and if the yield stress vanishes on the boundary.

Functional Analysis

March 23rd (Mon) Conference Room VII

9:30–11:45

- 1 Shuji Watanabe (Sanjo City Univ.) The first-order phase transition and the entropy gap in the BCS model of superconductivity with a uniform external magnetic field 15

Summary: We deal with a type I superconductor in a uniform external magnetic field. We established the BCS model of superconductivity with the external magnetic field. On the basis of the implicit function theorem, we show that there is a unique magnetic field (the critical magnetic field) given by a smooth function of the temperature and that there is also a unique nonnegative solution (the gap function) to the BCS gap equation given by a smooth function of both the temperature and the external magnetic field. Using the grand potential, we show that the phase transition from normal conductivity to superconductivity in a type I superconductor is of the first order. Moreover, we obtain the explicit expression for the entropy gap.

- 2 Shosuke Omori (Hosei Univ.) Rigged Hilbert space formulation for a quasi-Hermitian operator in composite system 15

Summary: This talk focuses on the rigged Hilbert space (RHS) formulation that describes Dirac's bra-ket formalism for a quasi-Hermitian quantum composite system. We propose an RHS that provides the bra and ket vectors and the spectral decomposition of the quasi-Hermitian operator. We also demonstrate that all descriptions by the bra-ket formalism are fully formulated within the dual spaces. These dual spaces are then used to address the issue of defining the adjoint of a quasi-Hermitian operator in non-Hermitian composite systems.

- 3 Makoto Nakamura (Univ. of Osaka) Nonexistence of global weak solutions of Klein–Gordon equations with gauge variant semilinear terms in FLRW spacetimes 10
Takuma Yoshizumi (Univ. of Osaka)

Summary: The Cauchy problem of Klein–Gordon equations with gauge variant semilinear terms in FLRW spacetimes is considered. Nonexistence of global weak solutions is reported.

- 4 Makoto Nakamura (Univ. of Osaka) On the asymptotic behavior of the semilinear Schrödinger equation in
Eiichi Sugimoto (Univ. of Osaka) FLRW spacetimes in one spatial dimension 10

Summary: The Cauchy problem of the semilinear Schrödinger equation is considered in FLRW spacetimes. The asymptotic behaviors of global solutions are characterized by the behaviors of free solutions.

- 5 Yukihide Tadano (Univ. of Hyogo) Dispersive estimates for the discrete Schrödinger equation on a honey-
Changhun Yang (Chunbuk Nat. Univ.) comb lattice 15
Younghun Hong (Chung-Ang Univ.)

Summary: We consider the long time behavior of solutions for discrete Schrödinger equation defined on a honeycomb lattice. In this talk, we show that the points where the Hessian of phase function associated to the free propagation of the discrete Schrödinger equation are identified with the three curves in the frequency space. We also give the ℓ^1 to ℓ^∞ dispersion estimates for the solution depending on frequency localization, and we obtain the slowest decay is of order $|t|^{-\frac{2}{3}}$.

- 6 Mitsuteru Kadowaki On scattering for three dimensional Schrödinger operators with absorb-
(Univ. of Shiga Pref.) ing potentials 15

Summary: In this talk, we consider scattering problem for three dimensional Schrödinger operators with absorbing potentials.

- 7 Itaru Sasaki (Shinshu Univ.) Holomorphy of ground states for the translation invariant Pauli–Fierz
 Yasumichi Matsuzawa (Shinshu Univ.) model in the dipole approximation 15
 Shinnosuke Izumi (Shinshu Univ.)
 Kouta Imura
 (Nagano Pref. Fujimi High School)

Summary: We study a quantum system where a free electron interacts with light within the dipole approximation. The model allows a fiber decomposition with respect to the electron’s momentum. We show that the ground state and its energy for each fiber Hamiltonian depend holomorphically on the coupling parameter corresponding to the electric charge, within a strip-shaped region of finite width containing the real axis. As a result, the radius of convergence of the perturbation expansion is given by half the width of this strip. This means that the perturbation expansion of the ground state in the charge variable is convergent.

- 8 Yuki Tsujimoto (Kyushu Univ.) The evaluation of the spatial decay of the ground state of the Pauli–
 Fumio Hiroshima (Kyushu Univ.) Fierz model from below. 15

Summary: In this talk, we evaluate the spatial decay of the ground state of the Pauli–Fierz Hamiltonian from below by using a path integral method. The evaluation from above is known, but it from below is not known and non-trivial. It can be obtained by using photon number rotations and a geodesic distance. As a result, the order of the spatial decay of the ground state is determined.

- 9 Masao Hirokawa (Kyushu Univ.) Asymptotics for anisotropic Rabi models 15
 Fumio Hiroshima (Kyushu Univ.)
Dong Yun Lee (Kyushu Univ.)

Summary: A one-parameter family of self-adjoint operators interpolating between the quantum Rabi Hamiltonian and its rotating-wave approximation is studied. A mathematically rigorous treatment of such interpolations has been lacking. Motivated by the physical claim that counter-rotating terms dominate at strong coupling, we analyze the limit in which the coupling constant of the anisotropic Rabi model tends to infinity. Our results provide an operator-theoretic description of this limit and clarify the spectral evolution from the rotating-wave approximation to the full Rabi model.

14:15–15:15

- 10 Wataru Ichinose (Shinshu Univ.) A rigorous mathematical formulation of time-continuous quantum mea-
 surement based on Feynman’s and von Neumann’s postulates 15

Summary: We develop a rigorous mathematical formulation of time-continuous quantum measurement based on the postulates of Feynman and von Neumann. Feynman’s path-integral approach describes evolution as a superposition of histories, by imposing restrictions on the path space corresponding to continuous observation. Caves and Mensky previously proposed the restricted Feynman path integrals on phenomenological grounds. The aim of this talk is to prove that the restricted Feynman path integrals naturally emerge from Feynman’s postulate under a simple approximation, and also from von Neumann’s instantaneous projection postulate. Our framework is applied to spin systems and to the mathematical formulation of the multi-slit interference, the quantum Zeno effect, and the Aharonov–Bohm effect. *The results of this talk have been published in Rev. in Math. Phys.* 36 (2024).

- 11 Kenta Higuchi (Gifu Univ.) Asymptotic analysis on the resonant tunneling effect for quantum walks 15

Summary: The resonant tunneling effect for quantum walks that depend smoothly on a small parameter $\varepsilon \geq 0$ is considered. The transmission probability $T_\varepsilon(z)$ is defined as a function of the spectral parameter $z \in \mathbb{S}^1 = \{z \in \mathbb{C}; |z| = 1\}$. The spectral parameter is related by $z = e^{-i\lambda}$ to the frequency $\lambda \in \mathbb{T} = \mathbb{R}/\mathbb{Z}$ of the oscillation. In our setting, transmission probability is zero function $T_0(z) \equiv 0$ for $\varepsilon = 0$. However, in the limit $\varepsilon \downarrow 0$, $T_\varepsilon(z)$ does not converge to $T_0(z)$ at each z which is asymptotically approached by a quantum resonance. Moreover, under a certain symmetry condition, it even asymptotically approaches one. This corresponds to the resonant tunneling effect.

- 12 Hisashi Morioka (Ehime Univ.) Resonant scattering for tunable quantum walks on graphs with tails 15
 Kenta Higuchi (Gifu Univ.)
 Ryuta Ishikawa (ABeam Systems Ltd.)
 Etsuo Segawa (Yokohama Nat. Univ.)
 Eijirou Yoshimura (Ehime Univ.)

Summary: We study the resonant scattering for discrete time quantum walks on graphs with some tails. In our arguments, we reduce the study of resonances to the perturbation of eigenvalues of a finite rank matrix associated with the internal graph. Then we can apply the Kato’s perturbation theory of matrices, and the reduction process of generalized eigenspaces allows us to derive an explicit asymptotic expansion of the scattering matrix. As a consequence, we obtain the resonant scattering at the resonant energies.

- 13 Toshimitsu Takaesu (Gunma Univ.) On the binding condition of a quantum field model by the decay of particle’s potential 15

Summary: The system of a particle interacting with a Bose field is investigated. It is proven that the binding condition holds by the decay of particle’s potential.

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

- Daichi Komori (Kindai Univ.) An application of Čech–Dolbeault cohomology to the symbol theory of pseudodifferential operators

Summary: The symbol theory of pseudodifferential operators was introduced by Aoki and Kataoka for the analytic study of such operators. Using the Borel–Laplace transformation, they constructed a morphism from the sheaf of pseudodifferential operators to the sheaf of symbols and proved that this morphism is an isomorphism. Furthermore, by means of this symbol theory, they established the invertibility theorem for pseudodifferential operators, among other results. In this talk, I will review some problems in their foundational theory along with its historical background, and present a solution based on the Čech–Dolbeault cohomology. The theory of Čech–Dolbeault cohomology was introduced by Honda, Izawa, and Suwa, and provides a new approach to computing relative cohomology with coefficients in the sheaf of holomorphic functions.

March 24th (Tue) Conference Room VII

9:45–10:30

- 14 Yasufumi Hashimoto Full-trace subgroups of congruence subgroups $\Gamma_0(2), \Gamma(2)$ 15
 (Univ. of Ryukyus)

Summary: In 2016, Lakeland generated full-trace subgroups of the modular group. In this talk, we generate full-trace subgroups for the congruence subgroups $\Gamma_0(2), \Gamma(2)$.

- 15 Ryosuke Nakahama (NTT Inst. for Funda. Math.) On spectral zeta functions of one-, two-photon quantum Rabi models and non-commutative harmonic oscillators 15

Summary: The quantum Rabi model is a fundamental model in quantum optics, describing an interaction between a photon and an atom, and the non-commutative harmonic oscillator is a purely mathematical model introduced by Parmeggiani–Wakayama ('02). In this talk, the speaker gives explicit formulas for the special values of the spectral zeta functions of these models at positive integer points.

- 16 Toshihisa Kubo (Ryukoku Univ.) The homomorphisms between Verma modules for $\mathfrak{sl}(3, \mathbb{C})$ 15
 Víctor Pérez-Valdés (Ryukoku Univ.)

Summary: The homomorphisms φ between (full) Verma modules for a finite-dimensional complex simple Lie algebra \mathfrak{g} are classical objects in representation theory. For example, those homomorphisms φ were classified by BGG–Verma around in 1970.

In this talk, we will revisit the well-known topic from the viewpoint of the F-method. More specifically, we will discuss the classification and construction of the homomorphisms φ between Verma modules for $\mathfrak{g} = \mathfrak{sl}(3, \mathbb{C})$ via the algebraic Fourier transform F_c . It turned out that, surprisingly, a classical tridiagonal determinant called the Cayley continuant appeared in the explicit formulas of the singular vectors. If time permits, the inverse F_c^{-1} of the Fourier transform F_c and the factorization formulas of φ will also be discussed.

10:45–11:45 Talk Invited by Functional Analysis Section

Yohei Ito (Aoyama Gakuin Univ.)^b Regular and irregular Riemann–Hilbert correspondences for \mathcal{D} -modules

Summary: The original Riemann–Hilbert problem asks whether there exists a Fuchsian differential equation having a prescribed monodromy representation. In 1984, Professor M. Kashiwara proved there exists an equivalence of categories between the triangulated category of regular holonomic \mathcal{D} -modules and that of \mathbb{C} -constructible sheaves, which is a solution to the Riemann–Hilbert problem for regular holonomic \mathcal{D} -modules. This correspondence is now called the regular Riemann–Hilbert correspondence. The problem of extending this correspondence to cover the case of irregular holonomic \mathcal{D} -modules had been open for 30 years. Professors A. D’Agnolo and M. Kashiwara made a breakthrough in this problem after two another groundbreaking developments: the first one is the theory of ind-sheaves (and subanalytic sheaves) by Professors M. Kashiwara and P. Schapira, and the second one is the theory of irregular meromorphic connections by Professor K. S. Kedlaya (in the analytic setting) and Professor T. Mochizuki (in the algebraic setting).

In this talk, I would like to explain the regular Riemann–Hilbert correspondence and results of Professors A. D’Agnolo and M. Kashiwara. Moreover, I would like to introduce some my attempts to the problem of extending the regular Riemann–Hilbert correspondence.

March 25th (Wed) Conference Room VII

9:30–11:25

- 17 Daisuke Hirota (Nat. Inst. of Tech., Tsuruoka Coll.) On surjective isometries on the unit sphere of direct sums of Banach spaces and Tingley’s problem 15

Summary: We investigate Tingley’s problem for surjective isometries between the unit spheres of direct sums of Banach spaces, where each component is an extremely \mathbb{C} -regular subspace of a continuous function space $C(K)$. Our aim is to clarify which kinds of properties, such as algebraic and geometric structures, are preserved under the existence of a surjective isometry between the unit spheres. We mainly treat the ℓ_1 and ℓ_p sums of such spaces for p in $(1, \infty)$ with $p \neq 2$, and present some related results and examples. Further perspectives on these problems are also discussed.

- 18 Nikita Evseev (Okinawa Inst. of Sci. and Tech. Grad. Univ.) Weak weak* time derivatives 15
 Malte Kampschulte (Charles Univ.)
 Alexander Menovschikov (HSE Univ.)

Summary: We develop a version of weak derivative for functions whose values lie in a time-dependent family of Banach spaces.

- 19 Yusuke Isono (Kyoto Univ.) Cocycle perturbations and ergodicity for actions on type III factors 15

Summary: We study cocycle perturbations of state-preserving actions on type III₁ factors. Extending Marrakchi–Vaes’s theorem for type II₁ factors, we show that a state-preserving \mathbb{Z} -action on a type III₁ factor with trivial bicentralizer admits a unitary cocycle, whose perturbation is an ergodic action.

- 20 Masaru Nagisa (Chiba Univ.* / Ritsumeikan Univ.) Law of large numbers for non-linear traces of the Choquet type on finite factors 15
 Yasuo Watatani (Kyushu Univ.*)

Summary: We introduced non-linear traces of the Choquet type on semi-finite factors \mathcal{M} as a non-commutative analog of the Choquet integral for non-additive measures. We need a weighted dimension function on the projections of \mathcal{M} , which is an analog of a monotone measure. We study the law of large numbers for non-linear traces of the Choquet type on finite factors \mathcal{M} . Since averages do not converge in general, we study the range of their accumulation points, that is, we estimate their limit supremum and limit infimum. We examine the trials of sequences consisting of self-adjoint operators, which appear in coin toss or Powers’ binary shifts. We have also found some unexpected examples of Powers’ binary shifts which satisfy what we call *the uniform norm law of large numbers*. This is an attempt at non-linear and non-commutative probability theory on matrix algebras and factors of type II₁.

- 21 Takehiko Mori (Chiba Univ.) Dynamical systems with bounded condition and C*-algebras 15

Summary: By introducing the totally uniqueness condition for maps, we establish a one-to-one correspondence between the family of invariant sets for the α -function (e.g. the α -map, also known as the Collatz map), where α and β are arbitrary positive odd numbers, and the family of reducing subspaces for the associated α -algebra. This extends the connection between the Collatz conjecture (also known as the α -problem) and the irreducibility of its associated α -algebra. We also introduce homomorphisms between dynamical systems with bounded conditions that preserve the structures of these dynamical systems. We prove the existence of an isomorphism between their associated α -algebras is proven for every isomorphism between dynamical systems with bounded condition.

- 22 Nanami Hashimoto (Keio Univ.) Equivalence of categories of KK-theory or E-theory for C*-algebras over topological spaces by reflection functors 15

Summary: For finite T_0 -spaces X and Y satisfying certain conditions, we introduce reflection functors between the categories $\mathfrak{KR}(X)$ and $\mathfrak{KR}(Y)$ of ideal-related KK-theory, as well as between the categories $\mathfrak{E}(X)$ and $\mathfrak{E}(Y)$ of ideal-related E-theory. These functors are reminiscent of the BGP-reflection functors in the representation theory of quivers. Consequently, whenever the undirected graphs associated with X and Y are the same tree, the reflection functors induce equivalences $\mathcal{B}(X) \simeq \mathcal{B}(Y)$, $\mathfrak{E}(X) \simeq \mathfrak{E}(Y)$, and $\mathcal{B}_E(X) \simeq \mathcal{B}_E(Y)$ for the KK-theoretic bootstrap categories, ideal-related E-theory, and the E-theoretic bootstrap categories, respectively.

- 23 Narutaka Ozawa (Kyoto Univ.) Proximality and selflessness for group C*-algebras 15

Summary: The selfless property for C*-algebras was introduced by Robert and known to imply many important properties such as simple, stable rank one, strict comparison, unique trace in the finite case and simple purely infinite in the infinite case. I will give a survey of the selfless property for C*-probability spaces and talk my recent result showing that a large class of C*-algebras are selfless.

14:15–15:15

- 24 Hiroyuki Osaka (Ritsumeikan Univ.) Generalized Hellinger divergences generated by monotone functions · · 15
Hiroki Shudo (Ritsumeikan Univ.)

Summary: In this paper we investigate quantum Hellinger type divergences which were studied by Bhatia–Gaubert–Jain (2019), Pitrik–Virosztek (2020), and Dinh–Lie–Osaka–Phan (2025). In particular, when $g : [0, \infty) \rightarrow [0, \infty)$ is a convex function defined by the form $g(t) = \alpha t^s$ ($\alpha > 0, s \in [1, 2]$) and $f : [0, \infty) \rightarrow [0, \infty)$ is an operator monotone function with $f'(1) = \lambda \in [0, 1]$, we introduce the quantum quantitative $\Phi_{g,\sigma}(A, B) = \text{Tr}(g(A\nabla_\lambda B - A\sigma_f B))$ for positive definite matrices A and B , and show that $\Phi_{g,\sigma}$ is a quantum divergence in the sense of Bhatia–Gaubert–Jain and also show that it is jointly convex and satisfies the data processing property by a trace preserving positive unital map Φ , that is, $\Psi_{g,\sigma}(A, B) \geq \Psi_{g,\sigma}(\Phi(A), \Phi(B))$.

- 25 Yuki Seo (Osaka Kyoiku Univ.) Rescaled \natural_α -Rényi divergences of all real orders · · · · · 15

Summary: In this talk, we show that the rescaled \natural_α -Rényi divergence extends to the extended orders $\alpha = 0, 1$, and it is defined for any real orders α . Moreover the positivity and equality condition hold for all α . We show that data processing inequality holds for all $\alpha \in [-1, 2] \setminus \{0, 1\}$ and joint convexity holds for $\alpha \in [0, 1]$.

- 26 Taro Sogabe (Kyoto Univ.)^b A presentation of certain Cuntz–Pimsner algebra and unique ergodicity
Kengo Matsumoto (Joetsu Univ. of Edu.) of certain ergodic automorphism · · · · · 15

Summary: In our previous work, we gave a Pimsner construction of an ergodic automorphism of the unital Kirchberg algebras. In the construction, we observed that there is a state that is invariant under the ergodic automorphism action. We simplify a presentation of the above Pimsner construction and show that there is a unique state that is invariant under the action of the ergodic automorphism by using this simplified presentation.

- 27 Ryoya Arimoto (Kyoto Univ.) Topological full groups arising from Cuntz and Cuntz–Toeplitz algebras
Taro Sogabe (Kumamoto Univ.) and their crossed products · · · · · 15

Summary: We investigate the topological full groups arising from the Cuntz and Cuntz–Toeplitz algebras and their crossed products with the Cartan subalgebras of Cuntz and Cuntz–Toeplitz algebras. We study the normal subgroups and abelianization of these groups and completely determine the KMS states of the reduced crossed products with respect to some canonical gauge actions.

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

- Masatoshi Ito (Maebashi Inst. of Tech.) Various weighted means and their relations

Summary: For two positive numbers or positive operators on a Hilbert space, the arithmetic, geometric and harmonic means are well known and have their weighted versions. Besides them, there exist many other means, for example, the logarithmic, Heinz, power difference, power, Heron means. But weighted versions of some means were not investigated. In this talk, we study various weighted means and their relations. Firstly, as a definition of weighted means, we propose the notion of a transpose symmetric path of t -weighted means. Next, we discuss relations among weighted means stated above by introducing new families of operator means including the weighted logarithmic mean by Pal, Singh, Moslehian and Aujla (2016). In this argument, we can newly introduce the weighted Heinz mean and the weighted power difference mean.

Statistics and Probability

March 23rd (Mon) Conference Room VIII

9:30–11:50

- 1 Zijian Xu (Fukuoka Univ.) Monge solutions and uniqueness in multi-marginal optimal transport with hierarchical jumps 15

Summary: We introduce a novel framework for multi-marginal optimal transport (MOT), termed Hierarchical Jump MOT (HJMOT), which generalizes the classical MOT by allowing mass to “jump” over intermediate spaces. This is achieved by augmenting each intermediate space with an isolated point, granting the transport path greater flexibility. Formulated on Polish spaces, we establish the existence of Kantorovich solutions and, under sequential differentiability and a twistedness condition, the existence and uniqueness of Monge solutions. The framework is robustly extended to smooth manifolds, where the core results hold under natural geometric adaptations of the assumptions. This provides a unified perspective for studying deterministic transport across diverse settings.

- 2 Takuya Nakagawa (Ritsumeikan Univ.) $L^{\alpha-1}$ distance between two one-dimensional stochastic differential equations with drift terms driven by a symmetric α -stable process 15

Summary: This paper develops a quantitative stability theory for one-dimensional SDEs with non-zero drift and time-dependent coefficients, driven by a symmetric α -stable process for $\alpha \in (1, 2)$. We establish the first explicit convergence rates for this broad class. Our main result is a Hölder-type estimate for the $L^{\alpha-1}(\Omega)$ distance between two solution paths, which quantifies stability with respect to the initial values and coefficients. In this estimate, the distance between coefficients is measured by a weighted integral norm constructed from the transition probability density of one of the solutions. The proof is based on a refined analysis of a mollified auxiliary function, for which we establish a new, sharper derivative estimate to control the drift terms.

- 3 Kaneharu Tsuchida (Nat. Defense Acad. of Japan) Smooth measures and positive continuous additive functionals attached to a compact nest 15
Takumu Ooi (Tokyo Univ. of Sci.)
Toshihiro Uemura (Kansai Univ.)

Summary: Positive continuous additive functionals (PCAFs) and smooth measures play a fundamental role in the transformation theory of stochastic processes and the fine analysis of Markov processes. These two objects are related through a one-to-one correspondence known as the Revuz correspondence, established within the framework of Dirichlet forms. Classical studies have mainly focused on Radon measures of finite energy integral. However, when dealing with more general Markov processes, one must consider smooth measures that are not Radon —sometimes nowhere Radon. This talk investigates the convergence relationship between general smooth measures and the corresponding PCAFs, using the concept of compact nests as the key analytical tool.

- 4 Kohki Iba (Univ. of Osaka) Conditioning and penalization for Lévy processes 15

Summary: The conditioning problem asks how the behavior of a stochastic process changes when it is conditioned not to visit a specified set. The (local-time) penalization problem is an extension: informally, it studies the behavior under a weighting that penalizes the accumulation of local time on a given set, thereby discouraging visits to that set. In this talk, for one-dimensional Lévy processes, I will present results on conditioning to avoid a bounded F_σ -set and on penalization that makes visits to finitely many points unlikely.

- 5 Arturo Kohatsu-Higa (Ritsumeikan Univ.) The derivative of expectations with respect to the initial value and integration by parts formulas for affine processes 15
Yuma Tamura (Ritsumeikan Univ.)

Summary: Affine processes play an important role in mathematical finance and other applied areas due to their tractable structure. In this talk, we present probabilistic representations and integration by parts (IBP) formulas for expectations involving affine processes. These formulas are expressed in terms of expectations of affine processes with modified parameters and are derived using Fourier analytic techniques and characteristic functions. The methodology can be applied to the classic Cox–Ingersoll–Ross (CIR) model, a model for interest rates in mathematical finance, where the initial value derivative corresponds to one of the “Greeks” used in option pricing in mathematical finance. The result can contribute to improving the speed of Greeks computation.

- 6 Ryoichiro Noda (Kyoto Univ.) Convergence of space-time occupation measures of Markov processes 15

Summary: We introduce space-time occupation measures (STOMs) as an extension of positive continuous additive functionals of Markov processes, and study their convergence. We show that if a sequence of Markov processes, their heat kernels, and the corresponding Revuz measures converge, and if these Revuz measures satisfy a uniform local Kato-type condition, then the associated STOMs converge jointly with the laws of the processes.

- 7 Yuji Hamana (Univ. of Tsukuba) Joint distribution of the hitting time to a square-root boundary and the hitting site for Brownian motion 10

Summary: We consider the first hitting time to a square-root boundary for Brownian motion and give a formula for the joint distribution of the hitting time and the hitting place by means of Gegenbauer polynomials and the density functions of the hitting time for higher dimensions.

- 8 Shota Osada (Kagoshima Univ.) On the ergodicity of unlabeled dynamics associated with random point fields 15

Summary: We study ergodicity of configuration-valued Markov processes defined by Dirichlet forms with standard carré du champ. While previous results assume extremality in Gibbsian random point fields, number-rigidity, or tail-triviality, we show that only tail-triviality is essential. Using a σ -field \mathcal{G}_∞ , we decompose random point fields and prove ergodicity for each component. In particular, \mathcal{G}_∞ -triviality implies ergodicity. Our result unifies existing criteria for ergodicity of infinite particle systems and applies to Poisson, Gibbs, determinantal, and Coulomb point fields.

- 9 Nariyuki Minami (Keio Univ.*) On spectral multiplicity of random one-dimensional Schrödinger operators 15

Summary: We report that the results of D. J. Gilbert (Proc. Roy. Soc. Edinburgh, 128A, 549–584, 1998) have direct applications to some one-dimensional Schrödinger operators with random potentials. In particular, if the Lyapunov exponent of an ergodic Schrödinger operator H vanishes on a set of positive Lebesgue measure, then the absolutely continuous spectrum of H , whose existence is guaranteed by Kotani’s theory, has multiplicity 2.

14:15–15:15 Award Lecture for the 2025 MSJ Analysis Prize

David Croydon (Kyoto Univ.) Cover times of random walks on some special trees

Summary: The cover time of a stochastic process is the time required for the process to visit every point in its state space. Motivated by applications in computer science, where the cover time can represent, for example, the running time of a randomized algorithm, there has been extensive research on how cover times scale for sequences of random walks on graphs of increasing size. After reviewing some of the major progress in this area, I will present several recent results concerning the cover time of random walks on critical Galton–Watson trees, the random conductance model on such trees, and the biased random walk on the binary tree. In each setting, the scaling limit of the cover time is random and can be expressed in terms of the cover time of a limiting stochastic process on a fractal state space. (In certain regimes of the random conductance model, the limiting process is degenerate.) The talk is based on various articles, including joint work with George Andriopoulos (NYU Abu Dhabi), Vlad Margarint (Charlotte), Laurent Menard (Paris Nanterre), and Marc Perlade (ENS Paris).

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

Kei Noba (Univ. of Osaka) On the scale functions of stochastic processes with no positive jumps

Summary: A one-dimensional Levy process without positive jumps is called a spectrally negative Levy process. For such processes, the associated scale function allows one to express the Laplace transform of the first exit time from an interval, as well as the potential measure when the process is killed upon exiting the interval. Owing to this utility, scale functions have been applied in various studies concerning the behavior of spectrally negative Levy processes. In recent years, motivated by their broad applicability, there has been growing interest in defining analogous scale functions for other real-valued stochastic processes without positive jumps, and in studying their properties. In this talk, I will briefly explain the properties and applications of scale functions for spectrally negative Levy processes, and introduce related results concerning scale functions for other processes without positive jumps, including some of my own work.

March 24th (Tue) Conference Room VIII

9:30–11:50

- 10 Ryosuke Sato (Hokkaido Univ.) Conservation operator processes from representation theory and their CLT 15

Summary: In this talk, we will study conservation operator processes, which are operator-valued processes acting on symmetric Fock spaces and behave similarly to compound Poisson processes. We show a CLT-type result for these processes in a general setting and discuss concrete examples related to asymptotic analysis in representation theory.

- 11 Noriyoshi Sakuma (Univ. of Osaka) On generalized Meixner-type free gamma distributions 2 —finite free
Yuki Ueda (Hokkaido Univ. of Edu.) probability— 10

Summary: Our main goal is to explain how the generalized Meixner-type free gamma distributions naturally arise as the limiting distributions governing the zeros of Jacobi and Bessel polynomials when their degree becomes large. The key tool is the finite S-transform, recently introduced by the second author, which serves as a finite-dimensional analogue of Voiculescu’s S-transform.

- 12 Ryo Inayoshi (Meijo Univ.) Operator information quantities of semigroups associated with functions of the number operator 15

Summary: In this talk, we present recent developments on the operator information quantity acting on white noise functionals. In particular, we give a stochastic expression of the operator information quantity of a semigroup generated by some function of the number operator through a white noise delta distribution centered at an infinite dimensional Ornstein–Uhlenbeck process.

- 13 Yushi Hamaguchi (Kyoto Univ.) Markovian lifting and ergodicity for stochastic Volterra equations 15

Summary: The solution of a stochastic Volterra equation (SVE) is generally a (finite-dimensional) stochastic process that is non-Markovian and non-semimartingale. However, by lifting it to an infinite-dimensional space, a Markov process on a certain Hilbert space (Markovian lift) is obtained. Furthermore, the solution of the original SVE can be recovered as a projection of this Markovian lift. The purpose of this research is to obtain a limit theorem for the solution of the original SVE by investigating the long-time asymptotic behavior of the Markovian lift. Specifically, we show the exponential weak ergodicity for the Markovian lift, and as a consequence we show the ergodicity for a stationary solution of the original SVE.

- 14 Hirotatsu Nagoji (Hiroshima Univ.) Strong uniqueness of Dirichlet operators related to stochastic quantiza-
Hiroshi Kawabi (Keio Univ.) tion for the $\exp(\Phi)_2$ -model 15

Summary: We consider Dirichlet forms related to stochastic quantization for the $\exp(\Phi)_2$ -model on the torus. We show strong uniqueness of the corresponding Dirichlet operators by applying an idea of (singular) SPDEs.

- 15 Soma Nishino (Tokyo Metro. Univ.) A central limit theorem for the stochastic cable equation 15

Summary: There has been growing interest in the asymptotic behavior of spatial averages of solutions to SPDEs, including the stochastic heat and wave equations. Using the Malliavin–Stein method, it has been shown under various conditions that suitably rescaled averages converge to the standard normal distribution. In this talk, we show that analogous results hold for the stochastic cable equation with Dirichlet/Neumann/periodic boundary conditions. Furthermore, under an additional assumption, we establish weak convergence in a functional sense and discuss the validity of this assumption.

- 16 Mikio Hirokane (Univ. of Osaka) Error distributions of Euler–Maruyama and local linearization schemes
Masaaki Fukasawa (Univ. of Osaka) for SDEs with additive noise 15
Kostas Kardaras
(London School of Econ.)

Summary: We study the scaled error processes of two discretization schemes for SDEs with additive Brownian noise. For the Euler–Maruyama scheme with step $1/n$, we show that the error process, when scaled by n , converges stably in the space of continuous paths to a non-degenerate Gaussian limit. For a local linearization scheme on the same grid, we instead scale the error process by $n\sqrt{n}$ and obtain a different stable limit distribution, again of Gaussian type. We will describe these two fluctuation regimes and the main ideas of the proof. This is joint work with Masaaki Fukasawa and Kostas Kardaras.

- 17 Shigeyoshi Ogawa (Ritsumeikan Univ.) On the regular solutions of noncausal SDE 15

Summary: The meaning and the richness as scientific notion of the SDE, $dX_t = a(t, x_t)dW_t + b(t, X_t)dt$, $X_0 = x_0 \in \mathbf{R}^1$, depends on the stochastic integral that gives a precise definition to the differential term $a(t, X_t)dW_t$. With a different stochastic integral we may have a different interpretation to the symbol of SDE. Now as another candidate for the stochastic integral we have the noncausal stochastic integral $\int f d_* W_t$ that was introduced by the author in 1979 (in Comptes Rendus 1979 fevrier), For the case of the noncausal integral we have the SDE $dX_t = a(X_t)d_* W_t + b(X_T)dt$ which we call the noncausal SDE. Since we are very much concerned with the property of such noncausal SDE, the aim of the talk is to show some results to the fundamental questions of the existence and uniqueness of solutions of the noncausal SDE, and to show some of its applications.

- 18 Rikuki Okamoto (Ritsumeikan Univ.)^b Properties of the initial noise-adjusted SIML high-frequency statistical estimator 15
Jiro Akahori (Ritsumeikan Univ.)

Summary: The SIML high-frequency statistical estimator is an estimator for the integrated volatility of an Ito process perturbed by microstructure noise, originally proposed by Naoto Kunitomo and Seisho Sato. Similar results include methods for estimating instantaneous volatility independently introduced by P. Malliavin and M. E. Mancino. However, a major challenge has been pointed out with both of the two aforementioned methods: consistency is lost due to initial noise. Consequently, a third, initial-noise-robust methodology has been proposed. In this presentation, we report on results concerning the consistency and asymptotic normality of the initial-noise-corrected SIML-type estimator.

12:00–12:30 Research Section Assembly

March 25th (Wed) Conference Room VIII

10:00–12:00

- 19 Yuichi Goto (Kyushu Univ.) Mixed difference integer-valued GARCH model for \mathbb{Z} -valued time series 15
Abdelhakim Aknouche (Qassim Univ.)
Christian Francq
 (JST CREST/Univ. of Lille)

Summary: We propose a flexible modeling framework for integer-valued time series that admits both positive and negative values, which naturally arise, for instance, after detrending nonnegative integer-valued data. The model extends the INGARCH-type structure by separately modeling the positive and negative parts and by incorporating a switching mechanism governed by Bernoulli dynamics, thereby enabling the accommodation of bimodality and sign transitions with dependence on past observations. We establish sufficient conditions for stationarity, ergodicity, and β -mixing of the proposed process, characterized by the spectral radius of a parameter matrix and by bounds on the switching probabilities. For parameter estimation, we introduce a mixed Poisson quasi-maximum likelihood estimator, and we show that it is consistent and asymptotically normally distributed under standard regularity assumptions.

- 20 Kou Fujimori (Shinshu Univ.) Lasso-type estimators for multivariate integer-valued autoregressive 15
Hiroshi Shiraishi (Keio Univ.) models with applications to inference for Hawkes processes
Junichi Hirukawa (Nanzan Univ.)
Konstantinos Fokianos
 (Univ. of Cyprus)

Summary: We consider Lasso-type estimation methods for the intensity functions of multivariate Hawkes processes via discrete approximations. Univariate Hawkes processes are known to be approximated by integer-valued autoregressive (INAR) models. We rigorously prove this fact in the multivariate setting. Then, we apply Lasso-type estimation methods, which have been established for vector autoregressive models, to multivariate integer-valued time series approximating Hawkes processes. We obtain an error bound for the estimator by verifying certain moment and mixing conditions of the multivariate INAR models, which serve as sufficient conditions for applying concentration inequalities for weakly dependent time series.

- 21 Xiaoqiang Zeng Note on an ADCINAR(p) process 15
 (Guangdong Univ. of Edu.)
Yoshihide Kakizawa (Hokkaido Univ.)

Summary: We propose an Alternative Dependent Counting nonnegative Integer-valued AutoRegressive process of the p th-order. We first discuss its probabilistic properties of the model, including (i) the conditional higher-order central moments and (ii) strictly stationarity (with ν th moment) and ergodicity. We next deal with point estimation about the model parameter and the innovation mean/variance and consider some hypothesis testing problems.

- 22 Takato Hashino (Kyushu Univ.) The Shannon entropy estimation via the Pitman–Yor process 15
 Koji Tsukuda (Kyushu Univ.)

Summary: The Shannon entropy, also known as the Shannon–Wiener index, is a fundamental measure for quantifying diversity and model complexity in fields such as information theory, ecology, and genetics. Although many existing studies assume that the true number of species is known, this assumption is often unrealistic in practice. Building on these developments, we propose a new entropy estimation method based on the Pitman–Yor process, a representative model in Bayesian nonparametrics. By approximating the unknown true distribution with an infinite-dimensional distribution, our approach enables stable estimation even in the presence of unobserved species. This methodology provides a principled way to handle uncertainty in species richness and improves the reliability of entropy-based diversity assessment.

- 23 Teruo Tanaka (Hiroshima City Univ.) Risk sensitive optimal stopping problems for discrete time multiparameter Markov processes 15

Summary: We consider discrete-time, risk-sensitive optimal stopping problems for multiparameter Markov processes. Using a probabilistic approach and an approximation method, we prove the continuity of the optimal stopping value function for Feller–Markov processes. In addition, we provide formulas for the corresponding optimal stopping rules and study the regularity of the approximating functions.

- 24 Rinka Sagawa (Waseda Univ.) Discriminant analysis for dependent noisy curves 15
 Yan Liu (Waseda Univ.)
 Valentin Patilea (ENSAI)

Summary: We present discriminant analysis for weakly dependent functional time series under local regularity conditions. The proposed classifier is constructed from estimated mean functions for two categories, using the Nadaraya–Watson estimator of functional time series with bandwidth-based local smoothing to adapt to varying regularities in the sample paths. We establish the asymptotic properties for the proposed classifier under some regularity conditions. Additionally, the finite-sample performance is evaluated through simulation studies. We also apply the method to some real data.

- 25 Shi Chen (Waseda Univ.) Portmanteau test of copula time series 15
 Yan Liu (Waseda Univ.)

Summary: We propose two portmanteau test procedures for copula time series. Copula time series capture the dependence structure independently of marginal distributions. We consider portmanteau tests by a residual-based approach and a probability integral transform-based approach to avoid effects of the nonlinear structure inherent in copula time series. The asymptotic distributions of proposed test statistics are obtained under the null hypothesis. The finite sample performance of our approaches is illustrated through numerical simulations.

- 26 Junichi Hirukawa (Nanzan Univ.) The second order generalization of Hájek–Le Cam asymptotic minimax
 Masanobu Taniguchi (Waseda Univ.) theorem 15
 Marc Hallin (Univ. Libre de Bruxelles)

Summary: The basic results concerning with the asymptotic theory of estimation and testing, Le Cam introduced so-called locally asymptotically normal (LAN) family of distributions. The convolution theorem for LAN case is obtained by Hájek. The convolution result was extended by Le Cam to more general situations than that of LAN case. These results sometimes called the Hájek–Le Cam asymptotic minimax theorem. In this talk we derive the second order generalization of Hájek’s convolution theorem. Furthermore, as a application of the second order Hájek’s convolution theorem, we lead to the second order Hájek–Le Cam asymptotic minimax theorem. It automatically provides the conditions that the second order asymptotic efficient estimators should satisfy.

14:15–15:15 Talk Invited by Statistics and Probability Section

Michiko Okudo (Chiba Univ.) Foundations of information geometry and its applications to Bayesian statistics

Summary: In this talk, I will begin with an introduction to information geometry, focusing on its fundamental geometric concepts and how it provides a framework for understanding Bayesian statistical inference. I will then review several of my recent results on Bayesian prediction and estimation from an information-geometric viewpoint. The first part proposes a construction of predictive distributions for curved exponential families by extending estimators beyond the parameter space and considering a geometric projection of Bayesian predictive distributions. The second part illustrates how geometric structures can guide prior selection, through the construction of shrinkage priors for covariance matrices of Normal models. Together, these results show that information geometry not only describes Bayesian procedures, but also suggest new ones.

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

Hideatsu Tsukahara (Seijo Univ.) Statistics of risk measures

Summary: Statistical methodology has an important role to play in risk measurement. In this talk, we will review and discuss some statistical issues on risk measures. Examples we consider are value-at-risk, expected shortfall, expectiles, and distortion risk measures. Several methods of estimating these risk measures based on time series data have been proposed, and we will try to explain them in some detail. Another main issue we would like to address is a problem of backtesting: the evaluation of risk measurement procedures using historical data, by comparing ex ante estimates of loss distributions or risk measures with the ex post realized losses. There have been several suggestions concerning backtestability of risk measures, which will be discuss in detail. We also examine and suggest backtesting procedures for predictive distributions, expected shortfall and distortion risk measures.

March 26th (Thu) Conference Room VIII

10:00–11:40

- 27 Tetsuya Sato (Tokyo Univ. of Sci.) Error bounds for high-dimensional Edgeworth expansion for sphericity
Ayaka Yagi (Tokyo Univ. of Sci.) test with two-step monotone missing data 15
Takashi Seo (Tokyo Univ. of Sci.)

Summary: For complete data, Muirhead (1982) studied an asymptotic expansion of the modified likelihood ratio test (LRT) statistic, and Wakaki (2007) derived the high-dimensional Edgeworth expansion and its error bound. For monotone missing data, Sato, Yagi, and Seo (2025a, 2025b) obtained asymptotic expansions of the LRT statistic and modified LRT statistic, but an error bound with monotone missing data remains unexplored. We consider the sphericity test $H_0 : \Sigma = \sigma^2 \mathbf{I}_p$ and derive the high-dimensional Edgeworth expansion for the standardized test statistic with two-step monotone missing data. Furthermore, using the inverse Fourier transformation, we derive error bounds of the Edgeworth expansion.

- 28 Shuhei Mano (Inst. of Stat. Math.) Direct sampling from conditional distributions by sequential maximum likelihood estimations 15

Summary: We can directly sample from the conditional distribution of any log-affine model. The algorithm is a Markov chain on a bounded integer lattice, and its transition probability is the ratio of the UMVUE of the expected counts to the total number of counts. The computation of the UMVUE accounts for most of the computational cost, which makes the implementation challenging. Here, we investigated an approximate algorithm that replaces the UMVUE with the MLE. Although it is generally not exact, it is efficient and easy to implement; no prior study is required, such as about the connection matrices of the holonomic ideal in the original algorithm.

- 29 Tetsuya Umino (Univ. of Tsukuba) Automatic sparse estimation of high dimensional block diagonal covari-
Kazuyoshi Yata (Univ. of Tsukuba) ance structures 15
Makoto Aoshima (Univ. of Tsukuba)

Summary: In this talk, we address sparse estimation of high-dimensional covariance matrices. We first examine the sample covariance matrix and show that its consistency can be guaranteed only under restrictive conditions, mainly because the non-diagonal elements contain substantial noise. To overcome this difficulty, we apply the methodology of automatic sparse estimation, which yields consistent estimators without requiring regularization parameters, although the computational cost remains high in high dimension. When the covariance matrix is assumed to have block diagonal structures, appropriate covariance blocks can be selected and the automatic sparse estimation procedure applied to each block, while still ensuring the consistency of the overall block-diagonal covariance matrix. We evaluate the performance of the proposed method through theoretical comparison and numerical simulations.

- 30 Shinpei Imori (Hiroshima Univ.) Model selection in linear regression models with group structure 15

Summary: This study considers a model selection problem in linear regression models with a group structure. The group structure is formulated by disjoint non-empty subsets of index set of regression coefficients. Our aim is to select the best combination among the candidate subsets. Based on the greedy algorithm that has attractive properties in conventional linear regression models, we construct a model selection algorithm for linear regression models with a group structure. Besides, we attempt to derive its theoretical properties from the predictive point of view under high-dimensional settings.

- 31 Kengo Fujisawa Bivariate ordinal logit model for symmetric ordinal categorical variables
(Tokyo Univ. of Sci., Yamaguchi) 15

Summary: The ordinal logit model is widely used as a model to predict ordinal categorical variables based on explanatory variables. However, applying separate ordinal logit models to two correlated ordinal categorical variables ignores the correlation between the variables. In this study, we propose new bivariate ordinal logit models for two ordinal categorical variables within the same classification. Our proposed models are particularly suitable for cases where the two variables exhibit a symmetric structure.

- 32 Riku Hosonuma (Tokyo Univ. of Sci.) Tests for the two-sample problem of sub-mean vectors with two-step
Tamae Kawasaki monotone missing data 15
(Aoyama Gakuin Univ.)
Takashi Seo (Tokyo Univ. of Sci.)

Summary: This study addresses the testing problem of sub-mean vector in a two-sample problem with two-step monotone missing data. We extend Rao's U -type test statistic, originally proposed for the one-sample case by Hosonuma, Kawasaki, and Seo (2025), to construct a corresponding test statistic for the two-sample setting. In constructing the proposed statistic, Hotelling's T^2 -type test statistic is employed. By applying a stochastic expansion, the distribution function of the test statistic is derived, and approximate upper 100α percentiles are obtained. Moreover, Monte Carlo simulations are conducted to numerically evaluate the accuracy of the approximations with respect to Type I error. The results from these simulations provide detailed insights into the performance of the proposed test under various conditions.

- 33 Yuki Hayashi (Nanzan Univ.) Parameter estimation and hypothesis testing for the generalized t-
Takayuki Shiohama (Nanzan Univ.) distribution 10

Summary: Modeling circular distributions in a flexible and interpretable manner has long been an important topic in circular statistics. The generalized t-distribution is known for its high flexibility, as it includes the generalized von Mises, generalized wrapped Cauchy, generalized cardioid, and Jones–Pewsey distributions as special cases. In this study, we investigate the asymptotic representation of the generalized t-distribution with respect to the generalized von Mises distribution and develop hypothesis testing procedures for the null hypothesis of the underlying data follows from the the generalized von Mises distribution. We also apply the proposed method to several circular data sets.

Applied Mathematics

March 23rd (Mon) Conference Room IX

9:30–11:35

- 1 Tomohiro Kamiyoshi On left production matrices of generalized Stirling numbers 15
 (Matsue Coll. of Tech.)
 Makoto Nagura
 (Osaka Electro-Comm. Univ.)
 Shin-ichi Otani (Kanto Gakuin Univ.)

Summary: In general, an exponential Riordan array has both right and left production matrices. While the Fundamental Theorem of Riordan Arrays (FTRA) gives the exponential generating functions of columns of the right production matrix, it does not apply to the left one, requiring a different method. In this talk, we show that for the generalized Stirling numbers with three parameters, defined by Hsu-Shiue, the left production matrix of the associated exponential Riordan array can be explicitly determined when indices are restricted to non-negative arguments. As a result, the recurrence relations for classical Stirling numbers, Whitney numbers, and related sequences can be obtained in a unified manner.

- 2 Hirotake Kurihara (Yamaguchi Univ.) Imprimitive association schemes and elimination theory 15
Akihiro Higashitani (Univ. of Osaka)

Summary: Several equivalent conditions for imprimitive association schemes are known. This talk will focus on imprimitivity from the perspective of multivariate P -polynomial association schemes, and will show its relationship with the elimination monomial order.

- 3 Kazunori Matsuda The minimum number of edges of connected simple graphs G with
 (Kitami Inst. of Tech.) $\text{ind-match}(G) = p$, $\text{min-match}(G) = q$ and $\text{match}(G) = r$ 15

Summary: In this talk, we investigate the minimum number of edges of connected simple graphs G with $\text{ind-match}(G) = p$, $\text{min-match}(G) = q$ and $\text{match}(G) = r$ for pair of integers p, q, r such that $1 \leq p \leq q \leq r \leq 2q$.

- 4 Hojin Chu (KIAS) Connectivity keeping trees in triangle-free graphs 10
Shinya Fujita (Yokohama City Univ.)
 Boram Park (Seoul National Univ.)
 Homoon Ryu (Ajou Univ.)

Summary: In 2012, Mader conjectured that for any tree T of order m , every k -connected graph G with minimum degree at least $\lfloor \frac{3k}{2} \rfloor + m - 1$ contains a subtree $T' \cong T$ such that $G - V(T')$ remains k -connected. In 2022, Luo, Tian, and Wu considered an analogous problem for bipartite graphs and conjectured that for any tree T with bipartition (X, Y) , every k -connected bipartite graph G with minimum degree at least $k + \max\{|X|, |Y|\}$ contains a subtree $T' \cong T$ such that $G - V(T')$ remains k -connected. In this work, we relax the bipartite assumption by considering triangle-free graphs and prove that for any tree T of order m , every k -connected triangle-free graph G with minimum degree at least $2k + 3m - 4$ contains a subtree $T' \cong T$ such that $G - V(T')$ remains k -connected. Furthermore, we establish refined results for specific subclasses such as bipartite graphs or graphs with girth at least five.

- 5 Diogo Kendy Matsumoto The structure of 3-self-centered unique eccentric point graphs of girth
 (Teikyo Univ. of Sci.) ≥ 4 15

Summary: A graph whose radius and diameter are both 3 is called a 3-self-centered graph. In this talk, we focus on 3-self-centered graphs satisfying some uniqueness condition (the unique eccentric point property) and describe their structure in the case $\text{girth} \geq 4$.

- 6 Masaki Kashima (Keio Univ.) Degeneracy and proper conflict-free degree-choosability of graphs 15
 Riste Škrekovski (Ljubljana Univ.)
 Rongxing Xu (Zhejiang Normal Univ.)

Summary: A proper conflict-free coloring of a graph is a proper coloring in which every non-isolated vertex has a color that appears exactly once in its neighbors. It is conjectured that every graph with maximum degree at least 3 has a proper conflict-free coloring using at most its maximum degree plus one colors. Motivated by the conjecture, in a previous research, we introduced the notion of proper conflict-free degree-choosability of graphs. In this talk, we will explain a conjecture on the relationship between the degeneracy and proper conflict-free degree-choosability of graphs, along with some partial results.

- 7 Atsuhiko Nakamoto Kempe equivalence of 5-colorings in 3-chromatic triangulations on the
 (Yokohama Nat. Univ.) projective plane 15
 Naoki Matsumoto (Univ. of Ryukyus)
 Kyosuke Wakayama
 (Yokohama Nat. Univ.)

Summary: For a graph G , two k -colorings of G are said to be Kempe equivalent if they can be transformed into each other by exchanging two colors i and j in a component of the subgraph of G induced by the vertices with color i and j . For many graph classes, the Kempe equivalence has been considered. In our talk, we prove that any two 5-colorings of 3-chromatic triangulations on the projective plane are Kempe-equivalent.

14:15–16:25

- 8 Hiroshi Goda Some expressions of graph zetas and the twisted Alexander polynomials,
 (Tokyo Univ. of Agri. and Tech.) and the knot volume 15
 Takayuki Morifuji (Keio Univ.)

Summary: We consider the zeta function of graphs and the twisted Alexander polynomials of knots. Since they have been developed separately, we explain the relationship between them through the notion of knot graphs. We also provide a new volume presentation of hyperbolic knots using matrix-weighted graphs and Bell polynomials.

- 9 Iwao Sato (Oyama Nat. Coll. of Tech.) The weighted complexities of abelian coverings of a graph 15
 Ayaka Ishikawa
 (Muroran Inst. of Tech.)
 Takashi Komatsu (Univ. of Yamanashi)
 Norio Konno
 (Ritsumeikan Univ./Yokohama Nat. Univ.*)
 Hideo Mitsuhashi (Hosei Univ.)
 Hideaki Morita (Muroran Inst. of Tech.)

Summary: We consider the weighted complexity of a regular covering of a graph G and the second weighted L -function of G . Furthermore, we show the inflation property and the induction property of the second weighted L -function of G . As applications, we present a formula for the weighted complexity of a $\mathbb{Z}_2 \times \mathbb{Z}_2$ -covering G .

- 10 Iwao Sato (Oyama Nat. Coll. of Tech.) The edge version of Konno–Sato theorem 15
Akahori Jiro (Ritsumeikan Univ.)
 Norio Konno
 (Ritsumeikan Univ./Yokohama Nat. Univ.*)
 Shohei Koyama (Ritsumeikan Univ.)
 Etsuo Segawa (Yokohama Nat. Univ.)

Summary: The Grover matrix of a graph G is a typical time evolution matrix of a discrete-time quantum walk on G . We express a determinant with respect to the Grover matrix of G by using a square matrix with size equal to the number of edges in G . Furthermore, we present a new expression for determinant with respect to the Grover matrix of G by using a square matrix with size equal to the number of vertices in G and treat its related topics.

- 11 Shohei Koyama (Ritsumeikan Univ.) Bootstrap quantum walks 15
Jiro Akahori (Ritsumeikan Univ.)
 Norio Konno
 (Ritsumeikan Univ./Yokohama Nat. Univ.*)
Iwao Sato (Oyama Nat. Coll. of Tech.)

Summary: Quantum walks (QWs) can be regarded as the quantum counterparts of classical random walks (RWs). Due to their interference structure, QWs exhibit diffusion and localization phenomena that are different from RWs. On the other hand, the bootstrap random walk (BRW) is a recursive model in which a new RW is constructed from the trajectory of a preceding one, thereby the generating higher-order walk in a hierarchical manner. The purpose of this study is to quantize the structure of the BRW and to introduce a new class of QWs, which we call the bootstrap quantum walk.

- 12 Shuhei Mano (Inst. of Stat. Math.) Symmetric quantum walks on Hamming graphs and their limit distri-
Robert Griffiths (Monash Univ.) butions 15

Summary: We study a class of symmetric quantum walks on Hamming graphs, where the distance between vertices specifies the transition probability. A special model is the simple quantum walk on the hypercube, which has been discussed in the literature. Eigenvalues of the unitary operator of the quantum walks are zeros of certain self-reciprocal polynomials. We obtain a spectral representation of the wave vector, where our systematic treatment relies on the coin space isomorphic to the state space and the commutative association scheme. The limit distributions of several quantum walks are obtained.

- 13 Hiroto Sekido (Yokohama Nat. Univ.) Effects of magnetic flux on the periodicity of quantum graph walks
Etsuo Segawa (Yokohama Nat. Univ.) 15

Summary: In Grover walks, the presence or absence of periodicity has been investigated for various classes of graphs. In this study, we examine how much of this periodicity is preserved in quantum graph walks when a magnetic field is introduced. In particular, for graphs that are periodic under Grover walks, we provide a formula that quantifies how far the powers of the time-evolution matrix deviate from the identity when a weak magnetic field is applied to a specific pair of symmetric directed edges.

- 14 Kenta Higuchi (Gifu Univ.) Sticky quantum walk model 15
Ryuta Ishikawa (Ehime Univ.)
Hisashi Morioka (Ehime Univ.)
Etsuo Segawa (Yokohama Nat. Univ.)

Summary: We consider a quantum walk model that receives an inflow and radiates an outflow at every time step. In this model, the strength of the inflow and outflow is tunable by a parameter, κ , and weakly converges to a stationary state. We find that, for small κ , the perturbed eigenvalues are robust to be peeled off from the unit circle; that is, they are sticky. Indeed, the distance between the perturbed eigenvalues and the unit circle is estimated by $O(\kappa^2)$. This sticky property induces scattering that penetrates the internal graph and can be observed for an appropriate frequency even with small $|\kappa|$.

16:40–17:40 Talk Invited by Applied Mathematics Section

Yusuke Ide (Nihon Univ.) Eigenspaces related to quantum walks on graphs

Summary: The theory of Quantum Walks (QWs) has been extensively developed in various fields in the last 25 years. Because the time evolution of QWs on finite graphs are determined by unitary matrices, the eigenvalues and eigenvectors of the time evolution matrices play essential roles in their behavior. In this talk, we show relationships between eigenspaces of time evolution matrices and graph structures.

March 24th (Tue) Conference Room IX

9:15–11:40

15 Xiao-Nan Lu (Gifu Univ.) Completely uniform nested pairings of Carmichael’s Steiner quadruple systems on projective lines 15

Summary: A combinatorial 3 -($v, 4, 1$) design is also called a Steiner quadruple system (SQS) of order v . A nested pairing of an SQS is a collection that contains a partition of each block into two unordered pairs. Such a pairing is completely uniform if every possible pair of points appears with the same multiplicity. This talk presents an explicit construction for completely uniform nested pairings of Carmichael’s Steiner quadruple systems on projective lines $\mathbb{F}_q \cup \{\infty\}$ for prime powers $q \equiv 7 \pmod{12}$.

16 Kosuke Suzuki (Yamagata Univ.) Exact ℓ^∞ -separation radius of the two-dimensional Sobol’ sequence ... 15

Summary: In this talk, we derive exact expressions for the ℓ^∞ -separation radius of the first $N = 2^m$ points of the two-dimensional Sobol’ sequence for all positive integer m . In particular, the separation radius of Sobol’ points is $O(N^{-3/4})$, which is strictly worse than the optimal rate $N^{-1/2}$.

17 Shuhei Tsujie (Hokkaido Univ. of Edu.) The correspondence of maximal Arrow’s single-peaked domains and regular vines 15
 Hung Manh Tran (Phenikaa Univ.)
 Tan Nhat Tran (Binghamton Univ.)

Summary: Consider a subset of the set of linear orders (preferences) over n alternatives such that the Condorcet paradox never arises; we call such a set a Condorcet domain. A well-known sufficient condition for being a Condorcet domain is the property of single-peakedness. In this talk I will present the correspondence between maximal Arrow’s single-peaked domains and regular vines, which originate in statistics.

18 Takuya Saito (Hokkaido Univ.) Convolution formulas for invariants of polymatroid sums and other weighted posets 15

Summary: This talk extends the convolution formula for the characteristic polynomials of matroids of the characteristic elements of weighted posets. A weighted poset consists of a poset equipped with a weight function satisfying functorial conditions. When the weight is pure, we define the characteristic element analogously to the characteristic polynomials of matroids. The main result is a convolution formula that uses restrictions and contractions to compute the characteristic elements of the product of two weights. As an application, we obtain a convolution formula for the sum of polymatroids. This framework is also applied to other various combinatorial structures.

19 Chie Nara (Meiji Univ.) Continuous flattening of convex polyhedral linkages and their reversing 15
 Erik D. Demaine (MIT) by Menger’s theorem
 Martin L. Demaine (MIT)
 Markus Hecher (MIT)
 Rebecca Lin (MIT)
 Victor Luo (MIT)

Summary: We prove two results about transforming any convex polyhedron, modeled as a linkage L of its edges. First, if we subdivide each edge of L in half, then L can be continuously flattened into a plane. Second, if L is equilateral and we again subdivide each edge in half, then L can be reversed, i.e., turned inside-out, where Menger’s theorem plays a key role.

- 20 Masato Konoike (Univ. of Osaka) On the magic positivity of Ehrhart polynomials of dilated polytopes 15

Summary: A polynomial $f(x)$ of degree d is said to be magic positive if all the coefficients of its expansion with respect to the basis $\{x^i(x+1)^{d-i}\}_{i=0}^d$ are nonnegative. It is known that if $f(x)$ is magic positive, then the polynomial appearing in the numerator of its generating function is real-rooted. In this talk, we explain that if a polytope is Ehrhart positive, then sufficiently large dilations make its Ehrhart polynomial magic positive, and once it becomes magic positive, it remains so under further dilations. Finally, we investigate how much certain polytopes need to be dilated to make their Ehrhart polynomials magic positive.

- 21 Aki Mori (Setsunan Univ.) Two-dimensional faces of order and chain polytopes 15

Summary: In this talk, we give an explicit combinatorial description of the two-dimensional faces of both the order polytope $\mathcal{O}(P)$ and the chain polytope $\mathcal{C}(P)$ of a partially ordered set P . Using these descriptions, we show that for any P , $\mathcal{C}(P)$ has equally many square faces, and at least as many triangular faces, as $\mathcal{O}(P)$ does. Moreover, the inequality is shown to be strict except when $\mathcal{O}(P)$ and $\mathcal{C}(P)$ are unimodularly equivalent. This proves the case $i = 2$ of a conjecture by Hibi and Li. This talk is based on joint work with Ragnar Freij-Hollanti and Teemu Lundström.

- 22 Akihiro Higashitani (Univ. of Osaka) On the equivariant γ -nonnegativity of order polytopes of graded posets 15

Summary: The equivariant Ehrhart theory of lattice polytopes has been introduced by Stapledon, developed by many researchers, and the study of the equivariant h^* -polynomials is getting one of the trends in the theory of lattice polytopes. On the other hand, the h^* -polynomials of order polytopes of graded posets are known to be γ -nonnegative by Brändén. In this talk, we prove that order polytopes of graded posets are always equivariant γ -nonnegative.

March 25th (Wed) Conference Room IX

9:25–12:00

- 23 Yusuke Asai (JIHS) Development of virus dynamics model describing cell-to-cell transmiss-
Shingo Iwami (Nagoya Univ.) sion 15
Yoshihisa Morita (Ryukoku Univ.*)

Summary: Viruses are pathogens that can cause severe disease, and much research has been conducted into the mechanisms of infection and the viral life cycle. In recent years, the importance of cell-to-cell infection, which is caused by direct contact between infectious cells and target cells, has become apparent. We have therefore constructed a mathematical model that describes cell-to-cell infection, comprising four compartments: target cells, eclipse phase cells, infectious cells and dead cells. Through simulations, we demonstrate that the constructed model exhibits traveling waves. Furthermore, we apply the phase plane analysis to obtain heteroclinic orbits corresponding to the traveling waves together with the condition for their existence.

- 24 Yusuke Asai (JIHS) Existence of traveling waves in a viral infection model with cell-to-cell
Shingo Iwami (Nagoya Univ.) transmission 15
Yoshihisa Morita (Ryukoku Univ.*)

Summary: We consider a cell-to-cell infection model consisting of the variables representing the concentration of target cells, eclipse phase cells, infectious cells and dead cells. The model describes the spread of infection from infected cells to adjacent target cells by spatially discrete coupling of the nearest infectious cells. We deal with the system on one dimensional space and show the existence of the traveling waves. The spread of spatial infection is also modeled by using a system of integro-differential equations and the existence of traveling waves is also shown in a similar way to the former model.

- 25 Toshiyazu Kuniya (Kobe Univ.) Hopf-bifurcation in a time-delayed multi-group SIR epidemic model for population behavior change 15

Summary: In this study, we construct a multi-group SIR epidemic model with time-delay for considering the effect of population behavior change. We obtain the basic reproduction number \mathcal{R}_0 , and show that the disease-free equilibrium is globally asymptotically stable if $\mathcal{R}_0 < 1$, whereas an endemic equilibrium exists if $\mathcal{R}_0 > 1$. For a special two-group case, we obtain sufficient conditions for Hopf bifurcation. By numerical simulation, we observe the occurrence of periodic solutions in two groups representing an urban area and a non-urban area. We conjecture that the epidemic size, response intensity of behavior change and heterogeneity in different groups can affect the occurrence of recurrent epidemic waves.

- 26 Sungrim Seirin Lee (Kyoto Univ./Kyoto Univ.) Pattern formation in skin diseases 15

Summary: Unlike the periodic and stationary skin patterns of animals described by Turing pattern formation, skin eruptions in skin diseases generally do not exhibit spatial periodicity and often display dynamically changing patterns within a relatively short time. In diseases such as urticaria, where the boundaries of eruptions are well-defined, the lesions expand and fuse, resulting in further morphological changes, and in some cases, they spontaneously disappear after a certain period of time. Thus, skin eruptions continuously form dynamic and transient patterns. We define this phenomenon as Transitional Pattern Formation. In this talk, I will introduce the fundamental mathematical structures that generate skin eruptions and discuss the pathophysiological mechanisms of chronic urticaria revealed through the analysis of mathematical models.

- 27 Natsume Motohashi (Hokkaido Univ.) On the existence of one-dimensional standing pulse solutions for a Hideo Ikeda (Univ. of Toyama) self-propelled motion model 15
Masaharu Nagayama (Hokkaido Univ.)

Summary: Self-propelled motion refers to the spontaneous, sustained movement of objects by modifying the physical or chemical properties of their surroundings. We focus on a phase-field model for such motion and prove the existence of standing pulse solutions. Since the model includes a non-local term, it is difficult to apply the conventional analytical singular perturbation method. However, by appropriately treating the non-local term, we can use the singular perturbation method. In this talk, we present an approach to handle the non-local term and the proofs of the existence of standing pulse solutions.

- 28 Peize Yu (Hokkaido Univ.) Optimizing nutrient-consuming motility of bacteria with mathematical Sohei Tasaki (Hokkaido Univ.) model 15

Summary: The random motility is often overshadowed by chemotaxis when regarding the sensitive motile behaviors of bacteria, despite its capability of describing a broader range of behavioral situations. This talk aims to explore such a gap by investigating the applicability and implications of exclusive nonlinear diffusion models in capturing the random motility of bacteria under diverse conditions. A comprehensive mathematical framework was developed to identify both advantages and drawbacks of energy-consuming motility response, and an optimization problem was then applied to evaluate the performance of different motility strategies. Numerical simulation confirms the capability of diffusion models to generalize bacterial motility strategy, as well as the existence of local optimal motility patterns under given environmental conditions.

- 29 Madoka Nakayama (Sci. Tokyo) Cell population migration cycle and response to environmental pH in
 Izumi Takagi (Tohoku Univ.) *Bacillus subtilis* 15
 Jun-ichi Wakita (Chuo Univ.)
 Wataru Shoji (Tohoku Univ.)
 Sohei Tasaki (Hokkaido Univ.)

Summary: Microbial populations are ubiquitous and some form a robust, multicellular structure called biofilm that protects the cells from environmental damage. The dispersion cycle is critical for controlling the population of important target microbes. Here, we show that the hysteresis of *Bacillus subtilis* cell-type regulation with respect to auto-inducing signal strength triggers the migration cycle of the cell population. We investigate migration cycle and its dependence on environmental conditions by quantitative analysis of cyclically expanding, concentric circular colonies. Next, we construct an input/output model that controls cell types in response to environmental conditions and signal density. On the basis of this model, we propose a migration cycle model for cell populations. The proposed model will widely predict biofilm-related phenomena and provide the basis for the description of highly self-regulating multicellular systems.

- 30 Keiichi Ueda (Univ. of Toyama) Pulse dynamics under internal and external environmental changes ... 15
 Yasumasa Nishiura
 (Hokkaido Univ./Chubu Univ.)

Summary: We investigate how traveling pulses in reaction-diffusion systems respond to spatial heterogeneities acting as external perturbations. A three-component model captures the interplay between intrinsic and extrinsic instabilities. Using a reduced ODE approach, we show that not only the strength but also the spatial configuration of heterogeneities crucially affects pulse dynamics.

- 31 Hajime Koba (Univ. of Osaka) Mathematical modeling of a soap bubble in air 15

Summary: We consider the governing equations for the motion of the viscous fluids in two moving domains and on an evolving surface from both energetic and thermodynamic points of view. We make mathematical models for a soap bubble floating in the air by our energetic variational and thermodynamic approaches. More precisely, we apply our energetic variational principle and the first law of thermodynamics to derive multiphase flow systems with surface tension and flow. Moreover, we investigate the enthalpy, the entropy, the Helmholtz free energy, and the Gibbs free energy of our model by applying the thermodynamic identity.

14:15–14:40 Presentation Ceremony for the 2025 Applied Mathematics Prize

14:50–16:30

- 32 Kazunori Matsui A numerical method for an elastoplastic model with linear kinematic
 (Tokyo Univ. of Marine Sci. and Tech.) hardening 15
 Yoshiho Akagawa (Kyoto Univ. of Edu.)

Summary: When a large force is applied to metallic materials, plastic deformation occurs, remaining even after the force is removed. In materials subjected to cyclic loading, strain hardening is observed. One effective description of this hardening behavior is the kinematic hardening rule, which accounts for the shift of the constraint set in stress space as plastic deformation develops. In this study, we propose a new numerical scheme for an elastoplastic model with linear kinematic hardening. We prove that the solution is stable under appropriate norms. Furthermore, this stability leads to the existence of a solution to the original problem.

- 33 Masato Kimura (Kanazawa Univ.) Mass conservation and gelation analysis of the Smoluchowski coagulation equation via the generalized moment method 15
Hisanori Miyata (Kanazawa Univ.)

Summary: The Smoluchowski coagulation equation (SCE) is a population balance model that describes the time evolution of cluster size distributions arising from particle aggregation. Although the equation is formally mass-conserving, its solutions may exhibit gelation, that is, a sudden loss of mass, when the coagulation kernel grows superlinearly. In this study, we rigorously investigate mass conservation and gelation in weak solutions of the SCE with inhomogeneous coagulation kernels. By introducing a generalized moment framework, we establish sufficient conditions for both mass conservation and gelation, expressed in terms of the initial data and the structural properties of the coagulation kernel.

- 34 Shinya Uchiumi (Hokkaido Univ.) Analysis of Lagrange–Galerkin scheme having boundary quadrature points 15

Summary: We consider the Lagrange–Galerkin (LG) method for the convection-diffusion problems. In this talk, we consider the quadrature formula having boundary quadrature points.

- 35 Haruka Nakamura (Univ. of Tokyo) On a monotone scheme for Hamilton–Jacobi–Bellman equations 15
Norikazu Saito (Univ. of Tokyo)

Summary: Hamilton–Jacobi–Bellman (HJB) equations are partial differential equations arising in dynamic programming in control theory. Their solutions, called value functions, give the minimal expected cost from a given time and state. The resulting HJB equation involves a Hamiltonian and is therefore typically nonlinear. For such nonlinear equations, monotonicity of numerical schemes often plays a crucial role, and the Semi-Lagrangian (SL) scheme is well known as a representative example. However, the SL scheme requires solving many minimization problems whose convexity or uniqueness is not guaranteed, which leads to implementation difficulties. In this talk, we propose a monotone scheme that does not rely on such minimization problems and report its convergence. We also discuss its validity by numerical experiments.

- 36 Takuya Tsuchiya (Meiji Gakuin Univ.) Structure-preserving numerical calculation of Klein–Gordon–Proca system 15
Makoto Nakamura (Univ. of Osaka)

Summary: We perform structure-preserving numerical calculations for the interacting system of the Klein–Gordon and Proca equations. We set initial values and investigate the difference between the results of the structure-preserving numerical calculations and those obtained using a general discretization scheme.

- 37 Tsuyoshi Yoneda (Hitotsubashi Univ.) Mathematical structure of a novel Reservoir-based gradient descent method and its high predictive accuracy in machine learning implementation 15

Summary: In this talk, we will present a new gradient descent method based on a reservoir, without using the error backpropagation algorithm, which forms the core of modern AI. We will highlight the advantages of this new learning scheme. Most existing libraries (such as TensorFlow and PyTorch) fundamentally rely on the backpropagation method, and it is extremely difficult for users to modify the core algorithms at the user level. My own approach starts from mathematics, leading to a model design that achieves a slimmer and more efficient set of learnable parameters. We will also introduce machine learning results that suggest this advantage (the corresponding source code has already been made publicly available).

16:45–17:45 Talk Invited by Applied Mathematics Section

Tomoki Uda (Univ. of Toyama) Advances in anisotropy-aware topological data analysis

Summary: Topological data analysis (TDA) provides a versatile framework for quantifying the shape of data, yet conventional approaches often overlook anisotropic or direction-dependent structures. In this talk, we introduce recent progress toward anisotropy-aware TDA, focusing on the development of anisotropic persistent homology and its geometric foundations. The proposed approach, based on the ellipse-cloud filtration, enhances the sensitivity of persistent homology to local anisotropy while remaining compatible with standard computational frameworks. We also briefly review the author’s earlier attempts to apply TDA-inspired ideas to fluid dynamics and other interdisciplinary fields. In addition, we emphasize how modern AI-assistance tools are directly accelerating research progress and broadening the scope of data-analytic applications.

March 26th (Thu) Conference Room IX

9:25–12:00

- 38 Toshiyuki Nakayama (Shunan Univ.) Probabilistic foundations for topological change detection in high-dimensional data analysis 15

Summary: High-dimensional time series data often exhibit topological structural changes (regime shifts) in their cluster or network shape. We introduce a robust framework using Persistent Homology (PH) for detection. First, we establish the probabilistic foundation of classical PH statistics (Total and Maximum Persistence) by deriving moment upper bounds under general distributions and proving tightness at the variance scale for Gaussian Mixture Models. This rigorously positions their scale-dependent behavior. Next, we propose a new stable statistic, PL+JS, which combines the Persistence Landscape (PL) and Jensen–Shannon (JS) distance. We prove the Holder continuity (stability) of PL+JS, enabling robust, non-parametric testing based on permutation tests without specific distributional assumptions. Finally, we demonstrate the method’s high-accuracy detection of daily governance regime shifts using time series data from a Decentralized Autonomous Organization (DAO).

- 39 Yoshitaka Watanabe (Kyushu Univ.) Stability analysis of Kolmogorov flow by an eigenvalue excluding method
Shuting Cai (Fujian Jiangxia Univ.) 15

Summary: Our aim is to prove the stability of the verified solution for the Kolmogorov flow. This stability can be transformed to the sign of the real parts of the eigenvalues for a linearized operator at the solution; that is, if the real part is negative, then the solution is stable. Assuming linearized system at the verified solution satisfies the principle of the exchange of stabilities, we implement an eigenvalue excluding method for the real axis. We show the stability of two nontrivial solutions by proposed method.

- 40 Takaaki Nishida (Kyoto Univ.*) Thermohaline convection in the horizontal layer with non-uniform heat
Fujiwara Hiroshi (Kyoto Univ.) supply 15
Chun-Hsiung Hsia (Nat. Taiwan Univ.)

Summary: We consider a thermohaline convection in the horizontal fluid layer such that the gravity is considered. The fluid is heated from above non-uniformly. An existence theorem of the stationary solutions is provided by a fixed point argument. Some interesting flow patterns are demonstrated by numerical computations.

- 41 Masakazu Akiyama (Univ. of Toyama) About a crystal structure simulator 15
 Takada Yu
 Haruhiko Morito (Tohoku Univ.)
 Yukari Katsura
 (Nat. Inst. for Materials Sci.)

Summary: The development of advanced functional materials requires the creation of novel molecules and exploration of their crystal structures. However, traditional approaches based on molecular dynamics and first-principles calculations demand significant computational resources and expertise. This study presents a web-based simulator that enables users to easily construct crystal structures without relying on conventional space group classifications. By extracting features from existing crystal data and applying machine learning, probabilistic interatomic distance data and Delaunay tetrahedral classifications were compiled into an SQL-based database accessible online. The integrated system supports both structure construction and analysis, successfully reproducing representative crystals such as Cu_3Au , Mg , Cu_2Mg , $BaTiO_3$ demonstrating its practical utility.

- 42 Kaname Matsue Bifurcation of blow-up solutions: correspondence between dynamics at
 (Kyushu Univ./Kyushu Univ.) infinity and structures stemming from asymptotic expansions 15

Summary: Bifurcation problems of type-I blow-ups for ODEs are considered. In preceding works we have derived correspondence of intrinsic information characterizing type-I blow-ups between (1) dynamics at infinity, and (2) asymptotic expansions. Using this correspondence, we shall derive the correspondence of criteria of the existence of bifurcations.

- 43 Hironari Miyoshi (Saitama Univ.) Stochastic particle processes constituting traveling wave solutions of the
 heat equation 15

Summary: We investigate particle movements in a finite-speed traveling wave solution associated with the heat equation. We approximate the heat equation as a wave equation, which is equivalent to the Goldstein–Taylor model. The Goldstein–Taylor model is a one-dimensional system of two transport equations that proceed in opposite directions. We define the probability of a random walk through the Goldstein–Taylor model. By varying the space and time interval of the random walk, we find two different stochastic processes and one deterministic process as the final scaling limit.

- 44 Kazuyuki Yagasaki (Kyoto Univ.*) Global linearization of dynamical systems by generalized eigenfunctions
 of the Koopman operators 15

Summary: Using generalized eigenfunctions of the Koopman operator or its infinitesimal generator, the Lie operator, we show that finite-dimensional linearization is possible in several simply connected regions of the phase space for finite-dimensional nonlinear dynamical systems. Such linearization is shown to enable us to prove the integrability of the dynamical systems in the regions if the changes of coordinates given by the generalized eigenfunctions are sufficiently smooth or analytic. We demonstrate our theory for four examples, the Duffing oscillator, van der Pol oscillator, Lorenz system and planar restricted three-body problem, and prove their smooth or analytic linearization and integrability in simply connected regions containing only one equilibrium.

- 45 Kazuyuki Yagasaki (Kyoto Univ.*) Feedback control of twisted solutions in the Kuramoto model on nearest
 neighbor graphs 15

Summary: We consider feedback control of twisted solutions in the Kuramoto model on nearest neighbor graphs that may be deterministic, random dense or sparse. The system is shown to be well approximated by its continuum limit, based on the previous results. Bifurcations of the twisted solutions in the continuum limit are discussed by the center manifold theory when the feedback control is applied or not applied.

- 46 Kei Nishi (Kyoto Sangyo Univ.) Dynamics of traveling pulses in reaction-diffusion systems subject to local external perturbation 15

Summary: Dynamical responses of traveling pulses in reaction-diffusion systems to spatio-temporally local, comoving perturbation is studied both numerically and analytically. When the parameters are near the codimension two bifurcation point of drift–saddle-node type, center manifold reduction can be applied to reduce the dynamics of the traveling pulses to a finite dimensional ordinary differential equations (ODEs). The reduced ODEs allow us to numerically examine the influence of the external perturbation on the pulse dynamics by changing the intensity and/or the position of the perturbation, and to analytically clarify the mechanism behind the numerical observations. These findings obtained through the study of the ODE system are also demonstrated for traveling pulses arising in the Gray–Scott model.

14:15–15:15

- 47 Tomoharu Suda (Tokyo Univ. of Sci.) A categorical approach to reconstruction of dynamics 15

Summary: Reconstruction of dynamical systems from data is an important problem in applications. In this talk, we will consider this problem from the viewpoint of category theory. First, we describe the mathematical structure of data generation by a dynamical system. Based on this framework, we show that a dynamical system can be reconstructed from the data it generates if the phase space is observable in a precisely defined sense.

- 48 Isamu Ohnishi (Hiroshima Univ.) Emergence of coherent state superpositions of quantum cat states in driven-dissipative Kerr cavities: Multi-mode steady-state analysis of the quantized Lugiato–Lefever equation 15

Summary: Driven dissipative quantum systems provide fertile ground for exploring non-equilibrium phase transitions and macroscopic quantum superposition. In this study, we investigate the second quantization of the Lugiato–Lefever equation (LLE), a paradigm model for pattern formation in nonlinear optical resonators. By mapping the classical LLE onto the Lindblad master equation in a multimode Kerr resonator, we reveal the emergence of a quantum cat state, a coherent superposition state exhibiting a negative Wigner function, in the steady state near the classical codimension 2 bifurcation point. Numerical simulations using QuTiP demonstrate spatial localization and quantum hysteresis of photon ensembles, paving the way for dissipative quantum simulators and fault-tolerant qubits. From the classical “bullet hole” model proposed by Professors W.J. Firth and A.J. Scroggie to quantum cats, optics continues to surprise.

- 49 Isamu Ohnishi (Hiroshima Univ.) Lie algebra frameworks to reflexive Banach spaces: Decoupling and normal forms for quadratic nonlinear systems in infinite dimensions 15

Summary: We extend the Lie algebra decoupling framework for first order evolution equations from separable Hilbert spaces to reflexive Banach spaces with a countable Schauder basis, considering equations. Leveraging the reflexivity property, which ensures well defined adjoints and weak compactness, we establish resonant conditions using adjoint representations and prove the solvability of the homological equation under nonresonance assumptions, yielding normal forms that eliminate nonresonant quadratic terms. This generalization addresses domain issues in nonHilbert settings, and extends to higher order normal forms with convergence in Gevrey classes via involutive PDE theory and the Cartan Kähler theorem, mitigating small divisors through spectral gaps.

- 50 Isamu Ohnishi (Hiroshima Univ.) Quantum many-body hysteresis described by Dirac–KG–Yukawa quantum field and its application 15

Summary: Paper 1 explores spin-polarized quantum many-body hysteresis in MOF/TI hybrids, using a QFT model coupling Klein–Gordon scalar (MOF vibrations) and Dirac spinor (TI electrons) fields via Yukawa interaction $g \bar{\psi} \psi \phi$. RG analysis at one-loop shows infrared freedom for perturbative catalysis, predicting 20-30

Paper 2 presents a Yukawa-coupled Klein–Gordon–Dirac framework for Rashba SOI in GeSn alloys, noting low hole mass (0.061 m_0), high g-factor (up to 15), and 0.462 meV spin-splitting, positioning GeSn for spintronics, quantum computing, and optoelectronics.

15:30–16:30 Talk Invited by Applied Mathematics Section

Asuka Takatsu (Univ. of Tokyo)^b How do we choose a geometry on the space of probability measures?

Summary: Wasserstein geometry and Information geometry are the geometry on the space of probability measures, and their aspects are different from each other. Roughly speaking, Wasserstein geometry is an extrinsic metric geometry which inherits the geometry of an underlying space. In contrast, Information geometry is an intrinsic geometry of a Riemannian metric together with connections which takes into account only the properties of probability measures. In this talk, I will describe both geometries and refer to their differences.

Topology

March 23rd (Mon) Conference Room III

9:30–11:15

- 1 Tomoya Yoshikawa (Okayama Univ.) Orientation double covers of non-orientable Lefschetz fibrations 15

Summary: In this talk, we consider the composition of the standard orientation double covering map and a non-orientable Lefschetz fibration. As an application, we introduce three transformations with respect to monodromy factorizations of non-orientable Lefschetz fibrations which do not change their isomorphism classes, using a similar result given by Kas and Matsumoto.

- 2 Noriyuki Hamada (Kyushu Univ.) Lefschetz fibrations with arbitrary signature 15
R. İnanç Baykur (UMass Amherst)

Summary: We develop techniques to construct explicit symplectic Lefschetz fibrations over the 2-sphere with any prescribed signature and any spin type when the signature is divisible by 16. This solves a long-standing conjecture on the existence of such fibrations with positive signature. As applications, we produce symplectic 4-manifolds that are homeomorphic but not diffeomorphic to connected sums of $S^2 \times S^2$, with the smallest topology known at the time of the work, as well as larger examples as symplectic Lefschetz fibrations.

- 3 Noriyuki Hamada (Kyushu Univ.) Exotic 4-manifolds with signature zero 15
R. İnanç Baykur (UMass Amherst)

Summary: We produce infinitely many distinct irreducible smooth 4-manifolds homeomorphic to $\#_{2m+1}(\mathbb{C}P^2 \# \overline{\mathbb{C}P^2})$ and $\#_{2n+1}(S^2 \times S^2)$, respectively, for each $m \geq 4$ and $n \geq 5$. These provide the smallest exotic closed simply connected 4-manifolds with signature zero known to date, and in each one of these homeomorphism classes, we get minimal symplectic 4-manifolds. Our novel exotic 4-manifolds are derived from fairly special small Lefschetz fibrations we build via positive factorizations in the mapping class group, with spin and non-spin monodromies.

- 4 Tsukasa Isoshima (Keio Univ.) Trisections and Lefschetz fibrations with $(-n)$ -sections 15
Reo Yabuguchi (Okayama Univ.)

Summary: A trisection introduced by Gay and Kirby is roughly speaking a decomposition of a 4-manifold into three 4-dimensional 1-handlebodies. In 2019, for a closed 4-manifold X that admits a Lefschetz fibration over S^2 with a (-1) -section, Castro and Ozbagci explicitly constructed a trisection of X from a monodromy of the Lefschetz fibration. In this talk, for a closed 4-manifold X that admits a Lefschetz fibration over S^2 with a $(-n)$ -section, where n is any integer, we explicitly construct a trisection of $X \# nCP^2$ by using a method similar to that of Castro and Ozbagci. This talk is based on a joint work with Reo Yabuguchi (Okayama University).

- 5 Yuichi Yamada Seifert manifolds in 4-manifolds constructed by pairs of surgeries along
(Univ. of Electro-Comm.) torus knots 10
Motoo Tange (Univ. of Tsukuba)

Summary: We study pairs of integer and rational positive Dehn surgeries along torus knots whose results are orientation-reversing homeomorphic Seifert manifolds. We have found that such pairs satisfy a simple summarized presentation with three integers. We study closed 4-manifolds constructed from such pairs of surgeries, by using framed links.

- 6 Motoo Tange (Univ. of Tsukuba) Cork equivalences 10

Summary: We define equivalences on the sets of the smooth structures of a 4-manifold by using cork. These quotient sets produce a sequence. On the other hand, $S^2 \times S^2$ -connected sum produces a similar sequence. These sequences are related by well-defined maps. By the corollary of this observation, we show a pair of 4-manifolds that are not related by a sequence of cork twists obtained by switching one 1-handle and one 0-framed 2-handle.

14:15–15:15

- 7 Tatsumasa Suzuki (Meiji Univ.) The pretzel knot $P(4, -3, 5)$ is not squeezed 15
Nobuo Iida
(Tokyo Woman's Christian Univ.)

Summary: We prove that an infinite family of three-strand pretzel knots is not squeezed. In particular, we show that $P(4, -3, 5)$ is not squeezed. This answers a question posed by Lewark in 2022. Our proof is obtained by comparing the Rasmussen invariant with the q_M -invariant introduced by Nobuo Iida and Masaki Taniguchi.

- 8 Kazuhiro Ichihara (Nihon Univ.) Euclidean lengths and the Culler–Shalen norms of slopes 10

Summary: In the study of exceptional Dehn fillings, two functions on slopes, called the Euclidean length on a horotorus and the Culler–Shalen norm, play important roles. In this talk, I investigate their relationship and establish two inequalities between them. As a byproduct, some bounds on the boundary slope diameter are given.

- 9 Ken'ichi Yoshida (Hiroshima Univ.) On hyperbolicity of weaves 15

Summary: We consider a class of links in the thickened torus, called weaves, which consist of components projected to geodesics in the vertical and horizontal directions on the torus. In this presentation, we characterize isotopy classes and hyperbolicity of weaves.

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

Yuya Murakami (RIKEN) Quantum modularity for quantum invariants

Summary: Quantum invariants are invariants of knots and 3-manifolds which relate deeply to mathematical physics and representation theory. In recent years, it has become increasingly clear that it is also deeply related to number theory, that is, quantum modularity for quantum invariants. This topic is interesting from a topological viewpoint since this is a refinement of establishing asymptotic expansions of quantum invariants, which is an important problem in quantum topology, and is interesting from a number-theoretic viewpoint since this gives examples of quantum modular forms, which are mysterious objects in number theory.

I have studied quantum modularity for quantum invariants. I obtained two linked results on topology and number theory: Establishing explicit asymptotic expansions of the Witten–Reshetikhin–Turaev invariants for negative definite plumbed 3-manifolds and establishing quantum modularity of false theta functions in full generality. Previous progress covers Seifert homology 3-spheres for the former and rank-one cases for the latter, both of which relied on single-variable integral representations. I address this limitation by developing two techniques: a Poisson summation formula with signature and a framework of modular series, both of which enable a precise and explicit analysis of multivariable integral representations.

In this talk, I will outline previous progress on quantum modularity for quantum invariants and my results.

March 24th (Tue) Conference Room III

9:30–11:00

- 10 Yoshihito Ogasawara Topology as Language of epistemology 10
(Shibaura Inst. of Tech./Miyoshigokinkogyo Co. Ltd.)

Summary: Science uses mathematics as its language, and this study aims to describe epistemology topologically. Here, topology is used as a language for describing not only the concept of form, but also the form of concepts (the concepts of concepts), for the purpose of the description of “our way of seeing things” itself. In addition, a phenomenological and existentialist worldview is adopted with the aid of the concept of Primitive Chaos, instead of the conventional objective worldview that is given a priori. Then, this study struggles to construct a new science, an existentialist science, or to make science existential.

- 11 Yuto Nakajima (Doshisha Univ.) On the topology of the limit set of non-autonomous IFS 15
Takayuki Watanabe (Chubu Univ.)

Summary: Fractals are ubiquitous in nature, and since Mandelbrot’s seminal insight into their structure, there has been growing interest in them. While the topological properties of the limit sets of IFSs have been studied—notably in the pioneering work of Hata—many aspects remain poorly understood, especially in the non-autonomous setting. In this talk, we present a homological framework which captures the structure of the limit set. We apply our novel abstract theory to the concrete analysis of the so-called fractal square, and provide an answer to a variant of Mandelbrot’s percolation problem. This work offers new insights into the topology of fractals.

- 12 Yukinobu Yajima (Kanagawa Univ.) Perfect pre-images of aD -spaces 15
Yasushi Hirata (Kanagawa Univ.)

Summary: A space X is *irreducible* if every open cover of X has a minimal open refinement. A space X is an aD -space if every closed subspace of X is irreducible. A continuous map $f : X \rightarrow Y$ is *perfect* if it is a closed map such that $f^{-1}(y)$ is compact for each $y \in Y$. We prove that Every perfect pre-image of a countably metacompact aD -space is also an aD -space.

- 13 Shuntaro Tomizawa (Univ. of Tokyo) Heterodimensional cycles derived from homoclinic tangencies via Hopf bifurcations 15

Summary: We analyze three-dimensional C^r diffeomorphisms ($r \geq 5$) exhibiting a quadratic focus-saddle homoclinic tangency whose multipliers satisfy $|\lambda\gamma| = 1$. For a proper unfolding family with three-parameters that split the tangency, vary the argument of the stable multipliers, and control the modulus $|\lambda\gamma|$, we show that a Hopf bifurcation occurs on this curve and that a homoclinic point to the bifurcating periodic orbit is present. As a consequence, the original map f can be C^r -approximated by a diffeomorphism exhibiting a coindex one heterodimensional cycle in the saddle case.

- 14 Jun O’Hara (Chiba Univ.) Identification of generic finite metric spaces by q -spectra 15

Summary: We introduce q -spectra of finite metric spaces by generalizing eigenvalues of adjacency matrices to functions of q , and show that they can identify “generic” finite metric spaces.

March 25th (Wed) Conference Room III

9:30–11:15

- 15 Masaki Taho (Univ. of Tokyo) Infinitely many tangent functors on diffeological spaces 15

Summary: We study tangent spaces in the setting of diffeological spaces. Several distinct tangent functors have been introduced, each of which extends the classical tangent functor from smooth manifolds. In this note, we construct infinitely many non-equivalent tangent functors on diffeological spaces. We compare our constructions with existing models, including the internal and external tangent spaces. Our results show that the choice of tangent functor is far from unique outside smooth manifolds.

- 16 Kohei Tanaka (Shinshu Univ.) The fundamental category of a poset-stratified space 15

Summary: The fundamental category of a directed space can be regarded as an analogue of the fundamental groupoid (or group) of an ordinary topological space. In this talk, we study the fundamental category of a space decomposed by a poset, where the direction is given by the partial order. We show that the fundamental category of a totally normal stellar complex is equivalent to its face category.

- 17 Ryo Horiuchi (Bukkyo Univ.) On the stratification of combinatorial spectra 15

Summary: In this talk, I apply the construction of Kan's combinatorial spectra from simplicial sets to Verity's stratified simplicial sets, yielding objects called stratified combinatorial spectra. The first is known to model spectra, and the second is expected to model weak omega-categories. Accordingly, stratified combinatorial spectra is expected to model the stabilizations of weak omega-categories. Moreover, I provide a combinatorial construction that extends the smash product of combinatorial spectra to the stratified one.

- 18 Syunji Moriya (Univ. of Aizu) Embedding calculus and Vassiliev spectral sequence 15

Summary: Vassiliev spectral sequence and Sinha spectral sequence are both related to cohomology of the space of long knots $\mathbb{R} \rightarrow \mathbb{R}^3$. Although they have different origins, the Vassiliev E_1 -page and the Sinha E_2 -page are isomorphic (up to a degree shift). In this talk, we prove that they have isomorphic E_∞ -pages if the coefficient ring is a field. Together with degeneracy of the Sinha sequence, this implies that the Vassiliev sequence degenerates at E_1 -page over \mathbb{Q} including the non-diagonal part. Our result also implies that the space of finite type n knot invariants taking values in \mathbb{F}_p or $\mathbb{Z}_{(p)}$ (modulo $n - 1$ invariants) is isomorphic to the space of weight systems of weight n if $n \leq p + 1$.

- 19 Syunji Moriya (Univ. of Aizu) Sinha's spectral sequence for long knots in codimension one and non-formality of the little 2-disks operad 15

Summary: We compute some differentials of Sinha's spectral sequence for cohomology of the space of long knots modulo immersions in codimension one over a field of characteristic 2 or 3. This spectral sequence is closely related to Vassiliev's spectral sequence for the space of long knots in codimension ≥ 2 . We prove that the d_2 -differential of an element is non-zero in characteristic 2, which has already essentially been proved by Salvatore, and the d_3 -differential of another element is non-zero in characteristic 3. These results have some applications to non-formality of operads.

14:30–16:15

- 20 Naoki Kitazawa (Osaka Metro. Univ.) Construction of Morse–Bott functions on 3-dimensional compact and connected manifolds with prescribed level sets 15

Summary: We discuss reconstruction of a Morse–Bott function on a 3-dimensional compact and connected manifold with prescribed level sets and exactly one critical value in the interior of the image. The Morse function case has been solved by the speaker in 2025 and the case of Morse(–Bott) functions on closed and connected surfaces has been solved by Michalak in 2018.

- 21 Naoki Kitazawa (Osaka Metro. Univ.) On a classification of Morse functions on S^3 or connected sums of copies of $S^2 \times S^1$ and lens spaces 10

Summary: We discuss a classification of Morse functions on S^3 or connected sums of copies of $S^2 \times S^1$ and lens spaces components of level sets containing no critical point of which are disjoint unions of spheres and tori. This is regarded as a higher dimensional version of a classification of Morse functions on closed (orientable) surfaces by Michalak in 2018. We also improve Saeki's result in 2006, characterizing the class of these fundamental 3-dimensional manifolds by the existence of Morse functions of the mentioned class. Main ingredients are local reconstruction of local Morse functions and additional arguments on Reeb digraphs of the functions, defined as the spaces of all components of all level sets of the functions.

- 22 Naoki Kitazawa (Osaka Metro. Univ.) Real algebraic functions with prescribed Reeb graphs 10

Summary: We discuss reconstruction of real algebraic functions with prescribed Reeb digraphs. Related explicit problems have been studied and affirmatively solved in the differentiable (smooth) situations. The differentiable case is started by Sharko in 2006, followed by Masumoto–Saeki in 2010. There nice smooth functions on closed surfaces have been reconstructed and critical points are represented by some very elementary polynomials. Later, in 2018, Michalak has considered reconstruction of Morse functions with prescribed Reeb digraphs, for example. The real algebraic case is essentially started by the speaker.

- 23 Runa Shimada (Kobe Univ.) Geometric properties under deformations of singularities 15

Summary: Singularities of map-germs are classified by codimension, that is, in order of how frequently they occur. The singularities that are next most common after the most generic ones are precisely those that appear or disappear in one-parameter deformations of a map. Therefore, in this talk we will investigate the geometric properties of singularities, including the behavior that arises through their deformations.

- 24 So Yamagata (Fukuoka Univ.) Categorification of the characteristic polynomial of a matroid 10
Takuya Saito (Hokkaido Univ.)

Summary: Khovanov introduced a bigraded cohomology theory for links, whose graded Euler characteristic recovers the Jones polynomial. Analogous constructions have been developed in other areas of mathematics, such as graph theory and hyperplane arrangements. The central concept of this talk is the matroid, a structure that captures the notion of abstract dependency, encompassing both cycles in graphs and linear dependence in vector spaces. In particular, we construct cohomology groups whose graded Euler characteristic gives the characteristic polynomial of a matroid, thereby generalizing the chromatic cohomology of graphs and the characteristic cohomology of hyperplane arrangements. This talk is based on a joint work with Takuya Saito.

- 25 Emiko Yorisaki (Tokyo Metro. Univ.) The realization spaces of certain conic-line arrangements of degree 7
Shinzo Bannai (Okayama Univ. of Sci.) 15
Hiro-o Tokunaga (Tokyo Metro. Univ.)

Summary: We study the embedded topology of certain conic-line arrangements of degree 7. Two new examples of Zariski pairs are given. Furthermore, we determine the number of connected components of the realization spaces of the conic-line arrangements with prescribed combinatorics. We also calculate the fundamental groups using SageMath and the package Sirocco in the appendix.

16:30–17:30 Talk Invited by Topology Section

- Florent Schaffhauser (Heidelberg Univ.) Moduli of vector bundles over real algebraic curves

Summary: Moduli spaces of vector bundles over algebraic curves have been studied extensively since the foundational results of Mumford, Narasimhan, Seshadri, and Newstead in the 1960s. Thanks to the properties of the Harder–Narasimhan stratification uncovered by Desale, Ramanan, Shatz, Atiyah and Bott, it turns out that the topology of these spaces is quite tractable. Over the complex numbers, in particular, the gauge-theoretic approach of Atiyah and Bott gives a recursive formula for the Betti numbers, as well as explicit generators of the cohomology ring. In joint work with Melissa Liu, we have been interested in extending the Atiyah–Bott method to the case when the base algebraic curve is defined over the field of real numbers. Additional topological invariants are necessary to distinguish the various connected components of the moduli space of real vector bundles, but we can compute the mod 2 cohomology of these components in an explicit way as well. In this talk, I will briefly review the analogy between the complex and real case, and explain how to construct generators of the mod 2 cohomology algebra of moduli spaces of real vector bundles.

March 26th (Thu) Conference Room III

9:30–11:00

- 26 Nariya Kawazumi (Univ. of Tokyo) A noncommutative Johnson lifting related to \mathbb{K} -framings and spin structures on surfaces 15

Summary: We introduce a notion of \mathbb{K} -framings on a surface for any unital commutative ring \mathbb{K} and a noncommutative generalization of the Johnson lifting for spin structures. These notions clarifies the Earle cohomology class of the mapping class group with coefficients in the first cohomology group of the surface. Moreover we can define a canonical \mathbb{K} -framing associated with any symplectic expansion for a compact surface with one boundary component.

- 27 Aoi Wakuda (Univ. of Tokyo) Separability criteria of loops on orientable surfaces via the TWG bracket 15

Summary: We provide algebraic criteria based on the TWG (Thurston–Wolpert–Goldman) bracket to determine whether two unoriented free homotopy classes of loops on an oriented surface have disjoint representatives. These criteria are analogous to those established in our previous work for the Goldman bracket, which deals with oriented free homotopy classes. As an application, we determine the center of the TWG Lie algebra of a pair of pants. We extend the method of Kabiraj, which was originally limited to oriented surfaces filled by simple closed geodesics with respect to a complete hyperbolic metric, and show that in this case, the center is generated by the class of loops homotopic to a point, and the classes of loops winding multiple times around a single puncture or boundary component.

- 28 Takuya Sakasai (Univ. of Tokyo) On the dihedral invariant Lie subalgebra of the derivation Lie algebra of the free associative algebra 10

Summary: We study a structure of the dihedral invariant Lie subalgebra of the derivation Lie algebra of the free associative algebra. This Lie algebra arose in a series of works by Kawazumi and Kuno on the Goldman–Turaev Lie bialgebra. We discuss the first and second homology groups of the dihedral invariant Lie subalgebra up to weight 6.

- 29 Toyo Taniguchi (Univ. of Tokyo) Drinfeld associators and Kashiwara–Vergne associators in higher genera 15

Summary: A Drinfeld associator is a certain Lie series deeply related to braids on a disk, which is a genus 0 surface. On the other hand, a solution to the Kashiwara–Vergne (KV) problem, originated from Lie theory, corresponds to a solution of the formality problem of the Goldman–Turaev Lie bialgebra associated with a pair-of-pants by the result of Alekseev, Kawazumi, Kuno and Neaf. These objects are first related by Alekseev and Torossian, and Massuyeau constructed an explicit map from the set of Drinfeld associators to the solution set of the KV problem. In this talk, we extend their method to higher genera to obtain a similar map based on Gonzalez’ definition of higher genus Drinfeld associators.

- 30 Masatoshi Sato (Tokyo Denki Univ.) On the 2-loop part of the Johnson cokernel 15
Yusuke Kuno (Tsuda Coll.)

Summary: I will discuss our recent work on the structure of the Johnson cokernel, which is the quotient of the symplectic derivation Lie algebra on the free Lie algebra by the image of the Johnson homomorphism. Continuing the work of Conant in 2016, which identified the 1-loop part of the Johnson cokernel as the Enomoto–Satoh obstruction, we study the 2-loop part. We give an explicit presentation of the 2-loop space and show that, in degree 6, the 2-loop trace map captures all the components of the Johnson cokernel that cannot be detected by the Enomoto–Satoh trace.

14:15–16:45

- 31 Shin Satoh (Kobe Univ.) Polynomial generalization of the $v_{2,1}$ - and $v_{2,2}$ -invariants for long virtual
Kodai Wada (Kobe Univ.) knots 10

Summary: Goussarov, Polyak, and Viro introduced two degree-two finite-type invariants $v_{2,1}(K)$ and $v_{2,2}(K)$ for long virtual knots K . In this talk, we extend these invariants to polynomial invariants $V_{2,1}(K;t)$ and $V_{2,2}(K;t)$ of K , satisfying $V_{2,1}(K;1) = v_{2,1}(K)$ and $V_{2,2}(K;1) = v_{2,2}(K)$. We show that they are not finite-type invariants of any degree with respect to virtualizations, but are of degree two with respect to crossing changes. Moreover, any pair of Laurent polynomials can be realized as $(V_{2,1}(K;t), V_{2,2}(K;t))$ for some long virtual knot.

- 32 Naoko Kamada (Nagoya City Univ.) Doubling of welded knots 10
Seiichi Kamada (Univ. of Osaka)

Summary: A welded link is an equivalence class of link diagrams possibly with virtual crossings. The equivalence is generated by Reidemeister moves and some additional moves involving virtual crossings. We introduce a method constructing a welded link diagram from a given diagram such that if two original diagrams are equivalent then the diagrams obtained the method are equivalent.

- 33 Akiko Shima (Tokai Univ.) Linear 4-charts with three crossings 15
Teruo Nagase (Tokai Univ.*)

Summary: A chart represents an oriented closed surface embedded in 4-space. In this paper, we investigate embedded surfaces in 4-space by using charts.

Let Γ be a chart, and we denote by $Cross(\Gamma)$ the set of all the crossings of Γ , and we denote by Γ_m the union of all the edges of label m . For a 4-chart Γ , if the closure of each connected component of the set $(\Gamma_1 \cup \Gamma_3) - Cross(\Gamma)$ is acyclic, then Γ is said to be *linear*. In this talk, we shall show that any linear minimal 4-chart with three crossings is lor-equivalent (Label-Orientation-Reflection equivalent) to the chart describing a 2-twist spun trefoil knot by omitting free edges and hoops.

- 34 Jumpei Yasuda (Osaka Metro. Univ.) On knot quandles of Suciu's ribbon knots 10

Summary: The knot group of an n -knot is the fundamental group of the complement of the n -knot. In 1983, Suciu constructed infinite many ribbon n -knots with isomorphic knot groups. In this talk, we consider knot quandles of Suciu's ribbon n -knots and prove that their knot quandles are mutually non-isomorphic. Furthermore, we compute types of these quandles.

- 35 Kokoro Tanaka (Tokyo Gakugei Univ.) On the monodromies of Suciu's n -knots 10
Takuya Sakasai (Univ. of Tokyo)

Summary: Suciu constructed an infinite family of fibered ribbon n -knots sharing the same knot group. Jablonowski proved that their knot quandles are pairwise non-isomorphic, and Yasuda later provided an alternative proof. In this talk, we present yet another proof of this result by analyzing the monodromies of Suciu's n -knots, which are certain automorphisms of the free group of rank two.

- 36 Kengo Kawamura (Osaka Sangyo Univ.) On skein relations of a cocycle invariant for p -colored links 10
Atsushi Ishii (Univ. of Tsukuba)
Kanako Oshiro (Sophia Univ.)

Summary: Let p be an odd prime. Using Mochizuki's 3-cocycle, a cocycle invariant of a shadow p -colored diagram of an unoriented link is obtained, which is independent from choice of its region p -coloring. In this talk, we introduce skein relations of the cocycle invariant for p -colored link, based on p -moves and splices, and give its recursive computation of $p = 3$ case through the skein relations.

- 37 Ayu Suzuki (Japan Women's Univ.) On embedding of homogeneous quandles and its examples 15

Summary: A quandle is an algebraic structure characterized by idempotence, existence of inverses, and (right) self-distributivity. It was originally introduced in the study of knot invariants and also has deep connections with symmetric spaces. In recent years, the study of quandle embeddings, particularly those into conjugation quandles associated with group actions, has received much attention. In this talk, we begin with the embeddings of spherical quandles into (S)Pin groups established by Eisermann and Yonemura, and then present a generalized framework for constructing embeddings of homogeneous quandles. As examples, we discuss embeddings of Grassmann manifold quandles and a family of spherical quandles equipped with rotation parameters.

- 38 Sam Nelson (Claremont McKenna Coll.) The forbidden quiver of a link 15

Summary: Using the forbidden moves from virtual knot theory, the Gauss diagram of an oriented classical or virtual link determines a quiver which is invariant under ambient isotopy, virtual isotopy and link homotopy. From this quiver we extract new polynomial link invariants. This is joint work with Stella Shah.

- 39 Sam Nelson (Claremont McKenna Coll.) Categorification of biquandle arrow weights using quivers 10
Migiwa Sakurai
 (Shibaura Inst. of Tech.)

Summary: Introduced in our previous research, biquandle arrow weights invariants are enhancements of the biquandle counting invariant for oriented virtual and classical knots defined from biquandle-colored Gauss diagrams using a tensor over an abelian group satisfying certain properties. In this talk, we categorify the biquandle arrow weight polynomial invariant using biquandle coloring quivers, obtaining new infinite families of polynomial invariants of oriented virtual and classical knots.

- 40 Masaki Ogawa (Tohoku Univ.) On Khovanov homology of link in $\mathbb{R}P^3$ and S^3 15

Summary: Khovanov homology is a homology theory defined for a knot diagram, and it yields a knot invariant. Its background lies in the Jones polynomial: taking the Euler characteristic of Khovanov homology recovers the Jones polynomial. As a knot invariant, Khovanov homology is powerful—for example, it detects the unknot. At the same time, it can be viewed as a functor from the cobordism category of knots, and its applications extend far beyond knot classification, reaching into four-dimensional topology and other areas. Khovanov homology was originally defined for knots in S^3 . Later, various extensions were developed for links in other 3-manifolds. In this work, we focus on the version defined for links in $\mathbb{R}P^3$ and on its relationship with the case of S^3 .

Infinite Analysis

March 25th (Wed) Conference Room VI

10:30–11:45

- 1 Ryota Akagi (Nagoya Univ.) Generalization of c -, g -vectors to real entries in cluster algebras and its finite type classification via Coxeter diagrams 15

Summary: In cluster algebras, integer vectors called c -vectors and g -vectors are important tools to study their combinatorial structures. By following a certain procedure, we may generalize them to real entries. I studied the structure of real c -, g -vectors by assuming a certain condition called sign-coherence. Then, enriched structures in the ordinary cluster algebras are preserved, and we found some hopeful observations for this generalization. In this talk, I will explain these structures and finite type classification under sign-coherence. This is a joint work with Zhichao Chen in University of Science and Technology of China.

- 2 Ryota Akagi (Nagoya Univ.) Sign coherence and its structure of real c -vectors associated with cluster-cyclic matrices of rank 3 15

Summary: In the cluster algebras, sign-coherence of c -vectors is important assumption. In general, it is difficult to determine the signs of c -vectors. We introduced the recursion of their signs when an exchange matrix is cluster-cyclic of rank 3, and due to this recursion, we gave a new proof of sign-coherence in this class. In this talk, I will explain this recursion and the structure of their signs. This is a joint work with Zhichao Chen in University of Science and Technology of China.

- 3 Ayaka Murakami (Ochanomizu Univ.) q -Heun equation and its q -integral transformation 15
Kouich Takemura (Ochanomizu Univ.)

Summary: Takemura showed that the q -Heun equation, which is a q -deformation of Heun's differential equation, has q -integral transformations related to the kernel function. We find new solutions of the q -Heun equation by combining polynomial-type solutions with the q -integral transformations.

- 4 Kanam Park A q -middle convolution and the q -Painlevé equation of type $E_6^{(1)}$ 15
(Toba Nat. Coll. of Maritime Tech.)

Summary: The middle convolution was introduced by Katz and formulated by Dettweiler and Reiter as an operation on Fuchsian differential systems. A q -difference analogue of the middle convolution was introduced by Sakai and Yamaguchi. Sasaki, Takagi and Takemura showed that the transformation obtained by applying the q -middle convolution to the linear equations associated with the q -Painlevé equation can be expressed in terms of the affine Weyl-group symmetries of the q -Painlevé equations. In this talk, I will report that by applying the q -middle convolution introduced by Sakai and Yamaguchi to the 3×3 matrix linear q -difference equation associated with the q -Painlevé equation of type $E_6^{(1)}$.

14:15–15:45

- 5 Takahiko Nobukawa (Kogakkan Univ.) A rank 3 linear q -difference equation with affine Weyl group symmetry of type $E_8^{(1)}$ 15

Summary: We give a linear q -difference equation of rank 3, which has the affine Weyl group symmetry of type $E_8^{(1)}$. The symmetry is presented by the q -middle convolution, introduced by Sakai–Yamaguchi and reformulated by Arai–Takemura. We also characterize the above equation by the spectral types of linear q -difference equations.

- 6 Taiki Fujii (Kobe Univ.) On the connection between Grothendieck polynomials and q -hypergeometric series 15
 Tatsushi Shimazaki (Kobe Univ.)

Summary: The Grothendieck polynomial $G_\lambda(x|\beta)$ was introduced by Lascoux and Schützenberger in the context of enumerative geometry. Fujii, Shimazaki, and Nobukawa clarified a connection between the specialization of the Grothendieck polynomial and the Gauss hypergeometric series as well as the Holman hypergeometric series. The latter is a multivariate hypergeometric series arising from representation theory and admits a summation formula. A q -analogue of this series was introduced by Milne.

In this talk, we discuss the relationship between the value of the Grothendieck polynomial under the principal specialization and the q -hypergeometric series developed by Heine and Milne.

- 7 Yuichi Ueno (Kogakkan Univ.) Quantization of higher order Painlevé systems 15

Summary: In this talk, we introduce a quantization of higher order Painlevé systems. Using the holomorphic property, we determine the quantum Hamiltonians for higher order Painlevé systems. These results show the method of the holomorphic property is useful also in quantum situation.

- 8 Ryo Okawa (Kyoto Univ.) Whittaker functions on affine Laumon spaces 15
 Jun'ichi Shiraishi (Univ. of Tokyo)

Summary: We derive the equations for the Whittaker functions defined by affine quantum groups using the Shapovalov form and the Drinfeld–Casimir.

- 9 Alexander Stokes (Waseda Univ.) Monodromy of monodromy surfaces 15

Summary: Painlevé equations are associated to complex algebraic surfaces in two different ways, which are related by biholomorphism under different instances of the Riemann–Hilbert correspondence. On the ‘left-hand side’ are Sakai surfaces, which provide Okamoto’s initial value spaces, and on the ‘right-hand side’ are monodromy surfaces coming from associated linear problems. Symmetries of Sakai surfaces form extended affine Weyl groups and provide Bäcklund transformations of the Painlevé equations. However, under the Riemann–Hilbert correspondence the actions of the affine Weyl groups become trivial on monodromy surfaces. In this talk we explain that there is still a shadow of the extended affine Weyl group symmetry on the other side of the Riemann–Hilbert correspondence, which takes the form of the monodromy group of the monodromy surface itself. Based on joint work with Pieter Roffelsen.

16:00–17:00 Talk Invited by Infinite Analysis Special Session

- Shunya Adachi (Utsunomiya Univ.) On Katz theoretic integral transformations

Summary: The theory of middle convolution, introduced by N. Katz, brought about groundbreaking developments in the study of Fuchsian ordinary differential equations. Middle convolution is an operation that is a refined formulation of the Euler transform (Riemann–Liouville transform). It sends one Fuchsian system to another and has many remarkable properties. While research on Fuchsian differential equations using middle convolution —such as global analysis of solutions, isomonodromic deformations, and the Deligne–Simpson problem— has achieved significant success, various attempts have also been made to extend middle convolution itself to differential equations beyond the Fuchsian case, such as linear differential equations with irregular singularities and linear Pfaffian systems in several variables, which have led to many important results. Recently, the speaker introduced a new transformation for linear Pfaffian systems, the middle Laplace transform, which is a refined formulation of the classical Laplace transform from the viewpoint of Katz theory. In this talk, we first give a brief overview of Katz theory and the related results mentioned above. We then explain the formulation and properties of the middle Laplace transform. Using this transformation, one can generalize middle convolution to linear Pfaffian systems with irregular singularities. If time permits, we will also discuss some applications to hypergeometric functions in several variables.

March 26th (Thu) Conference Room VI

10:30–11:45

- 10 Nobutaka Nakazono (Tokyo Univ. of Agri. and Tech.) Exact solutions to an autonomous dKdV equation via Painlevé-type ordinary difference equations 15

Summary: Hirota's discrete KdV equation is a well-known integrable two-dimensional partial difference equation regarded as a discrete analogue of the KdV equation. In this talk, we demonstrate that a variation of Hirota's discrete KdV equation with an additional parameter admits two types of exact solutions: discrete Painlevé transcendent solutions and periodic solutions described by Painlevé-type ordinary difference equations.

- 11 Genki Shibukawa (Kitami Inst. of Tech.) Little μ -function, the Rogers–Ramanujan continued fraction and Schur's q -Fibonacci numbers 15
Satoshi Tsuchimi (Kindai Univ.)

Summary: We present various formulas for specializations of the little μ -function, which is the degenerate limit of the generalized μ -function [ST]. These specializations satisfy the recurrence relation for the q -Fibonacci sequence, introduced by I. Schur [S], and we show that their initial values are expressed in terms of the theta functions.

- 12 Sota Miyazawa (Nat. Defense Acad. of Japan) A novel correspondence between paths for a crystal base of $U_q(\widehat{\mathfrak{sl}}_2)$ and Young diagrams 15
Taichiro Takagi (Nat. Defense Acad. of Japan)

Summary: Through an expression for the branching functions of a level 1 irreducible highest weight module of affine Lie algebra $\widehat{\mathfrak{sl}}_2$, we find their connection to the theory of minimal odd excludant in integer partitions. A new partition statistic, which we call sqrank, determines a set of partitions that are equinumerous with another set of partitions determined by the minimal odd excludant. The main result of the present work is to show that there is a combinatorial one-to-one correspondence between the set of partitions of n with sqrank r and the set of highest weight paths for a $U_q(\widehat{\mathfrak{sl}}_2)$ crystal that is associated with $2r + 1$ -dimensional irreducible \mathfrak{sl}_2 modules of degree n in a weight decomposition of the above level 1 highest weight module of $\widehat{\mathfrak{sl}}_2$.

- 13 Masato Kobayashi (Kanagawa Univ.) Decompositions of crystal graphs by skeleton RSK 15

Summary: An equivalence class under standardization of a type A crystal graph is a quasi-crystal. This forms its connected subgraph so that a crystal naturally splits into a union of those. We then introduce a new class of polynomials, crystal skeleton polynomials to better understand such decompositions. We came up with the idea, skeleton RSK, to describe it. In this talk, we will show more details of such topics.

14:15–15:15 Talk Invited by Infinite Analysis Special Session

- Shinsuke Iwao (Keio Univ.) Solving the Bethe equations for periodic TASEP and proving completeness

Summary: The periodic TASEP (Totally Asymmetric Simple Exclusion Process) is a stochastic model in which a finite number of particles move in one direction in a one-dimensional periodic lattice. The eigenvectors and eigenvalues of the Markov matrix for the periodic TASEP can be obtained by solving the corresponding Bethe equations. Although many researchers have attempted to analyze the solutions to the Bethe equations, a satisfactory method for deriving a general solution has not been achieved. In this talk, I present an algebraic-curve-based method that provides all solutions of the TASEP. This talk is based on joint work with Kohei Motegi (Tokyo University of Marine Science and Technology).