Final: 2025/8/1

The Mathematical Society of Japan

2025 Autumn Meeting

Titles and Short Summaries of the Talks

September, 2025

at Nagoya University

2025 The Mathematical Society of Japan

AUTUMN MEETING

Dates: September 16th (Tue)–19th (Fri), 2025

Venue: Higashiyama Campus, Nagoya University
Furo-cho, Chikusa-ku, Nagoya, 464-8601, Aichi, Japan

Contact to: Graduate School of Mathematics,
Nagoya University
Furo-cho, Chikusa-ku, Nagoya, 464-8601, Aichi, Japan
E-mail nagoya25sept@mathsoc.jp

The Mathematical Society of Japan

	I C13	II C15	III C23	IV C25	V S2X	VI S30	VII C33	VIII C35	IX C43
16th (Tue)	Functional Equations 9:00–12:00 14:15–16:30	Functional Analysis 9:30–10:30	Complex Analysis 9:30–11:10 15:40–16:30	Statistics and Probability 9:00–12:00	Applied Mathematics 9:30–11:45 15:30–16:35	Geometry 9:30–11:45 14:15–16:45	Infinite Analysis 9:30–11:45 14:15–15:20	Topology 9:30–12:00 14:30–16:00	Algebra 9:00–12:00 15:30–17:15
	Featured Invited Talks 13:00–14:00								
	Invited Talk 17:00–18:00	Invited Talk 10:45–11:45	Invited Talk 14:20–15:20	Invited Talks 14:15–15:15 15:30–16:30	Invited Talks 14:15–15:15 16:50–17:50		Invited Talk 15:30–16:30	Invited Talk 16:30–17:30	Invited Talk 14:15–15:15
17th (Wed)	Functional Equations 9:15–12:00	Functional Analysis 10:00–10:45	Complex Analysis 9:30–11:10	Statistics and Probability 9:20–11:20	Applied Mathematics 9:00–11:50 13:10–14:00		Infinite Analysis 9:30–10:35		Algebra 9:00–12:00
	Invited Talk 13:00–14:00	Invited Talk 11:00–12:00	Invited Talk 13:00–14:00			Invited Talks 10:20–11:20 12:50–13:50	Invited Talk 10:45–11:45		Invited Talk 13:00–14:00
	MSJ Prizes Presentation (Toyoda Auditorium) ····· (14:30–15:00) Plenary Talks (Toyoda Auditorium) Autumn Prize Winner ····· (15:15–16:15) Akio Tamagawa (Kyoto Univ.) ····· (16:30–17:30) Official Party (Hananoki Restaurant) ····· (18:00–20:00)								
18th (Thu)	Functional Equations 9:15–12:00 14:30–16:30	Functional Analysis 10:00–11:10 14:15–14:55	Real Analysis 10:00–11:30 14:15–15:30	Statistics and Probability 9:30–11:45	Applied Mathematics 10:00–12:00 14:15–16:00	Geometry 9:30–11:45 14:15–17:45	Found. of Math. & Hist. of Math. 10:00–11:55 15:30–16:45	Topology 9:30–11:30 14:15–16:00	Algebra 9:30–12:00 15:30–17:30
	Featured Invited Talks 13:00–14:00								
	Invited Talk 17:00–18:00	Invited Talk 15:10–16:10	Invited Talk 15:45–16:45	Invited Talks 14:15–15:15 15:30–16:30	Invited Talk 16:15–17:15		Invited Talk 14:15–15:15	Invited Talk 16:30–17:30	Invited Talk 14:15–15:15
19th (Fri)	Functional Equations 9:15–12:00 14:15–16:30		Real Analysis 10:00–12:00 14:15–15:45	Statistics and Probability 10:00–11:45	Applied Mathematics 10:00–12:00 14:15–16:00	Geometry 9:30–10:45	Found. of Math. & Hist. of Math. 9:30–10:30 14:15–15:30	Topology 9:30–12:00 14:15–16:30	Algebra 9:30–12:00 15:30–17:30
	Featured Invited Talks 13:00–14:00								
	Invited Talk 17:00–18:00		Invited Talk 16:00–17:00		Invited Talk 16:15–17:15	Invited Talk 11:00–12:00	Invited Talk 10:45–11:45		Invited Talk 14:15–15:15

Contents

Plenary Talks

September 17th (Wed) Toyoda Auditorium

Award Lecture for the 2025 MSJ Autumn Prize

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

Akio Tamagawa (Kyoto Univ.) Anabelian geomerty —past, present and future ..... (16:30–17:30)

Summary: Anabelian geometry was initiated by Alexander Grothendieck in the early 1980s. Its ultimate goal is to reconstruct algebraic geometry entirely in terms of (highly non-abelian) groups. Since 1990s, anabelian geometry has been greatly developed, especially in Japan. In this talk, I would like to discuss: (o) what is anabelian geometry; (i) what are typical fundamental results in anabelian geometry obtained so far; (ii) what are recent developments in anabelian geometry; and (iii) what will be the future of anabelian geometry.

Featured Invited Talks

September 16th (Tue)

Conference Room III

Junjiro Noguchi (Univ. of Tokyo⋆/Sci. Tokyo⋆) Value distribution and distribution of rational points III · · (13:00–14:00)

Summary: I gave the first talk under this title in the fall of 1997, and the second one in the spring of 2013, coinciding with my retirement. In this third one I would like to talk about some results and findings during the one round of Eto since then. For example, I will discuss an application of a Big Picard Theorem generalized for semi-abelian varieties to the proof of the Manin–Mumford Conjecture (Raynaud's Theorem) on the distribution of torsion points, combined with the o-minimal theory (2018). Applying the value distribution theory, we discuss analytic and rational sections of abelian varieties over function fields and Legendre's elliptic curves (Corvaja–N.–Zannier, 2022), and also the analytic Ax–Schanuel theorem from the view point of Nevanlinna theory (2024). If time allows, I would like to discuss some late result due to Xie-Yuan on the finiteness of rational sections in finite ramified covers of abelian varieties over function fields from the view point of Kobayashi hyperbolic geometry.

Conference Room IV

Hideki Tanemura (Chiba Univ.⋆) Stochastic analysis of infinite particle systems with interactions · (13:00–14:00)

Summary: In this talk, I will explain research on infinite particle systems with interactions. While systems with relatively weak interactions have been actively studied since around the 1980s, research on systems with long-range interactions began to develop rapidly around the year 2000, particularly through studies of models related to random matrices, and continues to be an active area of research today. In this talk, after introducing the historical development of the field, I will discuss the current state and future prospects of this research.

Conference Room VI

Guest Talk from Korean Mathematical Society

Cheol-Hyun Cho (Pohang Univ. of Sci. & Tech.) Geometric models of simple Lie algebras via singularity theory · (13:00–14:00)

Summary: It is well-known that ADE Dynkin diagram classifies both the simply-laced simple Lie algebras and simple singularities. We introduce a polygonal wheel in a plane for each case of ADE, called the Coxeter wheel. We show that equivalence classes of edges and spokes of a Coxeter wheel form a geometric root system isomorphic to the classical root system of the corresponding type. This wheel is in fact derived from the Milnor fiber of corresponding simple singularities of two variables, and the bilinear form on the geometric root system is the negative of its symmetrized Seifert form. Furthermore, we give a completely geometric definition of simple Lie algebras using arcs, Seifert form and variation operator of the singularity theory. This is a joint work with Wonbo Jeong and Beom-Seok Kim.

September 18th (Thu)

Conference Room II

Kyo Nishiyama (Aoyama Gakuin Univ.) Orbits on flag vrieties and representation theory: An overview ..... (13:00–14:00)

Summary: Let G be a reductive algebraic group and B one of its Borel subgroups. The homogeneous space G/B is called the full flag variety; it plays a central role in representation theory, geometry, and combinatorics. I will summarize the rich theory mainly from the representation-theoretic point of view. The topics include the Borel–Weil theorem, Beilinson–Bernstein localization, and the KGB classification of Harish-Chandra modules. A resolution of singularities of nilpotent varieties is given by the cotangent bundle over the flag variety and the moment map. The Springer–Steinberg theory ultimately relates the characteristic varieties and associated varieties of Harish-Chandra modules in this geometric setting.
In the latter half of the talk, I will focus on the theory of multiple flag varieties developed over the past two decades. If there are only finitely many orbits, it gives rise to rich combinatorics, such as the well-known Robinson–Schensted–Knuth correspondence, based on a generalization of the Springer–Steinberg theory. Recently, we have begun studies on real double flag varieties, where the orbits are related to intertwining operators realized as integral transforms with kernel functions related to relative invariants of prehomogeneous vector spaces.

Conference Room VI

Yoshihisa Kitagawa (Utsunomiya Univ.*) Construction of flat tori in the 3-sphere and its applications ..... (13:00–14:00)

Summary: An immersed surface M in the 3-dimensional unit sphere S^3 is called a flat torus in S^3 if M is homeomorphic to a torus and the Gaussian curvature of M is identically zero. Using the Hopf fibration $p : S^3 \to S^2$, we obtain many examples of flat tori in S^3. In fact, for each closed regular curve γ in S^2, the inverse image $p^{-1}(\gamma)$ is a flat torus in S^3 and it is called a Hopf torus in S^3. In 1975, Yau posed the problem of the classification of the flat tori in S^3. For this problem, the only known examples were the Hopf tori in S^3. In 1988, using a group structure on S^3, the author established a method for constructing all the flat tori in S^3, and showed that there exists a flat torus in S^3 other than the Hopf tori. After the discovery above, many other developments in the study of flat tori in S^3 were obtained. For example, by using the Arf invariant for knots, the author proved that every embedded flat torus in S^3 is invariant under the antipodal map of S^3.
In this talk, we explain the above method for constructing flat tori in S^3 and its applications to embedded flat tori in S^3. Furthermore, we discuss an open problem on the extrinsic diameter of flat tori in S^3.

September 19th (Fri)

Conference Room I

Tadayoshi Adachi (Kyoto Univ.) Quantum scattering in spatially homogeneous electromagnetic fields ..... (13:00–14:00)

Summary: In this talk, we give an outline of some topics on quantum scattering in spatially homogeneous electromagnetic fields. We mainly consider the following two cases: in the case where a possibly time-dependent electric field is applied, we deal with one of the inverse scattering problems via the Enss–Weder method; in the case where crossed constant electric and magnetic fields are applied, we deal with the problem of asymptotic completeness for a one body central force system. Prior to that, we will give a brief historical sketch of mathematical researches on the problem of asymptotic completeness.

Conference Room IX

Osamu Iyama (Univ. of Tokyo) Freeness and simplicity: Tilting theory revisited ····· (13:00–14:00)

Summary: A central goal in representation theory is to understand modules over a given ring. Among them, free modules and simple modules are particularly fundamental. While every module is both free and semisimple over a field, these classes become exceptional over general rings and have been widely generalized. In this talk, I will revisit tilting theory, a foundational framework for the study of derived categories. A highlight of recent developments involves semibricks and silting complexes, which can be viewed as far-reaching generalizations of semisimple modules and free modules, respectively. These notions give rise to unexpectedly rich structures, such as the complete lattice of torsion classes and the non-singular fan in the real Grothendieck group, and they have found applications in various mathematical contexts, including cluster algebras, Cohen–Macaulay modules, and cDV singularities.

Foundation of Mathematics and History of Mathematics

September 18th (Thu) Conference Room VII

10:00–11:55

1 Ikuo Yoneda (Nat. Inst. of Tech., Tokuyama Coll.) Quasi-geometric elimination of imaginaries and modular law in the real sort ····· 15

Summary: Quasi-geometric elimination of imaginaries is equivalent to geometric elimination of imaginaries by the full existence condition of anti-reflexive independence relation. We show that modular law in the real sort is equivalent to modular law together with geometric elimination of imaginaries. We also introduce quasi-modular law which is weaker than modular law, and these notions coincide under assuming geometric elimination of imaginaries. We consider whether quasi-modular law together with CM-triviality implies modular law or not.

2 Ikuo Yoneda (Nat. Inst. of Tech., Tokuyama Coll.) No implications between CF-property and elimination of imaginaries ····· 15

Summary: We present four kinds of o-minimal structures as follows. (1) CF-property with elimination of imaginaries. (2) Non CF-property with elimination of imaginaries. (3) CF-property without elimination of imaginaries. (4) Non CF-property without elimination of imaginaries. (1) and (2) have the definable choice. (3) and (4) are Will Johnson's example. Will Johnson humbly tells that he would rather not be a co-presenter and this result is due to Yoneda.

3 Koki Okura (Univ. of Tsukuba) Dp-finite groups expanded by closed sets ····· 15

Summary: At the last meeting, we talked about a structure on the ordered abelian group of formal Laurent series expanded by adding a continuous function. It was shown that this structure has dp-rank 2. It can be checked that its open core is identical to the original structure. In this talk, we will discuss some related topics such as a structure of dp-rank n, an expansion with the multiplication, and the group of p-adics.

4 Hirotaka Kikyo (Kobe Univ.) Akito Tsuboi (Univ. of Tsukuba*) Chromatic number of several countable graphs ····· 15

Summary: We consider several countable graphs and determine their chromatic number. We can directly show that the chromatic number of the triangle-free random graph is infinite. Also, we can see that there is an infinite graph with an infinite chromatic number with arbitrarily large girth. Let M be a structure obtained by Hrushovski construction using a predimension function. Then M has a finite chromatic number.

5 Koichiro Ikeda (Hosei Univ.) On theories having a type with tree property ····· 15

Summary: A type $p \in S(T)$ is said to have tree property, if there are $a, b, c \models p$ such that $tp(bc/a)$ is isolated, and a and b are independent. We want to expalain our result which says that there exists a small stable theory having a type with tree property.

6 Akito Tsuboi (Univ. of Tsukuba*) Applying HF to finite model theory: The power of proactive use ····· 10

Summary: In this short talk, we aim to demonstrate that the active use of HF simplifies discussions in finite model theory and is likely to inspire new developments.

7 Koitaro Nakaura (Univ. of Tokyo) On the chromatic numbers of stable and unstable graphs ····· 15

Summary: The chromatic number of a graph is the minimal cardinal κ for which there exists a vertex coloring with κ colors such that adjacent vertices have different colors. In this work, we study the chromatic numbers of uncountable graphs and their model-theoretic properties.

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

Masato Fujita (Japan Coast Guard Academy) Topologically tame ordered structures

Summary: Sets definable in ordered structures such as o-minimal structures are equipped with the topology induced from the order. Since van den Dries first proposed the concept of o-minimality in 1980's, various studies on o-minimality including its applications to other areas of mathematics have been conducted. In addition, several structures which satisfy more relaxed conditions than those imposed to o-minimal structures have been introduced and studied, expecting that sets definable in these structures still enjoy tame topological properties similar to that enjoyed in o-minimal structures. In this talk, the speaker introduces several such structures e.g. o-minimal structures, locally o-minimal structures and d-minimal structures, with an emphasize on topological nature of sets definable in these structures, especially, partition of definable sets into definable sets with extra tameness such as cells and manifolds.

15:30–16:45

8 Haruka Kogure (Kobe Univ.) On partially conservative sentences 1 ····· 15
Taishi Kurahashi (Kobe Univ.)

Summary: We say that a sentence φ is Γ-conservative over T if every Γ sentence provable in $T+\varphi$ is already provable in T. Guaspari introduced the notions of hereditarily conservative sentences, exactly conservative sentences, and essentirally Θ sentences, and then he asked the existence of essentially Θ sentences that are exactly hereditarily Γ-conservative over T for various possible pairs (Γ, Θ). We settle Guaspari's question affirmatively.

9 Haruka Kogure (Kobe Univ.) On partially conservative sentences 2 ····· 15
Taishi Kurahashi (Kobe Univ.)

Summary: In this talk, we present several results concerning variants of Solovay's theorem on the existence of doubly partially conservative sentences. First, we investigate Θ sentences that are doubly (Γ, Λ)-conservative over T for several triples $(\Theta, \Gamma, \Lambda)$. Among other things, we prove that the existence of a $\Delta_{n+1}(\mathsf{PA})$ sentence that is doubly (Σ_n, Σ_n)-conservative over T is equivalent to the Σ_{n+1}-inconsistency of T over PA. Secondly, we study Θ sentences that are hereditarily doubly (Γ, Λ)-conservative over T for several triples $(\Theta, \Gamma, \Lambda)$.

10 Yuta Sato (Kobe Univ.) Uniform Lyndon interpolation theorem for $\mathbf{N}^+\mathbf{A}_{m,n}$ through propositionalization and cut elimination ····· 15

Summary: We introduce a general method, called propositionalization, that enables one to reduce uniform Lyndon interpolation property (ULIP) of a logic to some weaker logic. We then prove ULIP of a nonnormal modal logic $\mathbf{N}^+\mathbf{A}_{m,n} = \mathbf{Cl} + \frac{\varphi}{\Box\varphi} + \frac{\neg\Box\varphi}{\neg\Box\Box\varphi} + \Box^n\varphi \to \Box^m\varphi$ by constructing a propositionalization of it into classical propositional logic $\mathbf{Cl}$, ULIP of which is already known. The cut admissibility of the sequent calculus for $\mathbf{N}^+\mathbf{A}_{m,n}$ plays a crucial role in the proof.

11 Takahiro Seki (Niigata Univ.) Associativity and commutativity of variations of residual axioms ····· 15

Summary: It is known that residual axioms between implication and fusion are not provable in non-associative substructural logics. Several variations of residual axioms exist in non-commutative substructural logics. In this talk, we examine the associativity and commutativity of substructural logics with these variations. We also show the equivalence and hierarchy of variations of residual axioms.

12 Ryo Kashima (Sci. Tokyo) On the completeness of infinitary proof systems for the modal mu-calculus ····· 15

Summary: There are two infinitary proof systems for the modal mu-calculus: one has an omega rule and the other has non-well-founded trees as proofs. Studer (2008) claimed that there is a translation from proofs in the first system to proofs in the second system. In this talk, we show that Studer's translation contains an error.

September 19th (Fri) Conference Room VII

9:30–10:30

Summary: We show that a game-theoretic variant of the Katětov order between ideals is connected to the geometric inclusion relation between idealized subtoposes of the effective topos.

Summary: The notion of probability plays a crucial role in quantum mechanics. It appears as the Born rule. In modern mathematics which describes quantum mechanics, however, probability theory means nothing other than measure theory, and therefore any operational characterization of the notion of probability is still missing in quantum mechanics. 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. In this talk, we make an analysis of the Wigner's friend paradox and its variant in the framework of quantum mechanics based on the principle of typicality.

Summary: The principle (†), which asserts that every ω_1-stationary preserving poset is semiproper, has several characterizations, such as the semistationary reflection principle and the strong Chang's conjecture. It is well known that (†) holds when a strongly compact cardinal is collapsed to ω_2 in a standard way. On the other hand, even when the target of the collapse is not ω_2, strong compactness still implies parts of (†). In this talk, we introduce an approach to studying aspects of (†) by counting how many Namba forcings are semiproper, and we discuss the validity of this method.

Summary: For an ideal $\mathscr{I}$ on ω, let $\mathcal{K}_{\mathscr{I}}$ denote the σ-ideal generated by sets of the form $\prod_{n<\omega} I_n$ where $I_n \in \mathscr{I}$ for each $n < \omega$. For example, when $\mathscr{I} = \mathrm{Fin}$ is the finite ideal, $\mathcal{K}_{\mathscr{I}} = \mathcal{K}$ is the σ-ideal generated by compact sets in ω^ω. We study cardinal invariants of $\mathcal{K}_{\mathscr{I}}$ for various ideals $\mathscr{I}$, such as $\mathrm{add}(\mathcal{K}_{\mathscr{I}}), \mathrm{non}(\mathcal{K}_{\mathscr{I}}), \mathrm{cov}(\mathcal{K}_{\mathscr{I}}), \mathrm{cof}(\mathcal{K}_{\mathscr{I}})$. This is a joint work with Aleksander Cieślak, Takehiko Gappo and Arturo Martínez-Celis.

10:45–11:45 Talk Invited by Section on Foundation and History of Mathematics

Summary: We show the consistency, relative to ZFC, of the following statement: a discontinuous homomorphism from $C(X)$ to a Banach algebra exists, the continuum hypothesis holds, and a forcing axiom weaker than Martin's axiom holds. Our forcing axiom is Martin's axiom restricted to two new properties denoted $\mathrm{EPC}_{\aleph_1}$ and $\mathrm{ProjCes}(E)$, where E is a fixed stationary and co-stationary subset of ω_1. The result provides a partial positive answer to a question raised by Woodin. In our model, every ladder system coloring can be uniformized on the complement of E; in particular, Whitehead's conjecture fails. Finally, we discuss how the property $\mathrm{EPC}_{\aleph_1}$ differs from other well-known properties of forcing posets.

12:00–12:15 Research Section Assembly

14:15–15:30

17 Tsukane Ogawa (Yokkaichi Univ.)
Tanaka Noriko (Naragakuen Univ.)
On the completion of the five vulumes of the *Kijutsu Kairo Hou* ····· 15

Summary: Each of the five volumes of Kijutsu Kairo Hou (Way of making calculation methods and explaining their process) written by the Takuma school's Oka Yukitada has two slightly contradictory titles. Taking inspiration from the four volumes of the book copied by Asano Uhei, I consider the circumstances of these books. These were originally separate works, then using the keyword "Kijutsu Kairo How" compiled into four volumes of work. The idea is natural, but giving the same title as the first volume to the whole work and then giving different titles to the remaining volumes is unnatural. It was compiled after Asano had copied it, but judging from the handwriting, it may have been written by Oka himself.

18 Noriko Tanaka (Naragakuen Univ.)
Ogawa Tsukane (Yokkaichi Univ.)
Takuma school, Oka Yukitada, Kijutu-Kairoho Vol. 5 and Shiki-Kijutsu math features ····· 15

Summary: We describe the characteristics of Mathematics of the five volumes of Kijutu-Kairoho and Shiki-kijutsu. The History of Japanese Mathematics before the Meiji Era is a six-volume compilation of "Kijutsu Kairoho" in five volumes, plus "Shiki Kijutsu", and the "Kairoho" is written in reference to the previous volumes. The book to which Shiki Kijutsu refers is not in the five volumes of "Kijutsu Kairoho", and the fact that the six volumes are combined together is disconcerting.

19 Koichi Hirata (Matsuyama Univ. / Ehime Univ.*)
Renjutsu: from the viewpoint of inversive coordinates of circles ····· 15

Summary: Ajima Naonobu's Renjutsu is known as a method for calculating the radius of a each circle in a circular chain. In Renjutsu, the radius of each circle is calculated using a recurrence formula. There are multiple four-circles Boshajutsu formulas to derive these recurrence formulas depending on the relative positions of the circles, and therefore multiple recurrence formulas also existed. In this research, the use of inversive coordinates of circles made it possible to combine all of Renjutsu's formulas into one.

20 Katsushi Waki (Yamagata Univ.)♭
Layout analysis of WASAN documents using `NDL_Layout` ····· 15

Summary: This paper reports the results of a layout analysis of WASAN documents, which is necessary for constructing a database of WASAN documents, conducted using a group of programs developed by the National Diet Library(NDL) for the purpose of performing OCR on classical materials.

21 Hideyuki Majima (Ochanomizu Univ.*)
On the sphere volume ratio ····· 15

Summary: We disucus on articles and books about the Sphere Volume ratio in Edo era, especially Iinkouki and Katsuyousanpou.

15:45–16:00 Mathematics History Team Meeting

Algebra

September 16th (Tue) Conference Room IX

9:00–12:00

1 Katsusuke Nabeshima (Tokyo Univ. of Sci.), Shinichi Tajima (Niigata Univ.*) — Comprehensive Gröbner systems approach to Chevalley's theorem on image of rational morphisms · · · 15

Summary: A new constructive proof of the affine version of Chevalley's Theorem is introduced by utilizing comprehensive Gröbner systems. This proof is algorithmic and simple, and the algorithm is much more effective than the others.

2 Koichiro Tani (Univ. of Osaka), Koji Matsushita (Univ. of Tokyo) — Standard multigraded Hibi rings and Cartwright–Sturmfels ideals · · · 15

Summary: In this talk, we introduce standard multigradings on Hibi rings, which are algebras arising from posets. We show that any standard multigrading on a Hibi ring that makes its defining ideal (called the Hibi ideal) homogeneous is induced by a chain of the underlying poset. After that, we calculate the multigraded Hilbert series of Hibi rings by generalizing the theory of P-partition and we compute the multidegree polynomials of Hibi rings. Furthermore, we characterize Hibi ideals that are Cartwright–Sturmfels ideals.

3 Koji Matsushita (Univ. of Tokyo), Akiyoshi Tsuchiya (Toho Univ.) — Invariants of graded rings associated with stable set polytopes · · · 15

Summary: Let G be a finite simple graph. The stable set polytope P_G of G is defined as the convex hull of the indicator vectors of all stable sets of G. In this talk, we study the a-invariant of the Ehrhart ring of P_G and the Castelnuovo–Mumford regularity of the toric ring of P_G. We establish relations between these algebraic invariants and certain combinatorial invariants of the original graph G.

4 Kyosuke Maeda (Nihon Univ.), Ken-ichi Yoshida (Nihon Univ.) — Ulrich ideals on rational triple points · · · 15

Summary: This talk will classify all Ulrich ideals by computing the canonical trace ideal, utilizing Tyurina's classification of two-dimensional rational triple points. The content of this talk is based on joint work with Ken-ichi Yoshida.

5 Ken-ichi Yoshida (Nihon Univ.), Kyosuke Maeda (Nihon Univ.) — Ulrich ideals on 2-dimensional quotient singularities · · · 15

Summary: We can classify all Ulrich ideals on 2-dimensional quotient singularities using the geometric structure of Ulrich ideals on rational singularities. This is a joint work with Maeda Kyosuke.

6 Kei-ichi Watanabe (Nihon Univ./Meiji Univ.), Tomohiro Okuma (Yamagata Univ.), Ken-ichi Yoshida (Nihon Univ.) — ♭ The canonical trace ideal and nearly Gorenstein property for 2 dimensional normal local rings · · · 15

Summary: A local ring A is called "nearly Gorenstein" if A is Cohen–Macaulay and the trace ideal of its canonical module (canonical trace ideal) contains the maximal ideal. In this talk, we consider the normal local rings of dimension 2 and explain how to compute the canonical trace ideal using the resolution of singularities of A. In particular, we give an algorithm to determine whether A is nearly Gorenstein and compute the canonical trace ideal for 2 dimensional rational singularities.

7 Sora Miyashita (Univ. of Osaka) When do pseudo-Gorenstein rings become Gorenstein? · · · 15

Summary: In this talk, we discuss the relationship between the trace ideal of the canonical module and pseudo-Gorensteinness. In particular, we show that if a graded domain satisfies certain mild assumptions and is pseudo-Gorenstein, then it is Gorenstein. As an application, we clarify the relationships among nearly Gorensteinness, almost Gorensteinness, and levelness—notions that generalize Gorensteinness—in the context of standard graded domains.

8 Mitsuhiro Miyazaki (Osaka Metro. Univ.) A new property between Gorenstein and Cohen–Macaulay properties of commutative rings · · · 15

Summary: There is a hierarchy of Noetherian local rings: regular, complete intersection, Gorenstein, Cohen–Macaulay and Buchsbaum. While studying these rings, in particular, Cohen–Macaulay and Gorenstein rings, many researchers feel that there is a gap between Gorenstein and Cohen–Macaulay properties. In order to fill this gap, level, almost Gorenstein and nearly Gorenstein properties are defined and studied. However, level property can only be defined for graded rings and there are few rings that are not Gorenstein but almost Gorenstein or nearly Gorenstein.

In this talk, we define a new property of Noetherian commutative rings between Gorenstein and Cohen–Macaulay properties, which have plenty of non-Gorenstein rings. We also explain criteria of this property for motivating examples of classes of rings.

9 Naoki Endo (Meiji Univ.) Deformation of the quasi-Gorenstein property in extended Rees algebras · · · 15

Summary: In this talk, we study the quasi-Gorenstein property of extended Rees algebras associated with Hilbert filtrations on a Noetherian local ring. We present necessary and sufficient conditions for the deformation of this property, characterized by the Cohen–Macaulayness of the Matlis duals of local cohomology modules. As a consequence, we provide a characterization of the quasi-Gorenstein property of extended Rees algebras in terms of the lengths of certain local cohomology modules.

10 Shinnosuke Ishiro (Gunma Nat. Coll. of Tech.), Kazuma Shimomoto (Sci. Tokyo) Perfectoid towers and lim Cohen–Macaulay sequences · · · 15

Summary: Perfectoid towers are a certain class of direct systems that approximate perfectoid rings via Noetherian rings. Shimomoto and I recently proved that perfectoid towers arising from Noetherian local domains become lim Cohen–Macaulay sequences, as introduced by Bhatt–Hochster–Ma. In this talk, we investigate the relationship between perfectoid towers and lim Cohen–Macaulay sequences.

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

Kenta Ueyama (Shinshu Univ.) Tilting theory for Artin–Schelter Gorenstein algebras

Summary: Tilting theory plays a crucial role in the study of algebraic triangulated categories, as it enables such categories to be realized as the derived categories of rings. In this talk, I will discuss tilting theory for triangulated categories associated with Artin–Schelter Gorenstein algebras. In the main part of the talk, I will present results from joint work with Osamu Iyama and Yuta Kimura on one-dimensional Artin–Schelter Gorenstein algebras. In particular, I will explain that the stable category of generically projective graded maximal Cohen–Macaulay modules over a one-dimensional Artin–Schelter Gorenstein algebra A admits a tilting object if and only if either A is regular or an invariant of A, called the average Gorenstein parameter, is non-positive.

15:30–17:15

Summary: Let R be a commutative noetherian ring. The singularity category of R, introduced by Buchweitz, is a triangulated category measuring the singularity of R. The Rouquier dimension of a triangulated category is an invariant that describing how many mapping cones need to be taken from a single object to generate the entire category. In this talk, we consider upper bounds for the Rouquier dimension of the singularity category of R. The main result generalizes the computational framework established in previous works.

Summary: It is a classical result that the singular locus and the non-Gorenstein locus of a ring satisfying good properties are closed subsets. In 2016, Iyengar and Takahashi proved that the cohomology annihilator is a defining ideal of the singular locus for several standard classes of rings. In this talk, we refine the result of Iyengar and Takahashi by focusing on the degrees of the Ext modules being annihilated and explicitly describe the defining ideals of such closed loci in terms of annihilators of specific Ext modules.

Summary: Let k be an algebraically closed uncountable field of characteristic zero. Let R be a complete local hypersurface over k. In this talk, under the assumption that R has finite or countable representation type, we completely classify the extension-closed subcategories of the category of maximal Cohen–Macaulay modules which are locally free on the punctured spectrum of R in dimension at most two.

Summary: Let $A = A(\alpha, \beta)$ be a down-up algebra with $\beta \neq 0$, $\deg x = n$, and $\deg y = m$ where $\gcd(n, m) = 1$ and $m \geq n \geq 1$, and ∇A the Beilinson algebra of A. It is known that down-up algebras $A = A(\alpha, \beta)$ with $\beta \neq 0$ are 3-dimensional cubic AS-regular algebra. For $n = m = 1$, the group and Lie algebra structure of Hochschild cohomology of ∇A were gave by Belmans. For $m > n = 1$, the group structure of Hochschild cohomology of ∇A were gave by Itaba-Ueyama. In this study, we compute the group and Lie algebra structure of the remainder cases. Moreover, we calculate Hocshchild cohomology ring of ∇A for $m \geq n \geq 1$.

Summary: The symmetric cohomology was defined initially for groups by Staic, which was recently generalized for cocommutative Hopf algebras over a field by Shiba–Sanada–Itaba. In this talk, we explain how we extended this notion to triangular bialgebras using the symmetric category, which is a variant of the simplex category.

Summary: Hopf algebras are the central role of representation theory and theory of decategorification. Khovanov, Qi and Farinati defined the derived category of H-modules, $A\#H$-modules for an H-module algebra A and H-comodules, respectively. They calculated the Grothendieck groups K_0 and G_0 of the derived categories of $A\#H$-modules and right H-comodules, respectively. The derived category of $A\#H$-modules is arising from a certain model structure; the author had showed that the category of $A\#H$-modules admits a certain model structure under certain assumption, of which the derived category is equal to Qi's.

September 17th (Wed) Conference Room IX

9:00–12:00

17 Ryota Wakao (Okayama Univ. of Sci.) On R-matrices constructed from Hopf superalgebras of low dimension · · · · · 10

Summary: In 2024, Garoufalidis and Kashaev showed that knot invariants can be constructed via R-matrices arising from braided Hopf algebras equipped with additional data. In this talk, we restrict our attention to the case where the braided Hopf algebras are Hopf superalgebras. This setting yields a rich supply of explicit examples of R-matrices and the resulting knot invariants.

18 Yasuhiko Asao (Fukuoka Univ.)
Shun Wakatsuki (Nagoya Univ.) Minimal projective resolution and magnitude homology of geodetic metric spaces · · · · · 15

Summary: Magnitude homology is an invariant for metric spaces, which was introduced by Hepworth–Willerton. Asao–Ivanov showed that the magnitude homology of a finite metric space is isomorphic to the derived functor Tor over some ring. In this talk, I will explain an application of the theory of minimal projective resolution to this derived functor. Especially in the case of a geodetic graph, torsion-freeness and a criterion for diagonality of the magnitude homology are established.

19 Sota Asai (Univ. of Tokyo) An extension theorem of semibricks in quiver representations · · · · · 15

Summary: A semibrick is a set of modules satisfying Schur's Lemma. In the representation of a finite acyclic quiver Q, we prove that any finite semibrick $\mathcal{S}$ can be extended to an infinite semibrick if there exists a brick in $\mathcal{S}$ which is not exceptional. Therefore any maximal finite semibrick consists of exceptional modules.

20 Yusuke Nishinaka (Nagoya Univ.) Costello–Gwilliam factorization algebras and vertex algebras · · · · · 15

Summary: Costello–Gwilliam factorization algebras encode the algebraic structure of observables in quantum field theories. On the other hand, vertex algebras provide an algebraic framework for two-dimensional conformal field theories. It is therefore natural to ask how Costello–Gwilliam factorization algebras on the complex plane relate to vertex algebras. In this talk, I will explain a general method for constructing vertex algebras from Costello–Gwilliam factorization algebras, called holomorphic factorization algebras. I will also present examples of such factorization algebras, constructed via the factorization envelope, which correspond to vertex algebras generated by a Lie algebra, such as affine vertex algebras.

21 Shuji Fujino (Tokyo Univ. of Sci.)
Yuta Kozakai (Tokyo Univ. of Sci.)
Kohei Takamura (Tokyo Univ. of Sci.) How to construct two-sided tilting complexes for generalized Brauer tree algebras · · · · · 15

Summary: Rickard constructed a tree-to-star one-sided tilting complex for Brauer tree algebras in 1989. Kozakai–Kunugi constructed explicitly a two-sided tilting complex that corresponds to the Rickard's one-sided tilting complex in 2018.
On the other hand, Membrillo-Hernández constructed a tree-to-star one-sided tilting complex for generalized Brauer tree algebras in 1997. We construct explicitly a two-sided tilting complex that corresponds to the Membrillo-Hernández's one-sided tilting complex for generalized Brauer tree algebras.

22 Shingo Okuyama
(Nat. Inst. of Tech., Kagawa Coll.)
Yasuhiro Omoda
(Nat. Inst. of Tech., Akashi Coll.)
Kazunori Nakamoto
(Univ. of Yamanashi) An example of a non-2-thick irreducible representation of the symmetric group · · · · · 15

Summary: The concept of m-thickness in irreducible representations of groups, introduced by two of the present authors, offers a new perspective on the classification of irreducible representations. In this work, we show that the irreducible representation $S^{(n-2,2)}$ of the symmetric group S_n is not 2-thick for $n \geq 5$. This example was obtained through computational analysis using the GAP system.

Summary: Skew brace is a group-like algebraic structure that was introduced in the study of the Yang–Baxter equation. Given any skew-brace-theoretic property X, one can ask for the natural numbers n such that every skew brace of order n has property X. In this research, we considered various properties of skew braces, such as being a bi-skew brace, two-sided, socle nilpotent, right nilpotent, and annihilator nilpotent. For these and many other properties X, we were able to classify the natural numbers n such that every skew brace of order n satisfies property X. We note that socle nilpotency is an important property that is closely related to the multipermutation level of solutions of the Yang–Baxter equation.

Summary: The (right) q-deformed rational numbers was introduced by Morier-Genoud and Ovsienko, and its left variant by Bapat, Becker and Licata. These notions are based on the q-deformed modular group. Here, we define the q-transpose for matrices in this group, and use it to give new proof of existing results, and also some new results (e.g., the criterion for the palindromicity of their numerators and denominators). Note that the numerators (and denominators) of left q-deformed rationals are essentially the normalized Jones polynomials of rational links, and both right and left q-rationals have combinatorial aspects.

Summary: Freeness of multiarrangements is extremely important in the study of freeness of arrangements. In particular, the exponents of 2-multiarrangements play an important role in freeness of 3-arrangement. However, it is not easy to compute exponents in general. Wakamiko (2007) determined bases and the exponents for multiarrangements of three lines over a field of characteristic zero. In this talk, we give an effective algorithm for computing the exponents of 2-multiarrangement of three lines over a field of positive characteristic.

Summary: In combinatorial games, in addition to the normal play where the last player wins, and the misère play where the last player loses, we present Ending Partizan Game, where we decide the winner by the final position, regardless of which player plays last. For example in Ending Partizan Subtraction Nim with $S = \{2, 3\}$, there is one pile of tokens, where the player can take either 2 or 3 tokens. If no token remains, Left wins, and if 1 token remains, Right wins. We show that there is a strong bias (Left has a big advantage) in this seemingly fair rule, and explain why such a bias occurs.

Summary: The notion of Surreal Numbers was introduced by Conway in 1976, but is not widely known in spite of its potential importance. In this talk, we interpret the notion of Surreal Numbers as the K-ring of the category of some combinatorial games, to show that Surreal numbers are well-established on the basis of rigorous modern mathematics. Considering that the ring of integers can be defined as the K-ring of the category of finite sets, our construction shows that Surreal Number is a natural generalization of the notion of classical numbers.

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

Tatsuyuki Hikita (Kyoto Univ.) On the Stanley–Stembridge conjecture

Summary: The Stanley–Stembridge conjecture was a long-standing problem in algebraic combinatorics about the chromatic symmetric functions for graphs defined by Richard Stanley in 1995. This conjecture states that the chromatic symmetric functions for certain graphs expand positively in terms of the elementary symmetric functions. Later, Shareshian–Wachs refined this conjecture by introducing a q-analogue of the chromatic symmetric functions called chromatic quasisymmetric functions. In this talk, I will give a probability theoretic interpretation of the coefficients of the elementary symmetric function expansions of the chromatic quasisymmetric functions for any unit interval graphs. In particular, I will give a proof of the original Stanley–Stembridge conjecture.

September 18th (Thu) Conference Room IX

9:30–12:00

28 Shota Maehara (Kyushu Univ.) An algebraic research on minimum number of chambers for line arrangements · · · · · 15

Summary: When we arrange a finite set of lines into a 2-dimensional real vector space, the complement of lines can be considered as a division of the plane. Let us call the maximal connected components chambers. It is well known that the number of chambers becomes maximum when all intersection points are double points. However, to determine the arrangement which gives the minimum number is much more difficult. A very famous theorem in the theory of hyperplane arrangement, called Yoshinaga's criterion, gives a lower bound of chambers in an algebraic way. We show a new result on the gap between the Yoshinaga's lower bound and the minimum number in real, based on the joint work with Torsten Hoge and Sven Wiesner.

29 Tatsushi Shimazaki (Kobe Univ.)
Takahiko Nobukawa (Kogakkan Univ.)
Taikei Fujii (Kobe Univ.)
The number of set-valued semistandard tableaux and special values of Grothendieck polynomials · · · · · 15

Summary: Grothendieck polynomials, defined by Lascoux and Schutzenberger as K-theoretic analogues of Schur polynomials, admit a combinatorial expression using set-valued tableaux introduced by Buch. In this talk, we define Grothendieck polynomials via this expression and study their special values. We show that a specific evaluation of Grothendieck polynomials yields a simple power of the parameter, using an involution on set-valued tableaux. As a consequence, the total number of set-valued semistandard tableaux is always odd for any Young diagram and any number of variables. The proof is purely combinatorial, relying on a sign-reversing involution on the set of set-valued tableaux that cancels all terms except one.

30 Takeshi Torii (Okayama Univ.)
Kazunori Nakamoto (Univ. of Yamanashi)
The moduli of subalgebras of the full matrix ring of degree 3 (4) · · · · · 15

Summary: We describe the moduli of 5-dimensional subalgebras of the full matrix ring of degree 3. We show that the moduli scheme has three irreducible components, whose relative dimensions over $\mathbb{Z}$ are all 4.

31 Kohei Aoyama (Univ. of Osaka) The property of being a Deligne–Mumford stack is not preserved by the warping stack · · · · · 15

Summary: In the context of motivic integration, M. Satriano and J. Usatine introduced the notion of a warped map, which generalizes the concept of an arc (i.e., an infinitesimal curve on an algebraic variety) to the setting of stacks. The warping stack is the moduli stack parameterizing all warped maps to a given target stack. In this talk, we present examples of Deligne–Mumford stacks for which the associated warping stacks are not Deligne–Mumford stacks.

Summary: The rationality problem is one of the classic problems in algebraic geometry. Especially, research on whether norm one tori are stably (resp. retract) rational or not was initiated by Endo–Miyata in 1975, and considerable progress has been made to date. In this talk, we discuss the stable (resp. retract) rationality for multinorm one tori, a natural generalization of norm one tori. More precisely, we give a solution to the above question under the assumption that split over finite Galois extensions with nilpotent Galois groups. This talk is based on a joint work with Sumito Hasegawa.

Summary: Based on the existence of the three-dimensional flips of types k1A, k2A ([S.Mori,1988]) on an extremal nbd $(X, C) \subset \mathbb{C}^4$,the author introduced three-dimensional Miyaoka–Yau type inequality with c_3 ([I.2018 Mar]). On the other hands, extensions of $S^2(\mathrm{gr}^i_C\Omega^1_X)$ works in the above S. Mori's proof. Following them, the author extended such inequality for extension of symmetric 2-forms, and also extended for C reducible via associated co-fibered product as deformations of such C, which associates sheaves of differential operators as resolution by Higgs sheaves $\mathscr{E}$ on (X, C), and moreover constructed algebraic or homological equivalences for such deformation via valuative extension for differential operators ([I.2018-2023]). In this work, in the case of C reducible, 1) to settle as follows: a) motivic sheaves via cubical resolution for the action of $\mathscr{E}$ on such co-fibered product ([Hanamura,2000]), b) decomposition theorem for 0-dimensionl supports of such differential operators (in the sense of Hodge module), and then: 2) to give such equivalences for deformations of C on suitable valuative extension, and to describe extension of associated symmetric 2-form, on which these results give alternatively generalization of [J.Kollár-Z.Tian,2023;Thm 53] and [S.Kebekus-C.Schnell,2021],resp.

Summary: Compact Kähler manifolds satisfy several nice cohomological properties such as Hodge symmetry and Hodge–Riemann bilinear relations. Friedman and Li recently showed that non-Kähler Calabi–Yau 3-folds which are obtained by conifold transitions of projective ones satisfy such properties. I will present examples of non-Kähler Calabi–Yau manifolds with such properties by smoothing normal crossing varieties.

Summary: We construct a locally ringed space, called the relative Matsui spectrum, associated to a triangulated category with an action. This generalizes both the Balmer spectrum (for tensor triangulated categories) and the Matsui spectrum (which does not require a tensor structure). The relative Matsui spectrum classifies thick subcategories closed under the given action via their supports. Its size reflects the richness of the action: more action yields a smaller spectrum, and vice versa. When the acting category is the category itself, we recover the Balmer spectrum under suitable conditions; when the acting category is small, such as D(Z), we recover the Matsui spectrum. Applications include classifying thick subcategories of twisted derived categories and matrix factorizations via their relative spectra.

Summary: We describe derived McKay correspondence for real reflection groups of rank 3 in terms of a maximal resolution of the logarithmic pair consisting of the quotient variety and the discriminant divisor with coefficient 1/2. As an application, we verify a conjecture by Polishchuk and Van den Bergh on the existence of a certain semiorthogonal decomposition of the equivariant derived category into the derived categories of affine spaces for any real reflection group of rank 3. This is joint work with Akira Ishii.

12:00–12:30 Research Section Assembly

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

Atsushi Ito (Univ. of Tsukuba) On M-regularity and rational maps defined by line bundles on abelian varieties

Summary: By considering the ratio of sections of a line bundle on an algebraic variety, we obtain a rational map from the variety to a projective space. Understanding when this rational map is actually a morphism, or when it becomes an embedding, is a fundamental problem in algebraic geometry. In the case of abelian varieties, that is, complex tori that can be embedded algebraically into projective space, Pareschi and Popa introduced the notion of M-regularity for coherent sheaves, leading to many interesting results on these questions in the 2000s. More recently, Jiang and Pareschi extended the notion of M-regularity to $\mathbb{Q}$-coherent sheaves (formal tensor products of coherent sheaves with rational powers of line bundles), enabling a more refined study of the above problems. In this talk, I will explain recent advances in this area.

15:30–17:30

37 Natsume Kitagawa (Nagoya Univ.) The standard models of del Pezzo fibrations of degree 4 ····· 15

Summary: Del Pezzo fibrations are geometric objects that naturally appear in the 3-dimensional minimal model program. Motivated by the classification problem of Mori fibre spaces, Corti defined the notion of standard models of del Pezzo fibrations as their preferred birational models. The main question is whether, for a given del Pezzo fibration, there exist standard models as birational models of the given one. We discuss this problem for del Pezzo fibrations of degree 4 in characteristics greater than 2.

38 Shuto Abe (Nagoya Univ.) Automorphism groups of Fano threefolds ····· 15

Summary: We introduce some results for the automorphism groups of Fano threefolds of No. 2.18.

39 Kiwamu Watanabe (Chuo Univ.) Quadratic varieties of small codimension ····· 15

Summary: Let $X \subset \mathbb{P}^{n+c}$ be a nondegenerate smooth projective variety of dimension n defined by quadratic equations. For such varieties, P. Ionescu and F. Russo proved the Hartshorne conjecture on complete intersections, which states that X is a complete intersection provided that $n \geq 2c+1$. As the extremal case, they also classified X with $n = 2c$. In this talk, we classify X with $n = 2c-1$.

40 Osamu Fujino (Kyoto Univ.)
Hiroshi Sato (Fukuoka Univ.) On non-projective complete toric varieties ····· 10

Summary: We show that every smooth non-projective complete toric threefold of Picard number at most five becomes projective after a finite succession of flops or anti-flips.

41 Shingo Taki (Tokai Univ.)
Kei Miura (Yamaguchi Univ.) Galois points and K3 surfaces ····· 15

Summary: We show that there exists a one-to-one correspondence between smooth quartic surfaces with a Galois point and K3 surfaces with a certain automorphism.

42 Ken Sato (Sci. Tokyo) On symplectic actions on higher Chow cycles on $K3$ surfaces ····· 15

Summary: An automorphism ρ of a $K3$ surface X is called *symplectic* if ρ^* satisfies $\rho^*\omega_X = \omega_X$, where ω_X is a non-zero holomorphic 2-form on X. Huybrechts conjectured that symplectic automorphisms of a $K3$ surface X act trivially on the Chow group $\mathrm{CH}^2(X)$ of codimension 2, and proved this in the case where the automorphism is of finite order. On the other hand, based on several explicit computations, I conjecture that symplectic automorphisms also act trivially on $\mathrm{CH}^2(X,1)_{\mathrm{ind}}$, the indecomposable part of the higher Chow group $\mathrm{CH}^2(X,1)$. By the results of Kahn, $\mathrm{CH}^2(X,1)_{\mathrm{ind}}$ and $\mathrm{CH}^2(X)$ arise from the same Chow motive $t_2(X)$. Thus, the above conjecture is the analogue of Huybrechts' conjecture. In this talk, I explain supporting examples for my conjecture (e.g., translation by an elliptic fibration) and its relation to more general conjectures concerning motives.

Summary: We propose the problem to find linear recurrence formulas which continue to produce square numbers. We relate such recurrences that generate three squares consecutively to a certain elliptic surface, which enables one to construct infinitely many examples of those recurrences.

September 19th (Fri) Conference Room IX

9:30–12:00

Summary: Suwa constructed the unit group scheme of the group algebra of a finite flat group scheme and formulated normal basis problem for torsors under a finite flat group scheme by adding embedding problem and sculpture problem. In this study, we consider the normal basis problem for torsors under a certain non-commutative finite flat group scheme.

Summary: This talk gives a theory of approximation of functors along given natural transformations, and its applications to the algebraic cobordism and the K-theory. Namely, we introduce the Goodwillie approximation of functors and apply it to the universal morphism from the algebraic cobordism to K-theory of oriented motivic spectra, yielding the Goodwillie approximation, which exhibits Bott periodicity and the Gabber rigidity.

Summary: We study the field generated by a p-torsion point of an elliptic curve over $\mathbb{Q}_p$ with good reduction.

Summary: For hypergeometric functions, the confluent type is known. As an example, Kummer's hypergeometric function is well-studied. Finite field analogues of hypergeometric functions have been studied. For Gauss' hypergeometric function over the complex numbers (resp. over finite fields), some relations with complex periods (resp. the numbers of rational points) of certain algebraic curves have been well-known. However, such relations have not been well-known for the confluent type. In this talk, we consider subvarieties of products of Fermat curves and Artin–Schreier curves, and express the numbers of rational points on them in terms of the confluent hypergeometric functions over finite fields.

Summary: We give a relation between Deninger's foliated dynamical systems attached to number rings and Connes–Consani's adelic spaces. It fits with the analogy between knots and primes in arithmetic topology and lights up a geometric view of class field theory.

Summary: In Iwasawa theory for graphs, an analogue of Kida's formula describing the behavior of the Iwasawa invariants has been established for unramified coverings. In this talk, we extend it to possibly ramified coverings.

50 Haruki Ito (Nagoya Univ.) Semi-integral points of bounded height on vector group compactifications ····· 15

Summary: Let X be an algebraic variety over a number field F and let H_L denote the counting function on the set $X(F)$ of rational points with respect to an adelically metrized line bundle L on X. Manin's conjecture concerns an asymptotic formula for the counting function $N(U, L, B) = \{P \in U \mid H_L(P) \leq B\}$ for a suitable subset U of $X(F)$. This conjecture was proposed by Y. Manin and his collaborators in the late 1980s. In this talk, we will prove Manin's conjecture for Darmon points on compactifications of vector groups, following ideas from the work of M. Pieropan, A. Smeets, S. Tanimoto, and A. V. Alvarado.

51 Masaki Kato (Ritsumeikan Univ.) Macdonald symmetric functions and multiple polylogarithms ····· 15

Summary: In this talk, we construct analogues of Macdonald symmetric functions in terms of p, q-multiple polylogarithms and show that they exhibit properties similar to those of Macdonald symmetric functions. Furthermore, we extend q-difference relations for p, q-multiple polylogarithms to those for Macdonald type.

52 Hiroshi Nozaki (Aichi Univ. of Edu.)
Masatake Hirao (Aichi Pref. Univ.)
Koji Tasaka (Kindai Univ.)
Spherical designs associated with finite quaternionic groups and their applications to modular forms ····· 15

Summary: Let X be a finite subset of $\mathbb{R}^d$. The harmonic strength $T(X)$ is the set of degrees $\ell \in \mathbb{N}$ such that $\sum_{x \in X} P(x) = 0$ for all harmonic polynomials P of degree ℓ. We consider three finite quaternionic groups: the binary tetrahedral group $2T$, the binary octahedral group $2O$, and the binary icosahedral group $2I$. Viewing quaternions as vectors in $\mathbb{R}^4$, we determine the harmonic strength of each group and prove their uniqueness as minimal spherical designs. Using this characterization, we identify the degrees ℓ for which the complex span of spherical theta functions $\theta_{G,P}(z)$ vanishes, where P runs over harmonic polynomials of degree ℓ. This result is obtained without relying on the theory of modular forms.

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

Toshiki Matsusaka (Kyushu Univ.)♭ (Mock) modular nature of q-series

Summary: What makes a "mock theta function", named by Ramanujan for its resemblance to classical theta functions, truly part of the theory of modular forms or theta functions? This question has intrigued mathematicians for decades. As the 21st century began, the theory of q-series satisfying various "broken" modular transformation laws gradually developed, and a clearer picture started to emerge. A major breakthrough came with the work of Zwegers, sho constructed theta functions associated with indefinite quadratic forms.

Since then, interest has grown in understanding a wide range of q-series within the modular framework, pushing its boundaries to include series once thought to lie beyond it. Indeed, once the (broken) modularity of a given q-series is established, the rich theory of classical modular forms becomes available, often leading to strong applications.

In this talk, I will give an overview of the history of mock theta functions, introduce several techniques for establishing modularity of q-series, and present some applications from my own work.

15:30–17:30

53 Shigeru Iitaka (Open Univ. of Japan / Gakushuin Univ.*)
Hikaru Kajita (Crimson Global Academy)
Double Euler functions and a kind of perfect numbers ····· 10

Summary: For a positive integer a, by $\varphi(a)$ we denote the number of $n(< a$, relatively prime to a, called Euler function.

Let $\varphi^2(a)$ be the composition $\varphi(\varphi(a))$, called called double Euler function. Given an integer m the number a satisfying $a - 4\varphi^2(a) = -m$ is said to be Double Euler perfect numbers.

We shall study them.

Summary: Let $a \geq 1$ be a fixed real number. For any natural number n, $\sigma_a(n)$ is defined by $\sum_{d|n} d^a$. We investigate the average of $\sigma_a(n)$ for square-free integers $n \leq x$.

Summary: H. L. Montgomery proved a relation for error terms in asymptotic formulas for the Euler totient function. J. Kaczorowski defined the associated Euler totient function which generalizes the classical Euler totient function and obtained an asymptotic formula for it. In this talk, we prove a relation on error terms similar to H. L. Montgomery's result for a certain special case of the associated Euler totient function.

Summary: A square-full number is a positive integer n such that if p is a prime number dividing n, then p^2 divides n. Let $R(N)$ be the number of representations of N as a sum of a prime number and a square-full number weighted with logarithmic function. In 2024, we obtained the asymptotic formula $\sum_{X<N\leq X+H} R(N)$ for $X^{\frac{1}{2}+\varepsilon} \leq H < X^{1-\varepsilon}$. In this talk, we will show the same asymptotic formula holds for the improvement range: $X^{\frac{32-4\sqrt{15}}{49}+\varepsilon} \leq H \leq X^{1-\varepsilon}$.

Summary: We deal with negative square moments of Dirichlet L-functions. Summing over characters modulo q, we obtain an asymptotic formula for the negative second moment of $L(1, \chi)$ involving conductors. As an application, we give the improved lower bound on the success probability of the algorithm which recovers a short generator of the input generator of a principal ideal.

Summary: We focus on multiple zeta functions (MZFs) defined by certain infinite series. In the simplest case, MZF is nothing but the classical Riemann zeta function. It is well known that Riemann zeta function has the analytic continuation to the whole complex plane and its value at non-positive integers can be expressed by the Bernoulli numbers. For general MZFs, it is also known that they have the analytic continuation. However, the set of all singularities of MZFs contains most non-positive integers. Many works have defined nice values of MZFs at non-positive integers, and most of these values can be expressed using Bernoulli numbers. In this talk, we present a new expression for the values of MZFs at non-positive integers using Stirling numbers.

Summary: Generalized symmetric multiple zeta values, introduced by Jarossay as an extension of symmetric multiple zeta values, are the main focus of this study. We investigate their algebraic structure and construct a corresponding Lie algebra under certain assumptions. This talk is based on the results of that construction.

Summary: My talk discusses a problem posed by Manchon about the existence of a map between two kinds of Hopf algebras of arborified multiple zeta values. Manchon constructed a map satisfying the compatibility condition but breaking the tree structure, whereas Clavier constructed a map that respects the tree structure but fails the condition. Based on Foissy's work, we extend Manchon and Clavier's results to planar rooted trees, and recursively construct a linear map satisfying required properties, which settles Manchon's problem.

Geometry

September 16th (Tue) Conference Room VI

9:30–11:45

1 Hiroyuki Hayashi (Kobe Univ.) On striction curves of ruled surfaces with finite multiplicities ····· 15

Summary: Ruled surfaces in $\mathbb{R}^3$ are a classical subject in differential geometry and have singularities in general. If a ruled surface is non-cylindrical, then we can take a striction curve which includes singularities of ruled surface. However, If a ruled surface is not non-cylindrical, a striction curve may not be taken. In this talk, we consider ruled surfaces with finite multiplicities and give the condition which has a striction curve, and we describe the behavior of the striction curve. We also describe relationships between the conditions for a singularity of a ruled surface and a striction curve.

2 Yoshio Agaoka (Hiroshima Univ.*) Ricci curvature of left invariant metrics and invariants —the 3-dimensional case— ····· 15

Summary: We consider the Ricci curvature of left invariant pseudo-Riemannian metrics on 3-dimensional Lie groups. Such a Ricci curvature must satisfy some identity, which becomes a long expression if we express it in terms of the components of the Ricci curvauture. But by using some GL(3,R)-relative invariants, we can express it relatively simple form. The result depends on the type of Lie algebras. In case it is unimodular the identity contains a constant term, which serves as an obstruction to the existence of Ricci flat metrics. On the contrary, in solvable case the identity does not contain a constant term. This fact is reasonable, because 3-dimensional solvable Lie algebras always admit almost flat Lorentz metrics.

3 Nozomi Nakatsuyama (Muroran Inst. of Tech.)
Masatomo Takahashi (Muroran Inst. of Tech.) Caustics and involutes of framed surfaces in Euclidean 3-space ····· 15

Summary: The caustics of regular surfaces are classical objects in differential geometry and singularity theory. Evolutes and involutes are also well known not only for regular plane curves but also for frontals. Moreover, evolutes and involutes are inverse operations. A framed surface is a smooth surface in Euclidean 3-space with a moving frame. In this talk, we define caustics and involutes of framed surfaces. We give conditions that the caustics and involutes are inverse operations of framed surfaces, like those of Legendre curves. This is joint work with Masatomo Takahashi.

4 Shun Kumagai (Hachinohe Inst. of Tech.)
Kenji Kajiwara (Kyushu Univ.) Planar curves with self-affinity in equiaffine geometry ····· 15

Summary: In this talk, we consider planar curves in equiaffine geometry and present a family of planar curves characterized by a symmetry called the extendable self-affinity. The extendable self-affinity has been recognized through the investigation of the symmetry of the log-aesthetic curve, which has been studied as a reference for designing aesthetic shapes in computer-aided geometric design and regarded as an analog of Euler's elastica in similarity geometry. Our new class includes the quadratic curve and the logarithmic spiral, a special case of the log-aesthetic curve.

5 Masahiro Morimoto (Tokyo Metro. Univ.) Affine differential geometry of parallel transport maps and weakly reflective submanifolds ····· 15

Summary: In the 1990s, C.-L. Terng and G. Thorbergsson studied a natural Riemannian submersion from an infinite dimensional Hilbert space onto a compact Riemannian symmetric space G/K. This map is called the parallel transport map over G/K. Later, N. Koike extended their theory to the case that G/K is a Riemannian symmetric space of non-compact type. Recently, I defined the parallel transport map over an affine symmetric space G/K and showed that it is an affine submersion with horizontal distribution. In this talk, my previous result is generalized to the case that G/K is a reductive homogeneous space, and its relation to weakly reflective submanifolds is shown.

6 Jun Matsumoto (Sci. Tokyo) A special class of affine maximal surfaces with singularities and its relationship with minimal surface theory ····· 15

Summary: A surface in $\boldsymbol{R}^3$ whose affine mean curvature vanishes everywhere is called an affine maximal surface. It can be regarded as an affine analogue of a Euclidean minimal surface in the sense that both have vanishing mean curvature. In the global theory of affine maximal surfaces, the affine Bernstein theorem has motivated the study of such surfaces with admissible singularities, which are called affine maximal maps and were defined by Aledo–Martínez–Milán. In this talk, we will define a special class of affine maximal maps, called *affine maxfaces*, and investigate their global properties by applying Euclidean minimal surface theory.

7 Kenzi Satô (Tamagawa Univ.) Fermat–Torricelli points of a spherical or hyperbolic triangle ····· 15

Summary: In this talk we consider and calculate explicitly Fermat–Torricelli points of a spherical or hyperbolic triangle. Fermat–Torricelli point is the point such that 3 geodesics passing through the point and vertices intersect at angle pi/3.

14:15–16:45

8 Naoki Kato (Chukyo Univ.) Left-invariant transversely affine foliations and a generalization of left-symmetric structures ····· 15

Summary: It is known that there exists a correspondence between left-invariant affine structures on a simply connected Lie group G and left-symmetric structures on the Lie algebra $\mathfrak{g}$ of G. In this talk, we define an algebraic structure on $\mathfrak{g}$, which we call a generalized left-symmetric structure, and give a correspondence between left-invariant transversely affine foliations of G and generalized left-symmetric structures on $\mathfrak{g}$. Moreover, we give an algebraic description of the completeness of left-invariant transversely affine foliations using this correspondence. We also present methods for constructing generalized left-symmetric structures.

9 Masamichi Deguchi (Tokyo Metro. Univ.) Maximal antipodal sets of oriented flag manifolds ····· 15

Summary: We study maximal antipodal sets of oriented flag manifolds $\widetilde{F}_{k_1,k_2-k_1}(\mathbb{R}^n)$. H. Tasaki reduced the problem of classification of maximal antipodal sets in oriented real Grassmannian manifolds to the problem of combination theory. We generalize his study to oriented flag manifolds. We classify all maximal antipodal sets of $\widetilde{F}_{k_1,k_2-k_1}(\mathbb{R}^n)$ in the cases (1) $k_1 = 1, k_2 \geq 2$, (2) $k_1 = 2, k_2 = 4$, (3) $k_1 = 2, k_2 = 5$ and (4) $k_1 = 3, k_2 = 6$. Moreover, for general k_1 and k_2, we give a method to construct (maximal) antipodal sets of $\widetilde{F}_{k_1,k_2-k_1}(\mathbb{R}^n)$.

10 Lijie Sun (Yamaguchi Univ.) Notes on the geometry of quaternionic Heisenberg group ····· 15

Summary: We investigate the 7-dimensional quaternionic Heisenberg group, a 2-step nilpotent Lie group with a 3-dimensional center. We prove that any two points in the group can be connected by a horizontal curve, thereby defining a sub-Riemannian distance. In addition, we analyze several geometric properties of the group, including its real hypersurfaces, almost contact 3-structure, and almost contact metric 3-structure.

Summary: Let (M^n, J, ω) be a Hermitian manifold with complex structure J and fundamental form ω with $n \geq 3$. If there exists a closed 1-form θ such that $d\omega = \theta \wedge \omega$, then the triple (J, ω, θ) is called a Locally Conformally Kähler (LCK) structure on M. We call this structure Vaisman if $\nabla\theta = 0$. In this talk we consider the classification problem of Vaisman structures on solvmanifolds, specially the case when J is not necessarily left-invariant. We show that every Vaisman solvmanifold is a finite quotient of a nilmanifold with associated Lie group $\mathbb{R} \times H_{2n+1}$, where H_{2n+1} is the Heisenberg group. We also discuss some applications and consequences of this result.

Summary: A necessary and sufficient condition for the intersection of two real flag manifolds in a complex flag manifold to be discrete are stated in a stronger form than previously known. The discrete intersection of real flag manifolds is the orbit of a Weyl group, which is an antipodal set of a complex flag manifold. The triple of two real flag manifolds and a complex flag manifold as an ambient space is constructed from a compact symmetric triad. It is shown that the compact symmetric triad can be taken to be canonical. Under the viewpoint, we state a necessary and sufficient condition for the intersection of two real flag manifolds to be discrete.

Summary: In this talk, we explain that it is possible to determine whether a lattice in a simply connected nilpotent Lie group N(a discrete subgroup whose quotient space is compact) can be isomorphic to the fundamental group of a smooth complex algebraic variety, by using a grading on the Lie algebra $\mathfrak{n}$ of N. We also explain the results obtained by applying this criterion to a certain class of nilpotent Lie algebras.

Summary: We show all of polars of Ss^c groups. This talk is a continuation of my talk at the MSJ Spring Meeting 2025.

Summary: An s-commutative set in a quandle or a symmetric space is a set in which, for any two points, the point symmetries at those points are commutative. This notion is a generalization of the antipodal set, which was introduced by Hiroshi Tamaru et al. Moreover we expect that they have geometric information about the quandles or symmetric spaces. In this talk, we will present a construction of s-commutative sets in real Grassmannian manifolds derived from representations of Clifford algebras. Altough our examples are not maximal, for the special cases, we will also explain that maximal s-commutative sets containing our examples can be constructed by our s-commutative sets.

September 17th (Wed) Conference Room VI

10:00–10:15 Presentation Ceremony for the 2025 MSJ Geometry Prize

10:20–11:20 Award Lecture for the 2025 MSJ Geometry Prize

Shin-ichi Matsumura (Tohoku Univ.) Structure theorems for varieties with non-negative curvature

Summary: A central problem in geometry is to uncover the structures of fibrations naturally associated with varieties, thereby decomposing them into fundamental building blocks. For instance, the Minimal Model Program in birational geometry predicts that all projective varieties decompose into Fano varieties, Calabi–Yau varieties, and canonical models, reflecting their Ricci curvature from the perspective of differential geometry. In this talk, I will present structure theorems for projective varieties (more generally, Kaehler spaces) that admit "non-negative curvature" in various senses, leading to a decomposition into Ricci-positive and Ricci-flat varieties. Specifically, I focus on (bi)holomorphic sectional curvature, pseudo-effective tangent bundles, and nef anti-canonical bundles, emphasizing their connections to rational curves, rigidity phenomena, and fundamental groups. As an application, I will describe an extension of the Beauville–Bogomolov–Yau decomposition to klt pairs, which further decomposes Calabi–Yau varieties into more fundamental components. This extension is motivated by the framework of the log Minimal Model Program.

12:50–13:50 Award Lecture for the 2025 MSJ Geometry Prize

Koichi Nagano (Univ. of Tsukuba) On the geometry of metric spaces with upper curvature bounds

Summary: I will survey recent developments in the geometry of metric spaces with upper curvature bounds, especially in the geometry of GCBA spaces. A GCBA space means a locally compact, separable, locally geodesically complete metric space with an upper curvature bound. Several years ago, Alexander Lytchak and I have examined geometric structure of GCBA spaces from viewpoints of Alexandrov geometry, and studied topological regularity of GCBA spaces incorporating ideas from geometric topology. Those researches lead to answers to long-standing open problems on GCBA spaces, and provide the possibility of global Riemannian geometry of GCBA spaces. Independently, Takashi Shioya, Takao Yamaguchi, and I have recently described geometric structure of 2-dimensional GCBA spaces precisely, and succeeded to define the curvature measures on them, and consequently established the Gauss–Bonnet theorem. I would like to introduce fascinations of the geometry of GCBA spaces.

September 18th (Thu) Conference Room VI

9:30–11:45

16 Isami Koga (Kyushu Int. Univ.)
Yasuyuki Nagatomo (Meiji Univ.)
Masaro Takahashi
(Kurume Nat. Coll. of Tech.)
Equivariant harmonic maps of quaternion projective spaces into Grassmannians ····· 15

Summary: We give the rigidity results on $\mathrm{Sp}(m+1)$-equivariant harmonic maps of the quaternion projective space $\mathbf{H}P^m$ into a complex Grassmann manifold $Gr_p(\mathbf{C}^{p+q})$ when q is less than $2m$. Our method depends upon differential geometry of vector bundles and connections; a generalization of do Carmo–Wallach theory based on a generalization of Theorem of Takahashi implies the result. We also obtain the rigidity of those maps into real or quaternion Grassmannians.

17 Yuya Takeuchi (Univ. of Tsukuba) CR Paneitz operator on non-embeddable CR manifolds ····· 15

Summary: The CR Paneitz operator is closely related to some important problems in CR geometry. In this talk, we consider this operator on a non-embeddable CR manifold. This operator is essentially self-adjoint and its spectrum is discrete except zero. Moreover, the eigenspace corresponding to each non-zero eigenvalue is a finite dimensional subspace of the space of smooth functions. Furthermore, we show that the CR Paneitz operator on the Rossi sphere, an example of non-embeddable CR manifolds, has infinitely many negative eigenvalues, which is significantly different from the embeddable case.

18 Rei Murakami (Tohoku Univ.) Complex Hessian equations and positivity ····· 15

Summary: We consider a class of partial differential equations on compact Kähler manifolds, known as complex (k,l)-Hessian equations, which generalize the complex Monge–Ampère equation. In this talk, we state a conjectural correspondence between the solvability of the complex (k,l)-Hessian equation and numerical positivity conditions, and present affirmative results in several concrete examples.

19 Kazuyuki Hasegawa (Kanazawa Univ.)
Vicente Cortés (Univ. of Hamburg)
Intrinsic characterization of projective special complex manifolds ····· 15

Summary: We define the notion of an S^1-bundle of projective special complex base type and construct a conical special complex manifold from it. Consequently the base space of such an S^1-bundle can be realized as $\mathbb{C}^*$-quotient of a conical special complex manifold. As a corollary, we give an intrinsic characterization of a projective special complex manifold.

20 Hiroyasu Satoh (Nippon Inst. of Tech.)
Hemangi M. Shah (Harish-Chandra Res. Inst.)
Conformal vector fields on complex hyperbolic space ····· 15

Summary: We prove that every conformal vector field on complex hyperbolic space $\mathbb{C}H^n$ ($n \geq 2$) is necessarily a Killing vector field. This demonstrates strong rigidity in contrast to real hyperbolic space, where many non-Killing conformal fields exist. Our approach uses the realization of $\mathbb{C}H^n$ as a Damek–Ricci space to reduce the problem to an overdetermined system of differential equations, which we solve using harmonic and holomorphic function theory. The result provides a noncompact, negatively curved analogue of the classical Lichnerowicz theorem for compact Kähler manifolds with positive scalar curvature.

21 Shuhei Katsuta (Nagoya Univ.) Combinatorial structure in Nevanlinna theory ····· 15

Summary: One of the classical approaches to Nevanlinna theory is the so-called Weyl–Ahlfors theory. In the textbook '*Meromorphic Functions and Analytic Curves*' authored by H. Weyl and his son, a relation—referred to as a *peculiar relation*—appears, describing a link between certain order functions and the one associated with a derived curve. These functions measure the area of the images of holomorphic curves restricted to the disc with respect to the Fubini–Study metric. In this talk, we generalize this relation and establish a previously unknown connection with Young diagrams.

22 Masanori Adachi (Shizuoka Univ.)
Yoshifumi Matsuda (Aoyama Gakuin Univ.)
Hiraku Nozawa (Ritsumeikan Univ.)
Harmonic measures and rigidity for transverse foliations on Seifert 3-manifolds ····· 15

Summary: We study the actions of lattices of $\mathrm{PSU}(1,1)$ on S^1. We follow the approaches of Frankel and Thurston proposed in preprints via foliated harmonic measures on the suspension bundles. We prove the Gauss–Bonnet formula for the S^1-connection associated with a harmonic measure, and show that a harmonic measure on the suspension bundle of the action with maximal Euler number has rigidity, having a form closely related to the Poisson kernel. As an application, we prove a semiconjugacy rigidity for foliations with maximal Euler number, which is analogous to theorems due to Matsumoto, Minakawa and Burger–Iozzi–Wienhard.

14:15–17:45

23 Naoki Kuroda (Univ. of Tokyo) ♭ Computations of Spin-Sp(4), Spin-SU(8), and Spin-Spin(16) bordism groups in dimensions up to 7 · · · · · 15

Summary: We investigate the structure of Spin-G bordism groups, focusing on the interplay between Spin and additional twisting symmetries such as Sp(4), SU(8) and Spin(16). Using techniques from spectral sequences, obstruction theory, and cohomology operations, we compute explicit generators for the Spin-G bordism groups in dimensions up to 7. This talk is based on arXiv:2504.15014.

24 Yasushi Homma (Waseda Univ.) Eigenvalue estimates and stability on positive quaternion Kähler manifolds · · · · · 15

Summary: Quaternion Kähler manifold (M, g) is a $4n$-dim Riemannian manifold whose holonomy group is included in $\mathrm{Sp}(1)\mathrm{Sp}(n)$. It is an interesting problem to show this Einstein metric g is stable since it supports LeBrun-Salamon conjecture that says the positive ($\mathrm{Scal} > 0$) quaternion Kähler manifolds are symmetric spaces. In this talk, we will show that the stability problem are closely related to eigenvalues on $C^\infty(M)$. This talk is based on a joint work with U. Semmelmann in Stuttgart University.

25 Tadashi Udagawa (Waseda Univ.) Classification of the tt*-Toda equation with the anti-symmetry condition · · · · · 15

Summary: In physics, S. Cecotti and C. Vafa introduced the topological anti-topological fusion (tt*)-equation to describe properties of N=2 supersymmetric field theories. In mathematics, B. Dubrovin described the tt*-equation as a flatness condition on a flat bundle (tt*-structure). The tt*-Toda equation is one of the few explicitly solvable tt*-equations and M. Guest, A. Its and C. Lin gave the global solution to the tt*-Toda equation. In this talk, we classify tt*-structures whose tt*-equations are the tt*-Toda equations (Toda-type tt*-structures). We consider a Z_{n+1}-multiplication on tt*-structures analogous to the $\mathbb{C}^*$-action introduced by Hitchin and we prove that a fixed point of the Z_{n+1}-multiplication gives the tt*-Toda equation with the anti-symmetry condition. As a corollary, we classify Toda-type tt*-structures by the anti-symmetry condition of the corresponding tt*-Toda equation.

26 Shota Hamanaka (Univ. of Osaka) Extremal metrics involving in scalar curvature · · · · · 15

Summary: I will discuss Riemannian metrics which are extremal in some sense. These extremality are involved in various types of rigidity theorems for scalar curvature. More precisely, I will focus on the rigidity theorems proved by Mario Listing and give some necessary conditions for a metric to be extremal in some sense. In addition, I will provide some examples that satisfy these necessary conditions.

27 Masaya Kawamura (Sugiyama Jogakuen Univ.) On the t-Gauduchon connection on almost Hermitian manifolds · · · · · 15

Summary: We study the t-Gauduchon connection and compute its curvature. Especially, we investigate some conditions on scalar curvatures for the negative Kodaira dimension.

28 Masato Inagaki (Nagoya Univ.) Spectral convergence of graph Laplacians with Ricci curvature bounds and in non-collapsed Ricci limit spaces · · · · · 15

Summary: This paper establishes quantitative high-probability bounds on the eigenvalues and eigenfunctions of ϵ-neighborhood graph Laplacians constructed from i.i.d. random variables on m-dimensional closed Riemannian manifolds (M, g) that satisfy a uniform lower Ricci curvature bound $\mathrm{Ric}_g \geq -(m-1)K$, a positive lower volume bound, and an upper diameter bound. These results extend to non-collapsed Ricci limit spaces that are measured Gromov–Hausdorff limits of such manifolds, and the bounds give a spectral approximation of weighted Laplacians on manifolds with non-smooth points.

29 Nikita Evseev (Okinawa Inst. of Sci. and Tech. Grad. Univ.) Rellich–Kondrachov theorem for mappings in metric spaces ····· 15

Summary: It is known that a Lipschitz continuous map from the Euclidean domain to a metric space is metrically differentiable almost everywhere. When the metric space is a Banach space dual to separable, the metric differential has its linear counterpart – weak* differential. But for an arbitrary metric or Banach space, a Lipschitz map is not necessarily weak* differentiable. In this work, we suggest an approach based on weak weak* derivatives. In particular, it provides a linear representation, meaning that we can calculate the value of the metric differential as a norm of some linear operator.

30 Takuma Byakuno (Kansai Univ.) An isometric embedding from a space of sequences of compact metric spaces into the Gromov–Hausdorff space ····· 15

Summary: We consider the open problem of whether any compact metric space can be isometrically embedded into the Gromov–Hausdorff space. In this talk, I will introduce an isometric embedding of a space of sequences of compact metric spaces.

31 Hiroki Ishikura (Univ. of Tokyo) Stallings–Swan's theorem for Borel graphs ····· 15

Summary: Stallings–Swan's theorem states that a group of cohomological dimension 1 must be a free group. We would like to talk about an analog of this theorem for Borel graphs. A Borel graph is a simplicial graph on a standard Borel space X (e.g., the real line) such that the edge set is a Borel subset of X^2. In this talk, every Borel graph has uniformly bounded degrees. Such objects have been studied in the context of countable Borel equivalence relations. For the proof, the idea of Dunwoody's cohomological criterion for accessibility of finitely generated groups plays a crucial role, and we will discuss a similar criterion for certain decomposition of Borel graphs.

32 Kenshiro Tashiro (Okinawa Inst. of Sci. and Tech. Grad. Univ.), Samuël Borza (Univ. Vienna) Varieties of the Grushin plane and the RCD condition ····· 15

Summary: Although it is widely known that a sub-Riemannian manifold with a smooth positive measure does not satisfy the RCD condition, there are several examples of RCD spaces that admit sub-Riemannian type singularity on their boundary, provided an equipped measure is degenerated. One of such spaces is called the Grushin half plane, which was independently studied by Pan–Wei and Rizzi–Stefani. In this talk, we introduce spherical, hyperbolic and infinite Hausdorff dimensional analogues of the Grushin half plane, and discuss the validity of RCD condition.

September 19th (Fri) Conference Room VI

9:30–10:45

33 Noriaki Ikeda (Ritsumeikan Univ.), Yuji Hirota (Azabu Univ.) Poisson maps in Hamilton Lie algebroids ····· 15

Summary: In a Hamiltonian Lie algebroid over a pre-symplectic manifold and over a Poisson manifold, we show that a momentum section on a Hamiltonian Lie algebroid is a Poisson map between proper Poisson manifolds, which is a generalization that a momentum map is a Poisson map between the symplectic manifold to dual of the Lie algebra.

34 Takumi Arai (Kyoto Univ.) Guillermou–Kashiwara–Schapira kernels of geodesic flows ····· 15

Summary: Guillermou–Kashiwara–Schapira proved that there exists a unique sheaf quantization of any homogeneous Hamiltonian isotopy on a cotangent bundle. In this talk, I will show an explicit construction of the sheaf quantization of geodesic flows on spheres and complex projective spaces.

35 Shinpei Baba (Univ. of Osaka) Bending Teichmüller spaces and character varieties ····· 15

Summary: The complex projective structures on a Riemann surface X correspond to a complex vector space of holomorphic quadratic differentials on X. By the holonomy map, this vector space properly embeds into the $\mathrm{PSL}(2,\mathbb{C})$-character variety of the surface, and its image is lagrangian. We construct analogues of such an analytic subvariety based on Thurston's parametrization of complex projective structures.

36 Ryo Hayami (Nagano Univ.) Cotangent path n-rackoids ····· 15

Summary: A Lie rackoid is a differential-geometric structure which can be seen as an integration of a Leibniz algebroid. A cotangent path rackoid is a Lie rackoid whose tangent Leibniz algebroid admits a quotient isomorphic to a standard Courant algebroid. In this talk, we will introduce a cotangent path n-rackoid whose tangent Leibniz algebroid admits a quotient isomorphic to a higher Courant algebroid.

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

Kento Osuga (Nagoya Univ./Nagoya Univ.) ♭ Volumes of moduli spaces of bordered Klein surfaces

Summary: Moduli spaces of oriented hyperbolic surfaces admit a symplectic form and their symplectic volumes satisfy a recursive relation which has now become known as Mirzakhani's recursion. It turns out that Mirzakhani's recursion can be also interpreted in terms of integrable hierarchy, Virasoro constraints, and topological recursion. Recently, it has been shown that a wide class of enumerative invariants computed by topological recursion can be generalised, by incorporating contributions from non-orientable surfaces. Then, an interesting question arises: can we generalise Mirzakhani's recursion into a non-orientable setting? I will discuss how to approach this question, report our progress so far, and conclude with future directions. This talk is based on a joint work in progress with Elba Garcia-Falde and Paolo Gregori.

Complex Analysis

September 16th (Tue) Conference Room Ⅲ

9:30–11:10

1 Natsuo Miyatake (Tohoku Univ.) On the existence, uniqueness, and approximation of the extended complete harmonic metrics ····· 15

Summary: Li–Mochizuki established a theorem stating that on any Riemann surface X and any $q \in H^0(K_X^r)$ that is non-zero unless X is hyperbolic, there exists a unique complete harmonic metric h with a fixed determinant on the cyclic Higgs bundle associated with q. The holomorphic section q induces a subharmonic weight function $\phi_q = \frac{1}{r}\log|q|^2$ on $K_X \to X$. In this talk, I extend the uniqueness part of the theorem of Li–Mochizuki to any subharmonic weight function φ whose exponential is smooth outside a compact subset $K \subseteq X$. I also show that a complete Hermitian metric associated with φ exists whenever e^{φ} is smooth. Furthermore, when φ can be monotonically approximated by a family of smooth weight functions $(\varphi_\epsilon)_{\epsilon>0}$, I show that the corresponding family of complete metrics $(h_\epsilon)_{\epsilon>0}$ converges monotonically to a complete metric h associated with φ.

2 Natsuo Miyatake (Tohoku Univ.) Harmonic metrics, subharmonic functions, entropy, and free energy ··· 15

Summary: Let X be a Riemann surface, and let $K_X \to X$ denote the canonical bundle. In this talk, using harmonic metrics and drawing an analogy with the canonical ensemble in equilibrium statistical mechanics, I introduce, for each semipositive singular Hermitian metric $e^{-\varphi}h_0$ on $K_X \to X$, each integer $r \geq 2$, and each non-zero real number β, two functions on X, which I call the entropy and the free energy.
By extending the estimate established by Dai–Li and Li–Mochizuki to general subharmonic weight functions, I provide an upper bound and a lower bound for the entropy. Additionally, I show that the difference between the lower and upper bounds of entropy converges to a finite real number if and only if $\beta > -1$. Also, I give a sufficient condition for the free energy to decrease monotonically at each point, and when $r = 2, 3$ I also give a sufficient condition for the entropy to increase monotonically at each point.

3 Natsuo Miyatake (Tohoku Univ.) Entropy, free energy, hyperbolic metrics, and redundancy ····· 15

Summary: Let X be a Riemann surface, and let $K_X \to X$ denote the canonical bundle. In the previous talk, I introduced, for each semipositive singular Hermitian metric $e^{-\varphi}h_0$ on $K_X \to X$, each integer $r \geq 2$, and each non-zero real number β, two functions on X, which I call the entropy and the free energy. In this talk, when φ satisfies a certain approximation condition, we provide, from the perspective of entropy and free energy, a necessary and sufficient condition for the function $e^{\varphi}h_0^{-1} \otimes h_X$ to be bounded on hyperbolic surfaces, where h_X denotes the complete hyperbolic Hermitian metric on $K_X \to X$. In particular, I introduce a new concept called the redundancy function and the lower redundancy constant, which quantifies the deviation of the entropy from maximum entropy, and show that lower redundancy constant being positive is equivalent to $e^{\varphi}h_0^{-1} \otimes h_X$ being bounded.

4 Takao Ohno (Oita Univ.)
Tetsu Shimomura (Hiroshima Univ.) Maximal and Riesz potential operators on Musielak–Orlicz spaces over unbounded metric measure spaces ····· 15

Summary: In this talk, we show the boundedness of the modified Hardy–Littlewood maximal operator on Musielak–Orlicz spaces over unbounded non-doubling metric measure spaces. As an application, we give Sobolev inequalities for the variable Riesz potentials on Musielak–Orlicz spaces over unbounded non-doubling metric measure spaces.

5 Ikkei Hotta (Yamaguchi Univ.)
Sebastian Schleißinger (Univ. of Würzburg)
Toshiyuki Sugawa (Tohoku Univ.)
Nonlinear resolvents and decreasing Loewner chains 15

Summary: We study nonlinear resolvents of infinitesimal generators of holomorphic semigroups and their connections to decreasing Loewner chains. For a bounded convex domain $D \subset \mathbb{C}$, the resolvent equation $w = z - tG(z)$ admits a unique solution $z = J_t(w)$ for all $t \geq 0$ if and only if G is an infinitesimal generator. We investigate conditions under which resolvents exist on unbounded convex domains and prove that they form decreasing Loewner chains under general assumptions. We also study the upper half-plane case in relation to free probability theory, providing a complete characterization of resolvent existence depending on the asymptotic behavior of G.

6 Shunsuke Kasao (Shibaura Inst. of Tech. Kashiwa Junior & Senior High School)
Yu Kawakami (Kanazawa Univ.)
Bloch–Ros principle and its application 15

Summary: There exists the duality between normal family theory and value distribution theory of meromorphic functions, which is called the Bloch principle. Zalcman formulated a more precise statement on it. In this talk, based on the Zalcman and Ros works, we comprehend the phenomenon of the trinity among normal family theory, value distribution theory and minimal surface theory and give a systematic description of the relationship among the Montel theorem, the Liuoville theorem and the Bernstein theorem as well as the Carathéodory–Montel theorem, the Picard little theorem and the Fujimoto theorem. We call this phenomenon Bloch–Ros principle.

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

Shun Kumagai (Hachinohe Inst. of Tech.)
Galois action on Teichmüller curves and related combinatorial objects

Summary: In 2005, Möller pointed out that the embedding of the family of affine deformations of an origami (square-tiled surface) into the moduli space is arithmetic. He presented the Grothendieck–Teichmüller theory on a particular origami and showed another proof of the $\widehat{GT}$-relation of the absolute Galois group $G_{\mathbb{Q}}$. The embedded curve (Teichmüller curve) admits a Fuchsian model of the group of affine self-symmetry called the Veech group. In this talk, we present an overview of Möller's theory and discuss the Veech groups in this context using combinatorial objects such as dessins, origamis, and tile structures. We study covering relations of origamis and their Teichmüller curves by introducing tile structures.

15:40–16:30

7 Junichiro Narita (Daido Univ./Daido Univ.*)
Mikihiro Hayashi (Hokkaido Univ.*)
Shigeo Segawa (Daido Univ.*)
On Hasumi's theorem for the classification of plane domains by Hardy classes 15

Summary: In 1969, Heins completed the chain of strict inclusion relations of null classes of open Riemann surfaces related to Hardy classes of all exponents. Moreover, Heins himself proposed the study to reproduce the above Heins diagram for plane domains. We call this investigation theme as the Heins problem. After Hejhal's solution for exponents greater than or equal to 1, in 1978, Hasumi published the paper very important from two view points: firstly it presented concrete examples of removable plane compact sets for Hardy-Orlicz classes; secondly it has been recognized as to have resolved the Heins problem completely for Hardy classes of all exponents. However, there is one slight deficiency in Hasumi's proof of the Heins problem, and the purpose of this presentation is to point out and correct it.

8 Katsuhiko Matsuzaki (Waseda Univ.), Fei Tao (Waseda Univ.) — Characterization of asymptotically smooth curve ····· 15

Summary: We construct an explicit example of an asymptotically conformal chord-arc curve that is not asymptotically smooth.This implies that a little Bloch and BMOA function is not necessarily VMOA, and that a symmetric and strongly quasisymmetric homeomorphism is not necessarily strongly symmetric.

9 Yûsuke Okuyama (Kyoto Inst. Tech.) — Schwarzian derivatives and their generalizations of meromorphic functions appearing in complex dynamics ····· 15

Summary: We would present a locally uniform and quantitative approximation of generalized (pre-)Schwarzian derivatives of the Koenigs–Poincaré–Schroder / Abel functions associated to non-super attracting / parabolic cycles of non-constant meromorphic functions f on the complex plane in terms of those of the iterations of f.

September 17th (Wed) Conference Room Ⅲ

9:30–11:10

10 Takanori Ayano (Osaka Metro. Univ.), Victor M. Buchstaber (Steklov Math. Inst.) — Solution to the KP equation in terms of a hyperelliptic function of degree 2 ····· 15

Summary: The KP equation is one of the most famous (2+1)-equations in the theory of nonlinear waves. Krichever constructed a solution to the KP equation in terms of the Riemann theta function associated with an algebraic curve. In this talk, we construct a new solution to the KP equation in terms of the sigma function associated with a hyperelliptic curve of genus $g \geq 2$ with one infinite point. Since the sigma function is completely determined by the coefficients of the defining equation of the curve, the well-known problem of constructing real-valued solutions is solved.

11 Takeo Ohsawa (Nagoya Univ.)♭ — An example of holomorphically nonconvex locally pseudoconvex analytic set in $\mathbb{C}^3$ ····· 15

Summary: Modifying a counterexample of Fornaess to a conjecture of Oka, a holomorphically nonconvex analytic surface will be constructed in such a way it is mapped to $\mathbb{C}^2$ in a locally pseudoconvex way and mapped into $\mathbb{C}^3$ as a locally closed analytic set.

12 Makoto Abe (Hiroshima Univ.⋆), Tatsuhiro Honda (Senshu Univ.) — Boundary distance functions of unramified Riemann domains over $\mathbb{C}^n$ ····· 15

Summary: Let (D, π) be an unramified Riemann domain over $\mathbb{C}^n$ and let d denote the boundary distance function of (D, π) with respect to an arbitrary complex norm on $\mathbb{C}^n$. Then, the function $-\ln d$ is subpluriharmonic in the sense of Fujita on D.

13 Tadashi Takahashi (Hagoromo Univ. of Int. Stud.) — A computer algebraic study on Yoshihara's defining equation ····· 15

Summary: The defining equation of a plane curve with a singular point of type A19 in two-dimensional complex projective space was obtained by Yoshihara in 1979. In this work we find the method (process and technique) for finding the defining equation of sextic curve in 2 dimensional complex projective space having a singular point of type A19. And in this process, we use computer algebra system to consider the role of Groebner bases and resultants.

Summary: We give the first main theorem and the second main theorem of Nevanlinna theory for meromorphic functions on complete Kähler manifolds which admit Green's functions regular at infinity. Our method is applicable also for the cases when the domain manifolds of meromorphic functions are strictly pseudo-convex domains and bounded regular domains in complex Euclidean spaces.

Summary: In this talk, we present an the exact expression for the Levi form of the logarithmic Fubini–Study distance to a non-singular complex curve S in a two-dimensional complex projective space. We also give expressions for the eigenvalues of the Levi form with respect to the Fubini–Study metric and show that they are infinitely differentiable functions defined in a neighborhood of S.

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

Takahiro Inayama (Tokyo Univ. of Sci.) L^2 estimates, L^2 extension theorems, and positivity of curvature

Summary: Hörmander's L^2 estimate and the Ohsawa–Takegoshi L^2 extension theorem play fundamental roles in complex analysis. Hörmander's L^2 estimate asserts that if a Hermitian metric has positive curvature, one can solve the dbar equation with an L^2 estimate determined by the metric. The Ohsawa–Takegoshi extension theorem states that if the metric has positive curvature, holomorphic functions defined on a complex submanifold (e.g., a hyperplane) can be extended to globally defined holomorphic functions with the L^2 estimate. In recent years, converses to both of these theorems have been actively studied and applied in various contexts. In this talk, I will present recent progress that I have mainly contributed to, and also discuss some open problems for future research.

Functional Equations

September 16th (Tue) Conference Room I

9:00–12:00

1 Shunya Adachi (Utsunomiya Univ.) Middle Laplace transform for linear Pfaffian systems and its application 10

Summary: Recently, the speaker introduced an operation called the middle Laplace transform for linear Pfaffian systems with singularities along hyperplane arrangements. This transformation can be regarded as a formulation of the Fourier–Laplace transform from the perspective of Katz's theory on linear differential equations in the complex domain. In this talk, we explain the basic idea behind this formulation using an illustrative example. Furthermore, we demonstrate that, by applying the middle Laplace transform and related transformations, one can obtain many linear Pfaffian systems that are globally analyzable. For instance, the Humbert confluent hypergeometric system in two variables belongs to this class.

2 Nobuki Takayama (Kobe Univ.*)
Hiromasa Nakayama (Nihon Univ.) Algorithm to classify hypergeometric systems to isomorphic classes ··· 10

Summary: We give an algorithm to stratify the parameter space of a given hypergeometric system into isomorphic classes.

3 Kazuki Ishibashi (Hiroshima Inst. of Tech.) A Hille–Kneser type oscillation criterion for linear differential equations with a PD-based operator 10

Summary: This study establishes a Hille–Kneser type oscillation criterion for linear differential equations involving conformable derivatives defined via proportional-derivative (PD) control. The classical Hille–Kneser theorem relies on the oscillation constant associated with the Euler equation. We extend this framework by introducing a novel Euler-type equation defined through a PD-based differential operator. By formulating the corresponding oscillation constant, we generalize the known oscillation and nonoscillation criteria, including the classical Hille–Kneser theorem, to cover differential equations incorporating a PD-based differential operator.

4 Hiroyuki Usami (Gifu Univ.*)
Manabu Naito (Ehime Univ.*) Necessary conditions for half-linear ordinary differential equations in order that they have solutions behaving exponentially 10

Summary: We consider second order half-linear ordinary differential equations near the infinity. We establish necessary conditions for such equations in order that they have exponentially growing (or decaying) solutions near the infinity.

5 Tomoyuki Tanigawa (Osaka Metro. Univ.)
Takaŝi Kusano (Hiroshima Univ.*)
Jaroslav Jaroš (Comenius Univ.)
Hiroyuki Usami (Gifu Univ.*) On the amplitude and the slope at zeros of oscillatory solutions of half-linear differential equations 10

Summary: The research objective is to elucidate the qualitative properties of oscillatory solutions of half-linear differential equations that, despite being nonlinear, possess the property that constant multiples of solutions are also solutions. In this talk, we present information concerning the amplitude of the oscillatory solutions and the slope at their zeros, which are part of this research objective.

Summary: This talk investigates the global dynamics of a class of nonlinear delay differential equations motivated by biological models such as the one proposed by Mackey and Glass for blood cell regulation. The model incorporates delayed feedback and a nonlinear damping term. It is rigorously shown that when the damping effect grows superlinearly, all solutions converge globally to a unique positive equilibrium, independent of initial conditions. This result provides a theoretical basis for the suppression of complex dynamics, such as chaos or sustained oscillations, often observed under weaker damping. The analysis combines nonlinear techniques, qualitative theory, and comparison arguments.

Summary: In this talk, we review recent results on the solvability of integrable partial differential equations such as the Korteweg–de Vries, nonlinear Schrödinger and modified Korteweg–de Vries equations under meromorphic initial conditions by quadrature when the inverse scattering technique is applied. These results are based on the differential Galois theory for linear differential equations.

Summary: We study the one-dimensional nonlinear bifurcation problem of Kirchhoff type with oscilatory and power nonlinearity. Let $\lambda = \lambda(\alpha)$ be the bifurcation parameter which is parameterized by $\alpha > 0$ (L^∞-norm of the solution u_λ associated with λ). Then we obtain the precise asymptotic formulas for L^2-norm of u'_λ and $\lambda(\alpha)$ as $\alpha \to \infty$ by using the precise time map argument.

Summary: The super-critical Brezis–Nirenberg problem in an annulus is considered. The new uniqueness result of positive radial solutions is established for the three-dimensional case. It is also proved that the problem has at least three positive radial solutions when the inner radius of the annulus is sufficiently small and the outer radius of the annulus is in a certain range. Moreover, for each positive integer k, the problem has at least k positive radial solutions when the exponent of the equation is greater than the critical Sobolev exponent and is less than the Joseph–Lundgren exponent.

Summary: We study a class of coupled ordinary differential equations whose solutions appear as asymptotic profiles of nonlinear dispersive systems. Focusing on the system's algebraic structure, we present a criterion for the existence of quartic conserved quantities. The condition is formulated in terms of the eigenstructure of an associated real matrix, whose rank characterizes the system's complexity. In particular, we show that if the matrix has a pair of purely imaginary eigenvalues and a corresponding eigenvector satisfies a positivity condition, then every solution exists globally in time and obeys a uniform bound. Moreover, we provide a classification of such systems up to real-linear changes of variables, revealing a canonical form that makes the structure of conserved quantities more transparent.

11 Ryuji Kajikiya (Osaka Electro-Comm. Univ.), Shingo Takeuchi (Shibaura Inst. of Tech.) — Estimate for the first eigenvalue of the one-dimensional p-Laplacian 10

Summary: We study the first eigenvalue $\lambda(p)$ of the one-dimensional p-Laplacian in the interval $(-1, 1)$ under the Dirichlet boundary condition. We give upper and lower estimates of $\lambda(p)$ and investigate its asymptotic behavior as $p \to 1 + 0$ or $p \to \infty$.

12 Ryuji Kajikiya (Osaka Electro-Comm. Univ.) — Least energy solutions of the Hénon equation in reflectionally symmetric or point symmetric unbounded domains 10

Summary: We study the Hénon equation in a reflectionally symmetric or point symmetric domain, which is unbounded but the Sobolev embedding is compact. We call $u(x)$ a least energy solution if it is a minimizer of the Rayleigh quotient corresponding to the Hénon equation. We shall show that no least energy solution is reflectionally symmetric and even. Furthermore, we prove the existence of a positive solution which has the exact symmetry of reflection.

13 Slim Ibrahim (Univ. of Victoria), Ikkei Shimizu (Kyoto Univ.) — Global perturbation of isolated equivariant chiral skyrmions from the harmonic maps 10

Summary: We consider the variational problem for the Landau–Lifshitz energy in the equivariant class. Under the regime of coefficients where the energy is positive perturbation from the Bogomol'nyi case, we construct solutions to the Euler–Lagrange equation, and investigate their profile and stability.

14 Yuki Amari (Keio Univ.) — Saddle point solutions in $SU(3)$ Yang–Mills theory: Hyperbolic monopole–antimonopole bound state 10

Summary: Yang–Mills theory is of great significance not only in physics but also in mathematics. Non-trivial solutions such as instantons and monopoles play central roles in the theory of connections, the study of four-dimensional manifolds, and integrable systems. In this talk, we present globally defined saddle-point solutions with finite action in four-dimensional SU(3) Yang–Mills theory. These solutions can be interpreted as bound states of hyperbolic monopoles and antimonopoles, where hyperbolic monopoles are a type of instanton. We describe the construction of these solutions and their remarkable properties.

14:15–16:30

15 Takeshi Suguro (Kumamoto Univ.) — Stability estimates for the Sobolev type functional inequality for a p-Laplace equation 10

Summary: We consider the Sobolev-type inequality for the Tsallis entropy, a one-parameter extension of the Boltzmann–Shannon entropy. We show the stability estimate for the inequality concerning the ZKB function, which is a fundamental solution to a p-Laplace equation. Moreover, we derive an extension of the Cramér–Rao inequality.

16 Naoki Hamamoto (Osaka Metro. Univ.) — The Poincaré–Wirtinger constant for curl-free fields on the ball 10

Summary: We investigate the best constant for curl-free vector fields in the Poincaré–Wirtinger inequality $\int_B |\nabla \boldsymbol{u}|^2 dx \geq C \int_B |\boldsymbol{u}|^2 dx$. Here B denotes the unit ball in $\mathbb{R}^N$ and $\boldsymbol{u} = \boldsymbol{u}(\boldsymbol{x})$ are smooth vector fields constrained by the condition $\int_B \boldsymbol{u}(\boldsymbol{x}) dx = \boldsymbol{0}$. We compute the new best value of the constant C by further imposing on $\boldsymbol{u}$ the curl-free condition.

Summary: We derive a differential identity for a class of p-Laplace type equations, which arise as the Euler–Lagrange equations associated with Hardy–Sobolev–Mazya inequalities. We then classify all positive finite energy cylindrically symmetric solutions when the dimension of the partial weight is greater than or equal to 3. As a consequence, we obtain the best constant and extremal functions for the related Hardy–Sobolev–Mazya inequalities.

Summary: We study the Smoluchowski–Poisson equation on the whole space R^n for $n \geq 3$. We introduce the notion of the blowup point with strong patterns and weak concentration rate and prove that the Hausdorff dimension of the set of such points is at most $n-2$.

Summary: We consider the semilinear elliptic equation $-\Delta u + V_\epsilon(x)u = u^{p_\epsilon - 1}$ in R^N where $N \geq 3$, $p_\epsilon = 2^* - \epsilon$, $0 < \epsilon \ll 1$ and $V_\epsilon(x) \geq 0$. Especially if the potential $V_\epsilon(x)$ is some discontinuous case, we study the existence of ground state solutions and behavior of such solutions as $\epsilon \to 0$.

Summary: We consider the bifurcation structure of radial solutions for the semilinear elliptic equations with singular weights in the unit ball. We deal with the exponential nonlinearity and power-type nonlinearities. In the un-weighted case, it is well-known that the bifurcation curve exhibits three different types depending on the dimension and the exponent of power, for higher dimensions. On the other hand, the curve exhibits only one type in two dimensions.
In this talk, we succeed in realizing a phenomenon such that the bifurcation curve exhibits all of the three types in two dimensions by choosing the weight suitably.

Summary: In this talk, we investigate the higher-order boundary behavior of large solutions to semilinear Poisson equations with exponential nonlinearities. Building upon the Keller–Osserman condition, we derive refined asymptotic expansions near the boundary of a smooth domain for large solutions, which blow up at the boundary. Our main results provide third-order estimates for nonlinearities which like $f(t) = e^t P(t)$, where $P(t)$ is a positive polynomial. I also analyze the special case $f(t) = e^t$, which exhibits unique structural simplifications, and establish, in a certain sense, the higher-order boundary expansion of large solutions for this particular nonlinear term. The analysis relies on precise estimates involving the boundary distance and the curvature of level sets. These findings extend previous work and contribute to a deeper understanding of singular boundary behavior in nonlinear elliptic PDEs.

Summary: We are concerned with positive radial solutions of the inhomogeneous elliptic equation $\Delta u + K(|x|)u^p + \mu f(|x|) = 0$ on $\mathbb{R}^N$, where $N \geq 3$, $\mu > 0$ and K and f are nonnegative nontrivial functions. If $K(r) \sim r^\alpha$, $\alpha > -2$, near $r = 0$, $K(r) \sim r^\beta$, $\beta > -2$, near $r = \infty$ and certain assumptions on f are imposed, then the problem has a unique positive radial singular solution for a certain range of μ. We show that existence of a positive radial singular solution is equivalent to existence of infinitely many positive bounded solutions which are not uniformly bounded, if p is between the critical Sobolev exponent $p_S(\alpha)$ and Joseph–Lundgren exponent $p_{JL}(\alpha)$.

Summary: In this talk, we deal with the following weakly coupled nonlinear Schrödinger system

$$\begin{cases} -\Delta_\alpha u + \omega u = |u|^2 u + \beta u |v|^2 & \text{in } \mathbb{R}^2, \\ -\Delta v + \tilde{\omega} v = |v|^2 v + \beta |u|^2 v & \text{in } \mathbb{R}^2, \end{cases}$$

where $-\Delta_\alpha$ denotes the Laplacian operator with a point interaction, ω greater then a suitable positive constant, $\tilde{\omega} > 0$, and $\beta \geq 0$. For any $\beta \geq 0$ this system admits the existence of a ground state solution which can have only one nontrivial component or two nontrivial components and which could be regular or singular. We analyse this phenomenon showing how this depends strongly on the parameters.

Summary: We study uniqueness and nondegeneracy of ground states for nonlinear scalar field equations in two dimensions with a point interaction at the origin. It is known that the all ground states are radial, positive, and decreasing functions. In this paper we prove the uniqueness of positive radial solutions by a method of Pohožaev identities. As a corollary, we obtain the uniqueness of ground states. Moreover, by a variational and ODE technique, we show that the ground state is a nondegenerate critical point of the action in the energy space.

Summary: We consider a priori estimate for solutions of the nonlinear Fokker–Planck equation with inhomogeneous spatial diffusion of a porous medium type subjected to the Neumann boundary condition. The equation is based on the continuity equation and the energy law in terms of a specific free energy. Note that we previously studied the long-time behavior of solutions under the condition that the solution is uniformly bounded. We derive a sufficient condition for a priori time-spatial uniform lower and upper bounds for solutions.

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

Kouichi Taira (Kyushu Univ.) Essential selfadjointness and spectral theory for the d'Alembertian on Lorentzian manifolds

Summary: The spectral theory of the Laplacian on Riemannian manifolds has been extensively studied from various perspectives, including applications to mathematical physics and its deep connections with geometry. In recent years, increasing attention has been paid to the spectral theory of the d'Alembertian on Lorentzian manifolds. This operator has been used in the construction of certain physical states in quantum field theory, and new phenomena-unseen in the Riemannian case-were discovered by Kassel and Kobayashi. On the other hand, from the viewpoint of partial differential equations, the d'Alembertian is hyperbolic rather than elliptic, making it significantly more difficult to handle. As a result, this area of research remains under development. In this talk, after reviewing several existing results on the spectral theory of the Laplacian, I will present some fundamental properties of the spectrum of the d'Alembertian that have recently been obtained.

September 17th (Wed) Conference Room I

9:15–12:00

26 Mostafa Fazly (UTSA)
Yasuhito Miyamoto (Univ. of Tokyo)
Linear-coupling effect in the 1D Gross–Pitaevskii system: Exact solutions and eigenvalue problems 10

Summary: We examine a linear coupling in the one-dimensional Gross–Pitaevskii system with Neumann boundary conditions. Exact solutions for this system are derived, and the dependence of these solutions on the linear coupling is thoroughly examined. In addition, we analyze the corresponding linearized eigenvalue problem, classifying both the eigenvalues and eigenfunctions. We also explore how the linear coupling influences the behavior of the eigenvalues.

27 Hiroshi Matsuzawa (Kanagawa Univ.)
Hidenori Kokufukata (Tsurumi Senior High School)
Ground state for a system of nonlinear Schrödinger equations with three waves interaction and critical nonlinearities 10

Summary: In this talk, we consider a system of nonlinear Schrödinger equations with three wave interactions and critical exponents. We discuss the existence of a nontrivial ground state solution. This problem has been studied by several researchers, for example Pomponio[*J. Math. Phys.* 51(2010)] and Kurata and Osada[*Commun. Pure Appl. Anal.* 20(2021)] in the case where all the exponents of the nonlinearities are subcritical.

In this talk, we will demonstrate that even when some of or all of the exponents of the nonlinearity admit the Sobolev critical exponent, a nontrivial ground state solution can still be obtained if the coupling constant is sufficiently large.

28 Reiri Miyamoto (Tokyo Univ. of Sci.)
Motohiro Sobajima (Tokyo Univ. of Sci.)
The critical Fujita exponent for one-dimensional semilinear heat equations with potentials and space-dependent nonlinearities 10

Summary: In this talk, we consider the existence/nonexistence of global-in-time positive solutions to the Cauchy problem of one-dimensional semilinear heat equations with potentials and space-dependent nonlinearities. Our interest is how the potential and the space-dependent weight contained in the nonlinearity affect the critical phenomenon for the global existence/nonexistence. In particular, we investigate the blow-up phenomenon caused by the local behavior of the solutions.

29 Junichi Harada (Akita Univ.) Remarks on the oscillating solutions to the 6D Fujita equation 6

Summary: We will discuss the existence of oscillating solutions to the 6D Fujita equation. To construct the solution, we prescribe initial data that oscillate at spatial infinity. These oscillating solutions are similar to the one constructed in Peter Poláčik and Eiji Yanagida (2003) for the JL supercritical case.

Summary: In this talk, we are concerned with a time-fractional semilinear heat equation including a fractional derivative with respect to time, called the Caputo derivative. In particular, we consider the self-similar solution which fulfills certain scaling structure derived from the equation. We prove that the self-similar solution can have a singularity according to the nonlinearity, due to the lack of the smoothing effect. Moreover, the asymptotic behavior is affected by the singularity, and differs from the classical one.

Summary: Let $0 < \theta \le 2$, $N \ge 1$ and $T > 0$. We are concerned with the Cauchy problem for the fractional semilinear parabolic equation

$$\begin{cases} \partial_t u + (-\Delta)^{\theta/2} u = f(u) & \text{in } \mathbb{R}^N \times (0,T), \\ u(x,0) = u_0(x) \ge 0 & \text{in } \mathbb{R}^N. \end{cases}$$

Here, $f \in C[0,\infty)$ denotes a rather general growing nonlinearity and u_0 may be unbounded. We study local in time solvability in the so-called critical and doubly critical cases. In particular, when $f(u) = u^{1+\theta/N}\,[\log(u+e)]^a$, we obtain a sharp integrability condition on u_0 which explicitly determines local in time existence/nonexistence of a nonnegative solution.

Summary: In this talk, we introduce the unconditional uniqueness of solutions in Herz spaces for the Hardy–Hénon parabolic equation, which is a semilinear heat equation with a power-type weight in the nonlinear term. It is expected that the power-type weight in the nonlinear term can be effectively handled within Herz spaces. In fact, while the known results on unconditional uniqueness in Lorentz spaces with power weights do not include the endpoint exponent cases, our result in Herz spaces does include these cases. In particular, for the large interpolation exponents of Herz spaces, there are examples that are not covered by Lorentz spaces with power weights. Thus, we achieve some essential progress in this direction.

Summary: We consider global existence of weak solutions in a three-dimensional Keller–Segel–Navier–Stokes system involving flux limitation ($|\nabla c|^{-\alpha}$ with $\alpha > 0$) and superlinear signal production (n^β with $\beta > 1$).

Summary: We consider the initial value problem for a drift-diffusion equation with an attractive drift term, which has infinitely many constant solutions, and study the large time behavior of global-in-time solutions to this problem around each stable constant solution. The purpose of this talk is to prove that the disturbances behave like the heat kernel in one dimensional space and like a solution of linear heat equations in higher dimensional space, as time tends to infinity.

Summary: In this talk, we consider concentration phenomena to a chemotaxis system with indirect signal production. We first confirm mass concentration phenomena at the origin by showing uniform-in-time boundedness of some energy functional. We then show an absence of mass quantization under a specific assumption associated with a Lyapunov functional.

36 Kazuhiro Oeda (Kyushu Sangyo Univ.)
Kousuke Kuto (Waseda Univ.)
Stationary solutions of a prey-predator model with directed population flux and a protection zone · · · · · 10

Summary: This talk considers a stationary prey-predator model with a protection zone, into which predators cannot enter. The movement of predators is governed by a nonlinear cross-diffusion term that depends on prey density. We show a sufficient condition on the model parameters for the existence of positive steady states and describe their bifurcation structure. In the limit where the cross-diffusion coefficient becomes large, the solutions exhibit singular asymptotic behavior influenced by the protection zone and the model parameters. These results provide valuable insights into how spatial structures affect population dynamics.

37 Yuki Kaneko (Kanto Gakuin Univ.)
Yoshio Yamada (Waseda Univ.)
Asymptotic behaviors and propagating terrace for a free boundary problem of a positive bistable reaction-diffusion equation under Dirichlet boundary conditions · · · · · 10

Summary: We consider a free boundary problem for a reaction-diffusion equation with positive bistable nonlinearity in a one-dimensional interval. This problem may be applied to model the spreading of biological species, where unknown functions are population density and spreading front of the species. In this talk, we will classify the asymptotic behaviors of solutions into four cases: Big spreading, Small spreading, Transition and Vanishing. Moreover we will show, when the big spreading occurs, the solution converges to a propagating terrace as time goes to infinity.

38 Yuki Tsukamoto (Tokyo Univ. of Sci.)
Appearance of stationary interfaces in the fast reaction limit · · · · · 10

Summary: This work concerns a two-component reaction-diffusion system with asymmetric reaction terms. Assuming nonnegative and segregated initial data, we show that the solution converges to the heat equation in the nonreactive region and vanishes elsewhere. The analysis uses barrier functions and a comparison principle adapted to the asymmetric structure to control behavior near the interface. In the limit, a stationary phase interface emerges, determined by the initial support of the reactive component.

39 Makoto Nakamura (Univ. of Osaka)
Kazusa Eguchi (Univ. of Osaka)
Kento Tachibana (Univ. of Osaka)
Global solutions for the Allen–Cahn type equation in de Sitter spacetime under a quartic potential · · · · · 10

Summary: The Cauchy problem for the Allen–Cahn type equation is considered in de Sitter spacetime under a quartic potential. Global solutions for small data are obtained by the symmetry breaking, and their asymptotic behaviors are shown. Blowing-up solutions are also considered.

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

Tatsuya Watanabe (Kyoto Sangyo Univ.)
Ground state solutions for nonlocal elliptic problems associated with the nonlinear Schrödinger–Poisson system

Summary: In this talk, we consider nonlocal elliptic problems associated with the nonlinear Schrödinger–Poisson system. Particularly, we are interested in the existence of ground state solutions (GSS), which play an fundamental role in the study of the stability of standing waves. There are two types of GSS; One is the least energy solution of the action functional with prescribed frequency (Action GSS), and the other is the minimizer of the energy functional under the mass constraint (energy GSS). First I present several known results for the existence of the action GSS and the energy GSS. Then I will introduce my recent result on the relation between two GSS. Some open questions will be also introduced.

September 18th (Thu) Conference Room I

9:15–12:00

40 Mamoru Aihara (Hokkaido Univ.) A game interpretation for the weighted p-Laplace equation ····· 10

Summary: In this talk, we obtain a stochastic approximation that converges to the viscosity solution of the weighted p-Laplace equation. We consider a stochastic two-player zero-sum game controlled by a random walk, two player's choices, and the gradient of the weight function. The proof is based on the boundary conditions in the viscosity sense and the comparison principle. These results extend previous findings for the non-weighted p-Laplace equation [Manfredi, Parviainen, Rossi, 2012].

41 Takuya Sato (Univ. of Tokyo) A game approach to free boundary problems of anisotropic forced mean curvature flow equations ····· 10

Summary: We consider the free boundary problems of degenerate elliptic equations that describe the level-set formulation of the interface motion evolved by anisotropic forced mean curvature flow. We develop a deterministic game representation for our equations based on a discrete approximation scheme proposed by R. V. Kohn and S. Serfaty in 2006 and establish the comparison principle for our free boundary problems. Since the standard doubling variable methods in the theory of viscosity solutions do not work for the free boundary problems, we prove the comparison principle by using the game approximation.

42 Hiroyoshi Mitake (Univ. of Tokyo)
Panrui Ni (Univ. of Tokyo) Optimal rate of convergence for homogenization of Hamilton–Jacobi equations with prescribed contact boundary conditions ····· 10

Summary: We study the periodic homogenization for convex Hamilton–Jacobi equations on perforated domains under prescribed contact boundary conditions. We first establish the representation formula by using the Skorokhod problem and modified Lagrangians. We then obtain the optimal rate of convergence for homogenization.

43 Hiroyoshi Mitake (Univ. of Tokyo)
Panrui Ni (Univ. of Tokyo) Rate of convergence for homogenization of nonlinear weakly coupled Hamilton–Jacobi systems ····· 10

Summary: We study the periodic homogenization problem of nonlinear weakly coupled systems of Hamilton–Jacobi equations in the convex setting. We establish a rate of convergence $O(\sqrt{\varepsilon})$ which is sharp.

44 Yasuhiro Fujita (Univ. of Toyama)
Norikazu Yamaguchi (Univ. of Toyama) Residence time for a Hamilton–Jacobi flow starting from a pathological function ····· 10

Summary: In this talk, we consider a Hamilton–Jacobi flow, which is defined as a viscosity solution of the initial value problem for some Hamilton–Jacobi equation. We show that residence time of this Hamilton–Jacobi flow starting from a pathological function (which means everywhere continuous and nowhere differentiable function) turns out to be rather simple.

45 Takashi Kagaya (Muroran Inst. of Tech.) Solvability for fully nonlinear parabolic equations with a singular Dirichlet boundary condition ····· 10

Summary: In this talk, we deal with the initial value problem for a class of fully nonlinear parabolic equations with a singular Dirichlet boundary condition in one space dimension. The interior equation includes, for example, a fully nonlinear p-Laplace type heat equation and a beta-power type curvature flow. The singular Dirichlet boundary condition depicts, for example, the asymptoticness of the ends of complete curve to parallel two lines in geometric flow of graphs. We study the dependence of the existence and non-existence of solution to the problem on the interior equation and the boundedness of the initial function.

Summary: We introduce a new notion of Monge solutions for time-dependent Hamilton–Jacobi equations in metric spaces. The central idea is to reformulate the problem as a stationary equation, assuming Lipschitz continuity of the initial data. We establish the well-posedness of the initial-value problem by proving both the uniqueness and existence of bounded Lipschitz Monge solutions. Uniqueness is obtained through a comparison principle, while existence follows from an optimal control representation. Finally, we demonstrate the equivalence of Monge solutions with existing notions of metric viscosity solutions.

Summary: Integral varifolds are a measure-theoretic generalization of submanifolds and provide a natural framework for studying the singular sets of submanifolds with mean curvature. In this talk, we present a regularity theorem for integral varifolds with L^p mean curvature that are close to a triple junction, that is, the union of three half-spaces meeting at equal angles along a common boundary.

Summary: We study the mean curvature flow, where the normal velocity of a hypersurface equals its mean curvature, under the contact angle boundary condition. When the wettability of the container is considered, the contact angle condition naturally arises from the capillary effects at the boundary. In this talk, I am going to present an existence theorem of weak mean curvature flow with prescribed contact angle via the elliptic regularization. A key step of the result is to estimate the first variation of the approximating surfaces.

Summary: The talk concerns regularity and structure results for p-elasticae in $\mathbb{R}^n$, with arbitrary $p \in (1, \infty)$ and $n \geq 2$. Planar p-elasticae are already classified and known to lose regularity. We show that every non-planar p-elastica is analytic and three-dimensional, with the only exception of flat-core solutions of arbitrary dimensions. Subsequently, we classify pinned p-elasticae in $\mathbb{R}^n$ and, as an application, establish a Li–Yau type inequality for the p-bending energy of closed curves in $\mathbb{R}^n$. This extends previous works for $p = 2$ and $n \geq 2$ as well as for $p \in (1, \infty)$ and $n = 2$.

Summary: I consider propagation and blocking phenomena of a curvature flow with a driving force in two-dimensional cylinders with periodically arrayed obstacles. In two-dimensional cylinders with undulating boundaries, Matano–Nakamura–Lou in 2006, 2013 characterize the effect of the boundary shape to propagation and blocking of the solutions under some boundary condition that implies time global existence of the classical solutions. However, in the case that the domains have obstacles, the solutions may develop singularities near obstacles. In this talk, I consider the effect of the shape and position of the obstacles to propagation and blocking of the solutions.

Summary: We study a coupled cubic nonlinear Schrödinger system with small initial data in a weighted L^2 space. Although the system lacks a coercive conserved quantity, we establish global existence and describe the modified-scattering-type behavior. The asymptotic profile is determined by a nonlinear ODE system, whose solutions are explicitly expressed using Jacobi elliptic functions. Our approach extends existing methods to systems without coercive conservation laws. By utilizing a quartic conserved quantity for the associated ODE system, we obtain the result.

Summary: We consider the system of three nonlinear Schrödinger equations with quadratic nonlinearity. In this talk, we prove the existence of traveling wave solutions to this system, which contain a translational parameter and two frequency parameters. The traveling waves will be constructed by the minimizing problem for the action functional. For some zero mass cases, we will use the profile decomposition to obtain the compactness of the minimizing sequence. We also characterize the initial data to obtain the global solution by the traveling waves.

14:30–16:30

Summary: In this talk we specify asymptotic behavior of small solutions to initial value problem for a two-component system of cubic nonlinear Schrödinger equations in one dimensional Euclidean space. As a consequence, the solution behaves like a free solution as $t \to +\infty$. Moreover, a non-decay result for the solution are derived, which is non-trivial in terms of the long range scattering.

Summary: We consider the initial value problem for the cubic derivative nonlinear Schrödinger equations in one space dimension with small initial data. Under the weak dissipativity condition in the sense of Li–Nishii–Sagawa–Sunagawa(2021), the global solution decays like $(\log t)^{-1/4}$ in L^2, and this rate is best possible in general. In this talk, we show that this decay rate is slightly lowered if the Fourier transform of the initial data vanishes at the point where the dissipation is not effective.

Summary: We discuss recent progress on the small data modified scattering for the final state problem of the cubic nonlinear Schrödinger equation with long-range linear potentials in one space dimension. The proof is based on a simple energy method and does not rely on global-in-time Strichartz estimates for Schrödinger equations with linear potentials. In particular, the class of potentials to which our theorem applies is large enough to accommodate slowly decaying negative potentials so that the associated Schrödinger operators may have negative eigenvalues.

Summary: In this talk, we study the focusing nonlinear Schrodinger equation. In particular, we deal with an exponential nonlinearity that correspond to the mass and energy criticalities in the two-dimensional case. For this case, we show that for initial values with an action functional smaller than that of the ground state, the solution scatters when the virial function is positive.

Summary: In this talk, we consider the long-time dynamics of quantum particles in the semi-classical regime. Our first main result shows that for the Hartree equation with short-range interaction potential, small-data solutions obey dispersion bounds and they scatter, where the smallness conditions and the bounds are independent of the reduced Planck constant $\hbar \in (0, 1]$. Then, taking the semi-classical limit $\hbar \to 0$, we prove that the Wigner transforms of such quantum scattering states converge weakly-$*$ to the corresponding classical scattering states for the Vlasov equation. As a direct consequence, we establish small-data scattering for the Vlasov equation without assuming smoothness on initial data.

Summary: We consider the Cauchy problem of the defocusing energy-critical stochastic nonlinear Schrödinger equation on the three-dimensional tori. We prove almost sure global existence of the solution.

Summary: We study a local smoothing property of the Schrödinger equation. Due to the infinite propagation speed of the Schrödinger equation, singularities in initial data move away from the origin. This phenomenon was captured as an inequality proven by Sjolin, Vega, and Constantin–Saut. Rogers (2008) also established local smoothing estimates via a time-space estimate. In this talk, we extend Rogers's inequality to the framework of modulation spaces. Our proof is based on the wave packet decomposition technique, which was employed by Rogers (2008) and Lee (2006).

Summary: We consider the Cauchy problem for the logarithmic Schrödinger equation and prove uniqueness of weak $H^s(\mathbb{R}^d)$ solutions for $s \in (0, 1)$, which improves on the previous uniqueness result in $H^1(\mathbb{R}^d)$. The proof is achieved by combining a nontrivial use of integral equations, local smoothing estimates, and quantitative estimates of the sublinear effect of the nonlinearity, based on the localization argument.

Summary: We study the Cauchy problem for a generalized Zakharov system in three space dimensions. We establish the global well-posedness and the growth of higher-order Sobolev norms of the solutions to a generalized Zakharov system by using the only higher energy estimate and completeness of function spaces. We note that the Fourier transform, Besov spaces, Bourgain spaces and any compactness argument are not used. As the consequence, we can construct the solution in some Sobolev space without a weight.

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

Shuji Yoshikawa (Hiroshima Univ.) Structure-preserving discretization of differential equations and its applications

Summary: The discretization of derivatives arises in various contexts, such as the derivation of functional inequalities through the corresponding difference inequalities and numerical simulations of differential equations. Especially, when discretizing derivatives in differential equations, it is often helpful in clarifying their analysis that the discretized difference equations inherit "structures" of the original differential equations in some sense. For example, if the discretization preserves the energy structure of the differential equations, the energy method applicable to the continuous case can be directly applied to the discretized system. In this talk, I will introduce recent results on the structure-preserving discretization and its mathematical analysis.

September 19th (Fri) Conference Room I

9:15–12:00

62 Takuma Yoshizumi (Univ. of Osaka)
Makoto Nakamura (Univ. of Osaka)
Blowup for semi-linear Klein–Gordon equations with positive initial energy in FLRW spacetimes 10

Summary: We consider the Cauchy problem for semilinear Klein–Gordon equations in Friedmann–Lemaître–Robertson–Walker (FLRW) spacetimes. The blow-up behavior of solutions is studied using the concavity method, originally developed for semi-linear wave equations in Minkowski spacetime. In the Minkowski case, blow-up conditions for large initial data were obtained by Zhang (2002), Wang (2008), and Yang and Xu (2018). In FLRW spacetimes, McCollum, Mwamba, and Oliver (2024) established a blow-up result for large initial data with positive initial energy. In this work, we refine their result and extend the class of initial data leading to blow-up with positive energy in FLRW spacetimes. The analysis is based on the concavity method introduced by Levine (1974). This is joint work with M. Nakamura.

63 Koji Wada (Hokkaido Univ.)
Kyouhei Wakasa (Muroran Inst. of Tech.)
Blow-up of solutions for discrete semilinear wave equation with the scale-invariant damping 10

Summary: We consider the blow-up problem for discretized scale-invariant nonlinear dissipative wave equations. It is known that the critical exponents for the PDE version are given by Fujita and Strauss exponents depending on the space dimensions. Our purpose is to obtain results for the discretized equations that correspond to those shown for the continuous one. We defined the blow-up of the solution in the discretization applied here and obtained the blow-up of the solution when p is smaller than the Fujita exponent. The proof is based on Matsuya(2013), who showed the blow-up problem for discrete semilinear wave equations without dissipative terms.

64 Shunsuke Kitamura (Tohoku Univ.)♭
Non-existence of time-local solutions of derivative type with spatial weights and non-compactly supported data in one space dimension ... 10

Summary: In this talk, I will report on the non-existence of time-local solutions of semilinear wave equations of derivative type with spatial weights and non-compactly supported data in one space dimension. I found a sufficient condition to occur the blow-up of solutions far from the origin by means of spatial weights and the decay of initial data.

65 Motohiro Sobajima (Tokyo Univ. of Sci.)
A weighted energy method for wave equations with time-dependent damping 10

Summary: We consider linear wave equations with time-dependent damping in N-dimensional exterior domains. In particular, we focus our attention to the energy decay property for the case where the damping coefficient does not belong to C^1.

66 I-Kun Chen (Nat. Taiwan Univ.)
Chun-Hsiung Hsia (Nat. Taiwan Univ.)
Daisuke Kawagoe (Kyoto Univ.)
On the existence and regularity of weakly nonlinear stationary Boltzmann equations 10

Summary: We consider a boundary value problem of the weakly nonlinear Boltzmann equation with the incoming boundary condition in a bounded convex domain. For the collision kernel, we consider the hard sphere model, hard potential model and the Maxwell model. With the diffuse reflection boundary condition, the $W^{1,p}_x$ regularity of the solution for $1 \le p < 3$ is known under the positive Gaussian curvature condition. In this talk, we show the existence of the solution in a weighted $W^{1,\infty}$ space assuming the positive Gaussian curvature condition, which implies that the solution belongs to $W^{1,p}$ for $1 \le p < 3$. A generalized Fredholm alternative theorem plays an important role in our analysis.

67 Dingqun Deng (Akita Univ.)
Shock wave stability for the 3D Boltzmann equation: Bridging kinetic theory and fluid dynamics 10

Summary: It is well known that, by taking the hydrodynamic limit under suitable scaling (e.g., as the Knudsen number or mean free path $\varepsilon \to 0$), kinetic equations yield macroscopic models such as the compressible Navier–Stokes or Euler equations. Consequently, the macroscopic wave patterns is also formed in the mesoscopic kinetic level. In this talk, we focus on the stability and long-time behavior of the 3-D Boltzmann equation in $\mathbb{R} \times \mathbb{T}^2$, considering perturbations around backgrounds composed of two 1-D shock waves (respectively, contact waves or rarefaction waves).

68 Naoto Deguchi (Sci. Tokyo)
On stability of time-periodic compressible Navier–Stokes flows in three-dimensional exterior domain 10

Summary: We study the stability of the time-periodic solution of the compressible Navier–Stokes equation in three-dimensional exterior domains, subject to time-periodic external forces that decay at spatial infinity. We establish the existence of the time-periodic solution when an external force is small enough. We also prove the global existence result for the initial value problem of the perturbation around the time-periodic solution, provided the initial perturbation is sufficiently small.

69 Masatoshi Okita (Kurume Nat. Coll. of Tech.)
Yoshiyuki Kagei (Sci. Tokyo)
Takayuki Kobayashi (Univ. of Osaka)
Ryosuke Nakasato (Shinshu Univ.)
On the asymptotic behavior of solutions to the compressible Navier–Stokes equations with the non-slip boundary condition in the half space 10

Summary: We consider the initial boundary value problem for the compressible Navier–Stokes equations with the non-slip boundary condition in the half space $\mathbb{R}^d_+$. The result on the global solvability, the time-decay of solutions and more detailed results are established by Kagei–Kobayashi (2002, 2005). In this talk, we investigate the asymptotic behavior of the solution which is essentially different from the one of the initial value problem in the whole space and the incompressible NS equations with the non-slip boundary condition.

70 Takayuki Kobayashi (Univ. of Osaka)
Ryosuke Nakasato (Shinshu Univ.)
Analyticity and asymptotic behavior of solutions to the compressible Navier–Stokes–Korteweg equations with the zero sound speed in critical spaces 10

Summary: In this talk, we consider the initial-value problem in the d-dimensional Euclidean space $\mathbb{R}^d$ ($d \ge 3$) for the compressible Navier–Stokes–Korteweg equations under the zero sound speed case (namely, $P'(\rho_*) = 0$, where $P = P(\rho)$ stands for the pressure). The purposes of this talk are to obtain the global-in-time solution around the constant equilibrium states $(\rho_*, 0)$ ($\rho_* > 0$) satisfying the estimate on the analyticity as established by Foias–Temam (1989), and investigate the L^p-L^1 type time-decay estimates in scaling critical settings based on Fourier–Herz spaces. In addition, we also introduce the first order asymptotic formula with higher derivatives for solutions as the application of the analyticity.

71 Masahiro Suzuki (Nagoya Inst. of Tech.)
Mingjie Li (Minzu Univ. of China)
Katherine Zhiyuan Zhang (Northeastern Univ.)
Stationary flows for viscous heat-conductive fluid in a perturbed half-space 10

Summary: In this talk, we consider the non-isentropic compressible Navier–Stokes equation in a perturbed half-space with an outflow boundary condition as well as the supersonic condition. This equation models a compressible viscous, heat-conductive, and Newtonian polytropic fluid. We show the unique existence of stationary solutions for the perturbed half-space. The stationary solution depends on all directions and has multidirectional flow. We also prove the asymptotic stability of this stationary solution.

72 Masahiro Suzuki (Nagoya Inst. of Tech.)
Wenrui Huang (Brown Univ.)
Benoît Pausader (Brown Univ.)
The asymptotic behavior of solutions to the Vlasov–Poisson equation in convex domains 10

Summary: In this talk, we consider the Vlasov–Poisson system in an acceptable convex domain with a perfectly conducting wall. We introduce the asymptotic domain for the domain. Then we show that for localized initial data, the velocity of particles is asymptotically supported in the closure of the asymptotic domain, and the time-global solutions exhibit the asymptotics of modified scattering.

73 Taiki Okazaki (Tohoku Univ.)
Tsukasa Iwabuchi (Tohoku Univ.)
On the uniqueness of the surface quasi-geostrophic equation with the fractional Laplacian 10

Summary: We consider the uniqueness of the solution of the surface quasi-geostrophic equation with fractional Laplacian. We show that the uniqueness holds in non-homogeneous Besov spaces without any additional assumption which is supposed to construct solutions. When the power of the fractional Laplacian is close to 2, we prove that the uniqueness with the regularity index $s = -1/2$. We extract the least regularity $s = -1/2$ for the well-definedness of the nonlinear term of the equation.

74 Mikihiro Fujii (Nagoya City Univ.)
Tsukasa Iwabuchi (Tohoku Univ.)
Sharp well-posedness and ill-posedness of the stationary quasi-geostrophic equation 10

Summary: In this talk, we consider the stationary problem for the quasi-geostrophic equation. This equation has the same scaling structure to the 2D stationary Navier–Stokes equations, which is ill-posed in the scaling critical Besov spaces including the narrowest case. Focusing on the inherent regularity structure of the nonlinear term, we show that the stationary quasi-geostrophic equation is well-posed in some scaling critical Besov spaces. Moreover, we show that the optimal range for the exponents of critical Besov spaces that ensure the well-posedness.

75 Yoshiki Iida (Waseda Univ.)
Resolvent problem for the linearized primitive equations on non-smooth layers 10

Summary: The primitive equations describes the motion of large-scaled fluids, such as ocean. We consider the resolvent problem for the linearized primitive equations on non-flat layers with C^1-boundaries. In our setting, one cannot expect that the solution to the resolvent problem does not belong to $W^{2,p}$. The aim of this talk is to discuss the solvability of the resolvent problem based on the idea of Geng–Shen (2025), which proves the resolvent estimate for the Stokes equations on C^1-domains.

14:15–16:30

76 Kento Sube (Waseda Univ.) Well-posedness and analyticity of solutions to the stationary MHD equations ····· 10

Summary: We consider the stationary problem of the MHD equations in the whole space. The aim of this talk is to show existence, uniqueness, regularity, and analyticity of solutions in the scaling invariant homogeneous Besov space $\dot{B}^{-1+3/p}_{p,q}$ for $1 \le p < 3$ and $1 \le q \le \infty$. In particular, for analyticity, we make a use of a technique so-called parameter trick. Such a trick is known as an elegant method to prove space-time analyticity of solutions to semi-linear or quasi-linear parabolic equations. It is clarified that the method of the parameter trick is also useful to the nonlinear elliptic equations such as MHD system.

77 Hiroki Ohyama (Kyoto Univ.)
Junha Kim (Ajou Univ.)
Ryo Takada (Univ. of Tokyo)
Asymptotics for the inviscid rotating stably stratified Boussinesq equations in a 3D layer ····· 10

Summary: We consider the initial value problem of the inviscid Boussinesq equations for rotating stably stratified flows in a three-dimensional infinite layer. We establish the long-time existence and uniqueness of classical solutions under the condition that both the rotating speed and the buoyancy frequency are sufficiently high. Furthermore, we consider the asymptotic limit of rapid rotation and strong stratification, and prove that the long-time solution strongly converges to that of the quasi-geostrophic equations.

78 Hiroki Ohyama (Kyoto Univ.) Long-time solvability and asymptotics for the 3D rotating MHD equations ····· 10

Summary: We consider the initial value problem for the 3D incompressible rotating MHD equations around a constant magnetic field. We prove the long-time existence and uniqueness of solutions for small viscosity coefficient and high rotating speed. Moreover, we investigate the asymptotic behavior of solutions in the limit of vanishing viscosity and fast rotation, and show that the velocity and magnetic field converge to the zero vector and the solution to the linear heat equation, respectively. We also derive the rates of these convergences in some space-time norm.

79 Masakazu Yamamoto (Gunma Univ.) Logarithmic time evolution of incompressible Navier–Stokes flow and symmetric structure of its drift term ····· 10

Summary: This presentation will treat the time evolution of the Navier–Stokes flow. In particular, a logarithmically time-evolving component is extracted. This logarithmic components reflect the symmetric structure of the equation, which varies depending on whether the spatial dimension is even or odd.

80 Yuta Koizumi (Waseda Univ.) On analyticity in time of Koch–Tataru solutions to the Navier–Stokes equations ····· 10

Summary: We establish the regularizing decay rate estimates of the mild solutions of the Navier–Stokes equations constructed by Koch and Tataru (2001). The estimates yield the solution is analytic in time variables. We also clarify that the solution in the Serrin's class is analytic in time variables.

81 Kenta Oishi (Nat. Inst. of Tech., Kagawa Coll.) Time-periodic solutions for the Lagrangian formulation of the one-phase problem for the incompressible Navier–Stokes equations ····· 10

Summary: We establish the unique existence of a time periodic solution of a problem which is obtained via the Lagrangian transformation from the one-phase free boundary problem for incompressible Navier–Stokes equations. Since the problem is quasilinear, we prove the maximal regularity for the associated linearized problem. To do this, we decompose the solution into its stationary and purely oscillatory part by the Fourier transform on the torus and, then, we estimate the purely oscillatory part based on the transference principle due to de Leeuw (1965). Moreover, to estimate the second derivative of the stationary part, we use a weighted L_q space in the underlying space while some of known results (e.g., Eiter–Kyed–Shibata (2023)) use weighted L_∞ spaces.

Summary: The incompressible Navier–Stokes system on the whole space is considered. We show the unique existence of strong solutions to the system with singular external forces. Although a similar result was obtained by Kozono and Shimizu (2018, 2019), we extend the lower bound of a regularity index appearing in the class for external forces. The proof relies on a combination of the maximal regularity theorem with a bilinear estimate of the convection term in a certain Sobolev space. In particular, such a bilinear estimate gives an evidence of the sharpness of our result in the sense of the regularity index.

Summary: In this talk, we consider the non-uniqueness of mild solutions to the two-dimensional forced Navier–Stokes equations in the half-space under the no-slip boundary condition. Albritton–Brué–Colombo (2022) established non-uniqueness for the three-dimensional forced Navier–Stokes equations by using the instability of a self-similar vorticity profile. Moreover, Albritton–Brué–Colombo (2023) extended their result to a smooth bounded domain under the no-slip boundary condition. In this study, we construct non-unique solutions based on the instability of self-similar vorticity that concentrates near the boundary at the initial time. In particular, we take into account the boundary layer when constructing non-unique solutions, in contrast to the previous study by Albritton–Brué–Colombo (2023).

Summary: Consider a generalized Oseen evolution operator in 3D exterior domains, that is generated by a non-autonomous linearized system arising from time-dependent rigid motions. This was found by Hansel and Rhandi, and then the theory was developed by Hishida, however, desired regularity properties such as estimate of the temporal derivative as well as the Hölder estimate have remained open. In this talk, we show those properties together with weighted estimates of the evolution operator. The results are then applied to the Navier–Stokes initial value problem, so that a new theorem on existence of a unique strong L^q-solution locally in time is proved.

Summary: Consider the stationary Navier–Stokes equations on the whole plane $\mathbb{R}^2$. For a given small (but not necessarily smooth) external force, there exists a unique strong solution that decays to a prescribed nonzero constant flow as $|x| \to \infty$, where the solution is bounded and uniformly continuous on $\mathbb{R}^2$. A central tool in our analysis is the product law in anisotropic Besov spaces.

Summary: Stability of stationary solutions to the Navier–Stokes equations in an exterior domain for any dimension $n \geq 3$ is considered. More precisely, the decay rate of solutions to Navier–Stokes equations perturbed by a stationary solution obtained by Borchers and Miyakawa (1995, Acta. Math) is studied. It is known that L^∞ decay rates of solutions and L^n decay rates of its derivative for initial data in L^n are more delicate to obtain in the exterior domain case than in the whole space or half space case. In this talk, the critical decay order $-1/2$ is attained for initial data in a weighted L^n space with either weighted L^q integrability, $q > n$, or additional low regularity.The perturbed system also includes an external force term in weighted spaces. In addition, continuity-in-time of the solution and its gradient are obtained.

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

Mitsuo Higaki (Kobe Univ.) A Runge-type approximation theorem for the unsteady Stokes equations

Summary: We investigate Runge-type approximation theorems for solutions to the 3D unsteady Stokes equations. More precisely, we establish that on any compact set with connected complement, local smooth solutions to the 3D unsteady Stokes equations can be approximated with an arbitrarily small positive error in L^∞ norm by a global solution of the 3D unsteady Stokes equations, where the velocity grows at most exponentially at spatial infinity and the pressure grows polynomially. Additionally, by considering a parasitic solution to the Stokes equations, we establish that some growths at infinity are indeed necessary. These results markedly differ from the Runge-type theorem for the heat equation in [Enciso–García-Ferrero–Peralta-Salas, 2019], where the approximations with decay at infinity can be achieved.

Real Analysis

September 18th (Thu) Conference Room III

10:00–11:30

Summary: Let p satisfy that $\frac{2}{p}$ is a natural number. From a certain representation of the Fourier transform of a function which is p-radial (a generalization of spherical symmetry in functions) and integrable on $\mathbb{R}^2$, we find a generalized Bessel function of order zero and define $J_\omega^{[p]}$ by adding order $\omega \geq 0$. Then, we consider $\mathcal{J}_{\omega,\varphi}^{[p]}$, which is made into a one-variable function by fixing a distorted angle φ of a distorted polar coordinate transformation. By the Erdélyi–Kober operator, we derive the differential formulas for $\mathcal{J}_{\omega,\varphi}^{[p]}$. In this talk, I will show that this formula can be applied to the lattice point problem of astroid-type p-circle, which is a closed curve generalizing a circle, and that the formula gives a generalized formula for the Hardy's identity, which plays a very important role in a circle's problem.

Summary: Concerning the boundedness of some sublinear operators on Herz spaces, in 1996, Li and Yang found the best possible range of index, and also in 1994 and 1995, Lu and Soria proved the boundedness on the power-weighted Herz spaces with critical index. In this talk, we will extend the above result to a sublinear operator satisfying another condition and a pair of two-power-weighted Herz spaces with indices beyond critical index, and further show the weak version of this result.

Summary: We characterize the Borel measures μ that satisfy the trace inequality for the Riesz potential, where the underlying integration is with respect to the Hausdorff capacity. We also establish a sufficient condition under which the two-weight inequality for the Riesz potential with respect to the Hausdorff capacity holds.

Summary: It is well known that minimizers of the Allen–Cahn-type functional $J_\epsilon(u) := \int_\Omega \frac{\epsilon|\nabla u|^2}{2} + \frac{W(u)}{\epsilon}$, where W is a double-well potential, resemble minimal surfaces in the sense that their level sets converge to a minimal surface as $\epsilon \to 0$. In this work, we consider the indicator potential $W(t) = \chi_{(-1,1)}(t)$, which leads to the Bernoulli-type free-boundary problem $\begin{cases} \Delta u = 0 & \text{in } \{|u| < 1\} \\ |\nabla u| = \epsilon^{-1} & \text{on } \partial\{|u| < 1\}. \end{cases}$ We prove that the transition layers are uniformly $C^{2,\alpha}$ regular, up to the free boundary. We interpret the family of level surfaces as a geometric flow, where time coincides with the level. This results in a closed system of equations from which uniform estimates readily follow.

Summary: In this talk, we present a regularity result for the stationary Fokker–Planck equation with general coefficients. Assuming the solution is given as a measure with an L^2-density, we show that this density exhibits both $W^{1,2}$-regularity and Hölder continuity. Our approach uses a reference measure associated with a sectorial Dirichlet form and applies elliptic regularity results for both divergence and non-divergence form equations. We further show that the solution density can be approximated by $W^{1,2}$-functions via the resolvent operator. Our results highlight the central role of Dirichlet form theory in establishing regularity results for invariant measures.

14:15–15:30

6 Yoshifumi Ito (Tokushima Univ.*) Reality of showing signs of physical phenomena ····· 15

Summary: In this lecture, we show that all physical phenomena arise by virtue the motions of material particles.
Thereby, we give the complete understanding of the phenomena of mechanics, electro-magnetism and natural statistical physics by using my new concepts of space and time.

7 Yoshifumi Ito (Tokushima Univ.*) Phenomena of spectra of the hydrogen atoms ····· 15

Summary: In this lecture, we give the new and complete solutions of the phenomena of spectra of hydrogen atoms by using the natural statistical physics.

8 Kenichi Mitani (Okayama Pref. Univ.) Skewness and modulus of smoothness in Banach space ····· 15

Summary: The concepts of skewness in Banach spaces, initially introduced by Fitzpatrick and Reznick, have been further explored in recent research. This presentation will delve into the latest findings regarding the relationship between skewness and the modulus of smoothness in general Banach spaces.

9 Shin-ya Matsushita (Akita Pref. Univ.) Inertial projection algorithm for fixed point problem ····· 15

Summary: In this talk, an iterative algorithm using metric projection to approximate the fixed points of a nonexpansive mapping in a Hilbert space is investigated. In particular, the properties of the algorithm when inertia terms are added to the algorithm will be discussed.

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

Toru Nogayama (Tokyo Univ. of Sci.) A study of function spaces with mixed norm

Summary: The purpose of this talk is to investigate function spaces with mixed norm. Mixed norm is defined by combining some norms. It is an important topic in harmonic analysis and there are many applications to partial differential equations. In the first half of this talk, we will review the fundamental facts on mixed norm and the typical function spaces with mixed norm, mixed Lebesgue spaces, which have different integrability for each variable. In the latter half, some recent works about several function spaces related to mixed norms will be discussed.

September 19th (Fri) Conference Room Ⅲ

10:00–12:00

10 Shohei Kohatsu (Tokyo Univ. of Sci.) Global existence and boundedness of weak solutions to a Keller–Segel system with flux dependent sensitivity and superlinear production ··· 15

Summary: We consider global existence and boundedness of weak solutions to a Keller–Segel system with flux dependent sensitivity and superlinear production. The main mathematical difficulty is the lack of uniform L^1 bounds for the superlinear term in the beginning, which implies that we also cannot rely on any estimates for the second component. To overcome this difficulty, we derive new differential inequalities to establish some bounds for the first component based on energy methods.

11 Naotaka Ukai (Chiba Univ.)
Daiki Mizuno (Chiba Univ.)
Ken Shirakawa (Chiba Univ.)
Harbir Antil (George Mason Univ.)
Solvability of a pseudo-parabolic system based on a gradient flow with unknown-dependent energy ····· 15

Summary: In this talk, we consider a generalized version of a pseudo-parabolic gradient system, which is based on the free energy for anisotropic image processing with orientation adaptation, developed by Berkels et al. [SFB 611, 2006]. A key feature of our system is the involvement of the subdifferential of an anisotropic metric γ, along with two matrix-valued operators A and B. In the context of image processing, B acts as a rotation matrix enabling orientation adaptation. In this study, we further incorporate a more general operator A, aiming to extend the applicability of the theory beyond image processing. Under suitable assumptions, we construct an energy-dissipative time-discrete scheme and provide mathematical results concerning the existence, uniqueness, and stability of solutions.

12 Hana Kakiuchi (Japan Women's Univ.)
Toyohiko Aiki (Japan Women's Univ.)
On behavior of free boundaries to two-phase Stefan problems for parabolic partial differential equation systems ····· 15

Summary: In this talk we extend solutions of the one-dimensional free boundary problem describing a baking process of bread. For the problem we assume that a region occupied by the breads 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. Since the boundary condition for the mass distribution contains the temperature field, we do not expect existence of strong solutions for the distribution in case the usual assumptions. Hence, we define a solution under the high regularity condition for initial data. Now, we aim to show behavior of the free boundary by the estimate of its derivative.

13 Daiki Mizuno (Chiba Univ.)
Ken Shirakawa (Chiba Univ.)
Optimal control problem for grain boundary motion with heat exchange and variable-dependent mobility ····· 15

Summary: In this talk, we consider an optimal control problem governed by a state system of parabolic PDEs. The state system is based on a mathematical model of grain boundary motion with heat exchange, proposed by Warren et al. (Acta Materialia, 51(20), 6035–6058, 2003). A key feature of the state system is the mobility that depends on unknown variables, and it has long been an obstacle for establishing uniqueness of solutions. While most previous studies assumed constant mobility to ensure uniqueness, recent results under suitable regularity assumptions have enabled analysis even with variable-dependent mobility. Based on this, we discuss the existence and necessary conditions for optimal control in a realistic setting, where temperature is indirectly controlled via heat sources.

14 Akiko Morimura (Japan Women's Univ.)
Toyohiko Aiki (Japan Women's Univ.)
Existence of weak solutions to a system describing moisture transport in porous media with an elliptic-parabolic equation ····· 15

Summary: We consider a two-phase flow model describing moisture transport in porous media. The model consists of a system of two nonlinear diffusion equations derived from mass conservation laws for water and air, where the diffusion coefficients depend on the unknown functions. Assuming that the air density is spatially uniform, we derive an initial-boundary value problem with Robin type boundary conditions. In this talk, we discuss the existence of weak solutions to this problem, including an elliptic-parabolic equation, based on approximate solutions constructed by the finite volume method.

15 Yuya Tanaka (Kwansei Gakuin Univ.)
Masaaki Mizukami (Kyoto Univ. of Edu.)
Boundedness and asymptotic behavior of classical solutions to a model for tuberculosis granuloma formation 15

Summary: This talk deals with a model for tuberculosis granuloma formation, which was proposed by Feng in 2024. For this model global existence of classical/weak solutions were established in 2-/3-dimensional settings by Fuest–Lankeit–Mizukami (2025). However, at least two problems are left: Boundedness of the solutions; global existence of classical solutions in three- and higher-dimensional settings. The purpose of this talk is to give some answer to these problems.

16 Yutaro Chiyo (Tokyo Univ. of Sci.)
Kazuki Hasegawa (Tokyo Univ. of Sci.)
Shohei Kohatsu (Tokyo Univ. of Sci.)
Tomomi Yokota (Tokyo Univ. of Sci.)
Global existence and boundedness in a one-dimensional quasilinear parabolic–elliptic–elliptic chemotaxis system with flux limitation 15

Summary: This talk deals with a quasilinear attraction-repulsion chemotaxis system with flux limitation in the one-dimensional setting. The main result asserts global existence and boundedness of classical solutions to the system under some conditions on initial data and parameters.

14:15–15:45

17 Chiharu Kosugi (Yamaguchi Univ.)
A class of energy conservation systems representing stretching and shrinking motions of the elastic 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 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 Yusuke Murase (Meijo Univ.)
Numerical analysis of mathematical modeling for moisture transport with upwind difference scheme 15

Summary: In this talk, we discuss numerical analysis of mathematical modeling for moisture transport with upwind difference scheme. Our moisture transport model in porous media is a multi-scale model configured by second order differential equations and a free boundary equation. I'll report about some results of numerical simulations and numerical stability of our scheme.

19 Risei Kano (Kochi Univ.)
Takahiro Yamanaka (Kochi Prefectural Sukumo High School)
On the boundary conditions of the Bernoulli–Euler beam model with piezoelectric effects 15

Summary: The piezoelectric effect is the property of an object to generate a voltage when a force is applied to it or, conversely, to deform when a voltage is applied to it. The solvability of the beam model with the piezoelectric effect is discussed. In this talk, the problem is discussed by extending the conditions to encompass the boundary conditions in the previous problems.

20 Hiroshi Watanabe (Oita Univ.)
Ken Shirakawa (Chiba Univ.)
Jose Salvador Moll (Univ. Valencia)
Existence of solutions to a 3D-model associated with grain boundary motion with anisotropy 15

Summary: We consider a 3D-model associated with grain boundary motion with anisotropy. The model is based on the three dimensional Kobayashi–Warren model for the dynamics of polycrystals. To formulate our 3D-model, we use a quaternion formulation for the orientation variable. In this talk, we obtain existence of solutions to the constrained L^2-gradient descent flow of the energy functional via several approximating problems.

Summary: In this talk, we discuss the zero-thickness limit of the auxiliary domain arising from a transmission problem for parabolic partial differential equations. It is known that the dynamic boundary condition, which includes the time derivative in the boundary condition, naturally emerges in this limit. Based on this characterization, we particularly address the recovery of regularity, referring to the result by Colli and Rodrigues (1990).

16:00–17:00 Talk Invited by Real Analysis Section

Yoshiho Akagawa (Kyoto Univ. of Edu.) Variational inequality with time-nonlocal unknown dependence for kinematic hardening

Summary: The perfect plasticity model proposed by Duvaut–Lions consists of a variational inequality describing the time evolution of plastic strain and an equation of motion for displacement. The strain-hardening model considered in this talk has a quasi-variational structure where the constraint set of the variational inequality depends time-nonlocally on the strain, which is an unknown function. This dependence is characterized by the parallel translation of the constraint set according to the strain history, and it is noteworthy that the time-nonlocality arises naturally from physical considerations. This model is also classified as a type of the Moreau sweeping process. In this talk, we present results on the existence, uniqueness, and continuous dependence on given data for the model with linear parallel translation. The proof strategy is to apply the Kenmochi–Yamada condition to the variational inequality and construct solutions to the system using the Banach fixed point theorem. Future challenges include the case of nonlinear parallel translation and applications to the isotropic hardening rule where the threshold function of the yield condition depends on unknown functions.

Functional Analysis

September 16th (Tue) Conference Room II

9:30–10:30

1 Shuji Watanabe (Sanjo City Univ.) The Bogoliubov transformation and the gap equation in the BCS model of superconductivity with external magnetic field II ····· 15

Summary: We deal with a type I superconductor in a uniform external magnetic field. We obtain the BCS-Bogoliubov gap equation with external magnetic field and apply 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) given by a smooth function of both the temperature and the external magnetic field. Using the grand potential, we show that the transition from the normal state to the superconducting state in a type I superconductor is of the first order. Moreover we obtain the explicit expression for the entropy gap.

2 Hiroki Sako (Niigata Univ.) On intertwining operators between quantum walks ····· 15

Summary: Quantum walks are mathematical objects acting on Hilbert spaces. They describe dynamical systems which appear in quantum physics. When we try to classify quantum walks, it is necessary to clarify which pair of two quantum walks are identified. I would like to say that two quantum walks are identified, if there exists a unitary intertwining operator between them, and if the operator satisfies some condition. In my talk, I propose how to formulate the condition for the intertwining operator. Under this formulation, I will show some classification result on analytic quantum walks. I will also demonstrate some 4-state quantum walk which contains a 2-state walk. The key point is that there exists an intertwining isometric operator from the latter walk to the former.

3 Fumio Hiroshima (Kyushu Univ.) Fiber decomposition of NcHO by 2pQRM ····· 15

Summary: In this talk we discuss (I) relationships between NcHO and 2pQRM, and (II) the asymptotic behaviors of the spectral zeta functions of 2pQRM.

4 Yoritaka Iwata (Osaka Univ. of Economics Law)
Takahiro Noi (Otemon Gakuin Univ.) Cauchy problem of any order hyperbolic evolution equations in Besov spaces ····· 15

Summary: The existence of solutions to evolution equations in Besov spaces has been mainly developed in 1st-order parabolic evolution equations. That is, there is not any remarkable abstract results in the other situations. In this paper, a procedure of proving the existence of solutions to general nth-order hyperbolic abstract evolution equations is presented.

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

Takeshi Wada (Shimane Univ.) On initial boundary value problems for Maxwell–Schrödinger equations

Summary: We consider the Maxwell–Schrödinger equations (MS) in the Lorenz gauge, in a bounded or exterior domain $\Omega \subset \mathbb{R}^d$, $d = 2, 3$. On $\partial\Omega$, we impose the Dirichlet condition on the Schrödinger function, and the conditions associated with the perfect electric conductor boundary conditions on the electro-magnetic potentials. We prove that the system (MS) has a unique time-local solution in the class $H^2(\Omega)$, and that the solution exists time globally if $d = 2$.

September 17th (Wed) Conference Room II

10:00–10:45

5 Akihito Hora (Hokkaido Univ.) Jucys–Murphy elements for wreath products and dynamical random multi Young diagrams 15

Summary: The branching rule for the wreath products of a finite group by the symmetric groups induces a stochastic process on the set of multi Young diagrams through random transitions of boxes between the diagrams. We observe time evolution of multi-interfaces obtained by taking appropriate scaling limits. We discuss dynamical limit shapes both in averaged and concentrated senses. The Jucys–Murphy elements for wreath products play an important role in our analysis.

6 Toshihisa Kubo (Ryukoku Univ.) The branching law of a scalar generalized Verma module for $(\mathfrak{sl}(n+1,\mathbb{C}),\mathfrak{p}_{1,n})$ to $\mathfrak{sl}(n,\mathbb{C})$ 15

Summary: Let $\mathfrak{g}=\mathfrak{sl}(n+1,\mathbb{C})$ for $n\geq 2$. We write $\mathfrak{p}:=\mathfrak{p}_{1,n}$ for the maximal parabolic subalgebra of $\mathfrak{g}$ corresponding to the partition $(1,n)$ of $n+1$. We write $M_{\mathfrak{p}}^{\mathfrak{g}}(\xi,s)$ for the generalized Verma module for $(\mathfrak{g},\mathfrak{p})$ induced from the simple $\mathfrak{p}$-module $(\xi,s)\in \mathrm{Irr}(\mathfrak{p})_{\mathrm{fin}}\simeq \mathrm{Irr}(\mathfrak{sl}(n,\mathbb{C}))_{\mathrm{fin}}\times\mathbb{C}$. Let $\mathfrak{g}'$ be a subalgebra of $\mathfrak{g}$ such that $\mathfrak{g}'=\{\mathrm{diag}(X',0):X'\in\mathfrak{sl}(n,\mathbb{C})\}\simeq\mathfrak{sl}(n,\mathbb{C})$ and put $\mathfrak{p}':=\mathfrak{p}\cap\mathfrak{g}'$. We define a generalized Verma module $M_{\mathfrak{p}'}^{\mathfrak{g}'}(\sigma,r)$ for $(\mathfrak{g}',\mathfrak{p}')$ similarly.
In this talk we shall determine the branching laws of $M_{\mathfrak{p}}^{\mathfrak{g}}(\mathrm{triv},s)|_{\mathfrak{g}'}$ and $\mathrm{Im}(\varphi)|_{\mathfrak{g}'}$ for a $\mathfrak{g}$-homomorphism $\varphi\in\mathrm{Hom}_{\mathfrak{g}}(M_{\mathfrak{p}}^{\mathfrak{g}}(\tau,u),M_{\mathfrak{p}}^{\mathfrak{g}}(\mathrm{triv},s))$. In relation to these branching laws, the factorization identities of a $\mathfrak{g}'$-homomorphism $\Phi\in\mathrm{Hom}_{\mathfrak{g}'}(M_{\mathfrak{p}'}^{\mathfrak{g}'}(\sigma,r),M_{\mathfrak{p}}^{\mathfrak{g}}(\mathrm{triv},s))$ will be also discussed.

7 Atsumu Sasaki (Tokai Univ.) Weyl group of reductive real spherical homogeneous space of real line bundle type 15

Summary: This talk will deal with a certain class in reductive real spherical homogeneous spaces, namely, of real line bundle type. We will focus on an explicit description of a Cartan decomposition and the study of the Weyl group for this class.

11:00–12:00 Talk Invited by Functional Analysis Section

Shuji Horinaga (NTT-IFM)♭ On local A-parameters containing unitary lowest weight representations of unitary groups and applications

Summary: Arthur's multiplicity formula leads to a systematic study of automorphic representations, and in particular, of the holomorphic modular forms, but it remains to verify all local A-parameters that contain a given unitary lowest weight representation of unitary groups. In the symplectic case, Moeglin and Renard describe all local A-parameters that contain scalar-type lowest weight representations. In this talk, we discuss the difference between the symplectic case and the unitary case. As an application of this study, we show that all the Shimura varieties for $\mathrm{U}(1,n)$ attached to imaginary quadratic fields with prime discriminant are of general type when $n>212$.

September 18th (Thu) Conference Room II

10:00–11:10

8 Takeaki Yamazaki (Toyo Univ.) On numerical range of generalized Aluthge trnasforms 10
Chafiq Benhida (Univ. de Lille)

Summary: We introduce an inclusion relation of the numerical range of generalized Aluthge transforms which extends Rose-Spitkovsky result.

9 Yuki Seo (Osaka Kyoiku Univ.) Matrix trace inequalities related to matrix geometric means ····· 15

Summary: In quantum information theory, Umegaki relative entropy $S_U(A|B)$, which is the quantum version of Kullback–Leibler divergence, is a fundamental quantity, where A and B are positive definite matrices. Umegaki relative entropy has been extended to one variable $D_\alpha(A|B)$ using Tsallis-type relative entropy, that is, $D_\alpha(A|B) \le S_U(A|B) \le D_{-\alpha}(A|B)$. In this talk, we show the lower bound of $D_\alpha(A|B)$.

10 Shigeru Furuichi (Nihon Univ.) Matrix inequalities via block matrices ····· 15

Summary: The positivity of block matrices has played a vital role in establishing logical relationships among their block entries. Building on this foundation, we delve deeper into this topic by proving several new relations involving these blocks' images under increasing and concave functions.

11 Junichi Fujii (Osaka Kyoiku Univ.*) A criterion of operator divergence ····· 15

Summary: Based on criterion for quantum divergences due to Bhatia et al., we propose those of operator divergence and give typical examples. Though the trace of an operator divergence is a quantum divergence usually, we observe that the converse is not true.

12 Dante Hoshina (Nat. Inst. of Tech., Kisarazu Coll.)
Shuhei Wada (Nat. Inst. of Tech., Kisarazu Coll.) ALM-framework in the theory of multivariate operator means ····· 15

Summary: This talk presents a generalization of the ALM-procedure introduced by Ando, Li, and Mathias, designed to extend the matrix geometric mean to more than two variables. While previous work, such as that of Uchiyama, has mainly focused on symmetric operator means, the goal here is to explore the method beyond that setting. Numerical results for three-variable operator means, obtained through this approach, are also provided using concrete matrix examples.

14:15–14:55

13 Katsuhisa Koshino (Kanagawa Univ.) Isometries between spaces of metrics ····· 15

Summary: In this talk, we shall establish the Banach–Stone type theorem on function spaces with the sup-norm consisting of continuous bounded pseudometrics and admissible metrics on metrizable spaces.

14 Hajime Moriya (Kanazawa Univ.)♭ Graded tensor-product extension of KMS states ····· 10

Summary: The tensor-product extension of KMS states (modular states) is not only well known but also provides several useful structural consequences in Tomita–Takesaki theory. In this talk, we consider an analogous problem for CAR systems, clarifying how the grading structure affects the proof and the assumptions.

15 Taro Sogabe (Kyoto Univ.)♭
Kengo Matsumoto (Joetsu Univ. of Edu.) Ergodic automorphisms on unital Kirchberg algebras ····· 15

Summary: The Kirchberg algebra is an important class of C*-algebras for which one has a well established K-theoretic classification tools, the Kirchberg–Philips theorem and Gabe–Szabo's theorem. Motivated by our previous research on the realization of reciprocal Cuntz–Krieger algebras, we give a Pimsner construction of ergodic automorphisms of an arbitrary unital Kirchberg algebras. The core idea of the construction is the ergodicity of the quasi-free automorphism of the Cuntz algebra shifting its infinite generating isometries together with the exact triangle picture of the theory of extensions of C*-algebras due to R. Meyer and R. Nest. We would like to explain this idea.

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

Michiya Mori (Univ. of Tokyo) Various generalizations of Wigner's theorem

Summary: I will survey generalizations of Wigner's unitary-antiunitary theorem and Uhlhorn's theorem.

Statistics and Probability

September 16th (Tue) Conference Room IV

9:00–12:00

1 Hiromichi Ono (Kyoto Univ.) Hausdorff dimension of the limit sets of tree iterated function systems 15

Summary: Using Iterated Function Systems is one of the way to construct fractals. In this talk, I discuss a generalization of the Iterated Function Systems, named Tree Iterated Function Systems, which can construct more complicated fractals. I first give a definition of the Tree Iterated Functions Systems. And then, I show a theorem about Hausdorff dimension of the limit sets of the Tree Iterated Function Systems.

2 Katsunori Fujie (Kyoto Univ.) Perturbed Random Matrices and Free Probability of Type B′ 15
Takahiro Hasebe (Hokkaido Univ.)

Summary: Classical free probability is often insufficient for describing random matrices with finite-rank perturbations. To address this, we introduce a new framework, "free probability of type B′". This framework distinguishes the main part from the perturbation, naturally leading to the structure of infinitesimal free probability. Our theory provides a unified view of non-commutative independence: we show that B'-freeness is equivalent to infinitesimal freeness , and that weak B'-freeness combined with Boolean independence is equivalent to conditional freeness. As an application, we prove the asymptotic infinitesimal freeness of principal minors of random matrices , establishing a connection to a multivariate inverse Markov–Krein transform.

3 Kenshiro Tashiro (Okinawa Inst. of Sci. and Tech. Grad. Univ.) The Bakry–Émery gradient estimate and the Dyson Brownain motion 15
Kohei Suzuki (Durham Univ.)

Summary: The Bakry–Émery gradient estimate (BE) is a characterization of the "Ricci curvature lower bound" on a smooth space such as a weighted Riemannian manifold. In this talk, we discuss the validity of BE on a singular metric measure space $X = (\mathbb{R}^n, d_{Eu}, w_\beta)$, where the measure w_β is modelled on the Dyson Browninan motion with inverse temperature β. We proved that if the inverse temperature is less than 1, then X fails BE,while X satisfies the BE for not less than 1. We also compare with previous researches on the configuration space, on which the BE holds for any inverse temperature.

4 Ryo Inayoshi (Meijo Univ.) An operator information quantity of a semigroup and associated differential equations 15

Summary: In this talk, we present recent developments on the operator entropy. In particular, we introduce an operator information quantity of a semigroup by extending the operator entropy of a semigroup, and prove characterizations of the operator information quantity and entropy in terms of operator-valued differential equations. As an application, by further extending those to the white noise theory, we give a stochastic expression of the operator entropy.

5 Masaaki Fukasawa (Univ. of Osaka) Limit distribution of errors in discretization of stochastic Volterra equations with multidimensional kernel 15
Minato Hojo (Univ. of Osaka)

Summary: This paper investigates the limit distribution of discretization errors in stochastic Volterra equations (SVEs) with general multidimensional kernel structures. While prior studies, such as Fukasawa and Ugai (2023), were focused on one-dimensional fractional kernels, this research generalizes to broader classes, accommodating diagonal matrix kernels that include forms beyond fractional type. The main result demonstrates the stable convergence in law for the rescaled discretization error process, and the limit process is characterized under relaxed assumptions.

Summary: We present a mathematical formulation of liquidity provision in decentralized exchanges. We focus on constant function market makers of utility indifference type, which include constant product market makers with concentrated liquidity as a special case. First, we examine no-arbitrage conditions for a liquidity pool and compute an optimal arbitrage strategy when there is an external liquid market. Second, we show that liquidity provision suffers from impermanent loss unless a transaction fee is levied under the general framework with concentrated liquidity. Third, we establish the well-definedness of arbitrage-free reserve processes of a liquidity pool in continuous-time and show that there is no loss-versus-rebalancing under a nonzero fee if the external market price is continuous.

Summary: In this study, we characterize the scale functions for spectrally negative Lévy processes killed by additive functionals via Volterra integral equations. We show that the resulting scale functions provide expressions for the two-sided exit problem and the potential measures. The results obtained here constitute a generalization of those in Li–Palmowski (2018) and Li–Zhou (2019).

Summary: Positive continuous additive functionals (PCAFs) of Markov processes, such as occupation times and local times, play a fundamental role in the analysis of Markov processes. In this work, we establish a formula for moments of certain random variables involving PCAFs of symmetric Hunt processes whose Dirichlet forms are regular. This result extends classical Kac's moment formula for absolutely continuous PCAFs of Brownian motion to a much broader setting. The moment formula is expressed in terms of the heat kernel of the underlying process and the Revuz measure associated with the PCAF.

Summary: We show that the Revuz correspondence from the set of all smooth measures of finite energy integrals to the set of positive continuous additive functionals, is a homeomorphism under the topology induced by the Dirichlet form and $L^2(\mathbb{P}_{m+\kappa})$-norm with the local uniform topology, respectively, where m is the underlying measure and κ is the killing measure of a Dirichlet form.

Summary: We establish an upper bound of the bottom of the essential spectrum for the generator associated with a regular Dirichlet form in terms of the rates of the volume growth/decay and big jump. Using this bound, we discuss how the bottom of the essential spectrum is affected by the volume growth and coefficient growth.

Summary: For the white noise ξ on $\mathbb{R}^2$, an operator corresponding to a limit of $-\Delta + \xi_\varepsilon + c_\varepsilon$ as $\varepsilon \to 0$ is realized as a self-adjoint operator, where, for each $\varepsilon > 0$, c_ε is a constant, ξ_ε is a smooth approximation of ξ defined by $\exp(\varepsilon^2\Delta)\xi$, and Δ is the Laplacian. This result is a variant of results obtained by Allez and Chouk, Mouzard, and Ugurcan. The proof is based on the heat semigroup approach of the paracontrolled calculus, referring the proof by Mouzard. For the obtained operator, the spectral set is shown to be $\mathbb{R}$.

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

Toru Sera (Univ. of Osaka) Distributional limit theorems for intermittent dynamical systems and one-dimensional diffusion processes

Summary: Intermittent dynamical systems refer to discrete-time dynamical systems generated by non-uniformly expanding maps with indifferent fixed points. Such systems are well known in statistical physics as models of intermittent phenomena and have also attracted considerable mathematical interest, particularly as representative examples of ergodic transformations preserving infinite measures. On the other hand, diffusion processes constitute a central class of continuous-time stochastic processes used to model various diffusive phenomena. Mathematically, they are characterized by satisfying the strong Markov property and having continuous sample paths up to their lifetimes. In this talk, we focus on the similarities between these two seemingly distinct mathematical objects–intermittent dynamical systems and one-dimensional diffusion processes–and discuss distributional limit theorems that they have in common. These include, for example, arcsine laws for the last visit times and occupation times.

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

Ryosuke Shimizu (Kyoto Univ.) Singularity phenomena of Sobolev spaces and energy measures on fractals

Summary: For $p \in (1, \infty)$, a suitably nice p-energy form $(\mathcal{E}_p, \mathcal{F}_p)$, which is a natural L^p-analogue of the standard regular Dirichlet form for $p = 2$, was constructed on a large class of self-similar sets in many recent works. It was also revealed that the value called p-walk dimension is deeply connected to the $(1, p)$-Sobolev space $\mathcal{F}_p$. This value is strictly greater than p for many self-similar sets while it is equal to p in the classical setting. As in the case of $p = 2$, it is expected that singularity phenomena may occur due to such an anomalous behavior of the p-walk dimension. In this talk, I will review some recent progress on singularity phenomena, some of which are completely new kinds of singularity results. Specifically, I will present the following three types of singularity results: the singularity of p-energy measures with respect to the reference measure, the singularity of p-energy measures among distinct values of $p \in (1, \infty)$, and the singularity of $(1, p)$-Sobolev space $\mathcal{F}_p$ among distinct values of $p \in (1, \infty)$.

September 17th (Wed) Conference Room IV

9:20–11:20

Summary: We consider optimal stopping problems for discrete time multiparameter Markov processes, and introduce nonlinear semigroups associated with optimal stopping problems for discrete time multiparameter Markov processes.

Summary: We consider a max-add criterion in a stochastic decision process model with a diverging branch system, which is one of the nonserial branch systems. For this decision process model, we use dynamic programming to derive a recursive formula.

Summary: The ham-sandwich theorem is famous as an application of Borsuk's antipodal theorem. It states that given measurable sets A_1,..,A_n with positive Lebesgue measure in R^n, it is possible to divide each one of them in half by a hyperplane. This talk attempts to extend the ham-sandwich theorem to some ratio not in half.

Summary: While accelerated failure time models are a fundamental tool in survival analysis, their performance can deteriorate in the presence of outliers. We propose a robust Bayesian accelerated failure time modeling framework based on a novel family of lifetime distributions, constructed via a scale mixture of generalized gamma distributions. The key innovation lies in introducing a super heavy-tailed mixing distribution, which ensures strong robustness to outlying observations. We show that the proposed method achieves full posterior robustness, providing reliable point estimation and uncertainty quantification even in the presence of outliers.

Summary: Under the Stein phenomenon, the most well-known estimator that dominates the MLE is the James–Stein estimator. In addition to the James–Stein estimator, sufficient conditions for an estimator to dominate the MLE have been extensively studied. However, the James–Stein estimator itself is also inadmissible, and therefore sufficient conditions for an estimator to dominate it are of interest. Apart from the work of Kubokawa (1994, Annals of Statistics), this topic has not been thoroughly investigated. In this talk, we will present a new sufficient condition. We will also introduce several estimators that do not satisfy Kubokawa's condition but do satisfy ours.

Summary: In this talk, we will discuss kernel type quantile regression. Especially, we propose a representation of the estimator based on an integral of the estimator. The kernel type estimators are density and distribution functions.

Summary: The first author has recently developed asymmetric kernel method to solve the boundary bias problem of the standard kernel density estimation using the location-scale kernel $k((x-\cdot)/h)/h$, for the data supported on $[0,\infty)$ or $[0,1]$. In this talk, we consider the problem of estimating the regression function when the (scalar) covariate is nonnegative. Asymptotic (conditional) biases and variances of three regression estimators are presented, i.e., Nadaraya–Watson (NW, local constant), local linear (LL), and Priestly–Chao's type estimators using asymmetric kernels. The results of the asymmetric kernel based NW/LL regression estimators are parts of the second author's master thesis (research paper; March, 2025, Graduate School of Economics and Business, Hokkaido University).

Summary: In this presentation, we continue our previous discussion on the problem of estimating the first principal eigenvector in the allometric regression model. In particular, in response to a question raised during the previous presentation, we evaluate the proposed estimator in a finite sample setting where the error vector does not necessarily follow a normal distribution, but rather an elliptically symmetric distribution.

20 Yuki Hayashi (Nanzan Univ.) Adaptive estimation for the parameters of Jones–Pewsey distribution
Takayuki Shiohama (Nanzan Univ.) 10

Summary: Modeling circular distributions in a flexible and meaningful manner has been a motivating topic within circular statistics. The Jones and Pewsey distribution is known as one of the flexible symmetric distributions, as it contains von Mises, wrapped Cauchy, and cardioid distributions as special cases. In this study, we examine the asymptotic expression of the Jones–Pewsey distribution in relation to the von Mises distribution and present a one-step estimator that is asymptotically efficient for estimating the parameters of the Jones–Pewsey distribution, eliminating the need for numerical methods. The finite sample performances of the maximum likelihood estimators, together with the proposed one-step estimators, are investigated by numerical simulations.

11:30–12:00 Research Section Assembly

September 18th (Thu) Conference Room IV

9:30–11:45

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

Summary: We consider the sparse and low-rank estimation methods for intensity functions of multivariate Hawkes processes. Univariate Hawkes processes are known to be approximated by integer-valued autoregressive (INAR) models in the weak topology. We prove this fact under multivariate settings. Then, we apply the sparse and higher-order reduced rank estimation methods, which are established for the autoregressive models with i.i.d. Gaussian noises, to the multivariate integer-valued time series approximating Hawkes processes. We obtain the error bound of the estimator by verifying some moment conditions and mixing conditions of the multivariate INAR models which are sufficient conditions to apply the concentration inequality for the weakly dependent time series.

22 Yuta Koike (Univ. of Tokyo) Second-order accuracy of the double wild bootstrap in high-dimensions 15

Summary: Motivated by statistical applications to simultaneous inference for a high-dimensional parameter, we consider the problem of approximating the distribution of the maximum of the components of a sum of high-dimensional independent random vectors. We show that the double wild bootstrap method with third-moment match is second-order accurate in this problem even when the dimension is much larger than the sample size.

23 Shogo Nakakita (Univ. of Tokyo) Generalization error analysis of binary linear classification problems by Lipschitz concentration 15

Summary: We analyze uniform generalization errors in binary linear classification problems with Lipschitz loss functions. Using a novel argument based on functional inequalities and the associated carré du champ (square field) operators, we demonstrate that these errors exhibit sharp concentration around their expectation under mild conditions.

24 Shogo Nakakita (Univ. of Tokyo) Sparse estimation of high-dimensional Ornstein–Uhlenbeck processes with repeated observations 15

Summary: We consider sparsity-regularized maximum likelihood estimation of the drift coefficient of high-dimensional Ornstein–Uhlenbeck processes with repeated and independent path observations. In particular, we consider Lasso estimation and Slope estimation of the drift coefficient, which regularize maximum likelihood estimation with component-wise ℓ^1-penalty and a weighted version of it. We see that the derived rates of convergence match the minimax optimal rates.

Summary: We propose a new test for assessing the diagonality of a covariance matrix in high-dimensional data with non-monotone missing values. Under the assumption that the missingness pattern follows the Missing Completely At Random (MCAR) mechanism, we consider imputing the missing entries with zeros and construct a test statistic based on the resulting data. We derive the asymptotic distribution of the test statistic under a high-dimensional regime and demonstrate its applicability to inference with complex missing patterns.

Summary: In this talk, we consider the sparse estimation of the high-dimensional covariance matrix. First, we consider the sample covariance matrix and show that the estimator holds consistency properties only under severe conditions. This is primarily due to the large amount of noise contained in the non-diagonal elements. To overcome such difficulty, we propose a new thresholding estimator for the non-diagonal elements of the covariance matrix based on the automatic sparse estimation methodology and establish its consistency under mild conditions. Finally, we check the performance of the proposed estimator through numerical simulations and actual data analysis.

Summary: This talk addresses change-point detection in high-dimensional, low-sample-size settings under a strongly spiked eigenvalue (SSE) model. We consider a multivariate CUSUM-type statistic that compares averages before and after each candidate time point. The method does not rely on sparsity assumptions, which are common in existing approaches. We establish the asymptotic properties of the proposed statistic under the null hypothesis of no change and show consistency of the change-point estimator under mild conditions. Furthermore, we derive the null distribution of the test statistic under the SSE model. Numerical studies demonstrate the effectiveness of the proposed method.

Summary: This talk considers general divergences between a spectral density and a parametric spectral density, and investigates first- and second-order robustness through the influence functions. All divergences are proved to be first-order robust. Second-order robustness is investigated with reference to the Whittle, the log-squares, the α-power, the α-entropy and the Hellinger divergence. The talk shows that the α-power divergence and the α-entropy divergence with $\alpha = 1/3$ are the most second-order robust, and the α-power divergence with $\alpha = 1/3$ is also second-order efficient. At the end, numerical studies which support the theoretical results will be shown.

12:15–12:45 Presentation Ceremony for the 2025 MSJ Analysis Prize

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

Takeshi Emura (Hiroshima Univ.) ♭ Factorial survival analysis for treatment effects under dependent censoring and its asymptotic theory

Summary: For estimating treatment effects on survival, it is not suitable to apply the classical analysis of variance method under the normal distribution model. Nonparametric methods are desirable for defining and estimating treatment effects, which do not impose any parametric model. In this talk, I review a nonparametric method for factorial survival analysis under dependent censoring, which utilizes copula-graphic estimators. The asymptotic distribution of the proposed estimator is derived by the martingale approach and functional delta method. To implement the method, we introduce an R function, surv.factorial(.). To investigate the performance of the global and local tests for no treatment effects, we conduct simulation studies and report the results. We also analyze a dataset on colon cancer patients and discuss the consequences.

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

Tomoaki Imoto (Univ. of Shizuoka) The constructions of flexible circular, toroidal, and cylindrical distributions and their applications

Summary: Data related to direction appears in various situations such as wind direction, animal movement, ball passing in a sports game, and so on. Directional statistics is the statistics for analyzing such data. The main topic in this talk is the directional distributions, which play a central role in directional statistics. We especially focus on the circular distribution, the toroidal distribution, which is the joint distribution of two circular variables, and the cylindrical distribution, which is the joint distribution of linear and circular variables. Concerning these distributions, we introduce the methods for constructing flexible and tractable distributions and show the applications to real directional data.

September 19th (Fri) Conference Room IV

10:00–11:45

29 Hiroto Inoue (Nishinippon Inst. of Tech.) F-t joint distribution and its application for two-sample problem ····· 15

Summary: This talk introduces the F-t distribution on an affine group. It has the F-distribution and the t-distribution as its marginal ones. It arises from a random variable defined in a group theoretical way via the QR decomposition of the data matrix. Its density function is calculated using the Haar measure of the group, and generally based on analysis on the real Siegel domains. As an application, we present a numerical experiment for an invariant simultaneous test for two-sample problem.

30 Rintaro Ichiya (Waseda Univ.) Detection of chaotic behaviors in stochastic systems ····· 15
Rinka Sagawa (Waseda Univ.)
Yan Liu (Waseda Univ.)

Summary: We present statistical methods for quantifying chaotic behaviors in stochastic processes. We introduce the local block Lyapunov exponent and the diagonal Lyapunov dispersion ratio as fundamental statistical tools to distinguish chaotic behaviors in stochastic processes. We establish the asymptotic theories for these statistical tools under a general setting. As a macroscopic measure, we quantify the sensitive dependence induced by chaos in each block and investigate the distributional distortion in stochastic processes. Numerical simulations under different parameter settings illustrate the satisfactory performance of our statistical approach. Additionally, we apply this method to the financial market data, providing evidence for the possible chaotic behaviors in the data.

Summary: We develop a normalizing transformation for the Hill estimator that enhances its finite-sample convergence. This transformation, grounded in a higher-order asymptotic expansion, is explicitly provided. It improves the approximation to the standard normal distribution more effectively than variance stabilization or the Wilson & Hilferty approach. Our theoretical analysis is supported by numerical simulations that demonstrate its superior accuracy in practice.

Summary: Conjoint analysis has become a popular tool in marketing research and social research. Fitting simple conjoint model with Gumbel distribution to observed data is basic process of conjoint analysis. Some extensions of the model are proposed to expand its flexibility, however, extension makes the estimation procedure complicated. Models with Gaussian distribution have potential flexible modeling and may be applied widely, but fitting this modeling to observed data is considered to require Monte Carlo method. In this talk, an estimation procedure for Conjoint Analysis Model with Gaussian Distribution is considered, in which Monte Carlo method is not used. This procedure can evaluate derivatives of the likelihood by parameters as well as the value itself which enables numerical optimization procedure to fit maximum likelihood.

Summary: For T-way ($T \geq 2$) contingency tables with nominal categories, Bhapkar and Darroch (1990) introduced the hth-order marginal symmetry (MS_h^T) model. Tomizawa (1995) and Saigusa *et al.* (2016) proposed measures to represent the degree of departure from the MS_1^T and MS_2^T models, respectively. This presentation proposes a measure to represent the degree of departure from the MS_h^T model ($h = 1, \ldots, T-1$). The proposed measure is expressed as a weighted sum of the Kullback–Leibler divergence, and takes values in $[0, 1)$ when $h = 2, \ldots, T-1$, and in $[0, 1]$ when $h = 1$. The proposed measure is 0 if and only if the hth-order MS_h^T model holds.

Summary: In the previous talk, we proposed a new goodness-of-fit test, the OVL-q test ($q = 1, 2, \ldots$), which can be considered an extension of the Kolmogorov–Smirnov test and the Kuiper test (equivalent to OVL-1 and OVL-2, respectively). In this talk, we will introduce how to calculate the test statistic associated with OVL-q ($q \geq 3$). Furthermore, we will discuss the statistical power of OVL-q ($q \geq 3$).

Summary: Numerical and asymptotic partitioning of goodness-of-fit statistics have been considered for numerous models in contingency tables. In this talk, we focus on partitioning goodness-of-fit statistics for symmetry in contingency tables. The symmetry model is doubly flat, and can be represented as the intersection of an e-flat submodel and an m-flat submodel that is orthogonal to the former. As a result, the Wald test statistic for the symmetry model can be exactly partitioned into Wald test statistics corresponding to these submodels. This talk reports the connection between Information Geometry and the exact partitioning of the goodness-of-fit test statistic for symmetry in contingency tables.

Applied Mathematics

September 16th (Tue) Conference Room V

9:30–11:45

1 Kazunori Matsuda (Kitami Inst. of Tech.) — The minimum number of edges of connected graphs with ind-match$(G) = p$, min-match$(G) = q$ and match$(G) = r$ ····· 15

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

2 Shinya Fujita (Yokohama City Univ.) — High connectivity keeping paths in graphs ····· 10

Summary: In this talk, some recent results on the existence of high connectivity keeping paths in highly connected graphs will be reviewed.

3 Atsuhiro Nakamoto (Yokohama Nat. Univ.)
Naoki Matsumoto (Univ. of Ryukyus)
Kyosuke Wakayama (Yokohama Nat. Univ.)
Alkajim Ahadi Aradais (Mindanao State Univ.) — 4-Polychromatic 5-coloring of subcubic plane graphs ····· 15

Summary: In this talk, we define a new coloring of plane graphs, which is called an m-polychromatic k-coloring. Then we prove that every triangular-face-free subcubic plane graph has a 4-polychromatic 5-coloring. This result is related to the earlier research on polychromatic coloring of even-sided maps on surfaces. In order to prove the main result, we will use some results on coloring of 1-planar graphs and the generating theorem of 4-connected plane triangulations.

4 Shohei Satake (Kumamoto Univ.)
Yoshinori Yamasaki (Ehime Univ.) — On the embeddability of the Markoff mod p graph ····· 15

Summary: For prime numbers $p > 3$, the Markoff mod p graph is a finite 3-regular graph on the set of non-zero Markoff triples over the finite field $\mathbb{F}_p$. In this talk, we investigate the structure of the Markoff mod p graph by focusing on its embeddability. Precisely, we first prove that the Markoff mod p graph is not toroidal for all prime numbers $p > 3$ but $p = 7$. Moreover, by constructing disjoint minors of the complete bipartite graph $K_{3,3}$, we also show that for infinitely many primes p of positive density, the Markoff mod p graph has genus at least 3 and it is not apex.

5 Emerson Gaw Escolar (Kobe Univ.)
Woojin Kim (KAIST) — Barcoding invariants and their equivalent discriminating power ····· 15

Summary: The persistence barcode plays a central role in persistent homology. For multi-parameter persistent homology, which lacks a complete discrete invariant, many alternative invariants have been proposed. Many of these invariants are akin to persistence barcodes, in that they assign (signed) multisets of intervals. Furthermore, to any interval decomposable module, they assign the multiset of intervals that correspond to its summands. Naturally, identifying the relationships among invariants of this type, or ordering them by their discriminating power, is a fundamental question. To address this, we formalize the notion of barcoding invariants and compare their discriminating powers. One of our main results is that all barcoding invariants with the same basis possess equivalent discriminating power. This talk is based on arXiv:2412.04995.

Summary: The notion of ellipsoidal design was first introduced by Pandey (2022) as a full generalization of spherical designs on the unit circle S^1. In this talk, we elucidate the advantages of examining the connections between ellipsoidal design and the two-dimensional Prouhet–Tarry–Escott problem, originally introduced by Alpers and Tijdeman (2007) as a natural generalization of the classical one-dimensional PTE problem. As one of our main theorems, we prove that the Alpers–Tijdeman solution is equivalent to a certain two-dimensional extension of the Borwein's solution for the classical one-dimensional PTE problem. As a by-product of this theorem, we discover a family of ellipsoidal 5-designs among the Alpers–Tijdeman solution.

Summary: There have been many studies on the construction methods of spherical designs. For example, de la Harpe and Pache (2007) showed that each shell of the 16-dimensional Barnes–Wall lattice and the shorter Leech lattice forms a spherical 7-design. In this talk, we consider the subdesign problem of such "shell designs" to explore the characteristics of point configurations on shells. Based on Tanino et al. (2025), we show that a suitable B_n-orbit of a generalized corner vector can be embedded as a subset of certain shells in the two lattices mentioned above. Moreover, these shells can be decomposed into mutually disjoint 7-designs, offering a novel approach in the study of such structures.

Summary: In thik talk, we investigate the existence of m-stiff configurations in the unit sphere S^{d-1}, which are spherical $(2m-1)$-designs that lie on m parallel hyperplanes. We establish two non-existence results: (1) for each fixed integer $m > 5$, there exists no m-stiff configuration in S^{d-1} for sufficiently large d; (2) for each fixed integer $d > 10$, there exists no m-stiff configuration in S^{d-1} for sufficiently large m. Furthermore, we provide a complete classification of the dimensions where m-stiff configurations exist for $m = 2, 3, 4, 5$. We also determine the non-existence (and the existence) of m-stiff configurations in S^{d-1} for small d $(3 \leq d \leq 120)$ with arbitrary m, and also for small m $(6 \leq m \leq 10)$ with arbitrary d.

14:15–15:15 Talk Invited by Applied Mathematics Section

Masatake Hirao (Aichi Pref. Univ.) Spherical design theory and its applications

Summary: A spherical design is a finite set of points on the sphere that enables exact integration of all polynomials up to a certain degree by averaging their values over those points. Since the seminal work of Delsarte et al. in 1977, the concept has been systematically developed from a combinatorial perspective. In recent years, its applications have extended beyond combinatorics into a wide range of fields, including numerical analysis, statistics, and machine learning, showing its increasing importance. In this talk, we aim to provide an overview of several topics related to spherical designs and explore their potential for broader application. We begin with a brief survey of the theory, followed by discussion of applied topics closely connected to our recent work, such as statistical experimental design, directional statistics, and quasi-Monte Carlo methods on the sphere. By examining the relationships and shared structures among these areas, we seek to offer a unified perspective centered on spherical design theory.

15:30–16:35

9 Xiao-Nan Lu (Gifu Univ.) Completely uniform nested pairings in Boolean Steiner quadruple systems 15

Summary: A combinatorial 3-$(v, 4, 1)$ design is also called a Steiner quadruple system (SQS) of order v. Given an SQS, *nested pairings* arise by partitioning 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 of completely uniform nested pairings in Boolean SQSs of order 2^m for all odd $m \geq 3$, together with analogous existence results for even m. These results resolve two open problems posed by Chee *et al.* (2025) on the existence of such designs.

10 Munenori Inagaki (Kobe Univ.)
Yukihiro Uchida (Tokyo Metro. Univ.)
Masanori Sawa (Kobe Univ.)
Hideki Matsumura (Tokyo Metro. Univ.)
The multidimensional Prouhet–Tarry–Escott problem and combinatorial designs I 15

Summary: The multidimensional Prouhet–Tarry–Escott (PTE) problem, which finds applications in areas such as discrete tomography, was introduced by Alpers and Tijdeman (2007) as a natural generalization of the classical one-dimensional case. In this talk we create a noble connection between the multidimensional PTE problem and combinatorial design theory. Refining Alpers and Tijdeman's notion of triviality for multidimensional PTE solutions, we establish lower bounds on the size of non-trivial solutions, with particular attention to low-degree cases.

11 Nobuko Miyamoto (Tokyo Univ. of Sci.)
Shoko Chisaki (Osaka Inst. of Tech.)
Ryoh Fuji-Hara (Univ. of Tsukuba*)
Mutually orthogonal block sequences and spreads in a finite projective space 15

Summary: We propose a combinatorial structure called mutually orthogonal block sequences (MOBS), which increases the level of independence among sequences beyond what can be achieved through randomization. To construct such sequences, we present a method based on spreads in projective spaces.

12 Kazuki Matsubara (Saitama Univ.)
Shoko Chisaki (Osaka Inst. of Tech.)
Ryoh Fuji-Hara (Univ. of Tsukuba*)
Nobuko Miyamoto (Tokyo Univ. of Sci.)
A construction of regular rectangular designs 15

Summary: The rectangular design (RD) is defined as a class of partially balanced incomplete block designs with an association scheme. In this talk, we present a new construction method for regular RDs using the pairwise symmetric additive BIB designs introduced in Sawa et al. (2007).

16:50–17:50 Talk Invited by Applied Mathematics Section

Mariko Hagita (Ochanomizu Univ.) Discrete mathematical approaches to impression evaluation

Summary: This talk presents a series of studies applying discrete mathematical structures-especially graph theory and block designs-to impression evaluation and related data analysis problems. The research initially stemmed from the development of distributed coloring algorithms designed to reduce bias in simulations caused by correlations in pseudo-random number placement. In addition, we proposed a weight updating algorithm on graphs to correct distortions arising from unequal numbers of comparisons. These methods were later adapted to address vector selection and rank reconstruction in impression evaluation tasks, and further extended through collaboration with visualization researchers. We also investigate the problem of recovering global rankings or score ratios from partial pairwise comparison data. By incorporating block designs into the comparison process, we propose a method to estimate relative frequencies from a limited number of observations, and study the mathematical conditions under which such ratio recovery is accurate. Experimental results with small-scale datasets have shown promising accuracy, although difficulties arise when the underlying ratios are highly skewed or the number of comparisons is insufficient. This research lies at the intersection of algebra, graph theory, and combinatorics, demonstrating how insights from pure mathematics can be effectively applied to practical domains such as impression evaluation, data visualization, and market analysis. The talk will summarize past accomplishments, current investigations, and future directions, with an emphasis on developing tools that are accessible even to users without advanced mathematical training.

September 17th (Wed) Conference Room V

9:00–11:50

13 Taisuke Hosaka (Yokohama Nat. Univ.) Pulsation of quantum walk on graph with bridge ····· 15
Etsuo Segawa (Yokohama Nat. Univ.)

Summary: In this talk, we introduce and show phenomenon of the quantum walk called pulsation. For two simple connected graphs, we add a bridge between two graphs. We put the weight $\epsilon \geq 0$ for the bridge and 1 for other edges, respectively. The parameter ϵ can be regarded as the degree of the connection. In this setting, we construct the quantum walk model and get the pulsation occur for sufficiently small ϵ.

14 Tatsuya Tsurii (Tokyo Univ. of Information Sci.) A study on periodicity of Fourier walk using group structures obtained from its evolution matrix ····· 15
Naoharu Ito (Nara Univ. of Edu.)
Itsuki Kawabata (Takatsuki Yanagawa Junior High School)

Summary: In this talk, we consider the Fourier walk on complete graphs with n vertices and a self-loop at each vertex, and group structures obtained from its evolution matrix. Then, we show that the group structures play an important role to find a period of that walk when n is odd.

15 Hiroto Sekido (Yokohama Nat. Univ.) Periodicity of quantum graph walks defined by covering graphs ····· 15
Etsuo Segawa (Yokohama Nat. Univ.)

Summary: Quantum graph walks are defined by a graph and parameters determined by a Schrodinger equation and its boundary conditions. In this study, we investigate the existence of periodicity in quantum graph walks defined on certain covering graphs of strongly regular graphs with periodicity. Building on previous work, we compute the characteristic polynomial of the time evolution matrix for quantum graph walks on a covering graph using the Schur complement. The coefficients of the resulting monic polynomial are given by elementary symmetric functions of the eigenvalues. If the walk is periodic, these eigenvalues must be algebraic integers, and so are their symmetric functions. Applying known properties of algebraic integers to these coefficients allows us to narrow down the possible parameters.

16 Kei Saito (Nihon Univ.)
Yusuke Ide (Nihon Univ.)
Norio Konno (Nihon Univ.)
Kazuhiro Saito (KDDI Research, Inc.)
Satoshi Watanabe (KDDI Research, Inc.)
A spectral mapping theorem for the quantum searching algorithm via quantum walks 15

Summary: Quantum walks, regarded as quantum analogues of classical random walks, have attracted attention for their applications in quantum algorithms. Among them, Grover's quantum search algorithm is a prominent example that reflects graph structures. In such models, unitary evolution is governed by coin and shift operators, with the search vertex inducing a non-uniform modification. Analyzing these non-uniform systems is generally difficult. This talk presents a method to determine the eigenvalues of non-uniform quantum walks used in search algorithms by extending the spectral mapping theorem given by Segawa, Suzuki(2019). By analyzing the corresponding uniform system, we derive spectral information for the non-uniform case.

17 Tomohiro Washino (Nat. Inst. of Tech., Nara Coll.)
Tadashi Takahashi (Hagoromo Univ. of Int. Stud.)
Defining equations of the set of true parameters 15

Summary: We consider statistical model be a three-layer neural network with two hidden units. It is known by Watanabe that near the singular region where the number of hidden units changes from 2 to 1, the set of parameters that realize the true distribution can be expressed as a set of zeros of finite polynomials by series expansion of the activation function [1], [2]. In this presentation, we transform the coordinate system of the polynomial and obtain the defining equations of the set of parameters and the singularity set of the statistical model when the number of hidden units is 2 and the true distribution is realized with hidden units of 1.

18 Hirotake Yaguchi (Mie Univ.*)
Generation of nonrecursive n-bit pseudorandom numbers by two times (n-bit)×(n-bit) multiplication ($n = 64, 128, 192, ..., 16384$) 15

Summary: We show that we can generate nonrecursive n-bit pseudorandom numbers by two times (n-bit)×(n-bit) multiplication ($n = 64, 128, 192, ..., 16384$). The algorithm, which we call xMS, can be described using functions defined by $T_{2^k}(X, Y) = 2^k XY - \lfloor 2^k XY \rfloor + 1$, $X, Y \in [1, 2)$, and $T_{2^k}(X, X)$. We consider mathematically the condition that xMS generates random numbers. We also show the way of reducing the times of (n-bit)×(n-bit) multiplication from two times to one time.

19 Tetsuya Nagano (Univ. of Nagasaki*)
Note on unforgeability of a digital signature scheme based on Finsler encryption 15

Summary: Finsler encryption(FE) is a cryptographic scheme constructed on a Finsler space in which linear parallel displacement is asymmetric. Under the Linear Parallel Displacement(LPD) assumption, it has been proven to achieve IND-CPA security. The LPD assumption asserts that it is computationally infeasible to determine arbitrary instances of linear parallel displacement.In this study, assuming a known Finsler space with asymmetric linear parallel displacement, we present an overview of the Finsler encryption and a digital signature scheme derived from it. We then proceed to establish a proof of unforgeability of the proposed signature scheme. Throughout the discussion, we restrict our attention to two-dimensional Finsler spaces for simplicity.
This work is conducted in collaboration with Mr. Masayuki Fukumitsu of the University of Nagasaki.

20 Masaki Kashima (Keio Univ.) Degree sum condition for claw-free graphs to have a 2-factor with few components ····· 15

Summary: A Hamilton cycle of a graph is a cycle that passes through all the vertices of a graph, and a 2-factor of a graph is a 2-regular spanning subgraph. A graph is said to be claw-free if it does not contain a claw (a star with three edges) as an induced subgraph. Sufficient conditions for a claw-free graph to have a Hamilton cycle and related structures have been intensively studied for a long time. Following the stream, we investigate a minimum degree sum condition for a claw-free graph to have a 2-factor with a bounded number of components. This result partially solves a conjecture posed by Faudree et al. in 2012.

21 Jun Fujisawa (Keio Univ.) Matching extension in regular non-bipartite graphs ····· 15

Summary: In 2023, Aldred et al. proved that for $m \geq r \geq 3$, if G is an r-regular cyclically $(mr - r + 1)$-connected bipartite graph, then every matching M in G with $|M| = m$ such that each pair of edges in M is distance at least 3 apart is contained in a perfect matching of G. In this talk, we show that a result analogous to that of Aldred et al. holds when G is non-bipartite, provided that there exist many edge-disjoint paths of odd length with both ends in $V(M)$, and no small cyclic edge-cut separates an odd cycle from another cycle.

22 Kenta Noguchi (Tokyo Univ. of Sci.) 4-connected graphs with and without HISTs ····· 15

Summary: In this talk, we consider homeomorphically irreducible spanning trees in graphs. Motivated by a conjecture of Malkevitch, we present 4-connected graphs with and without HISTs, obtained via line graphs.

13:10–14:00

23 Iwao Sato (Oyama Nat. Coll. of Tech.)
Takashi Kmatsu (Univ. of Yamanashi)
Norio Konno
(Ritsumeikan Univ./Yokohama Nat. Univ.*)
A characteristic polynomial for the transition probability matrix of a correlated random walk on a graph ····· 15

Summary: We define a correlated random walk (CRW) induced from the time evolution matrix (the Grover matrix) of the Grover walk on a graph G, and present a formula for the characteristic polynomial of the transition probability matrix of this CRW. As applications, we give the spectrum of the transition probability matrices for the CRWs induced from the Grover matrices of regular graphs and semiregular bipartite graphs. Furthermore, we consider another type of the CRW on a graph.

24 Kosei Watanabe (Nagoya Univ.) A decomposition formula of a Bartholdi zeta function of some covering of a hypergraph ····· 15

Summary: Zeta functions such as the Ihara and Bartholdi zeta functions have been studied for graphs and extended to hypergraphs. A decomposition formula , which relates the zeta function of a covering hypergraph to that of its base, shows that the former is divisible by the latter. Sato and Saito showed decomposition formulae for group coverings of hypergraphs,and Li and Hou showed decomposition formulae for other types of hypergraph coverings. I have derived a decomposition formula for the Bartholdi zeta function of hypergraphs,which extends their results.

25 Takashi Komatsu (Univ. of Yamanashi)
Norio Konno
(Ritsumeikan Univ./Yokohama Nat. Univ.*)
Iwao Sato (Oyama Nat. Coll. of Tech.)
Hideo Mitsuhashi (Hosei Univ.)
Matrix zeta function on covering graphs ····· 15

Summary: The Grover matrix of a graph X is a typical time evolution matrix of a discrete-time quantum walk on X. We treat the Grover matrix of a finite covering of X, and present a decomposition formula for the determinant of it. Furthermore, we define an L-function of a graph with respect to the Grover matrix, and present its determinant expression. As a corollary, we express the determinant of the Grover matrix of a covering of X as a product of its L-functions.

September 18th (Thu) Conference Room V

10:00–12:00

26 Kota Ikeda (Meiji Univ.)
Tomoyuki Miyaji (Kyoto Univ.)
Characterization of a periodic solution in a differential-difference equation derived from the optimal velocity model ····· 15

Summary: Traffic congestion is often described by self-organized wave propagation. In this study, we analyze periodic solutions of a differential-difference equation derived from the optimal velocity (OV) model on a circuit. Numerical observations suggest the existence of periodic solutions with transition layers connecting nearly constant states. Assuming the OV function is approximated by a step function, we rigorously construct heteroclinic orbits that correspond to these constants. Furthermore, we establish the existence of periodic solutions exhibiting similar profiles. Our results provide a mathematical characterization of congested traffic states and clarify their relation to previously known solutions in the literature.

27 Yumihiko S. Ikura (Meiji Univ.)
Hirokazu Ninomiya (Meiji Univ.)
On periodic solutions generated by Greenberg–Hastings cellular automata ····· 15

Summary: We analyzed the periodic solutions of a three-state Greenberg–Hastings Cellular Automaton (GHCA) on a rectangular lattice, where interactions occur only between nearest neighbors and the system is free from external influences. Each lattice point can be in one of three states: rest (0), excited (1), or refractory (2). The periodic solutions consist of combinations of the transitions $1 \to 2 \to 0$ and $1 \to 2 \to 0 \to 0$ over time. Letting the number of each type of transition within one period be N and M respectively, the period becomes $3N + 4M$, with $N + M$ excitations occurring per cycle. This study investigates the existence of periodic solutions for all $(N, M) \in \mathbb{N}^2$, and also reveals that solutions with regions oscillating at different periods can exist.

28 Kazuo Takemura (Nihon Univ.)
Green's function for nonlocal multipoint boundary value problems of the linear differential operator $(-1)^M(d/dx)^{2M}$ ····· 15

Summary: This research derives Green's function for a nonlocal multipoint boundary value problem associated with the operator $(-1)^M(d/dx)^{2M}$ on the interval $(0, 1)$. The boundary conditions consist of weighted nonlocal constraints imposed at multiple points where periodic and antiperiodic conditions alternate. The constructed Green's function is based on Green's function for the clamped boundary value problem and inherits its fundamental properties. This work contributes to a deeper understanding of the structure of nonlocal boundary value problems and is expected to provide a foundation for future studies on positivity proofs and best constant evaluations in Sobolev-type inequalities.

29 Tetsuya Ishiwata (Shibaura Inst. of Tech.)
Yu Ichida (Kwansei Gakuin Univ.)
Yukihiko Nakata (Aoyama Gakuin Univ.)
On the effects of distributed delays on blow-up of solutions ····· 15

Summary: It is well known that time delays sometimes cause instability and oscillation in the solutions of differential equations. In this talk, we mainly focus on delay differential equations with distributed delay and discuss the effects of time delay for such instabilities from the viewpoint of a finite time blow-up of the solutions.

30 Koichi Anada (Waseda Univ. Senior High School)
Tetsuya Ishiwata (Shibaura Inst. of Tech.)
Takeo Ushijima (Tokyo Univ. of Sci.)
Remarks on behavior for Type II blow-up solutions of a quasilinear parabolic equation in the curve shortening problems ····· 15

Summary: We consider curve contractions by the power of their curvatures with a positive exponent α. It is well-known that the contractions can be described by a quasilinear parabolic equation, which has a type II blow-up solution if $0 < \alpha \leq 1$. In this talk, we investigate eventual monotonicity for solutions of the quasilinear parabolic equation and asymptotic behavior on the boundary of the blow-up set for type II blow-up solutions.

31 Hideki Murakawa (Ryukoku Univ.)
Yoshitaro Tanaka (Future Univ.-Hakodate)
A relationship between haptotaxis and chemotaxis in cell sorting phenomena ····· 15

Summary: Cells self-organize in two principal ways. Haptotactic sorting relies on direct contact through elongated protrusions and is described by nonlocal advection PDEs, whereas chemotactic sorting depends on chemical gradients and is typically modeled by the Keller–Segel system. Despite their different mechanisms, both cues often produce similar patterns. We compare a nonlocal aggregation model for haptotaxis with a Keller–Segel type chemotaxis system and show, using suitable kernel approximations, that their dynamics closely match.

32 Masumi Kondo (Okayama Univ. of Sci.)
Masakazu Onitsuka (Okayama Univ. of Sci.)
Conditional Ulam stability for the Gompertz model ····· 15

Summary: This study focuses on conditional Ulam stability of the Gompertz model, a well-known growth model that characterizes tumor growth. Ulam stability refers to the property that for any approximate solution, there exists a true solution, such that the difference between them remains bounded. In this presentation, we present our main theorem and illustrate its utility with an example using data representing breast cancer tumor growth.

14:15–16:00

33 Yu Ichida (Kwansei Gakuin Univ.)
Daisuke Yamane (Ritsumeikan Univ.)
Pull-in and touchdown phenomena in mathematical models of micro-machine behavior ····· 15

Summary: In this talk, we focus on parallel plate electrostatic actuators, which are a type of micro-electro-mechanical system (MEMS). In response to a question from the field of mechanical engineering, we study how the solution behavior of the MEMS model, which is represented by second-order ordinary differential equations, changes when spring characteristics are considered by using the Poincaré-type compactification and the blow-up technique.

34 Hideki Kawahara (Nagoya Univ.)
Numerical approximation of delay differential equations via operator splitting in fractional domains ····· 15

Summary: We develop a rigorous framework for the numerical approximation of both autonomous and non-autonomous delay differential equations (DDEs), with a focus on the implicit Euler method and sequential operator splitting.

To overcome the difficulty that the delay operator does not generate an analytic semigroup in the standard space $L^1[\tau, 0]$, we embed the problem into the interpolation space $\left(L^1[\tau, 0], W_0^{1,1}[\tau, 0]\right)_{\theta,1}$ for $0 < \theta < 1$, where the differential operator becomes sectorial. This allows the full operator $L = A + B$ to generate an analytic semigroup $T_L(t)$, enabling the use of semigroup theory to derive sharp error estimates.

We prove that the implicit Euler method achieves a global error of order $\mathcal{O}(h)$, while the Lie–Trotter splitting method yields an error of order $\mathcal{O}(h^{2\theta-1})$ in the interpolation norm.

35 Yoshitaka Watanabe (Kyushu Univ.), Shuting Cai (Fujian Jiangxia Univ.) — Numerical verification for Elkouh's problem representing fluid flow between parallel circular disks ····· 15

Summary: The present talk presents a computer-assisted proof of the existence of solutions for Elkouh's equation, which is representative of fluid flow between parallel circular disks.The proposed approach is based on an infinite-dimensional fixed-point theorem with interval arithmetic. Various existing proofs with mathematically rigorous error bounds show the validity of the presented numerical verification method.

36 Takuya Tsuchiya (Meiji Gakuin Univ.) — On structure-preserving numerical calculation of wave equation for a vector field ····· 15

Summary: We present numerical results of the wave equations with constraints for a vector fields. We use this equation as the Hamiltonian form. In the simulations, we use the structure-preserving numerical calculation to preserve the global constraint as the integration of the Hamiltonian density and the local constraint as the constraint equation.

37 Akitoshi Takayasu (Univ. of Tsukuba) — Computer-assisted proof of a saddle-to-saddle connection in the Swift–Hohenberg equation ····· 15

Summary: In this talk, we introduce a computer-assisted proof for the existence of a saddle-to-saddle connection between equilibria of the one-dimensional Swift–Hohenberg equation. Our approach consists of three key components. First, we compute a parameterization of the finite-dimensional unstable manifold of the source equilibrium using the parameterization method. Second, we obtain a rigorous enclosure of the infinite-dimensional stable manifold of the target equilibrium via a Lyapunov–Perron approach. Finally, by rigorously controlling the PDE flow, we solve a projected boundary value problem whose boundary conditions are defined by the unstable and stable manifolds.

38 Makoto Okumura (Konan Univ.) — A finite difference scheme for the Cahn–Hilliard equation with dynamic boundary conditions using a nonlinear difference ····· 15

Summary: Recently, Furihata has proposed various types of nonlinear difference operators, such as logarithmic difference, aiming to bring out other superior features instead of relaxing linearity. In this study, a certain summation formula is derived for the square root difference operator among the above nonlinear difference operators. Also, we construct a structure-preserving scheme for the Cahn–Hilliard equation with dynamic boundary conditions imposed by Liu and Wu using the square root difference operator. In this talk, we report the results.

16:15–17:15 Award Lecture for the 2024 Applied Mathematics Prize

Masato Kimura (Kanazawa Univ.) — Irreversible fracture phase field models: Energy dissipation structure and applications

Summary: In this lecture, we will explain the mathematical fundamentals of the Irreversible Fracture Phase Field Model (F-PFM), a variational fracture model for quasi-static crack propagation in brittle materials, including the derivation of the model and its energy dissipation structure. We will also introduce various extensions and applications of the model.

September 19th (Fri) Conference Room V

10:00–12:00

39 Shunji Horiguchi — Extended Schröder's method ····· 10

Summary: We define an extended Schröder's method. We give two formulas for the quadratic convergence of the extended Schröder's method. We then give the relation between these two formulas.

Summary: We argue that Newton's method, the extended Newton's method and the Schröder's method becomes the interior and exterior division point, respectively. For this reason, we also define an extended Schröder's method.

Summary: This study suggests a relationship between continued fractions used in number theory and an integer-type algorithm for solving ODEs proposed Sakaguchi and Hayashi in 2009. It has been known that the numerical results for the rational-valued ratios among the expansion coefficients calculated by this algorithm are often very similar to the convergents of the continued fractions of the true exact ratios. This presentation clarifies the reason for this, by showing the coincidence between the sequences of the integer-valued coefficients in an (Gram–Schmidt-type) quasi-orthogonalization process of integer-valued vectors used in this algorithm and the integer sequences appeared in the continued fractions. This coincidence directly implies the equivalence between the above quasi-orthogonalization process and a modified version of Euclidean algorithm.

Summary: This study focuses on linear partial differential equations (PDE) that arise in topology optimization where the thickness of a structure is constrained. The thickness derived from the PDE is a fictitious one, and the key challenge of this work is to verify its equivalence to the intuitive, geometrically defined thickness. In this talk, we demonstrate that the thickness of an annulus as a simple shape with constant thickness is equivalent within a general domain. The proof involves constructing a reference solution within a whole space and evaluating the difference using the maximum principle and an interior H^1 estimate.

Summary: We deal with the bistable reaction-diffusion equation on a tree-shape metric graph, modeling the introduction of an invasive species as $t \to -\infty$. We investigate the asymmetric behavior of a front-like entire solution as it moves through a junction with two branches. Under a suitable condition, we prove that a front wave along one branch is blocked after the first branching point in the presence of an additional junction, while on the other branch, it asymptotically converges to a front profile far from the first branching point.

Summary: We study bifurcations of the completely synchronized state in a continuum limit (CL) for the Kuramoto model (KM) of identical oscillators with two-mode interaction depending on two graphs. Here one of the graphs is uniform but may be deterministic dense, random dense or random sparse, and the other is a deterministic finite nearest neighbor. We use the center manifold reduction technique and prove that the CL suffers bifurcations at which the one-parameter family of completely synchronized state becomes unstable and a stable two-parameter family of ℓ-humped sinusoidal shape stationary solutions ($\ell \geq 2$) appears, where n represents the node number.

45 Takashi Furuya (Doshisha Univ.) Transformers are universal in-context learners 15

Summary: Transformers define in-context mappings, which predict new tokens based on a given set of tokens, such as prompts in NLP or patches in vision tasks. In this work, we study their ability to process an arbitrarily large number of context tokens by modeling the context as a probability distribution over tokens, becoming discrete when the number of tokens is finite. Our main result shows that deep transformers are universal approximators of continuous in-context mappings over compact domains. In contrast to previous results, we prove that a transformer with fixed embedding dimensions and a fixed number of attention heads - can achieve any target accuracy, regardless of the number of input tokens, including infinitely many.

46 Ryota Kawasumi (Gunma Univ.) Universal approximation property of neural ODEs via Orlicz norms
Ikeda Masahiro (Univ. of Osaka) 15

Summary: In this talk, we investigate the class of continuous functions representable by invertible neural networks based on Neural ODE architectures. Orlicz spaces are a class of function spaces that generalize classical Lebesgue spaces. Here, we assume that the Orlicz spaces under consideration, such as the $L \log L$ space, satisfy the Δ_2-condition. To this end, we first introduce the notion of an Orlicz universal approximator. Next, we prove the smooth Orlicz approximation theorem, using the properties of mollifiers in Orlicz spaces. Finally, we demonstrate the compatibility of composition and approximation in Orlicz spaces, and establish the Orlicz-universal approximation property for the images of Lipschitz functions under ODE flow maps.

14:15–16:00

47 Enhao Liu (Kyoto Univ.) Interval multiplicities of persistence modules 15
Hideto Asashiba (Shizuoka Univ.*)

Summary: Interval modules play a fundamental role in persistent homology, as they encode the lifespan of topological features and admit simple characterizations. We present an explicit formula for computing interval multiplicities–i.e., the multiplicities of interval module summands–in persistence modules over arbitrary finite posets. This generalizes the classical one-parameter formula linking multiplicities of birth-death pairs to persistent Betti numbers. We then introduce the essential-cover technique, which enables efficient computation of interval multiplicities by transforming persistence modules over complex posets into ones over simpler, algorithmically tractable posets such as zigzag posets, where fast algorithms are available. This technique allows interval multiplicities to be computed directly from the filtration level of topological spaces.

48 Kota Takeda (Nagoya Univ.) Error analysis of the ensemble Kalman filter with partial and noisy observations 15

Summary: In numerical weather prediction, future states are predicted by integrating a dynamical model initialized with the current state, which is estimated from past observations. However, this estimation faces two challenges: (a) observations contain noise, and (b) observations are spatially sparse relative to the model resolution. Data assimilation addresses these issues by combining models and data to estimate the state. We focus on the Lorenz 96 model as a dynamical model and the Ensemble Kalman Filter (EnKF) as a data assimilation algorithm. Whereas prior work established uniform-in-time error bounds for fully observed systems, no such analysis exists in the partially observed case. We establish such bounds with well-designed observations and appropriate modifications to the EnKF.

49 Shunsuke Kaji (Meijo Univ.)♭ An inverse problem of partial differential equation for the future of
Yasushi Ota (St. Andrew's Univ.) interest rate 15

Summary: Valuation of futures of interest rate critically depends on the market price of risk specified for a particular market. An inverse problem of future pricing for interest rate is to determine the nature of this price, namely, the stochastic behaviour of interest rate implied by current market prices of futures with different maturities. We give a rigorous mathematical formulation of this inverse problem and establish uniqueness by using the Carlemann estimate.

Summary: This letter addresses the open problem of optimal prediction horizon selection for Model Predictive Control (MPC) in noisy linear systems, comparing its performance against Linear Quadratic Regulator (LQR), Kalman-filtered LQR, and Sliding Mode Control (SMC). Using Lyapunov theory, we propose a framework to quantify the trade-off between output variance and computational cost, proving that N=10minimizes variance (0.092202) under Gaussian noise.

Summary: This study addresses an open chal-lenge in control systems real time suppression of random noise with jump and diffusion components by proposing a method using Poisson and Wiener-driven stochastic differential equations with model predictive control (MPC)for outdoor festivals. Achieving over 90% suppression of cheer spikes and low frequency noise, the approach introduces a novel extension of linear SDEs with Van der Pol andDuffing-type nonlinear SDEs, ensuring stability via a rigorously proven stochastic Lyapunov function.

Summary: The quantum walk (QW) can be regarded as the simplest quantum model of the random walk (RW) in probability theory. The goal of this study is to derive a QW version of the probability distribution of the maximum value recorded by RW when RW is conditioned to start from the origin and return to the origin again at some time. In this talk, we formulate the problem of conditional maximum distribution in QW and introduce the analysis method.

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

Summary: Traveling waves solutions that maintain their shape while propagating at a constant speed play a fundamental role in the modeling of nonlinear wave phenomena. In particular, they arise as prototypical solutions in reaction-diffusion systems, such as electrical pulses along axons or chemical reaction fronts. The spectral properties of the linearized operator around a traveling wave govern its spectral (in)stability and bifurcation behavior. In one dimensional spaces, tools such as the Evans function and the stability index provide analytic and topological approaches to spectral stability. These have proven effective not only in characterizing stability but also in studying boundary value problems and bifurcations. A natural and intriguing question then arises: How does the stability of a traveling wave change when it is truncated to a large but bounded interval with Dirichlet or Neumann boundary conditions? Answering this requires distinguishing between eigenvalues induced by boundary effects and accumulation sets of eigenvalues. This talk addresses such questions in higher-dimensional domains, particularly cylindrical geometries. We first outline how notions such as the Evans function and stability index can be extended to multidimensional traveling waves. We then examine how the spectral problem changes when the domain is truncated along the direction of propagation. This leads to a deeper understanding of how domain dimensionality and boundedness influence the mathematical structure of spectral stability.

Topology

September 16th (Tue) Conference Room VIII

9:30–12:00

1 Norihisa Takahashi (Ritsumeikan Univ.)
Hiraku Nozawa (Ritsumeikan Univ.)
On certain irreducible finite group actions on surfaces ····· 10

Summary: Ishizaka classified up to conjugacy hyperelliptic periodic automorphisms of a surface. Here, an involution I on a surface Σ_g is hyperelliptic if and only if $\Sigma_g/\langle I\rangle$ is homeomorphic to S^2. In this talk, we give a classification, up to conjugacy, of irreducible periodic automorphisms of a surface Σ_g which commute with an involution ι such that $\Sigma_g/\langle\iota\rangle$ is homeomorphic to T^2. This talk is based on joint work with Hiraku Nozawa (Ritsumeikan University).

2 Naoyuki Monden (Okayama Univ.)
Susumu Hirose (Tokyo Univ. of Sci.)
On Nielsen equivalence classes of two-elements generators of mapping class groups ····· 15

Summary: In general, there is a natural equivalence relation on generating sets for a group G, called *Nielsen equivalence*. In this talk, we give infinitely many Nielsen equivalence classes on generating pairs of the mapping class group of a closed oriented surface of genus at least eight.

3 Nariya Kawazumi (Univ. of Tokyo)
Arthur Soulié
(Univ. Caen Normandie / CNRS)
On stable covariantly twisted cohomology of the mapping class group for surfaces ····· 15

Summary: We prove the stable twisted cohomology of the mapping class group for surfaces with coefficients in the d-th exterior power of the first rational homology group of the unit tangent bundle of the surface is not free over the stable twisted cohomology algebra of the mapping class group with rational trivial coefficients if and only if $d \neq 2$.

4 Nariya Kawazumi (Univ. of Tokyo)
On the Weil–Petersson symplectic form on the Teichmüller space ···· 15

Summary: We introduce a natural cell decomposition of a closed oriented surface associated with a pants decomposition, and an explicit groupoid cocycle on the cell decomposition which represents each point of the Teichmüller space $\mathcal{T}_g$. As an application, we give a topological proof of Wolpert's formula for the Weil–Petersson symplectic form in terms of the Fenchel–Nielsen coordinates. Moreover we discuss the multiplicative constant between the Weil–Petersson and the Atiyah–Bott–Goldman symplectic forms.

5 Takuya Sakasai (Univ. of Tokyo)
Yuuki Tadokoro (Tokyo Univ. of Sci.)
Kokoro Tanaka (Tokyo Gakugei Univ.)
A variant of groups defined by Kim and Manturov ····· 10

Summary: We consider some groups related to the group Γ_n^4 defined by S. Kim and V. O. Manturov. We discuss their structures (generating sets, abelianizations and so on) from a group theoretical point of view.

6 Kanako Oie (Nara Women's Univ.)
Hiroshige Shiga (Sci. Tokyo*)
Ryo Matsuda (Kyoto Univ.)
On the spectrum of the number of geodesics and tight geodesics in the curve complex ····· 15

Summary: Let S be an oriented surface of type (g,n), and let $\mathcal{C}(S)$ be its curve complex. While there are typically infinitely many geodesics between two vertices in $\mathcal{C}(S)$, the set of tight geodesics is always finite, and in some cases, even all geodesics can be finite.
We consider the spectrum $\mathfrak{Sp}_d(S)$ of the number of geodesics of length $d \geq 2$ in $\mathcal{C}(S)$, and the corresponding spectrum $\mathfrak{Sp}_d^T(S)$ for tight geodesics. We show that $\mathfrak{Sp}_d(S) \subset \mathfrak{Sp}_d^T(S)$ in general, but $\mathfrak{Sp}_2(S) = \mathfrak{Sp}_2^T(S)$. Moreover, we show that $\mathfrak{Sp}_2(S)$ and $\mathfrak{Sp}_2^T(g,n)$ are completely determined in terms of (g,n).

7 Aoi Wakuda (Univ. of Tokyo) A separability criterion for two loops on an orientable surface and the Goldman bracket 15

Summary: In this talk, we give an algebraic criterion, via the Goldman bracket, for when two (not necessarily simple) free homotopy classes of loops on an oriented surface have disjoint representatives. As an application, we determine the center of the Goldman Lie algebra of a pair of pants. We extend Kabiraj's method, which was originally limited to oriented surfaces filled by simple closed geodesics, 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.

8 Tsukasa Ishibashi (Tohoku Univ.) Cyclic quantum Teichmüller theory 15

Summary: We construct a finite-dimensional projective representation of the dotted Ptolemy groupoid when the quantum parameter q is a root of unity, clarifying the role of parameters involved in the cyclic quantum dilogarithm as 'coefficients' in quantum cluster algebra. We introduce the quantum intertwiner associated with a mapping class as a composite of cyclic quantum dilogarithm operators, whose trace defines a quantum invariant. We prove that it coincides with the transpose of the reduced quantum hyperbolic operator of Baseilhac–Benedetti. We provide a geometric method to decompose the space of quantum states into irreducible modules of the Chekhov–Fock algebra. The reduced version of quantum intertwiner conjecturally coincides with the Bonahon–Liu (and Bonahon–Wong–Yang) intertwiner.

14:30–16:00

9 Reo Yabuguchi (Okayama Univ.) Knot surgered elliptic surfaces for a $(2, 2h+1)$-torus knot 15
Naoyuki Monden (Okayama Univ.)

Summary: This talk addresses Problem 4.18 from Kirby's problem list, which is whether every simply connected, closed 4-manifold admits a handle decomposition without 1- and 3-handles. We show that for any positive integer h and $n \geq 1$, the knot surgered elliptic surface $E(n)_{T(2,2h+1)}$, where $T(2, 2h+1)$ is a $(2, 2h+1)$-torus knot, admits such a decomposition. The construction uses Lefschetz fibrations and Kirby diagrams "on surfaces." This provides new examples of smooth 4-manifolds with no 1- and 3-handles.

10 Natsuya Takahashi (Univ. of Osaka) Stein fillings of planar contact 3-manifolds admitting genus-2 relative trisections 15
Nobutaka Asano (Tsuyama Nat. Coll. of Tech.)

Summary: We study Stein fillings of contact 3-manifolds supported by open book decompositions with genus-0 pages. For such fillings that admit a relative trisection genus at most 2, we give a partial classification of their diffeomorphism types.

11 Tatsumasa Suzuki (Meiji Univ.) The non-simply connected Price twist for the 4-sphere 15
Tsukasa Isoshima (Keio Univ.)

Summary: A cutting and pasting operation on a P^2-knot S in a 4-manifold is called the Price twist. The Price twist for the 4-sphere S^4 yields at most three 4-manifolds up to diffeomorphism, namely, the 4-sphere S^4, the other homotopy 4-sphere $\Sigma_S(S^4)$ and a non-simply connected 4-manifold $\tau_S(S^4)$. In this talk, we study some properties and diffeomorphism types of $\tau_S(S^4)$ for P^2-knots S of Kinoshita type.

12 Motoo Tange (Univ. of Tsukuba) Exotic E(n) without 1-handles 15

Summary: Does any simply connected closed 4-manifold have a handle decomposition without 1-handles or 1-, 3-handles? This is a well-known question in 4-dimensional manifolds. The minimum number of 1-handles of a simply connected closed 4-manifold M is diffeomorphism invariant. We denote the invariant by $h(M)$. We consider $E(n)_{p,q}$ and $E(n)_K$, which are exotic to the elliptic surface $E(n)$. We show that a sufficient condition satisfying $h(E(n)_{p,q}) = 0$ and $h(E(n)_K) = 0$.

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

Shuhei Maruyama (Kanazawa Univ.) On the Euler class of foliated sphere bundles

Summary: A foliated bundle is a fiber bundle equipped with a foliation on the total space that is transverse to the fibers and whose codimension equals the dimension of the fiber. In terms of structure groups, a foliated bundle is a fiber bundle whose structure group can be reduced to a discrete group. Consequently, the universal characteristic classes of foliated bundles can be seen as the group cohomology class of diffeomorphism groups of the fibers. In this talk, I will first review several results concerning the Euler class of foliated circle bundles, such as the Milnor–Wood inequality and Tsuboi's theorem relating it to the Calabi invariant. I will then discuss the extent to which these results can be generalized to other settings.

September 17th (Wed) Conference Room VI

10:00–10:15 Presentation Ceremony for the 2025 MSJ Geometry Prize

10:20–11:20 Award Lecture for the 2025 MSJ Geometry Prize

Shin-ichi Matsumura (Tohoku Univ.) Structure theorems for varieties with non-negative curvature

Summary: A central problem in geometry is to uncover the structures of fibrations naturally associated with varieties, thereby decomposing them into fundamental building blocks. For instance, the Minimal Model Program in birational geometry predicts that all projective varieties decompose into Fano varieties, Calabi–Yau varieties, and canonical models, reflecting their Ricci curvature from the perspective of differential geometry. In this talk, I will present structure theorems for projective varieties (more generally, Kaehler spaces) that admit "non-negative curvature" in various senses, leading to a decomposition into Ricci-positive and Ricci-flat varieties. Specifically, I focus on (bi)holomorphic sectional curvature, pseudo-effective tangent bundles, and nef anti-canonical bundles, emphasizing their connections to rational curves, rigidity phenomena, and fundamental groups. As an application, I will describe an extension of the Beauville–Bogomolov–Yau decomposition to klt pairs, which further decomposes Calabi–Yau varieties into more fundamental components. This extension is motivated by the framework of the log Minimal Model Program.

12:50–13:50 Award Lecture for the 2025 MSJ Geometry Prize

Koichi Nagano (Univ. of Tsukuba) On the geometry of metric spaces with upper curvature bounds

Summary: I will survey recent developments in the geometry of metric spaces with upper curvature bounds, especially in the geometry of GCBA spaces. A GCBA space means a locally compact, separable, locally geodesically complete metric space with an upper curvature bound. Several years ago, Alexander Lytchak and I have examined geometric structure of GCBA spaces from viewpoints of Alexandrov geometry, and studied topological regularity of GCBA spaces incorporating ideas from geometric topology. Those researches lead to answers to long-standing open problems on GCBA spaces, and provide the possibility of global Riemannian geometry of GCBA spaces. Independently, Takashi Shioya, Takao Yamaguchi, and I have recently described geometric structure of 2-dimensional GCBA spaces precisely, and succeeded to define the curvature measures on them, and consequently established the Gauss–Bonnet theorem. I would like to introduce fascinations of the geometry of GCBA spaces.

September 18th (Thu) Conference Room VIII

9:30–11:30

13 Naoki Kitazawa (Osaka Metro. Univ.) Reconstructing Morse functions with prescribed preimages of single points 15

Summary: We present a fundamental and natural problem on Morse functions, reconstruction of Morse functions with prescribed preimages of single points containing no critical points, which are closed manifolds. This was essentially started by the speaker.
Related studies on smooth functions on closed surfaces were essentially started by Sharko in 2006. At critical points the functions are represented by very elementary polynomials and critical points are isolated. A study by Masumoto-Saeki in 2010 follows it where critical points of the smooth functions on the closed surfaces may not be isolated. Later Michalak has succeeded in reconstruction of Morse functions on closed surfaces with prescribed preimages. For the closed surface case, preimages containing no critical points are disjoint unions of circles.

14 Naoki Kitazawa (Osaka Metro. Univ.) Reconstructing Morse functions on 3-dimensional compact and connected manifolds with prescribed preimages of single points 10

Summary: We present the following fundamental and natural problem on Morse functions, essentially started by the speaker: reconstructing Morse functions with prescribed preimages of single points containing no critical points, which are closed manifolds. The speaker has affirmatively solved the case where the dimensions of the manifolds of the domains of the functions are 3-dimensional, completely.
This has been solved in certain situations where connected components of these preimages are boundaries of compact and connected manifolds of a certain class, by the speaker around 2020: especially, in the surface case and the 3-dimensional case before with the preimages being orientable surfaces, this was solved previously.

15 Naoki Kitazawa (Osaka Metro. Univ.) A most natural special generic map whose image is an immersed compact manifold of codimension 0 and the cohomology rings of the manifolds 15

Summary: The natural height function of the unit sphere, the canonical projections of the unit spheres, and Morse functions with exactly two critical points on spheres or the functions in so-called Reeb's sphere theorem, are generalized to special generic maps as higher dimensional versions. They are known to restrict the topologies and the differentiable structures of the manifolds, shown by O. Saeki etc. As simplest examples, manifolds represented as connected sums of products of two spheres admit natural special generic maps into Euclidean spaces in considerable cases. As our recent new study, we concentrate on a most natural special generic map whose image is a given immersed compact manifold of codimension 0 and the cohomology rings of the manifolds.

16 Gakuto Kato (Nihon Univ.) On a construction of stable maps from a 3-manifold into the plane 10

Summary: For any link, we give a visual construction of stable maps f from the 3-sphere into the real plane enjoying the following properties; the set of definite fold points of f coincides with a given link and f only has certain type of fibers containing two indefinite fold points.

Summary: Given a family of varieties, the Euler discriminant locus distinguishes points where Euler characteristic differs from its generic value. For a good family of very affine varieties, it is proven that the Euler discriminant locus is purely one-codimensional unless it is empty. Of particular interest is a family of very affine hypersurfaces. We coin the term hypergeometric discriminant for a Lagrangian cycle which computes the Euler characteristic of a given fiber. We establish a formula of hypergeometric discriminant in terms of likelihood equations.

Summary: It is known that every space X is embedded as a closed subspace in some irreducible space Z. We proved that Z can be taken as $L(X) = L(Z)$.

Summary: About 20 years ago, we proved that there exists a nonseparable connected metrizable space with no hereditarily normal compactification. This is a counterexample to Gartside's problem. The following question related to Gartside's problem is still open: If a connected metrizable space X has a hereditarily normal compactification, is X separable? Here, we present a partial solution to this problem. Let X be a connected and locally connected metrizable space with a hereditarily normal compactification. We then prove that X is separable.

14:15–16:00

Summary: The sheaf theory is expected to elucidate detailed properties of persistence modules and give features of multi-parameter persistence modules for applications. However, the categories of sheaves on two or more-dimensional Euclidean spaces have more complicated structures than those on 1-dimensional Euclidean space. To overcome this difficulty, we focus on a quantized contact transform, known as the Radon transform. The Radon transform for sheaves is a useful dimension reduction technique and induces a categorical equivalence between the localized bounded derived categories of sheaves on n-dimensional Euclidean space and those on (n-1)-dimensional sphere times 1-dimensional Euclidean space. We show that the Radon transform keeps extended pseudo-distances defined on these categories.

Summary: We bring spaces over the classifying space BS^1 of the circle group S^1 to persistence theory via the singular cohomology with coefficients in a field. Then, the cohomology interleaving distance between spaces over BS^1 is introduced and considered in the category of persistent differential graded modules. In this talk, we show that the distance coincides with the interleaving distance in the homotopy category in the sense of Lanari and Scoccola and the homotopy interleaving distance in the sense of Blumberg and Lesnick. Moreover, upper and lower bounds of the distance are investigated with the cup-lengths of spaces over BS^1.

22 Kohei Tanaka (Shinshu Univ.) Directed homotopy theory on stratified spaces and small categories ··· 15

Summary: Since the 1990s, Directed Algebraic Topology has been developed to provide a geometric framework for describing irreversible concepts and phenomena. In this talk, we consider spaces stratified by posets (partially ordered sets), and study the homotopy theory based on directed paths that respect the poset order. In particular, we focus on the structure of the fundamental category, a directed analogue of the fundamental groupoid, and introduce a combinatorial approach to its analysis.

23 Masaki Taho (Univ. of Tokyo) Topology and diffeology via metric-like functions ····· 15

Summary: In this talk, we investigate spaces equipped with a family of metric-like functions satisfying certain axioms. These functions provide a unified framework for defining topology, uniformity, and diffeology. The framework is based on a family of metric-like functions originally introduced for spaces of submanifolds. We show that the topologies, uniformities, and diffeologies of these spaces can be systematically derived from the proposed axioms. Furthermore, the framework covers examples such as spaces with compact-open topologies, tiling spaces, and spaces of graphs, which have appeared in different contexts. These results support the study of spaces with metric-like structures from both topological and diffeological perspectives.

24 Tadayuki Haraguchi (Naragakuen Univ.)
Kazuhisa Shimakwa (Okayama Univ.*) Adjunction spaces of diffeological spaces ····· 15

Summary: In this talk, we introduce homotopy equivalence of adjunction spaces constructed by attaching n-dimensional cubes on the category of diffeological spaces.

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

Toshiyuki Akita (Hokkaido Univ.) Associated groups of quandles, Wirtinger presentations, and group homology

Summary: In this talk, I explain the relationships among the associated groups of quandles and symmetric quandles, Wirtinger and twisted Wirtinger presentations, and low-dimensional group homology.

September 19th (Fri) Conference Room VIII

9:30–12:00

25 Keisuke Himeno (Hiroshima Univ.) The unoriented band unknotting number of torus knots ····· 10

Summary: The unoriented band unknotting number of a knot is the minimum number of oriented or non-oriented band surgeries that turn the knot into the unknot. Batson examined a certain non-oriented band surgery for a torus knot. The minimum number of these operations required to turn a torus knot into the unknot is called the pinch number, and it can be easily calculated from the parameters of the torus knot. In this talk, we show that the unoriented band unknotting number and the pinch number coincide for torus knots. In the proof, we use the torsion order of the unoriented knot Floer homology.

26 Tetsuya Itoh (Kyoto Univ.) Slice Cromwell inequality of homogeneous knots ····· 10

Summary: Cromwell proved that the minimum v-degree of the HOMFLY polynomial of homogeneous knot K is bounded above by $2g(K)$. We point out its slice version holds; the minimum v-degree of the HOMFLY polynomial of homogeneous knot K is bounded above by $2g_4(K)$, the slice genus of K.

27 Yujiro Miki
Kodai Wada (Kobe Univ.) 4-moves and Kawauchi's conjecture for 2-component links ····· 10

Summary: A 4-move is a local deformation on a link adding or removing four half-twists. We prove that there is a link-homotopically trivial 2-component link that cannot be deformed into the trivial 2-component link by a finite sequence of 4-moves. This disproves Kawauchi's conjecture on 4-moves for 2-component links.

Summary: A sphere eversion necessarily involves an odd number of quadruple point jumps. Motivated by this classical result, we introduce a topological invariant defined for generic immersions from a closed oriented surface Σ to $\mathbb{R}^3$, designed to detect the first occurrence of such a jump during the eversion process. This invariant generalizes Arnold's strangeness invariant for plane curves to one higher dimension, both in domain and target. It is defined via a sum of indices associated with triple points, and detects only quadruple point jumps modulo 2, while remaining unchanged under other standard types of local jumps typically appearing in generic regular homotopies.

Summary: Satoh and Taniguchi introduced the n-writhe J_n for each non-zero integer n, which is an integer invariant for virtual knots. It is obvious that the virtualization of a real crossing is an unknotting operation for virtual knots. In our previous research, we showed that if $\{r_n\}_{n\neq 0}$ is a sequence of integers with $\sum_{n\neq 0} nr_n = 0$, then there exists a virtual knot K whose virtual unknotting number equals one and $J_n(K) = r_n$ for any $n \neq 0$. In this talk we show that there exist infinitely many virtual knots having such properties by using the vertex connected sum on Gauss diagrams.

Summary: Let K be a ribbon 2-knot, and R a ribbon disk presentation of K. Then we prove that the α_2-invariant of K is coincident with the sum of signs of interleaved pairs of ribbon intersections of R. This is related to the $v_{2,1}$-invariant of a long virtual knot due to Goussarov–Polyak–Viro by identifying a linear ribbon disk and a diagram of a long virtual knot.

Summary: A partial matching is presented by a lattice presentation, and deformations between a pair of partial matchings are associated with dissolutions of lattice diagrams. The notions of a dotted diagram and deformations of dotted diagrams were introduced based on dissolutions of lattice diagrams. Here we consider dotted diagrams and their deformations, and reduced diagrams given by them.

Summary: A torus-covering T^2-link $\mathcal{S}_n(a, b)$ is a surface-link determined from a pair of n-braids a and b. We consider $F = \mathcal{S}_n(a, b)$ such that the closure of a is a knot. We determine the number of conjugacy classes of irreducible metabelian $SU(2)$-representations of the knot group of F. Further, we consider relation between this number and the p-colorability.

Summary: We call a finite group G a twisted Alexander vanishing (TAV) group of a knot K if there exists an epimorphism f of the knot group $G(K)$ onto G such that the twisted Alexander polynomial associated with the composition of f and the regular representation of G is zero. In this talk, we present several properties of TAV groups.

34 Yuki Matsushima (Tokyo Metro. Univ.) On the HOMFLY polynomial of an r^2-periodic knot ····· 15

Summary: We give the algebraic property of the HOMFLY polynomial of a 9-periodic and a 25-periodic knot, and we predict the algebraic property of the HOMFLY polynomial of an r^2-periodic knot for an odd prime r.

35 Keita Nakagane
Jun Yoshida (RIKEN)
Noboru Ito (Shinshu Univ.)
Twists on Frobenius algebra and link homology ····· 10

Summary: We discuss twists on Frobenius algebras in the context of link homology. In his paper in 2006, Khovanov asserted that a twist of a Frobenius algebra yields an isomorphic chain complex on each link diagram. Although the result has been widely accepted for nearly two decades, a subtle gap in the original proof was found in the induction step of the construction of the isomorphism. Following discussion with Khovanov, we decided to provide a new proof. Our proof is based on a detailed analysis of configurations of circles in each state.

14:15–16:30

36 Hajime Kubota (Kyoto Univ.) On grid homology for diagonal knots ····· 15

Summary: Grid homology is a combinatorial invariant for knots in S^3 and is isomorphic to knot Floer homology. A diagonal knot is one which is represented by a good grid diagram in some sense. We partially determine grid homology of diagonal knots. We compare diagonal knots to various classes of knots, such as positive braids, fibered positive knots, and L-space knots.

37 Satoshi Tsuchimi (Kindai Univ.) The Kontsevich function and the Zwegers' μ-function ····· 15

Summary: In this talk, we regard the Kontsevich function F, which is an important function in knot invariants, as a specialization of the formal solution K of the q-Kummer equation, and compute the q-Borel summation $\widetilde{K}$ of K. Furthermore, we present the relation between $\widetilde{K}$ and the Zwegers' μ-function, and some formulas such as pseudo-periodicities and modularities.

38 Sakumi Sugawara (Hokkaido Univ.) The comology ring of the 3-manifold defined from a combinatorial line arrangement ····· 15

Summary: For a complex projective line arrangement, Cohen–Suciu proved that the cohomology ring of the boundary manifold is isomorphic to the double of the cohomology ring of the complement. In this talk, we demonstrate its generalization to combinatorial line arrangements. We introduce the boundary manifold for a combinatorial line arrangement. We compute its cohomology ring by constructing explicit cycles and then prove the doubling formula.

39 Yuya Koda (Keio Univ. / Hiroshima Univ.)
Kazuto Takao (Tohoku Univ.)
Diagrammatic criteria for strong irreducibility of Heegaard splittings and finiteness of Goeritz groups ····· 15

Summary: Casson–Gordon gave a criterion for Heegaard splittings of 3-manifolds to be strongly irreducible. By strengthening it, Lustig–Moriah gave a criterion for Goeritz groups of Heegaard splittings to be finite. Their criteria are based on Heegaard diagrams formed by maximal disk systems of the handlebodies. We generalize them for arbitrary disk systems, including minimal ones. As an application, we give Heegaard splittings with non-minimal genera and finite Goeritz groups.

40 Yasuyoshi Tsutsumi (Kobe Shinwa Univ.) Lescop invariants of both the Brieskorn–Hamm manifolds obtained by Dehn surgeries on knots in an integral homology 3-sphere ····· 10

Summary: Let p and q be pairwise coprime with $p \neq 0$ and $q > 0$. Let the Brieskorn–Hamm manifold be a homology lens space and the order its the first homology group is $|p|$.We classify the Brieskorn–Hamm manifold and the resulting 3-manifold of p/q-surgery along a knot K in an integral homology 3-sphere by using the Lescop invariant.

Summary: In this talk, we discuss a conjecture that any knot in any oriented closed 3-manifold is determined by its complement. We first report on results for knots representing generators of the fundamental group. As with previous results, this result is proven using Dehn surgery. The key idea is to show that trivial and nontrivial Dehn surgeries along such a knot yield non-homeomorphic manifolds. In this direction, we also discuss the Purely Cosmetic Surgery Conjecture, which states that Dehn surgeries along inequivalent slopes never produce orientation-preservingly homeomorphic 3-manifolds. Two results for knots in homology spheres will also be presented.

Infinite Analysis

September 16th (Tue) Conference Room VII

9:30–11:45

1 Shota Shigetomi (Kyushu Univ.)
Kenji Kajiwara (Kyushu Univ.)
Shizuo Kaji (Kyushu Univ./Kyoto Univ.)
A proof of existence of Kaleidocycle 15

Summary: A Kaleidocycle is a linkage mechanism consisting of k congruent tetrahedra. One of the features of this mechanism is that it deforms like a bubbling ring. It is known that this motion can be described by integrable systems if the motion is regarded as a deformation of discrete curves, but it has not been proven that this mechanism exists in the first place. In this talk, we will show that Kaleidocycle exists if the number of connecting tetrahedra k is greater than or equal to six.

2 Serban Matei Mihalache (Univ. of Tokyo)
Tomoro Mochida (Tohoku Univ.)
From polygon equations to simplex equations 15

Summary: We study solutions of the simplex and polygon equations and their properties. In particular, we show that if a solution of the $(2n+1)$-gon equation and a solution of its dual satisfy a certain compatibility condition, they give rise to solutions of the $2n$- and $(2n-1)$-simplex equations.

3 Youichi Shibukawa (Hokkaido Univ.)
Davide Ferri (Univ. of Turin)
Quiver-theoretic Yang–Baxter equation and Garside theory (1) 15

Summary: We explain properties of the structure category and the structure groupoid defined by a solution to the quiver-theoretic Yang–Baxter equation from the viewpoint of Garside theory.

4 Youichi Shibukawa (Hokkaido Univ.)
Davide Ferri (Univ. of Turin)
Quiver-theoretic Yang–Baxter equation and Garside theory (2) 15

Summary: We explain how to construct solutions to the quiver-theoretic Yang–Baxter equation from suitable quotient categories.

5 Yosuke Kawamoto (Okayama Univ.)
Alexander I. Bufetov (Steklov Math. Inst. RAS, etc.)
Boundary Feller–Dynkin processes associated with Laguerre processes 15

Summary: We established the consistency of Laguerre processes with a fixed parameter with respect to a new projective system. Based on this, we obtain a boundary process associated with this consistent family by applying the method of intertwiners.

6 Yusuke Ohkubo (Setsunan Univ.)
Kac determinant for a q-deformation of the direct sum of the N=1 super Virasoro algebra and the free fermion algebra 15

Summary: A certain free field realization of the quantum toroidal algebra of type $\mathfrak{gl}_2$ gives rise to a q-deformation of the direct sum of the N=1 super Virasoro algebra and the free fermion algebra. In this talk, we present a conjecture on the Kac determinant for this deformed algebra.

7 Rei Inoue (Chiba Univ.)
Atsuo Kuniba (Univ. of Tokyo)
Yuji Terashima (Tohoku Univ.)
Junya Yagi (Tsinghua Univ.)
Quantized six-vertex model on a torus 15

Summary: The quantized six-vertex model on a torus was introduced by Kuniba–Matsuike–Yokeyama by replacing the weights of the (original) six-vertex model with elements of the q-Weyl algebra. This gives a three-dimensional integrable lattice model, in which a layer transfer matrix, depending on two spectral parameters associated with the homology cycles of the torus, can be defined not only on the square lattice but also on more general graphs. In this talk, for a class of graphs that we call admissible, the commutativity of the layer transfer matrices is proved by introducing four types of tetrahedron equations and two types of inversion relations.

8 Toshio Oshima (Univ. of Tokyo*)
Transformations of Pfaffian systems with logarithmic singularities along hyperplane arrangements 15

Summary: We study transformations of Pfaffian systems with logarithmic singularities along hyperplane arrangements. They are coordinate transformations, restrictions, boundary values, additions, middle convolutions etc. In particular, we derive the corresponding transformations of the eigenvalues and multiplicities of the residue matrices along the hypersurfaces.

14:15–15:20

9 Genki Shibukawa (Kitami Inst. of Tech.)
Satoshi Tsuchimi (Kindai Univ.)
A degeneration of the generalized Zwegers' μ-function according to the Ramanujan difference equation 15

Summary: We introduce a degeneration analogue of the generalized Zwegers' μ-function defined by Shibukawa–Tsuchimi [ST1] (which we call *little μ-function), and give their fundamental formulas. The little μ-function is equal to the image of the q-Borel and q-Laplace transformation of a divergent (basic) solution for the Ramanujan difference equation.*

10 Yousuke Ohyama (Tokushima Univ.)
Connection problems on q-Lommel functions 15

Summary: We show q-analogue of the Lommel functions, which are solutions to nonhomogeneous q-Bessel functions. Since there are three types of q-analogue of the Bessel equations, we consider all three types. The q-Lommel functions are divergent around the origin, but they are not necessary convergent around the infinity. We consider q-Stokes phenomenon for the q-Lommel functions by q-Borel–Laplace method.

11 Yumi Arai (Ochanomizu Univ.)
On q-middle convolution and generalized q-hypergeometric equation .. 15

Summary: Sakai and Yamaguchi introduced the q-convolution and the q-middle convolution as q-analogue of the convolution and the middle convolution by Dettweiler and Reiter. Arai and Takemura reformulated the q-convolution and the q-middle convolution. In this talk, we obtain the n-th order generalized q-hypergeometric equation by repeatedly applying the q-analogue of addition and the reformulated q-middle convolution to Heine's q-hypergeometric equation.

12 Taikei Fujii (Kobe Univ.)
Nobukawa Takahiko (Kogakkan Univ.)
Linear relations for Kajihara's q-hypergeometric series $\Phi^m_{1,1}$ and $\Phi^m_{2,0}$ 15

Summary: The variants of Heine's q-hypergeometric equation were introduced by Hatano, Matsunawa, Sato and Takemura. A higher order extension E_M and its degeneration E'_M were introduced by one of the speakers. The equation E_M admits solutions in terms of Kajihara's q-hypergeometric series. Kajihara's q-hypergeometric series is an important multivariable generalization of q-hypergeometric series which has some duality. In this talk, we give new linear relations for Kajihara's q-hypergeometric series from the viewpoint of connection problem for E'_M.

15:30–16:30 Talk Invited by Infinite Analysis Special Session

Takafumi Mase (Univ. of Tokyo) Exact calculation of degrees for lattice equations

Summary: The theory of degree growth and algebraic entropy plays a crucial role in the field of discrete integrable systems. However, a general method for calculating degree growth for lattice equations (partial difference equations) is not yet known. In this talk, I will propose a new method to rigorously compute the exact degree of each iterate for lattice equations. Halburd's method, which is a novel approach to computing the exact degree of each iterate for mappings (ordinary difference equations) from the singularity structure, forms the basis of our idea. The strategy is to extend this method to lattice equations. First, I will illustrate, without rigorous discussion, how to calculate degrees for lattice equations using the lattice version of Halburd's method and discuss what problems we need to solve to make the method rigorous. Then, I will provide a framework to ensure that all calculations are accurate and rigorous. If time permits, I would also like to discuss how to detect the singularity structure of a lattice equation.

September 17th (Wed) Conference Room VII

9:30–10:35

13 Tatsushi Shimazaki (Kobe Univ.)
Takahiko Nobukawa (Kogakkan Univ.)
Taikei Fujii (Kobe Univ.)
Pecial values of Grothendieck polynomials in terms of hypergeometric functions 15

Summary: Grothendieck polynomials are K-theoretic analogues of Schur polynomials, first introduced by Lascoux and Schutzenberger. A determinantal formula analogous to the Weyl formula for Schur polynomials was given by Ikeda and Naruse. In this talk, we adopt this formula as the definition of Grothendieck polynomials and introduce their special values. We show that these special values are related to the Gauss hypergeometric functions and the Holman hypergeometric functions. In particular, we explain how the number of set-valued semistandard tableaux can be computed from this special value by taking the limit of the parameter q approaching one and by specializing the parameter beta to one.

14 Eriko Shinkawa (Tohoku Univ.)
Kazuya Aokage (Ariake Nat. Coll. of Tech.)
HiroFumi Yamada (Rikkyo Univ.)
Virasoro action on Schur Q-functions and Pfaffian identities 15

Summary: We study the action of the Virasoro algebra on Schur Q-functions, defined as Pfaffians of alternating matrices associated with strict partitions. Explicit formulas for both positive and negative Virasoro operators are derived from a bilinear identity among Q-functions. Connections to integrable hierarchies are briefly discussed.

15 Masashi Hamanaka (Nagoya Univ.)
Shangshuai Li (Shanghai Univ.)
Shan-Chi Huang (Nagoya Univ.)
Da-Jun Zhang (Shanghai Univ.)
Four-dimensional Wess–Zumino–Witten model and soliton resonances 15

Summary: We present two kinds of resonance soliton solutions on the Ultrahyperbolic space U for the G=U(2) Yang equation, which is equivalent to the anti-self-dual Yang–Mills (ASDYM) equation. We reveal and illustrate the solitonic behaviors in the four-dimensional Wess–Zumino–Witten (WZW4) model through the sigma model action densities. The Yang equation is the equation of motion of the WZW4 model. In the case of U, the WZW4 model describes a string field theory action of open N=2 string theories. Hence, our solutions on U suggest the existence of the corresponding classical objects in the N=2 string theories. Our solutions include multiple-pole solutions and V-shape soliton solutions. The V-shape solitons suggest annihilation and creation processes of two solitons and would be building blocks to classify the ASDYM solitons, like the role of Y-shape solitons in classification of the KP (line) solitons. We also clarify the relationship between the Cauchy matrix approach and the binary Darboux transformation in terms of quasideterminants. Our formalism can start with a simpler input data for the soliton solutions and hence might give a suitable framework for the classification of the ASDYM solitons.

16 Kanehisa Takasaki (Osaka Metro. Univ./Kyoto Univ.*)
Large BKP vs. B-Toda in Lax–Sato form 15

Summary: Krichever and Zabrodin obtained the B-Toda hierarchy from the 2D Toda hierarchy by imposing a constraint in the Lax–Sato form. Guan, Wang, Rui and Cheng derived a Lax–Sato form of the Large BKP hierarchy from a bilinear equation of the tau function, and pointed out that the large BKP hierarchy is closely related to the B-Toda hierarchy. The two hierarchies are thus shown to be substantially equivalent. This talk presents a description of solutions of these systems in the language of factorization of a difference operator.

10:45–11:45 Talk Invited by Infinite Analysis Special Session

Yuji Kodama (Ohio State Univ.) ♭ KP solitons and the Schottky uniformization

Summary: Real and regular soliton solutions of the KP hierarchy have been classified in terms of the totally nonnegative (TNN) Grassmannians. These solitons are referred to as KP solitons, and they are expressed as singular (tropical) limits of shifted Riemann theta functions.
In the talk, for each element of the TNN Grassmannian, we construct a Schottky group, which uniformizes the Riemann surface associated with a real and regular finite-gap solution. Then we show that the KP solitons are obtained by degenerating these finite-gap solutions.
This talk is based on a collaborative work with Takashi Ichikawa (Saga University)