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The Mathematical Society of Japan

2026 Autumn Meeting

Titles and Short Summaries of the Talks

September, 2026

at Kobe University

2026 The Mathematical Society of Japan

AUTUMN MEETING

Dates: September 1st (Tue)–4th (Fri), 2026

Venue: Rokkodai Campus (Tsurukabuto 1st Campus)
Kobe University
1–2–1, Tsurukabuto, Nada-ku, Kobe, 657-0011, Japan

Contact to: Graduate School of Science and Faculty of Science
Kobe University
1–1, Rokkodai-cho, Nada-ku, Kobe, 657-8501, Japan
E-mail kobe26sept@mathsoc.jp

The Mathematical Society of Japan

	I B109	II B110	III B029	IV B210	V K301	VI K401	VII K601	VIII K302	IX K402
1st (Tue)	Functional Analysis 9:30–10:30 14:20–15:30	Functional Equations 9:00–12:00 14:15–16:30	Geometry 9:30–12:00 14:15–16:45	Algebra 9:00–12:00 15:30–18:00	Complex Analysis 9:30–11:10 15:40–16:50	Statistics and Probability 9:30–12:00	Topology 9:30–12:00 15:40–17:40	Infinite Analysis 9:30–10:30 14:30–16:30	Applied Mathematics 9:00–12:10 15:25–16:50
	Featured Invited Talks 13:00–14:00								
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	MSJ Prizes Presentation (Idemitsu Sazo Memorial Rokkodai Auditorium) ····· (14:45–15:15) Plenary Talks (Idemitsu Sazo Memorial Rokkodai Auditorium) Autumn Prize Winner ····· (15:30–16:30) Takashi Shioya (Tohoku Univ.) ····· (16:45–17:45) Official Party (Restaurant SAKURA) ····· (18:15–20:15)								
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Plenary Talks

September 2nd (Wed) Idemitsu Sazo Memorial Rokkodai Auditorium

Award Lecture for the 2026 MSJ Autumn Prize

Autumn Prize Winner ..... (15:30–16:30)

Takashi Shioya (Tohoku Univ.) Coarse geometry of metric measure spaces ..... (16:45–17:45)

Summary: In this talk, I will discuss joint work with Takayuki Okuda (Hiroshima University) on the coarse geometry of metric measure spaces. Using ideas from optimal transport theory, we introduce a notion of measured coarse equivalence and define a corresponding variant of the uniformly finite homology of Block and Weinberger, called measured Block–Weinberger homology. We prove that this homology is invariant under measured coarse equivalence and, under the local doubling condition, that the vanishing of its 0-th homology is equivalent to non-amenability. The proofs combine techniques from optimal transport theory and the disintegration of measures. Some examples will also be presented.

Featured Invited Talks

September 1st (Tue)

Conference Room III

Kazushi Ueda (Univ. of Tokyo) Geometry of singularities ····· (13:00–14:00)

Summary: Singularities are ubiquitous in mathematics, and their definitions and roles vary across different fields. In this talk, we will discuss the relationship between singularities and geometry centered on mirror symmetry, with a view toward differential equations, sheaves, and (infinity-)categories.

Conference Room IV

Guest Talk from Taiwan Mathematical Society

Tzu-Yueh Wang (Academia Sinica) From entire curves to integral points ····· (13:00–14:00)

Summary: In this talk, I will discuss recent developments in GCD methods and filtration methods. I will describe GCD methods toward the Green–Griffiths–Lang conjecture for entire curves omitting $n+1$ hypersurfaces, and new filtration methods that allow hypersurfaces with non-empty intersections. The filtration methods yield applications to one-parameter families of unit equations, exponential Diophantine equations, digit problems, and the distribution of integral points. The results are based on joint work with Carlo Gasbarri, Ji Guo, Khoa D. Nguyen, Chia-Liang Sun, Aaron Levin, Min Ru, and Zheng Xiao.

Conference Room V

Toshihiro Nakanishi (Shimane Univ.*/Osaka Metro. Univ.) Lars Ahlfors —to the summit of mathematics ····· (13:00–14:00)

Summary: 2026 marks the 30th anniversary of Lars Ahlfors—the Finnish-American mathematician who received one of the first Fields medals at the age of 29. Ahlfors had been a leading figure in complex analysis during the 20th century. He developed theories of Riemann surfaces, value distribution, conformal invariants, Kleinian groups, and quasiconformal mappings laying the ground work for Teichmüller space. Ahlfors was so talented that whatever he touched turned into a fashionable object to study. So, when Walter Hayman was asked by his graduate student for advice, he simply said 'Watch Ahlfors!'. Ahlfors is also known for his book Complex Analysis considered as the standard text on the theory of functions of one complex variable. I tell about Ahlfors' contribution to mathematics in order to complement the story of the life of Lars Ahlfors described in his biography by Olli Lehto recently translated to Japanese language.

September 3rd (Thu)

Conference Room I

Narutaka Ozawa (Kyoto Univ.)♭ Uniform amenability at infinity ····· (13:00–14:00)

Summary: Amenability is arguably the most important notion in Analytic Group Theory. While it has numerous applications in various areas, many familiar groups, particularly those that contain non-cyclic free groups, are not amenable. The weaker notion, called exactness or amenability at infinity, was introduced in the late 1990s and has found very useful in Operator Algebra Theory and Geometric Topology. The class of exact groups is considerably wide and contains most of the familiar groups such as linear groups and (relatively) hyperbolic groups. We introduce the notion of uniform exactness, or uniform amenability at infinity, for discrete groups and conjecture that it holds for linear groups and (relatively) hyperbolic groups. As the first step, we prove it for free groups, their limit groups, and their cousins. This shows a novel strong convergence phenomenon that any convergent sequence of such groups in the space of marked groups converges strongly in the operator algebraic sense. In particular, convergence of the spectral radius formula is uniform over probability measures on such groups whose supports have a fixed cardinality.

Conference Room IV

Takeshi Saito (Univ. of Tokyo) Developments of etale cohomology, through its history ···· (13:00–14:00)

Summary: Etale cohomology is a cohomology theory for schemes and was introduced by Grothendieck in 1960s aiming at solving the Weil conjectures, that is a geometric analogue of the Riemann Hypothesis. It does not only define the cohomology groups for varieties but also constructs various functors connecting the derived categories of sheaves on varieties, called the 6 operations. Some of its early developments including the functional equation of the L-functions, the Grothendieck–Ogg–Shafarevich formula can be traced in Grothendieck–Serre correspondence. The index formula generalizing the GOS formula to higher dimension came much later, through the analogy with micro local analysis. We recall some of the developments through its history.

September 4th (Fri)

Conference Room II

Hideo Kozono (Waseda Univ. / Tohoku Univ.) ♭ Helmholtz–Weyl decomposition and magnetohydrodynamic equations ········ (13:00–14:00)

Summary: We first introduce the L^r-Helmhltz–Weyl decomposition in 3D bounded domains with smooth boundary, which means that every L^r-vector field is expressed by the direct sum of the harmonic part, the range of rotation of vector potentials and the range of gradient of scalar potentials. Simultaneously, we establish a unique harmonic representative of the second cohomology group. Next, we address its application to the magnetohydrodynamic (MHD) equations in 3D domains with arbitrary geometry. It will be clarified that the harmonic vector field gives a non-trivial equilibrium state of the MHD equations, and it is exponentially stable provided its L^1-norm is sufficiently small. Finally, we discuss the stationary problem and existence of time-periodic solutions. This is based on joint works with K. Noda (Kyoto Univ.), S. Shimizu (Kyoto Univ.) and T. Yanagisawa (Waseda Univ.).

Conference Room VI

Yuta Koike (Univ. of Tokyo) Denoising diffusion probabilistic models and the Föllmer process ········ (13:00–14:00)

Summary: The Föllmer process is a Brownian motion conditioned to have a pre-specified distribution at time 1. This process can be interpreted as an "augmented" time-compressed version of the reverse stochastic differential equation (SDE) for denoising diffusion probabilistic models (DDPMs). While this fact has been indirectly used to analyze DDPM sampling errors via discretization of the reverse SDE, connections between direct discretization of the Föllmer process and the DDPM sampler have not yet been fully explored. In this talk, we aim to clarify this point while surveying relevant results from existing work.

Foundation of Mathematics and History of Mathematics

September 3rd (Thu) Conference Room VIII

9:00–10:30

1 Katsushi Waki (Yamagata Univ.) Progress report on the digitization of the Sakuma library ····· 15

Summary: This report details the progress of the digitization project for the "Sakuma Library" a collection of rare materials held by the Yamagata University Library, which began in fiscal year 2024.

2 Koichi Hirata (Matsuyama Univ. / Ehime Univ.*) On circle chain problems studied by Chiou Abe ····· 15

Summary: Chiou Abe's circle chain problems are more complex version of Naonobu Anjima's circle chain problems. The chain consists of k sub-circles chain sandwiched between two circles of main n circles chain. In this study, we will examine Abe's circle chain problems from the perspective of inversive coordinates of circles.

3 Noriko Tanaka (Naragakuen Univ.) Methods of expressing factorization in different mathematical schools ····· 15

Summary: In the Seki school, factorization seems to have been practiced beginning with Ajima Naonobu (1732–1798). This suggests that Ajima was most likely the first person in Japan to carry out factorization.In the Saijo school, Aida Yasuaki (1747–1817) expressed procedures similar to factorization by substituting letters for parts of equations. In the Takuma school, Oka Yukitada (?–?) made use of the distinctive notation of the Takuma school to present many examples of complex factorization.

4 Makoto Tamura (Osaka Sangyo Univ.) Overview of the Shuihudi bamboo slips "Suanshu" of the Han Dynasty ····· 15

Summary: The Shuihudi bamboo slips "Suanshu" of Han Dyanasty were unearthed in late 2006, and we inspected some of them in December 2009 ([2]). In 2014, at the international conference on the Beida Qinjian, we learned that a draft report on "SuanShu" had already been completed. The report, which had remained unpublished for a long time, but was eventually published in December 2025 ([1]). In this talk, we will introduce an overview of this "Suanshu".

5 Hideyuki Majima (Ochanomizu Univ.*) On the publications of Jinkouki edited by Yoshida Mitsuyoshi ····· 15

Summary: We discus on articles and books about Jinkouki edited by Yoshida Mitsuyoshi in Edo era.

6 Tsukane Ogawa (Yokkaichi Univ.)
Mitsuo Morimoto (Sophia Univ.*)
Noriko Tanaka (Naragakuen Univ.)
On the equation problems in the *Taisei Sankei* —The concept and calculation method ····· 15

Summary: The equation problems in the *Taisei Sankei* are sometimes lumped together with the elimination method in today's linear algebra, but when examined in detail, this is not necessarily the case. This presentation describes three points. (1) The numbers given in the problem are arranged in a rectangular form, and the equivalent of the modern "sweep-out algorithm" is applied, but only until a single linear representation is obtained, without forcing the diagonal elements to all 1's. (2) The equal signs do not align because the numbers in the question appear in that order. (3) For integer division, some calculations were actually performed using an abacus.

10:40–11:40 Talk Invited by Section on Foundation and History of Mathematics

Nobuo Miura (Kobe Univ.⋆) Who named the Pythagorean Theorem?: Tracing the development of early modern western mathematics through Euclid's Elements

Summary: This lecture addresses the question of how and when the so-called Pythagorean Theorem acquired its now-familiar name. The Pythagorean Theorem is arguably the most widely known theorem in mathematics. It appears with a formal proof in Proposition 47 of Book I of Euclid's Elements, and from antiquity to the present it has been applied across a wide range of mathematical domains. Yet, despite its present ubiquity, the theorem was not referred to by this name in antiquity, nor for many centuries thereafter. This raises a fundamental historical question: who first named it the "Pythagorean Theorem"? Although it is difficult to provide a definitive answer, it is possible to identify candidate texts in which the designation may first have appeared. The lecture begins by surveying scholarly views concerning the discovery of the theorem and its association with Pythagoras. It then examines how the theorem was described and referred to in different historical contexts, including ancient Greek mathematics, the medieval Arabic tradition, the medieval Latin West, and the early modern period. Particular attention is given to the role of Euclid's Elements, not only as the source in which the theorem is classically formulated, but also as a central text in the transmission and transformation of mathematical knowledge. The lecture further argues that the naming of the theorem as the "Pythagorean Theorem" emerges only in the seventeenth century. This development is considered in relation to broader intellectual changes of the period, especially the growing tendency to attach personal names to theorems and laws. Finally, the lecture explores the conditions under which this designation became stabilized and widely accepted, tracing the historical processes through which it has been transmitted into modern mathematical discourse.

11:45–12:00 Mathematics History Team Meeting

14:15–17:30

7 Masato Fujita (Japan Coast Guard Acad.) O-minimal structures possessing finitely many dimension functions ··· 15

Summary: If an o-minimal structure has finitely many dimension functions possessing the van den Dries property, the number of these dimension functions is $2^m - 1$ for some positive integer m.

8 Koki Okura (Univ. of Tsukuba) Distality in ordered abelian groups ····· 15

Summary: Let G be an ordered abelian group. Aschenbrenner, Chernikov, Gehret, and Ziegler showed that if G has finite spines, then it is distal if and only if for any prime p, G/pG is finite. In this talk, we generalize this result by omitting the assumption of finite spines. For a prime p, we define a 'valuation' $\mathfrak{s}_p$ on G. It induces counterparts of value groups and residue fields, called spines and ribs. Our result states that G is distal if and only if for any prime p, the sizes of ribs with respect to $\mathfrak{s}_p$ are uniformly bounded.

9 Akito Tsuboi (Univ. of Tsukuba⋆) A property of algebraic independence in small theories ····· 10

Summary: In stable theories, independence is defined via forking, and the notion of weight is built from this independence relation. In particular, in superstable theories every type has finite weight. This finiteness plays a central role in Lachlan's theorem that superstable Ehrenfeucht theories do not exist. In this talk, we show that an analogous phenomenon concerning weight can be obtained under the much weaker assumption of smallness, without appealing to the stability-theoretic framework.

10 Koichiro Ikeda (Hosei Univ.) Generic structures with infinitely many generators ····· 15

Summary: In this talk, we want to explain the following problem: Is there a saturated generic structure M satisfying that $Th(M)$ is strictly stable and not ω-categorical?

Summary: Coloring problems for infinite structures have long been studied in combinatorics. For example, let M be the random graph, respectively $(\mathbb{Q}, <)$. Then, it is well known that for every finite coloring of the vertices of M, there exists a monochromatic substructure $M_0 \subset M$ such that $M_0 \cong M$. On the other hand, for finite colorings of the edges of M, respectively of the two-element subsets of M, one cannot in general find a monochromatic substructure isomorphic to M.
Akito Tsuboi (2024) proved that, for the random graph, the nonexistence of a monochromatic isomorphic substructure is equivalent to the existence of unbounded independent strict orders: for any substructure $N \subset M$ with $N \cong M$, there is $M_0 \subset N$ with $M_0 \cong M$ such that $\kappa_{\mathrm{srd}}(\mathrm{Th}(M_0, f_c)) = \infty$. In this talk, we show that an analogous result also holds for $(\mathbb{Q}, <)$.

Summary: This talk explains a differential-algebraic comparison between the Ramanujan system for the Eisenstein series E_2, E_4, E_6 and the Schwarzian differential equation of the modular j-function. In a differentially closed field of characteristic zero, the classical formula for j yields explicit differential-rational transformations between the corresponding non-degenerate loci. Combining this comparison with the theorem of Freitag and Scanlon on the strong minimality of this Schwarzian equation, we prove strong minimality of the non-degenerate Ramanujan locus and deduce that the generic type represented by the tuple E_2, E_4, E_6 has Lascar U-rank one.

Summary: We constructed structures with a theory having SOP3 by Hrushovski construction. But if you change parameters then it seems that you will get structures with a simple theory. In SOP3 cases, we will discuss about TP1, TP2 and some propeties implied by NTP2.

Summary: In model theory, various ranks are essential tools for investigating theories, such as the dp-rank in NIP theories. Originating from Shelah's ict-patterns, the dp-rank has been widely investigated, and its properties such as sub-additivity are well known. Recently, the sub-additivity of burden has been proved under dependent dividing by establishing its equivalence to the "NIP dp-rank." Inspired by this approach, this talk introduces "generalized dp-ranks" by considering classes of formulas other than NIP. We investigate their properties, including sub-additivity, aiming to find a universal framework to systematically prove the additivity of various model-theoretic ranks.

Summary: A Hausdorff space X is (topological) n-manifold if every point of X has a neighborhood which is homeomorphic to $\mathbb{R}^n$. It is known that there are exactly four connected 1-manifolds; the real line $\mathbb{R}$, the circle S^1, the long line $\mathbb{L}$, and the long lay $\mathbb{L}_+$. In this talk, under the absence of the Axiom of Choice, there can be a connected 1-manifold which is not homeomorphic to $\mathbb{R}$, S^1, $\mathbb{L}$, and $\mathbb{L}_+$.

Summary: Several classical cardinal invariants of the continuum can be formulated as invariants of the Boolean algebra $\mathcal{P}(\omega)/\mathrm{Fin}$, where Fin denotes the set of all finite subsets of ω. In this talk, we study analogous cardinal invariants for quotient Boolean algebras of the form $\mathcal{P}(X)/\mathcal{I}$, where $\mathcal{I}$ is an ideal on a countable set X. We discuss how these invariants reflect combinatorial properties of the ideal $\mathcal{I}$ for several ideals, including the eventually different ideal $\mathcal{ED}$, its variant $\mathcal{ED}_{\mathrm{fin}}$, and the random ideal $\mathcal{R}$.

Summary: The classical evasion number $\mathfrak{e}$ and the constant evasion numbers $\mathfrak{e}_2^{const}(k)$ are cardinal characteristics related to prediction. In previous work, the speaker introduced the local weak constant evasion numbers. These form an infinite family of cardinal characteristics between $\mathfrak{e}$ and $\mathbf{non}(\mathcal{E})$. In this talk, we further generalize them by introducing parameterized local weak constant evasion numbers $\overline{\mathfrak{e}_2^b}$, where $b \in {}^\omega\omega$ is a sequence of natural numbers.
Our main result establishes a dichotomy for these invariants. For every $b \in {}^\omega\omega$, either $\mathbf{cov}(\mathcal{N}) \leq \overline{\mathfrak{e}_2^b}$ or $\overline{\mathfrak{e}_2^b} \leq \mathbf{non}(\mathcal{E})$. Moreover, which side of the dichotomy holds is determined by the convergence or divergence of the series $\sum_n 2^{-b(n)}$.

Summary: In modern set theory, models of set-theory are constructed starting from a universe (of set theory) in which "we live." The standpoint to consider the totality of these models of set theory as the ultimate objects is called Set-theoretic Multiverse. Even if we want to consider a set-generic version of the multiverse in which we only consider the universes constructed by set forcing extensions and reverse operation thereof, we come up to the problem that, strictly speaking, the generic extensions of the initial universe do not exist since the initial universe V is already the class of all sets. The reverse operation of taking grounds of V is real in the sense that they are uniformly definable by parameters deciding them. In this talk, we show that under one of the extremely strong generic large cardinal axioms the (undefinable) multiverse is reflected down to a set of grounds which is definable in ZFC.

September 4th (Fri) Conference Room VIII

9:10–10:30

Summary: In our former works, based on the toolkit of algorithmic randomness, we presented an operational refinement of the Born rule, called the principle of typicality, for specifying the property of the results of quantum measurements in an operational way. The Wigner's friend paradox is a Gedankenexperiment regarding when and where the reduction of the state vector occurs in a chain of the measurements by several observers. In our former work, we extended the framework of the principle of typicality so that it can be applicable to the situation, such as the Wigner's friend paradox, where apparatuses perform measurements over other apparatuses. In this talk, we propose an improvement of this framework, named Direct PoT, which is still more simple and therefore seems more plausible.

Summary: In algorithmic randomness, universality play a fundamental role in characterizing ML-randomness. This talk focuses on a phenomenon in which the total resources naturally associated with universal detectors are themselves random. We prove that the initial capital of a universal c.e. martingale, the integral of a universal integral test, and the minimal description weight of a weakly universal prefix-free machine are all left-c.e. ML-random reals. In particular, the halting probability of such a weakly universal machine is also ML-random. These results can be viewed as natural extensions of the result that the measures of the components of a universal ML-test are left-c.e. ML-random reals.

21 Gunnar Wilken (Okinawa Inst. of Sci. and Tech. Grad. Univ.) Direct generalization of Goodstein's theorem 15

Summary: We present a most direct method to generalize Goodstein's theorem (Goodstein 1944) and Cichon's independence proof (Cichon 1983). This is demonstrated by a Goodstein principle independent of the fragment Π^1_1-CA_0 of second order number theory. The method is centered around the concept of quotient of a set of ordinals, which allows for a 1-1 correspondence between (unique) ordinal notations and natural numbers and builds on my work on fundamental sequences (Wilken 2026).

22 Satoru Kuroda (Gunma Pref. Women's Univ.) Bounded reverse mathematics of Pfaffian and matchings 15

Summary: We formalize Pfaffian in weak arithmetic theory and prove its basic properties. As applications, two algorithms for computing perfect matchings are formalized and their correctness are proved in some weak systems. Our work improves previously known bounds on the provability of matching algorithms due to Le and Cook.

23 Makoto Kikuchi (Kobe Univ.) Taishi Kurahashi (Kobe Univ.) Computable functions on nonstandard models of arithmetic 15

Summary: We discuss some aspects of computable functions on nonstandard models of arithmetic.

10:40–11:40 Talk Invited by Section on Foundation and History of Mathematics

Yudai Suzuki (Oyama Nat. Coll. of Tech.) ♭ Second incompleteness theorem and reflection principles via ω-models

Summary: In the study of provability, one approach is to understand provability through provability predicates. For example, Gödel's second incompleteness theorem and reflection principles can be seen as kinds of this approach.

It is known that truth in ω-models behaves like provability. In this talk, we introduce some recent results on ω-model versions of the second incompleteness theorem and reflection principles. We also show some applications of these theorems to computability theory, especially to the separations of computability theoretic degrees.

This talk includes joint work with Keita Yokoyama, and joint work with Keita Yokoyama and Juan P. Aguilera.

11:45–12:00 Research Section Assembly

14:15–17:30

24 Tsubasa Kumasaka (Kobe Univ.) Taishi Kurahashi (Kobe Univ.) Fixed points in abstract provability structures 15

Summary: Beklemishev & Shamkanov introduced Abstract Provability Structures (APS) to study Gödel's second incompleteness theorem (G2). An APS is a preordered set with two operators $\Box$ and $\boxtimes$, representing provability and refutability, which enables an abstract and general analysis of G2. We extend their work by studying the fixed points of finite compositions of $\Box$ and $\boxtimes$. In particular, we show that every operation in which $\boxtimes$ occurs exactly twice has an explicitly given fixed point, and that for operations containing a single $\boxtimes$, the existence and uniqueness of fixed points form a hierarchy.

25 Akihiro Ueshima (Kobe Univ.) On non-standard models of arithmetic with incomparable sets of theorems 15

Summary: The incompleteness theorems imply the existence of non-standard models of Peano Arithmetic (PA) that contain non-standard proofs of standard sentences that are actually unprovable in PA. [Kikuchi and Kurahashi 2016] investigates how such non-standard proofs exist within these non-standard models. In this study, we extend the work of [Kikuchi and Kurahashi 2016] by focusing on models understood as forks of incomparable models.

Summary: We discuss the first incompleteness theorem from the viewpoint of extensionality. We study how independent sentences can be effectively constructed for extensions of Peano Arithmetic. We compare several forms of effective finite essential incompleteness and examine whether such constructions can depend only on the extension of a theory.

Summary: In this paper, we investigate arithmetical completeness with respect to finite Kripke models of quantified modal logic. We adapt the finite model embedding techniques of Artemov and Japaridze to two settings involving finite Kripke models. First, for conversely well-founded finite Kripke models of quantified modal logic, we construct a Σ_2 provability predicate together with an arithmetical interpretation that embeds the model into arithmetic. Second, for finite constant domain Kripke models of quantified modal logic, we construct a Σ_1 provability predicate satisfying $\mathbf{D2^U}$ and an arithmetical interpretation yielding such an embedding.

Summary: We study a variant of the modal μ-calculus based on the constructive modal logic CK. We define game semantics for the constructive μ-calculus and prove its equivalence to the birelational Kripke semantics. We then use the game semantics to prove the soundness and completeness of a fully-labeled non-wellfounded proof system for it.

Summary: We study a hybrid logic $\mathbf{Ke}(@)$ with *empty names*, that is, where nominals may fail to refer. We define a Hilbert-style axiomatization for $\mathbf{Ke}(@)$ and prove its soundness and strong completeness. We also study the relation between $\mathbf{Ke}(@)$ and the standard hybrid logic $\mathbf{K}(@)$.

Summary: In nonstandard analysis the halo of a point in a topological space is the intersection of the nonstandard extensions of all its open neighbourhoods. We define a parametric family of modal operators from the halo by varying which elements of the nonstandard extension are admitted as witnesses, and identify four canonical instances. Two recover well-known modalities: the topological closure and the Cantor derivative. A third reduces to Kripke semantics over the specialisation preorder. The fourth, purely nonstandard instance admits only nonstandard witnesses. The Transfer Principle forces it to coincide with the omega-accumulation point operator, a classical topological notion not previously studied in modal logic. Unlike the Cantor derivative, the omega-accumulation operator maps arbitrary sets to closed sets without any separation axiom, yielding an omega-Cantor–Bendixson decomposition on all topological spaces. Axiom 4 holds universally, again without separation conditions. We prove that K4 is the complete logic over infinite spaces, and GL over infinite omega-scattered spaces.

Summary: We focus on *necessitation*, the inference rule $\frac{\varphi}{\Box\varphi}$, and analyze its effect on the computational complexity of satisfiability problems for modal logics.
In this presentation, we show that the satisfiability problems for consistent extensions of N by closed formulas, NR, and ND are NP-complete. we also show that the satisfiability problems for closed fragments of consistent extensions of N by closed formulas are NP-complete, while closed fragments of NR and ND are in P.

Summary: We introduce a new propositional logic, called very weak subintuitionistic logic **VF**, by adapting the relational semantics of Fitting, Marek, and Truszczyński for the pure logic of necessitation **N** to the propositional setting. We prove that **VF** and its closed negative extensions are sound and complete with respect to this semantics, and that they have the disjunction property and the finite frame property. We also prove that **VF** is strictly weaker than the weak subintuitionistic logic **WF** of Shirmohammadzadeh Maleki and de Jongh. Finally, we study modal companions of **VF** and its closed negative extensions via Corsi's modified Gödel translation.

Summary: We first introduce two different families of modal logics in an intuitionistic setting, Intuitionistic Modal Logics (IMLs) and Constructive Modal Logics (CMLs), and discuss why they part company with each other, what motivates their study, and how they compare with each other. We then take a deeper look at the logics that do not fit to the IML and CML traditions, including the logic **FIK** recently introduced by Balbiani et al. Finally, we introduce a new logic **KI**, whose semantics may appear natural from a point of view of classical modal logic, then we show that **KI** is neither a CML nor an IML, very similarly to **FIK**.

Summary: The prenex normal form theorem (PNFT) is a well-known metatheorem on classical predicate logic. It is said to characteristically express the behavior of quantifiers in classical predicate logic. Following earlier work, we consider different forms in which PNFT may hold. We introduce a notion of PNFT of type n, which distinguishes "degrees" of validity of PNFT. We then construct, for every $n \geq 1$, uncountably many intermediate predicate logics enjoying the PNFT of type n. All of these logics have the same propositional fragment as intuitionistic logic.

Summary: Dynamic epistemic logic is the logical study of information flow, knowledge acquisition, and belief revision. Publicly announcing to a group of agents that a formula holds, called a public announcement, is one of the major topics in the field. It is known that there are formulas that change their truth values when announced repeatedly. For a finite or infinite sequence σ of 0s and 1s, we say that a formula is σ-valid if its truth pattern under iterated announcements is always σ whenever the initial truth value matches the first digit of σ. In this talk, we classify all possible notions of σ-validity.

Algebra

September 1st (Tue) Conference Room IV

9:00–12:00

1 Akiyoshi Tsuchiya (Toho Univ.) Classification of Gorenstein simplices of maximal dimension ····· 13

Summary: Lattice polytopes whose Ehrhart rings are Gorenstein form an important class in Ehrhart theory, toric geometry, and commutative algebra. In this talk, we discuss Gorenstein lattice simplices of maximal possible dimension for a fixed degree. A theorem of Di Rocco, Haase, Nill, and Paffenholz implies that if a d-dimensional Gorenstein simplex is not a lattice pyramid and has degree s, then $d \leq 2s-1$. We classify the extremal case $d = 2s-1$ in terms of even binary self-complementary codes. As an application, we obtain the classification of Gorenstein simplices of degrees 3 and 4, including the fact that there are exactly 6 such simplices in dimension 5 and degree 3, and exactly 19 such simplices in dimension 7 and degree 4, up to isomorphism.

2 Akiyoshi Tsuchiya (Toho Univ.) Classification and counting of Gorenstein simplices with a special h^*-polynomial ····· 13

Summary: We discuss Gorenstein lattice simplices with h^*-polynomial $1+t^k+t^{2k}+\cdots+t^{(v-1)k}$. This class generalizes the form that appears in the classification of Gorenstein simplices of prime normalized volume. Hibi, Tsuchiya, and Yoshida classified the case where v is a product of two primes and conjectured that, for general v, the number of equivalence classes depends only on the divisor lattice of v. We prove this conjecture by giving a classification in terms of strict divisor chains and associated combinatorial data, and obtain an explicit counting formula.

3 Koji Matsushita (Univ. of Tokyo) On toric rings associated with root systems ····· 13

Summary: In this talk, we consider toric rings associated with signed posets, which are combinatorial objects arising from root systems. These rings can be regarded as a generalization of Hibi rings. We discuss our results on the divisor class groups of these rings and on a characterization of when they are Gorenstein. If time permits, we will also explain a characterization of their conic divisorial ideals.

4 Kenta Mori (Kwansei Gakuin Univ.)
Ryo Motomura (Toho Univ.)
Hidefumi Ohsugi (Kwansei Gakuin Univ.)
Akiyoshi Tsuchiya (Toho Univ.)
Toric rings of unconditional lattice polytopes ····· 13

Summary: Unconditional polytopes are convex polytopes that are symmetric with respect to all coordinate hyperplanes and arise naturally from anti-blocking polytopes by reflection. We investigate algebraic relations between an anti-blocking lattice polytope and its associated unconditional lattice polytope. We prove that the toric ring of an anti-blocking lattice polytope is normal if and only if the toric ring of the associated unconditional lattice polytope is normal. We also show that the toric ideal of an anti-blocking lattice polytope is generated by quadratic binomials if and only if the same holds for the associated unconditional lattice polytope. As an application, we obtain a graph-theoretic characterization of quadratic generation of symmetric stable set ideals.

Summary: In this talk, we show criteria of canonical trace radical (CTR) property of some Stanley–Reisner rings. Let $\mathbb{K}$ be a field and Δ a simplicial complex. First, we show that if Δ is doubly Cohen–Macaulay over $\mathbb{K}$, then the Stanley–Reisner ring $\mathbb{K}[\Delta]$ is CTR.
Next we consider low dimensional case. First, we show that if $\dim \Delta = 0$, then $\mathbb{K}[\Delta]$ is CTR. Next, we consider the case where $\dim \Delta = 1$. We consider Δ as a graph and show the following: $\mathbb{K}[\Delta]$ is CTR if and only if a vertices with degree 3 or more and 2 or more are adjacent, then the edge between them is a part of a certain cycle.

Summary: We establish a new criterion for Moreno-Socías' conjecture for a fixed tuple $(n; d_1, \ldots, d_m)$. Fröberg's conjecture is known to admit three equivalent formulations in terms of generic properties, existence of a single sequence, and generic sequences. We prove that an analogous equivalence also holds for Moreno-Socías' conjecture. The key step is to show that the coincidence of Hilbert series, obtained from the known equivalence for Fröberg's conjecture, forces the reduced Gröbner bases of a specialized sequence and the corresponding generic sequence to have the same leading monomials. As an application, the verification of Moreno-Socías' conjecture is reduced to constructing a single sequence with the desired properties. We also obtain a similar criterion for a variant concerning ideals whose quotient rings have Krull dimension one.

Summary: We discuss Demazure-type construction of certain graded rings. Our purpose is to develop the construction for seminormal graded rings under certain conditions.

Summary: In this talk, we discuss defining ideals of numerical semigroup rings whose pseudo-Frobenius numbers form an arithmetic progression. We focus on a conjecture stating that the defining ideal is generated by the 2-minors of a certain matrix if and only if the pseudo-Frobenius numbers form an arithmetic progression of length $n-1$, where n denotes the embedding dimension. We explain a proof of this conjecture when the embedding dimension is sufficiently large. We also describe the structure of pseudo-Frobenius numbers and present explicit forms of the corresponding defining ideal

Summary: We solve a question posed by Herzog, Kumashiro and Stamate regarding the upper bound for the multiplicity of a far-flung Gorenstein numerical semigroup.

Summary: In this talk, we give a complete characterization of nearly Gorenstein Rees algebras over two-dimensional regular local rings. Moreover, we discuss several related topics.

Summary: It is well known that a Gorenstein rational singularity is a rational double point. Previously, the speaker announced a classification of nearly Gorenstein rational triple points and a criterion for nearly Gorenstein rational singularities. Using these results, we classified rational surface singularities with multiplicity 4 which are nearly Gorenstein rings.

Summary: The notion of level in a triangulated category, introduced by Avramov, Buchweitz, Iyengar, and Miller, measures the number of mapping cones needed to build a given object out of a specified full subcategory. In this talk, we discuss levels of bounded complexes with respect to resolving subcategories. In the classical case, Altmann, Grifo, Montano, Sanders, and Vu studied levels with respect to projective modules and the New Intersection Theorem for level. Awadalla and Marley studied Gorenstein projective analogues of lower bounds for such levels. The main topic of this talk is to establish lower bounds for levels in terms of resolution dimensions. This recovers results of Awadalla and Marley, and extends them to levels with respect to several other resolving subcategories.

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

Norihiro Hanihara (Kyushu Univ.) Calabi–Yau structures and tilting theory for singularity categories

Summary: In Cohen–Macaulay representation theory, Calabi–Yau triangulated categories arise as the stable category of Cohen–Macaulay modules over certain Gorenstein rings such as commutative rings, (truncated) preprojective algebras, and so on. The stable category is also equivalent to the singularity category in the sense of Buchweitz and Orlov. In the talk, we discuss a lift of the Calabi–Yau property of a triangulated category to its differential graded enhancement, which is called a Calabi–Yau structure. We will explain a systematic construction of Calabi–Yau structures on enhanced singularity categories, and its application to tilting theory.

15:30–18:00

Summary: We develop cocompletion and completion procedures for small abelian categories equipped with dimension functions. The cocompletion process with respect to the dimension function is defined as a combination of Ind-completion and Serre quotient, and we show that it satisfies a certain universal property. For a split abelian category satisfying a certain condition, we prove that the cocompletion of the completion coincides with the completion of the cocompletion.

Summary: Auslander–Bridger, Evans–Griffith, and Auslander–Reiten established deep connections between categories of higher syzygies and torsionfreeness. Auslander's grade conditions play a central role in this relationship. In this talk, we relate Auslander's grade conditions to Serre's conditions. As an application, under suitable finiteness assumptions on homological dimensions, we recover several recent results asserting that higher torsionfreeness follows from Serre's conditions.

Summary: For a field k and a finite acyclic quiver Q, support tilting kQ-modules are known to be in bijection with the clusters of the cluster algebra $\mathcal{A}_Q$ of Q. In this talk, we extend this correspondence from fields to arbitrary ring indecomposable commutative Noetherian rings. More precisely, for such a ring R, 2-term silting complexes over RQ, up to additive equivalence, are shown to correspond bijectively to the clusters of $\mathcal{A}_Q$. As an application, when Q is Dynkin, torsion classes in modRQ are classified by order-preserving maps from Spec$R$ to the poset of clusters.

Summary: The symmetric cohomology was introduced for groups by Staic, and was generalized to cocommutative Hopf algebras by Shiba, Sanada, and Itaba. In this research, we further generalize this notion and define the braided cochain complex and the braided cohomology of braided coalgebras in linear monoidal categories, using monoidal functors from the augmented braided category. As an application, we prove that the braided cochain complex of quasi-triangular bialgebras is a braided Morita invariant. We also provide an example by dealing with the Sweedler Hopf algebra, which is both non-cocommutative and finite-dimensional.

Summary: Recent developments, such as silting theory and derived Morita theory, show that derived categories of connective DG-algebras arise naturally in the representation theory of algebras. Motivated by this perspective, d-truncated connective DG-algebras and their associated d-extended module categories were introduced as higher-dimensional generalizations of algebras and their module categories. In this talk, I will discuss Auslander–Reiten theory for extended module categories over truncated DG-algebras and its connection with higher cluster tilting theory.

Summary: Classification of noncommutative quadric hypersurfaces is one of the major projects in noncommutative algebraic geometry. In recent years, we are dedicated to complete the classification of noncommutative central conics. To achieve this goal, we and other authors develop some theories to study and classify some classes of noncommutative quadric hypersurfaces in a series of papers. In this paper, we completely classify noncommutative central conics by developing a general theory of homogenization and dehomogenization for noncommutative algebras. We show that there are bijections among the following sets of objects:the set of isomorphism classes of 4 dimensional Frobenius algebras, the set of isomorphism classes of noncommutative affine pencils of conics, and the set of isomorphism classes of noncommutative central conics.

Summary: The singularity categories of rational double points are known to be Krull–Schmidt categories. In characteristic zero, the indecomposable objects in these categories have been completely classified, relying on the fact that rational double points are quotient singularities by finite subgroups of the special linear group of degree two. On the other hand, in positive characteristics, since rational double points are not necessarily quotient singularities, how to describe the indecomposable objects in their singularity categories has yet to be investigated thoroughly. In this talk, I will explain a method to determine the indecomposable objects corresponding to the vertices of the Auslander-Reiten quiver of the singularity category for a rational double point defined over an algebraically closed field of arbitrary characteristic.

Summary: Different moduli problems often capture different aspects of the geometry of algebraic varieties. In this talk, I discuss a class of surfaces arising from dihedral reflection groups and explain how their birational geometry can be described in terms of Bridgeland moduli spaces on a natural root stack associated with the maximal resolution. The resulting wall-and-chamber structure describes the MMP of the maximal resolution and is shown, via the derived McKay correspondence, to intersect the region arising from King stability for representations of a noncommutative algebra. As an application, we obtain a new proof of Ishii's conjecture for dihedral reflection groups and place the relation between quiver moduli and surface geometry in the framework of Bridgeland stability. This talk is based on arXiv:2605.22474.

Summary: The geometric Langlands correspondence (GLC) is a geometric analogue of the Langlands conjecture in number theory, relating algebraic geometry, representation theory, and many other areas. Dima Arinkin's 2001 result established the GLC for the case $G = SL_2$ on the complex projective line P^1 with four fixed regular singularities. When one attempts to extend this to five or more singularities, it turns out to be more natural to decompose the correspondence into a Radon transform-type correspondence and a GLC-like correspondence. In this talk, I will explain the calculations of cohomology that support the proof of this GLC-like correspondence in the P^1 with five fixed regular singularities case.

Summary: We construct rank 2 special Ulrich bundles on the Fano threefold of degree 10 with Picard number 2, namely the blow-up of $\mathbb{P}^3$ along a general smooth complete intersection of two cubic surfaces.

September 2nd (Wed) Conference Room IV

9:00–12:00

Summary: Based on S. Mori's proof of the existence of 3-dimensional flips for an extremal neighborhood $(X, C) \subset \mathbb{C}^4$ of irreducible reducble exrremal curve C with type k1A, k2A by using "2-game" between $l(P), q(P)\,(P \in D \in |-K_X|)$ related to extension of $S^2(\mathrm{gr}^1_C\,\Omega^1_X)$ under abundance property ([S.Mori 1988]), the author had studied 1)–2) as follows ([the auhor,2018-2026]): 1) 3-dimensional Miyaoka–Yau type inequality $(\mathrm{MY})_{3,c_3}$ with $c_3 := c_3(X)$ for such a (X, C), and 2) similar such an inequality $(\mathrm{MY})_{3,c_3,S^2}$ for $(\mathrm{MY})_{3,c_3}$ under extension of $S^2(\mathrm{gr}^1_{C_s}\,\Omega^1_X)$ in (X, C_s) with reducible $C =: C_s$, regarding to followings i)–iii): for such a C_s, i) Higgs sheaves $(\mathscr{E}, \theta_s)$ associated to such 2-game under the cofibered products $({}^2_1\square^1_0)_\sharp$ of C_s, ii) for infinitesimals $\Delta^{\cdot}_{(i)}\,(i \in [1, 2])$ of (tri-)diagonals $\Delta_{(1)}$ (or, $\Delta_{(2)}$) in $({}^2_1\square^1_0)_\sharp$, differential operators $\mathscr{D}_{(1)} := \mathscr{D}\!\mathit{iff}^{\cdot}_{(1)}(i = 1$ case) (or, $\mathscr{D}_{(2)} := \mathscr{D}\!\mathit{iff}^{\cdot}_{(2)}$ $(i = 2$ case)) as corresponding to $\mathscr{E}$ in i), and iii) for topologicality associated to valuative extensions of $(\underline{\nu}, \underline{P})$, homological equvalence deformations for c_1^3, c_1c_2 with $c_i = c_i(X)$ in $(\mathrm{MY})_{3,c_3,S^2}$ by CH_0 as Chow cycle complexes via $\Delta^{\cdot}_{(i)}$ ([S.Bloch-V.Srinivas 1983]) and via Hodge module (M, K, F, V) for $\mathscr{D}^{\cdot}_{(i)}$ with weights $w_\bullet\,(\bullet \in \{\underline{\nu}, \underline{P}\})$ from $(\underline{\nu}, \underline{P})$ under related triple cover ([R.Miranda 1985]). In this talk, the author reports mainly followings A) and B): A) to formulate (c_2, c_3)-(or,c_3-)sectional genera analogues by (rapidity related to) $\kappa_\nu(D) = \kappa_\sigma(D)$ ([N.Nakayama 2004]) under limit of θ_s as such 2-game or extension of $S^2(\mathrm{gr}^1_{C_s}\,\Omega^1_X)$ for c_1-sectional genera in the case of pseudo-effective divisor as in the tautological divisor ([Y.Miyaoka 1977]), and B) to give automorphisms of movable cone $\mathrm{Mov}(X)$ for (X, C_s) following to A) by degenerations of the complexes K in (M, K, F, V) associated to homological equivalence deformations with $w_\bullet$ as "characters" of related 2-groups.

Summary: In this talk, we study polarized smooth projective varieties (X, H) for which an exterior power $\bigwedge^r T_X$ of the tangent bundle is an H-Ulrich bundle. Our main result gives a complete classification in the case of Picard number one. More precisely, if X is a smooth projective variety of dimension $n \geq 2$ with $\rho(X) = 1$ and $\bigwedge^r T_X$ is H-Ulrich for some $0 < r < n$, then $(X, H) \simeq \left(\mathbb{P}^2, \mathcal{O}_{\mathbb{P}^2}(2)\right)$.

Summary: The study of rational curves on Fano varieties in positive characteristic presents several difficulties. One such difficulty is the existence of inseparable maps, which may yield pathological components of the moduli spaces of rational curves. In this talk, we discuss how to overcome this difficulty, and describe some results on the structure of moduli spaces of rational curves on certain del Pezzo varieties in positive characteristic.

Summary: We formulate algebraic cobordism as the universal oriented cohomology theory on an ∞-category of spans. After recalling the axioms on line bundles and admissible morphisms, we state the universal property of the resulting cobordism spectrum. We then apply the span formalism to perfectoid v-stacks and state the tilting invariance

$$\mathrm{MGL}_{\mathrm{perf}}(R) \simeq \mathrm{MGL}_{\mathrm{perf}}(R^\flat)$$

for a perfectoid algebra R and its tilt $R^\flat$.

Summary: In the late 20th century, Gel'fand, Kapranov, and Zelevinsky (GKZ) developed a modern theory of discriminants and resultants. Central to their theory is a polynomial called the principal A-determinant. This polynomial led to the discovery of the secondary polytope and is one of the origins of combinatorial algebraic geometry. Topologically, its zero locus coincides with the Euler discriminant locus of toric hypersurfaces with a fixed monomial support. In this talk, we introduce the principal matroid determinant for a realizable matroid and report an analog to the GKZ theory. In our framework, reciprocal linear spaces replace toric varieties, while matroids and their flats replace the roles of convex polytopes and their faces.

Summary: For a generic one-parameter degeneration of projective hypersurfaces, we show that the periods of the limiting mixed Hodge structure are generated by certain special values of logarithm, Gamma and Dirichlet L-functions. Our proof is based on the analytic continuation of solutions to the GKZ system.

Summary: The speaker will introduce a family of lattice polarized K3 surfaces. The period mapping for the family enables us to identify a five dimensional weighted projective space and the Looijenga compactification, that is defined by a hyperplane arrangement, of a bounded symmetric domain. The deformation parameters of the family of K3 surfaces are closely related with invariants of the complex reflection group of exceptional type with the maximal rank.

30 Ryo Ohashi (Univ. of Tokyo) Superspecial plane quintic curves and Gaussian hypergeometric series 13

Summary: In this talk, we study plane quintic curves with cyclic automorphism groups of orders 8 and 10. These curves are represented by one-parameter families, and their superspeciality can be characterized explicitly in terms of truncated Gaussian hypergeometric series. Using this characterization, we determine the exact number of isomorphism classes of superspecial plane quintic curves with automorphism groups of order 10. We also develop an efficient algorithm for enumerating such curves with automorphism groups of order 8, and present computational results for characteristics between 13 and 10000.

31 Ryunosuke Nakano (Hokkaido Univ.), Keiji Matsumoto (Hokkaido Univ.) Algebro-geometric aspects of a certain limit theorem expressed by the hypergeometric series $F(\frac{1}{6}, \frac{1}{2}, 1; x)$ 13

Summary: The algebro-geometric prototype is Gauss's arithmetic-geometric mean, whose common limit is expressed by the hypergeometric series $F(\frac{1}{2}, \frac{1}{2}, 1; x)$; Jacobi's period formula relates the periods, theta constants and hypergeometric series of the Legendre family of elliptic curves. We develop this framework (periods, Jacobi-type formula, isogeny) for the case where $F(x) = F(\frac{1}{6}, \frac{1}{2}, 1; x)$ arises as a period. From the genus-three curve $C(x)\colon w^6 = z^5(z-x)(z-1)^3$, we form an elliptic curve E_λ as a quotient by an involution and realize $F(x)$ as its normalized period. We establish an analogue of Jacobi's formula, and prove that iterating the pair of maps M_1, M_2 arising from the degree-two isogeny gives a common limit $M(a_0, b_0) = a_0/F(\frac{1}{6}, \frac{1}{2}, 1; 1-(b_0/a_0)^3)^2$.

32 Shuhei Tsujie (Hokkaido Univ. of Edu.), Masamichi Kuroda (Nippon Bunri Univ.) The characteristic quasi-polynomials of non-crystallographic root systems $\mathrm{H}_2, \mathrm{H}_3$, and H_4 10

Summary: The characteristic quasi-polynomial of a hyperplane arrangement over the ring of integers was introduced by Kamiya, Takemura, and Terao as a generalization of the characteristic polynomial. In particular, characteristic quasi-polynomials associated with crystallographic root systems are known to possess several remarkable properties. Characteristic quasi-polynomials can also be defined for hyperplane arrangements over the ring of integers of an algebraic number field. In this talk, we report on the relationship between the characteristic quasi-polynomials of the non-crystallographic root systems H_2, H_3, and H_4, and those of the crystallographic root systems A_4, D_6, and E_8.

33 Yukino Yagi (Univ. of Osaka), Masahiko Yoshinaga (Univ. of Osaka) Filtered Varchenko–Gelfand algebras of hyperplane arrangements and oriented matroids 13

Summary: The Varchenko–Gelfand (VG) algebra is defined as the algebra of R-valued functions on the chambers of a real hyperplane arrangement. This algebra has a natural filtration by the degree with respect to Heaviside functions, giving rise to the associated graded VG algebra. While the graded algebra is isomorphic to the Orlik–Solomon algebra when the coefficient ring R is an integral domain of characteristic 2, we investigate VG algebras over coefficient rings of characteristic different from 2. Specifically, we study to what extent VG algebras determine the underlying oriented matroid structures. Our main result shows that for arrangements generic in codimension 2, the oriented matroid can be recovered from both the filtered and graded VG algebras.

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

Atsushi Takahashi (Univ. of Osaka) Mirror symmetry and full exceptional collections in derived categories

Summary: A Frobenius manifold is a complex manifold whose tangent sheaf carries a Frobenius algebra structure satisfying certain flatness conditions. In mirror symmetry, Frobenius manifolds arising from Gromov–Witten theory are expected to be isomorphic to those arising from deformation theory. This notion originates in Kyoji Saito's theory of primitive forms and was later axiomatized by Dubrovin in the context of two-dimensional topological field theories. Derived categories also admit several realizations, for instance via coherent sheaves on algebraic varieties and Lagrangian Floer theory. Kontsevich's homological mirror symmetry predicts equivalences between such categories. Moreover, full exceptional collections are expected to reflect monodromy phenomena, as illustrated by Dubrovin's conjecture relating the monodromy data of semisimple Frobenius structures to their numerical data. Bridgeland showed that the space of stability conditions on a triangulated category has a natural complex manifold structure, and physical intuition suggests that it should carry a Frobenius structure. A central problem is to understand this space in terms of the above categorical data. We expect semiorthogonal decompositions of a derived category to provide an important clue; in particular, "good" ones should induce a stratification of the space of stability conditions. As a first step, we study full exceptional collections, expected to correspond to maximal-dimensional strata, and examine the relevant compatibility properties. This talk surveys our recent results from this perspective.

September 3rd (Thu) Conference Room IV

9:00–12:00

34 Yuto Nogata (Hirosaki Univ.) Cyclotomic numbers of order $q-1$ over $\mathbb{F}_{q^r}$ ····· 13
Hayaki Kudo (Hirosaki Univ.)

Summary: Let $q = p^n$, $r \in \mathbb{Z}_{\geq 2}$, $e = q-1$, and $k = \frac{q^r-1}{e}$. In this talk, we discuss the cyclotomic numbers $(a,b)_{q-1}$ over $\mathbb{F}_{q^r}$. We prove that $(a,b)_{q-1} \leq \lceil \frac{k}{2} \rceil$ for all $0 \leq a, b \leq q-2$ except when $q = 2$ and $r \geq 3$. We also give sharper bounds for prime values of r, especially for $r = 2$ and $r = 3$.

35 Koichi Betsumiya (Hirosaki Univ.) Codes generated by matrices whose co-ranks are cyclotomic numbers
Yusuke Kasai (Hirosaki Univ.) ····· 13
Hayaki Kudo (Hirosaki Univ.)
Yuto Nogata (Hirosaki Univ.)

Summary: Cyclotomic numbers $(a,b)_e$ are deeply related to the separation of $\mathbb{F}_q$ by cyclotomic cosets. We consider linear codes $C_{(a,b)}$ generated by the matrix $C^{(a,b)}$ whose corank is a cyclotomic number. We classify the structure of $C_{(a,b)}$ depending on the parameter a. In particular, we have $(a,b)_e \leq \frac{k}{2}$ for $a = \frac{e}{2}$.

36 Shusei Narumi (Hirosaki Univ.) On the number of k-full integers between successive k-th powers ····· 13
Yohei Tachiya (Hirosaki Univ.)

Summary: Let $k \geq 2$ be an integer. In this talk, we will investigate the distribution of k-full integers between three successive k-th powers. More precisely, for any integers $\ell, m \geq 0$, we establish the explicit asymptotic density for the set of integers n such that the intervals $(n^k, (n+1)^k)$ and $((n+1)^k, (n+2)^k)$ contain exactly ℓ and m k-full integers, respectively. As an application, we present that there are infinitely many triples of consecutive perfect k-th powers in the sequence of k-full integers.

Summary: We study the lattice point problem for generalized circles $|x_1|^p + |x_2|^p = r^p$, called p-circles (Lamé curves), in the cuspidal range $0 < p < 1$. Our focus is the lattice point error term $P_p(r)$ and its optimal exponent α_p. Unlike the classical case $p = 2$, which is closely related to Hardy's identity and Bessel functions, the cuspidal case remains poorly understood. Restricting to the countable family with $(2/p) \in \mathbb{N}$, called astroid-type p-circle, we introduce generalized p-Bessel functions associated with distorted angular components. In previous work, we derived a Hardy-type identity giving an explicit oscillatory representation of P_p. In this talk, we show that these generalized p-Bessel functions possess a hierarchical structure generated by Erdélyi–Kober-type fractional integral and differential operators. This yields order-shift formulas and suggests the effectiveness of fractional analytic methods for cuspidal lattice point problems.

Summary: We study the transcendence of the Mahler-type infinite products generated by second-degree polynomials.

Summary: Let $\varphi(n)$ denote the Euler totient function. We study the analytic part associated with the summatory function of $\sigma_1(n)$ and obtain explicit bounds under the Riemann Hypothesis. In particular, we establish an upper bound of order $x^{\delta'} \exp\left(\frac{\log x}{\log\log x}\right)$, where $\delta' = \max\{1/2, \delta\}$.

Summary: In 1970, T. M. Apostol introduced a generalization of the Möbius function. In 2001, A. Bege further generalized this function. Since then, several researchers have studied the partial sums of these functions. In this talk, we present improved estimates for the partial sums of Bege's generalized Möbius functions.

Summary: Denote by $\omega_z(n)$ the number of distinct prime divisors $p \le z$ of the natural number n. Using an idea by Granville and Soundararajan we investigate $\sum_{n\le x} (\omega_z(n) - \log\log z)^k$. Fix an integer $k \ge 2$. For sufficiently large x and $z \ge e^e$ with the restriction $z \le x^{1/k}$, we show a precise asymptotic formula for the sum.

Summary: We consider the value-distribution of the Euler–Zagier type multiple zeta-functions with identical arguments on the critical line. Mishou showed the set of the values of the Euler–Zagier double sum with identical arguments on the critical line is dense in the complex plane under the Riemann Hypothesis. In this talk, we generalize Mishou's result to the r-fold Euler–Zagier multiple zeta-functions with identical arguments for $r \ge 4$.

Summary: We study Laurent series expansions of the Barnes multiple zeta function

$$\zeta_r(s, a; w_1, \dots, w_r) = \sum_{m_1,\dots,m_r \geq 0} (a + m_1 w_1 + \cdots + m_r w_r)^{-s}.$$

Explicit formulas are obtained for the constant term and higher Laurent coefficients at $s = r$. We also determine the corresponding coefficients at the remaining poles $s = r - j$ $(1 \leq j \leq r - 1)$, expressing them in terms of polygamma functions and their higher derivatives.

Summary: The Schur multiple zeta functions introduced by Nakasuji–Phuksuwan–Yamasaki are defined as sums over semi-standard Young tableaux, which is analogous to the tableau representation of classical Schur functions. While the product of Schur functions expands as a linear combination of Schur functions, the product of Schur multiple zeta functions is known to expand into a similar form by taking the summation over all variable permutations (i.e., under the action of symmetric group S_n, where n is the number of variables). In this talk, we introduce refined formulas by restricting the group action on the sum, from S_n to its subgroup S_m that fixes the remaining $n - m$ variables. Furthermore, we present an extension of this restriction to the alternating group A_m for certain special cases.

Summary: In this talk, I will discuss an explicit formula for the special values of the p-adic multiple L-functions introduced by Furusho, Komori, Matsumoto, and Tsumura. I will begin by recalling a formula of Furusho and Jarossay, which expresses these special values as infinite sums of cyclotomic multiple harmonic values whose coefficients are cyclotomic multiple Bernoulli numbers. The main result of this talk gives a more explicit form of this expression by describing these coefficients in terms of special values of generalized Euler–Zagier–Lerch type complex multiple zeta functions. To obtain this result, I will recall twisted multiple Bernoulli numbers, which are precisely such special values, and then explain an explicit formula expressing cyclotomic multiple Bernoulli numbers in terms of twisted multiple Bernoulli numbers. I will conclude by writing out the resulting formula explicitly in low-depth cases.

12:00–12:30 Research Section Assembly

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

Wataru Kai (Tohoku Univ.) ♭ Linear patterns of prime elements in number fields and their connection to Hilbert's Tenth Problem

Summary: Let K be a number field and $\mathcal{O}_K$ its integers. I will discuss when a given set of finitely many polynomials of degree 1 with $\mathcal{O}_K$-coefficients can take simultaneous prime values in $\mathcal{O}_K$. This builds upon my former joint work with Mimura, Munemasa, Seki and Yoshino, and extends work of Green–Tao–Ziegler for the case $K = \mathbb{Q}$.

I will also mention how the main result was used independently by Koymans–Pagano, Alpöge–Bhargava–Ho–Shnidman and Zywina to draw an even more negative answer to Hilbert's Tenth Problem (on determining solvability of Diophantine equations, original negative answer in 1970) via constructions of elliptic curves and abelian varieties of specified ranks.

15:30–18:00

Summary: Let $k = \mathbb{Q}(\sqrt{m})$ be a real quadratic field. We developed a new algorithm and verified that the Iwasawa invariant $\lambda_2(k)$ vanishes for $m < 10^6$. This talk is based on joint work with K. Komatsu, T. Fukuda, and N. Kumakawa.

Summary: Let p be a prime number and $k/\mathbb{Q}$ a finite extension. Let K/k be a $\mathbb{Z}_p$-extension. A result of Ozaki shows that the maximal finite submodule of unramified Iwasawa modules and capitulations in K/k are closely related. In this talk, we extend Ozaki's result to certain $\mathbb{Z}_p^d$-extensions.

Summary: For the cyclotomic $\mathbb{Z}_2$-extension k_∞ of an imaginary quadratic field k, we consider whether the Galois group $G(k_\infty) = \mathrm{Gal}(\mathcal{L}(k_\infty)/k_\infty)$ of the maximal unramified pro-2-extension over k_∞ is metabelian or not. To investigate whether examples of metabelian type exist, we study the 2-class field towers of intermediate fields k_n in k_∞/k. In this work, we exhibit certain imaginary quadratic fields k for which $G(k_1)$ are metabelian and have cyclic commutator subgroups.

Summary: In this talk, we study the Iwasawa λ-invariant of the cyclotomic $\mathbb{Z}_2$-extension of a real quadratic field $\mathbb{Q}(\sqrt{p_1p_2p_3p_4})$, where p_1, p_2, p_3 and p_4 are distinct odd prime numbers satisfying certain arithmetic conditions. Greenberg's conjecture asserts that the Iwasawa λ- and μ-invariants vanish for the cyclotomic $\mathbb{Z}_l$-extension of any totally real number field and any prime number l. While several infinite families of real quadratic fields satisfying the conjecture for $l = 2$ are known, their discriminants have at most three odd prime factors. We present a new infinite family of real quadratic fields with exactly four odd prime factors satisfying Greenberg's conjecture for $l = 2$.

Summary: For a number field k and an odd prime number p, we consider the maximal multiple $\mathbb{Z}_p$-extension $\tilde{k}$ of k and the unramified Iwasawa module $X(\tilde{k})$, which is the Galois group of the maximal unramified abelian p-extension of $\tilde{k}$. In this talk, we classify the CM-fields k in which p splits completely and for which $X(\tilde{k}) = 0$.

Summary: In this talk, we give a computable criterion of the triviality of the unramified Iwasawa module over the maximal multiple $\mathbb{Z}_p$-extension of a CM-field satisfying some basic assumptions. The criterion is a generalization of Gold's theorem on imaginary quadratic fields, and is based on the Koch type presentation of a pro-p Galois group with restricted ramification, which is analogous to the Milnor presentation of a link group from a viewpoint of arithmetic topology.

52 Mahiro Tokizane (Univ. of Osaka) Stark–Heegner points and the class number one problem for real quadratic fields of Richaud–Degert type ··· 13

Summary: Gauss conjectured that there are infinitely many real quadratic fields with class number 1. This problem remains one of the most important unsolved problems. On the other hand, it is known that there are only finitely many real quadratic fields of the so-called Richaud–Degert (R-D) type with class number 1 (Mollin–Williams). Recently, Caeiro and Darmon discovered a new approach using Stark–Heegner points, which are real quadratic analogues of Heegner points. In this talk, we generalize their method. Assuming the rationality of Stark–Heegner points and other conditions, we show that we can completely determine those of class number 1 among $(\mathbb{Q}(\sqrt{(an)^2 \pm 2a}))$, which is a special case of R-D type real quadratic fields.

53 Takenori Kataoka (Tokyo Univ. of Sci.) Construction of graph coverings with prescribed Iwasawa invariants ·· 13

Summary: A fundamental result in Iwasawa theory for graphs is an analogue of Iwasawa's class number formula. The first main result of this talk is that every pair of non-negative integers can be realized as the Iwasawa λ- and μ-invariants of a $\mathbb{Z}_p$-covering of graphs. The second extends this to multiple $\mathbb{Z}_p$-coverings.

54 Yukiko Yanagida (Tohoku Univ.) ♭ Counting cycles in isogeny graphs via the trace of Hecke operators ··· 13

Summary: Estimating the number of cycles in finite graphs is important for understanding graph structures and for potential applications to cryptography. In this talk, we focus on supersingular isogeny graphs.
For distinct primes $p \neq l$, we consider the isogeny graph $G_1(p, l)$ and study estimates for the number of its cycles. We first review bounds depending on p, and then present our main theorem, which is independent of p in certain cases.
To estimate the number of cycles, we use the Ihara zeta function associated with graphs and the trace formula for Hecke operators. We explain the relationship between the Ihara zeta function and the number of cycles, and discuss connections with estimates arising from trace formulas for Hecke operators.

55 Jinbo Yu (Nagoya Univ.) Schur–MacMahon q-series ··· 13
Henrik Bachmann (Nagoya Univ.)

Summary: Quasimodular forms appear in multiple areas of mathematics, including number theory, enumerative geometry, and combinatorics. However, finding a $\mathbb{Z}$-spanning set for the space of quasimodular forms with integer coefficients remains an open problem. In this talk, we introduce the Schur–MacMahon q-series, which are mixed weight quasimodular forms. We prove that this family spans the ring of quasimodular forms over $\mathbb{Q}$. Furthermore, we conjecture that it forms a $\mathbb{Z}$-spanning set for the space of integer coefficient quasimodular forms. As evidence, we prove that the space spanned by this family over $\mathbb{Z}$ is closed under the derivation $q\frac{d}{dq}$.

September 4th (Fri) Conference Room IV

9:00–12:00

56 Naoki Ochi (Nagoya Univ.) Minimum obstruction modulus of primitive, positive definite integral binary quadratic forms ··· 13

Summary: Let $Q(x, y)$ be a positive definite integral binary quadratic form. It is known that there exist integers k, m such that $Q(x, y)$ cannot represent m modulo k. This congruence condition is called a "local obstruction." In this talk, we define the "minimum obstruction modulus of $Q(x, y)$" and present an explicit formula for it in the case of primitive, positive definite integral binary quadratic forms.

Summary: For each non-negative integer N and positive integer ℓ, a periodic continued fraction (PCF) of the form $[a_1, ..., a_N, \overline{a_{N+1}, ..., a_{N+\ell}}]$ is called (N, ℓ)-type. In 2021, Brock–Elkies–Jordan generalized the theory of PCFs over $\mathbb{Z}$ to the ring of integers in a number field. In particular, they considered the case where the number field is an intermediate field of the $\mathbb{Z}_2$-extension over $\mathbb{Q}$ and asked whether an (N, ℓ)-type PCF for X_n exists. In this talk, we answer their question for types $(1, 2)$ and $(0, 3)$.

Summary: This talk studies a generalization of the discrete part of the Markov–Lagrange spectrum. Classically, Markov numbers arise as positive integer solutions of the Markov equation $x^2 + y^2 + z^2 = 3xyz$ and are closely related to the discrete Markov–Lagrange spectrum.
We consider the generalized Markov equation $x^2 + y^2 + z^2 + k_1yz + k_2zx + k_3xy = (3 + k_1 + k_2 + k_3)xyz$, where $k_1, k_2, k_3 \geq 0$, and study the generalized Markov numbers appearing in its positive integer solutions. The main result shows that these numbers naturally produce elements of the Markov–Lagrange spectrum. More precisely, if n is a (k_1, k_2, k_3)-generalized Markov number appearing in position i, then $\sqrt{((3 + k_1 + k_2 + k_3)n - k_i)^2 - 4}/n$ is realized as the Lagrange constant of a quadratic irrational number.

Summary: Rosen introduced the ring of finite algebraic numbers $\mathcal{P}^0_{\mathcal{A}}$ as a subset of $\mathcal{A} = \prod \mathbb{F}_p / \bigoplus \mathbb{F}_p$. In this talk, we show that the sequence of Frobenius traces for any elliptic curve over $\mathbb{Q}$ is finite transcendental by using the Sato–Tate conjecture. In addition, we prove a similar result for principally polarized abelian varieties over $\mathbb{Q}$ whose associated ℓ-adic Galois representations are surjective.

Summary: In this talk we consider deformations of Galois representations associated to Hilbert modular forms. In particular, we discuss the structure of the deformation ring of infinite level obtained by Taylor–Wiles–Kisin patching. We then give a condition for when it is formally smooth over O, where O is the ring of integers of a finite extension of $\mathbb{Q}_l$.

Summary: Frobenius–Witt differentials, introduced by T. Saito in 2022, play an important role in the theory of characteristic cycles in mixed characteristic. In particular, Saito proved that, for a regular Noetherian scheme X over $\mathbb{Z}_{(p)}$ satisfying a certain finiteness condition, the sheaf $F\Omega_X$ of Frobenius–Witt differentials of X is a locally free $\mathcal{O}_{X_{\mathbb{F}_p}}$-module of "correct" rank. In this talk, the speaker will introduce "log" Frobenius–Witt differentials and give a "log analogue" of the above result.

Summary: The Coleman–Chabauty method, introduced by Coleman (1985), is well known as a way to explicitly determine the rational points of an algebraic curve. Based on Coleman's p-adic integration, this method provides an upper bound for the number of rational points of an algebraic curve under certain conditions. The speaker has introduced a new concept, called the Torsion Packet Envelope, as a method for determining the rational points of algebraic curves. In this talk, we will present this method together with some of its applications to Diophantine problems.

63 Hohto Bekki (Saga Univ.) On integral representations of Catalan's constant and Apéry's constant · · · · · 13

Summary: The Beilinson conjectures predict that (the transcendental part of) special values of L-functions of motives are described by their regulators. Motivated by the work of Otsubo, who gave explicit computations of the regulators of Fermat curves, we aim to find some explicit formulas for the regulators of higher-dimensional Fermat hypersurfaces. In this talk, I would like to report on some curious integral representations of Catalan's constant and Apéry's constant that we observed in the course of this project. This talk is based on joint work in progress with Lambert A'Campo, Steven Charlton, Aleksander Horawa, Finnley Paolella, Constantin Torp, and Antonia Zerbs.

64 Sin Yi Tsang (Ochanomizu Univ.) Skew braces with a trivial automorphism group · · · · · 13

Summary: For a group G, it is known that $\mathrm{Aut}(G) = 1$ if and only if $|G| = 1, 2$. For a skew brace A, it is natural to ask whether $\mathrm{Aut}(A) = 1$ if and only if $|A| = 1, 2$. This turns out to be false—using `GAP`, we found that there are skew braces A of order 24 and 54 for which $\mathrm{Aut}(A) = 1$. A classification of the skew braces A with $\mathrm{Aut}(A) = 1$ seems to be difficult. In this talk, we present our new result, which states that for each odd prime p, there is a skew brace A of order $2p^3$ such that $\mathrm{Aut}(A) = 1$. We will discuss the construction and some future problems.

65 Xichuan Tan (Univ. of Tsukuba) Log chiral de Rham complex and A_n-singular surfaces · · · · · 13

Summary: We present a construction of the chiral de Rham complex over an algebraic surface with at most rational singularities of A_n-type. An explicit formula for the character of the chiral structure sheaf is also provided.

66 Hiroshi Yamauchi (Tokyo Woman's Christian Univ.)
Ching Hung Lam (Academia Sinica) Classification of real forms of lattice vertex algebras · · · · · 13

Summary: We classify real forms of lattice vertex algebras. This talk is based on joint work with Ching Hung Lam.

67 Kenichiro Tanabe (Tokyo City Univ.) On irreducible weak modules for the fixed-point subalgebra of the Heisenberg vertex operator algebra · · · · · 13

Summary: We give a new series of irreducible weak modules for the fixed-point subalgebra of the Heisenberg vertex operator algebra.

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

Hideya Watanabe (Rikkyo Univ.) Quantum coordinate coalgebras and bi-$\imath$-crystals

Summary: A quantum symmetric pair, which is a quantization of a symmetric space G/K, consists of a quantized enveloping algebra U_q of the Lie algebra of G and its coideal subalgebra $U^\imath$. The coideal subalgebra $U^\imath$ is a quantization of the Lie algebra of K, and is referred to as an $\imath$-quantum group. Quantum symmetric pairs can be thought of as generalizations of quantum groups (= quantized enveloping algebras). Many important results involving quantum groups, such as universal R-matrices, canonical bases, and crystal bases, have been extended to quantum symmetric pairs. It is well-known that the Hopf dual A_q of U_q is a quantization of the coordinate ring of the affine variety G. The quantum coordinate algebra A_q has the (dual) canonical basis and the crystal basis with a bi-crystal structure. When G is of type A, the bi-crystal is related to classical combinatrics such as Robinson–Schensted–Knuth correspondence. The aim of this talk is to extend this construction to quantum symmetric pairs and see what kind of combinatrics would arise as bi-$\imath$-crystals.

15:30–18:00

Summary: Groupoids generalize groups and arise in many areas of mathematics. We introduce crossed Burnside rings of finite groupoids. For a finite groupoid $\mathcal{G}$ and a $\mathcal{G}$-monoid S, the crossed Burnside ring is defined as the Grothendieck ring of the slice category $\mathrm{Set}^{\mathcal{G}}/S$. For the conjugation action, it contains the ordinary Burnside ring of $\mathcal{G}$ as a subring. We also describe a relation between Burnside rings with the Hadamard product and action groupoids. Finally, we prove that the crossed Burnside ring of a finite groupoid decomposes as a direct product of the crossed Burnside rings of the isotropy groups of its connected components.

Summary: Let G be a finite group and let K be a field of charateristic 0. Let $KB(G)$ be the Burnside ring of G over K. We construct an element $\sigma^G \in KB(G)$, which gives a rational number $m(G)$ that is the sum of the inverses of the element orders in G, by using the deflation morphism $\mathrm{Def}^G_{G/G}$.

Summary: To define the q-deformed rational numbers, Morier-Genoud and Ovsienko introduced the subgroup G_q of $GL(2, \mathbb{Z}[q^{\pm 1}])$ for which $G_q/Z(G_q)$ is isomorphic to the modular group. Let ζ_n be a primitive n-th root of unity. We show that the specialization of G_q at $q = \zeta_n$ is finite if and only if $n = 2, 3, 4, 5$, while the case $n = 6$ is still "mild". When $n = 3, 4$ (resp. $n = 5$), the specialization is closely related to the binary tetrahedral group (resp. binary icosahedral group). We also give an application to the normalized Jones polynomials of rational links.

Summary: Among the finite groups of Lie type, Suzuki and Ree groups are most mysterious because they are not rational points of algebraic groups. However, Naert showed in his dissertation that they are given by groups over twisted rings. We define Lie algebras over twisted rings and compute the Lie algebras of Suzuki and Ree groups. We give an explicit description of the Cartan subalgebras and root spaces.

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 talk, we determine the m-thickness of all the irreducible representations of S_n ($n \leq 5$) over a field of characteristic 0.

Summary: We present a method to study the m-thickness of finite-dimensional irreducible representations of complex connected simple Lie groups via the structure of their weight posets. As a result, we proved the conjecture that m-thickness implies $(m-1)$-thickness for any WMF irreducible representation.

Summary: James's conjecture predicted a strong characteristic-independence property for decomposition numbers of type A Hecke algebras in blocks whose weight is smaller than the characteristic of the coefficient field. We describe a new explicit counterexample to this conjecture. The counterexample occurs in surprisingly small rank and is found by the explicit computation of a Gram matrix for the relevant Specht module.

Summary: In the module category $\mathsf{mod}A$ of a finite dimensional algebra A, a torsion class $\mathcal{T}$ is said to be compact if it is generated by a single module. This and the dual condition define the notion of bicompact torsion classes. I conjecture that a torsion class is bicompact if and only if it is functorially finite, and prove it for hereditary algebras and also for semistable torsion classes. This gives that Demonet Conjecture implies Enomoto Conjecture, both of which are important conjectures on brick infiniteness.

Summary: We describe the set of irreducible components of representation varieties of 2×3 persistence modules and describe the Kashiwara operators.

Summary: Two-sided tilting complexes are complexes of bimodules whose derived tensor functors induce derived equivalences between algebras. In 1991, Rickard showed that if there exists a one-sided tilting complex of A-modules whose endomorphism algebra is B, then there exists a two-sided tilting complex of A-B-bimodules. However, it is sometimes not easy to explicitly construct a two-sided tilting complex from a given one-sided tilting complex based on his proof.
In this talk, for a finite-dimensional symmetric algebra over an algebraically closed field, we explicitly construct a two-sided tilting complex corresponding to a one-sided tilting complex that sends simple modules to shifts of indecomposable modules. This construction generalizes the construction of two-sided tilting complexes over generalized Brauer tree algebras by Fujino, Kozakai, and Takamura in 2025.

Geometry

September 1st (Tue) Conference Room III

9:30–12:00

1 Yasunori Kimura (Toho Univ.) A new Euler geodesic of a spherical or hyperbolic triangle ····· 10
Kenzi Satô (Tamagawa Univ.)

Summary: The circumcenter, barycenter, and orthocenter of a planar triangle lie on a straight line. For a spherical or hyperbolic triangle, the barycenter and orthocenter split into multiple points. It is already known that the circumcenter, one of barycenters, and one of orthocenters of a spherical or hyperbolic triangle lie on a geodesic. The authors proved that the circumcenter, another barycenter, and another orthocenter of a spherical or hyperbolic triangle lie on another geodesic.

2 Yasuo Matsuda On the curvature circles of the cycloid curves ····· 15

Summary: This study demonstrates a method for constructing the curvature circles of the cycloid curves.

3 Yoichi Maeda (Tokai Univ.) A three-dimensional model of $SL(2,\mathbb{R})$ with hyperboloid of two sheets, and the visualization of its group structure ····· 10

Summary: In this talk, we consider a mapping from SL(2,R) to three-dimensional Minkowski space. With this model, we can visualize its group structure. For two elements A, B in SL(2,R), there are four points corresponding to A, B, AB, and BA in the Minkowski space. The purpose of this study is to visualize the non-commutativity of the groups. The difference between AB and BA becomes clear with the Minkowski cross product of two vectors. In this model, it can also be seen that subgroups like the set formed by lower triangular matrices are given as certain Euclidean planes passing through the origin.

4 Atsushi Kameyama (Gifu Univ.) Polygonal common fundamental domains for lattiices in the plane ···· 15

Summary: A lattice is a rank 2 discrete subgroup of the group of translations acting on the plane. When two lattices act on the plane, a subset of the plane that serves as a fundamental domain for both lattices is called a common fundamental domain. In this talk, we investigate conditions under which there exists a common fundamental domain that is a polygon.

5 Yuhei Kogo (Hokkaido Univ.) Finite-gap solutions of the Pohlmeyer–Lund–Regge equation and the associated curve evolution ····· 15

Summary: This talk studies finite-gap solutions of the Pohlmeyer–Lund–Regge (PLR) equation and their associated curve evolutions. The Lund–Regge evolution describes a space curve satisfying $\gamma_{st} = \gamma_s \times \gamma_t$, and a Hasimoto-type variable built from curvature and torsion reduces this geometry to a complex PLR equation. Using spectral data on a hyperelliptic curve, we construct Baker–Akhiezer functions and obtain a theta-function formula for finite-gap PLR solutions. Substituting the corresponding $SU(2)$-valued Lax solution into the Sym formula reconstructs a family of space curves in $\mathbb{R}^3$. We also give necessary and sufficient conditions for the reconstructed curve to be closed in the spatial direction or periodic in time, expressed through Abelian integrals. This provides a PLR analogue of the Calini–Ivey closure theory for vortex filaments.

6 Katsuhiro Moriya (Univ. of Hyogo) A representation formula for minimal timelike surfaces in the four-dimensional pseudo-Euclidean space of index two ····· 10

Summary: This talk presents a representation formula for minimal timelike surfaces in the four-dimensional pseudo-Euclidean space $\mathbb{E}^4_2$, based on the author's recent work. Classical Weierstrass-type representations for such surfaces involve integration as an essential step. In contrast, the new formula provides a direct parametrization without any integration. By a result of Chen, every minimal timelike surface can be locally expressed as the sum of two null curves, reducing the problem to the description of null curves in $\mathbb{E}^4_2$. We show that every null curve can be represented explicitly in terms of four real-valued functions and their derivatives.

7 Reiko Miyaoka (Tohoku Univ.)♭ Chern's conjecture in the Dupin case ····· 10

Summary: Chern's conjecture states that a closed minimal hypersurface in the Euclidean sphere is isoparametric if it has constant scalar curvature. When the number g of distinct principal curvatures exceeds three, few satisfactory results are known, and additional assumptions seem necessary. Here, we impose the Dupin condition, which is far weaker than the isoparametric one, and obtain: A closed proper Dupin hypersurface with constant mean curvature is isoparametric if (i) g=3, (ii) g=4 and it has constant scalar curvature, or (iii) g=4 and it has constant Lie curvature, and (iv) g=6 and it has constant Lie curvatures. These cover all non-trivial cases for closed proper Dupin hypersurfaces. The argument relies on advanced tools from Lie sphere geometry and combines topological and geometric methods.

8 Riku Kishida (Sci. Tokyo) A new framework of zero mean curvature surfaces in the isotropic 3-space ····· 15

Summary: The isotropic 3-space $\mathbb{I}^3$ is the 3-dimensional real vector space with the degenerate inner product of signature $(0++)$. For a space-like surface in $\mathbb{I}^3$, the mean curvature function can be defined in a natural way. A space-like surface whose mean curvature function vanishes everywhere is called a zero mean curvature surface. A zero mean curvature surface in $\mathbb{I}^3$ admits Weierstrass-type representation formulas. In this talk, we introduce a class of zero mean curvature surfaces with singularities in $\mathbb{I}^3$, which we call ZMC-faces. As an application of ZMC-faces, we show that several Osserman-type inequalities can be obtained under certain assumptions on both completeness and finiteness of the total curvature. We also present some examples which attain the equality in these inequalities.

9 Shuhei Katsuta (Nagoya Univ.) A proof of the Fujimoto conjecture via planar networks ····· 15

Summary: In 1990, H. Fujimoto proved that the nondegenerate Gauss map of a complete minimal surface in $\mathbb{R}^m$ can omit at most $\frac{m(m+1)}{2}$ hyperplanes in general position in the complex projective space $\mathbb{P}^{m-1}$. He also showed that this bound is optimal for all odd integers m and for even integers $4 \leq m \leq 16$, and conjectured that the same is true for all even integers $m \geq 4$. Recently, we proved this conjecture. In this talk, we will present an outline of the proof. A key ingredient is a planar network arising from the theory of totally positive matrices.

14:15–16:45

10 Haruka Sugai (Tokyo Univ. of Sci.) Classification of five-dimensional homogeneous manifolds of negative curvature ····· 15

Summary: Every homogeneous manifold of negative curvature is known to be isometric to a Lie group with a left invariant metric. We define an SNC-algebra to be a Lie algebra which admits an inner product of strictly negative curvature. In the speaker's joint paper in 2022, we classified SNC-algebras in dimension four. In this presentation, we explain the classification of SNC-algebras in dimension five.

Summary: In this talk, we would like to introduce the rigidity results for G-equivariant harmonic maps of the sphere S^m into real or complex Grassmannians of low rank for $G = \mathrm{SO}(m+1)$, $\mathrm{Spin}(m+1)$, G_2 (when $m = 6$) and $\mathrm{Spin}(7)$ (when $m = 7$).

Summary: For a Lie algebra homomorphism between real semisimple Lie algebras, the Split Dynkin index, introduced by Okuda (RIMS Kokyuroku, 2022), is a non-negative integer matrix that encodes combinatorial information on the restricted root systems. This talk presents results on the computation of Split Dynkin indices for Lie algebra homomorphisms arising from real semisimple symmetric pairs.

Summary: We explicitly describe all polars, centrioles and maximal antipodal sets of oriented Lagrangian Grassmann manifolds.

Summary: In the theory of discontinuous groups, it is important to determine whether a group action is proper. In particular, many researchers have studied the following setting: let G be a locally compact Hausdorff group, H, L closed subgroups of G, and consider the natural L-action on the homogeneous space G/H. In this setting, the properness of this action can be approached from the viewpoint of coarse geometry. Coarse geometry is systematically developed by Roe. This geometry provides a framework for studying boundedness and asymptotic behavior. From this perspective, in this talk, we give a properness criterion for the natural L-action on G/H in the case where G is solvable.

Summary: The Hurwitz–Radon number is a classical invariant related to the composition problem of quadratic forms and to the existence of linearly independent vector fields on spheres. Recently, Kannaka and Tojo introduced generalized Hurwitz–Radon numbers associated with a real reductive Lie algebra and its representation. In this talk, we focus on one of these invariants, denoted by $\rho^{(2)}$, and give a geometric interpretation in terms of fundamental vector fields induced by Lie group actions. Given a Lie group G, a subspace of its Lie algebra $\mathfrak{s}$, and a G-manifold M, we define a numerical invariant measuring the maximum number of pointwise linearly independent fundamental vector fields. We show that, in a special setting, this invariant coincides with $\rho^{(2)}$.

Summary: We study fixed-point sets of S^1-actions and compatible complex structures on quaternionic manifolds. If the first Chern class of a fixed-point component is nontrivial, then there is no hypercomplex structure on the quaternionic manifold containing the prescribed compatible complex structure induced from a twistor function on that component. Furthermore, we determine the connected components of fixed-point sets arising from quaternionic S^1-actions on the quaternionic projective space.As a consequence, we generalize Pontecorvo's example.

17 Yusei Aoki (Hakodate Nat. Coll. of Tech.) Conjugate and focal values along Legendre trajectories on totally η-umbilic real hypersurface 10

Summary: We study variations of Legendre trajectories for Sasakian magnetic fields associated with contact metric structures on totally η-umbilic real hypersurfaces in a non-flat complex space form. We calculated conjugate and focal values along Legendre trajectories.

September 2nd (Wed) Conference Room Ⅲ

10:00–10:15 Presentation Ceremony for the 2026 MSJ Geometry Prize

10:20–11:20 Award Lecture for the 2026 MSJ Geometry Prize

Shinpei Baba (Univ. of Osaka) Complex projective structures on a Riemann surface and representations of the surface group

Summary: Complex projective structures on a surface provide a rich interplay between Riemann surface structures, hyperbolic geometry, and representations of its fundamental group into $PSL(2, C)$. In particular, their holonomy representations are not necessarily discrete, and projective structures provide geometric meaning to such general representations. In this talk, we discuss various relations between complex projective structures and their holonomy represenetations.

13:00–14:00 Award Lecture for the 2026 MSJ Geometry Prize

Kouichi Yasui (Univ. of Osaka) Exotic smooth structures on 4-manifolds and genus functions

Summary: A central problem in 4-dimensional topology asks whether a given smooth 4-manifold admits an exotic smooth structure (i.e., another smooth 4-manifold homeomorphic but not diffeomorphic to the given one), and if so, whether it admits infinitely many pairwise non-diffeomorphic exotic smooth structures. To approach this problem, various methods for constructing and distinguishing exotic smooth structures have been developed over the past four decades. In this talk, I will survey some of these methods, focusing on the roles of handlebodies, corks, and genus functions. I will also discuss closely related topics such as exotically knotted submanifolds in 4-manifolds.

September 3rd (Thu) Conference Room Ⅲ

9:30–11:45

18 Yusuke Shiobara (Shinshu Univ.) Towards Riemannian diffeology 15

Summary: Diffeology provides a natural generalization of differential geometry, yet its Riemannian theory remains underdeveloped. We introduce a framework for Riemannian diffeology based on Blohmann's tangent functor and the metric framework of Iglesias-Zemmour. A weak Riemannian metric on a diffeological space is defined as a smooth symmetric positive 2-tensor on an appropriate tangent object. This yields the category of weak Riemannian diffeological spaces and isometries, containing Riemannian manifolds modeled on locally convex spaces. We show that the induced pseudodistance is a genuine distance under a natural separation condition. Examples include diffeological adjunction spaces and mapping spaces $(C^\infty(M, N))$. Moreover, the metric is compatible with loop concatenation on free loop spaces, suggesting connections to string topology. This talk is based on joint work with Katsuhiko Kuribayashi and Keiichi Sakai.

Summary: This talk presents a framework for formulating the vacuum Einstein field equations on infinite-dimensional Lorentzian manifolds modeled on the Hilbert space ℓ^2. In infinite dimensions, the usual contractions defining the Ricci tensor and scalar curvature may diverge. To address this problem, we impose a trace-class condition on curvature operators, which makes the Ricci tensor, scalar curvature, and Einstein tensor well defined. Within this framework, we construct basic trace-class vacuum solutions, including an ℓ^2analogue of the Minkowski metric and infinite-dimensional Kasner metrics. We then prove a rigidity theorem for spherically symmetric solutions: every spherically symmetric trace-class vacuum metric is flat. Thus, unlike the finite-dimensional Schwarzschild-Tangherlini family, no nontrivial spherically symmetric black-hole-type vacuum solution exists in this trace-class infinite-dimensional setting.

Summary: The Borell–Brascamp–Lieb inequality is an integral inequality concerned with the L1-norm of two functions and that of the t-interpolation of them. I will discuss some aspects of the inequality on weighted Riemannian manifolds satisfying the curvature dimension condition. Specifically, I will present a theorem on the rigidity of curvature and measure for this inequality. I will also discuss connections with the Brunn–Minkowski inequality and its rigidity, and conclude with a few further questions related.

Summary: Recently, synthetic Lorentzian geometry has emerged as an active area of research, developed in the same spirit as synthetic Riemannian geometry which includes the theories of (R)CD and Alexandrov spaces. A Lorentzian pre-length space (LpLS) is a metric space endowed with an additional Lorentzian distance. In synthetic Lorentzian geometry, LpLSs play roles analogous to these of metric spaces in the Riemannian setting. In particular, they generalize smooth spacetimes and naturally arise as limits of sequences of spacetimes. Furthermore, many geometric notions, especially curvature bounds, admit formulations parallel to those in metric geometry. In this talk, I will introduce the notion of Lorentzian Hausdorff measure and present a coarea-type inequality for this measure. If time permits, I will also discuss some related local structural properties of LpLS.

Summary: The Tits boundary is a boundary at infinity that describes the large-scale distribution of curvature in a CAT(0) space. It is defined using the angle structure intrinsic to CAT(0) spaces, and its structure and its relationship to the geometry of the underlying space have been extensively studied in connection with various topics, including rank rigidity and relative hyperbolicity. In joint work with Tomohiro Fukaya, the speaker constructed the Tits boundary for coarsely convex spaces, a broad class of non-positively curved spaces that includes CAT(0) spaces. In this talk, we outline its definition and discuss geometric properties of coarsely convex spaces that follow from the structure of their Tits boundaries.

Summary: I'll discuss weighted Yamabe flow on asymptotically flat smooth metric measure spaces and its interaction with the weighted ADM mass. I'll first show that the asymptotically flat structure is preserved along the flow. In the range of the dimensional parameter $m > 2 - n$, $m \neq 0$, I'll show that the weighted ADM mass is constant and that the weighted Einstein–Hilbert functional is non-increasing under a certain assumption. Under another weaker assumption, I'll show instead that the weighted ADM mass is monotone non-increasing along the flow.

24 Shun Maeta (Chiba Univ.) Rotational symmetry and classification of complete gradient Yamabe solitons ····· 15

Summary: In this talk, we classify two- and three-dimensional nontrivial, nonflat, complete gradient Yamabe solitons. In particular, we show that any three-dimensional nontrivial, nonflat, complete shrinking gradient Yamabe soliton is rotationally symmetric. In higher dimensions, we also show that any nontrivial complete shrinking gradient Yamabe soliton whose scalar curvature is bounded below by the soliton constant everywhere and is strictly greater than the constant at some point is rotationally symmetric. This assumption is optimal. Furthermore, a complete classification of nontrivial complete expanding gradient Yamabe solitons with bounded scalar curvature is provided.

14:15–16:00

25 Kei Funano (Tohoku Univ.) ♭ A study of the distribution of eigenvalues of the Laplacian on convex domains ····· 10

Summary: I will explain my study of the Distribution of Eigenvalues of the Laplacian on Convex Domains.

26 Moe Fujii (Nagoya Univ.) Steklov first-eigenvalue maximization and maximization of the variance of maps on the boundary ····· 15

Summary: In this talk, I will define weighted Steklov eigenvalue problem with Bakry–Émery Laplacian and maximization problem of its first eigenvalue for all Riemannian metric under some condition. I will also talk about maximization problem of the variance of maps, which is a dual of maximization problem of the first eigenvalue. I will especially explain the relationship between two maximizing problem (weak duality) and some examples.

27 Kazumasa Narita (Yonago Nat. Coll. of Tech.) Second variation formula for the Laplace eigenvalue functional on closed manifolds ····· 15

Summary: For a closed Riemannian manifold (M, g) of dimension n, let $\lambda_1(g)$ be the first positive eigenvalue of the Laplace–Beltrami operator Δ_g and $\mathrm{Vol}(M, g)$ the volume of (M, g). Considering the scale-invariant quantity $\lambda_k(g)\mathrm{Vol}(M, g)^{2/n}$ as a functional over all the metrics in a fixed conformal class, we derive a second variation formula for the functional. As a corollary, we prove that if the canonical flat metric on a torus is such that the multiplicity of λ_1 is two, then the flat metric is not a maximal point of the functional in its conformal class. This is a higher dimensional extension of Karpukhin's very recent work.

28 Tomoya Nakamura (Kogakuin Univ.)
Naoki Kimura (Tokyo Univ. of Sci.) Correspondence of Koszul–Vinberg structures with Poisson structures, and of Jacobi–Koszul–Vinberg structures with Jacobi structures ····· 15

Summary: It is known that Koszul–Vinberg structures on an affine manifold correspond with Poisson structures on the total space of its tangent bundle. In this talk, we show that Koszul–Vinberg structures on a left-symmetric algebroid correspond with Poisson structures on its prolongation. Moreover, we show that Jacobi–Koszul–Vinberg structures on a Jacobi-left-symmetric algebroid correspond with Jacobi structures on its prolongation.

29 Tomoya Nakamura (Kogakuin Univ.)
Naoki Kimura (Tokyo Univ. of Sci.) Correspondence of Koszul–Vinberg–Nijenhuis structures with Poisson–Nijenhuis structures, and of compatible Koszul–Vinberg pairs with compatible Poisson pairs ····· 15

Summary: We prove that Koszul–Vinberg structures on a left-symmetric algebroid correspond with Poisson structures on its prolongation. In this talk, we show that Koszul–Vinberg–Nijenhuis structures on a left-symmetric algebroid correspond with Poisson–Nijenhuis structures on its prolongation. Moreover, we show that compatible Koszul–Vinberg pairs on a left-symmetric algebroid correspond with compatible Poisson pairs on its prolongation.

30 Naoki Kimura (Tokyo Univ. of Sci.) Tomoya Nakamura (Kogakuin Univ.) Examples of Jacobi–Koszul–Vinberg structures, Koszul–Vinberg structures, Jacobi structures, and Poisson structures on $\mathbb{R}^n$ and their characteristic foliations 10

Summary: We present a two-parameter family of Jacobi–Koszul–Vinberg structures on $\mathbb{R}^2$. We also give Koszul–Vinberg structures on $\mathbb{R}^3$ and Jacobi structures on $\mathbb{R}^5$ which are obtained from the Jacobi–Koszul–Vinberg structures on $\mathbb{R}^2$. In addition, we provide Poisson structures on $\mathbb{R}^6$ which are obtained from both of the Koszul–Vinberg structures on $\mathbb{R}^3$ and the Jacobi structures on $\mathbb{R}^5$. Furthermore, we consider their characteristic foliations.

16:15–17:15 Talk Invited by Geometry Section

Tadashi Fujioka (Fukuoka Univ.) Recent developments in Busemann geometry

Summary: Busemann spaces are metric spaces with non-positive curvature in the sense that the distance function is convex along every pair of geodesics. They generalize the well-known CAT(0) spaces, which are defined by triangle comparison. The main difference of these two is whether or not they include Banach spaces and Finsler manifolds. In this talk, I will discuss recent developments in the geometry of Busemann spaces, building upon the geometry of CAT(0) spaces.

September 4th (Fri) Conference Room Ⅲ

9:30–11:45

31 Xiaozhou Zhou (Ritsumeikan Univ.) Quandle presentations of surface knots in 4-manifolds and bridge numbers 15

Summary: The fundamental quandle is an invariant for distinguishing surface knots, yet computable presentations have traditionally been limited to surfaces embedded in the 4-sphere. Building on the framework of banded unlink diagrams introduced by Hughes, Kim, and Miller, we give a Wirtinger type presentation of the fundamental quandle of surface links in arbitrary 4-manifolds. As applications, we extend the work of Sato and Tanaka to show that for any $b \geq 4$ and $m \geq 0$, there exist infinitely many pairwise non-local surface knots with bridge number b in $\mathbb{C}P^2 \# m\overline{\mathbb{C}P^2}$, and we distinguish infinite families of surface knots with isomorphic knot groups, extending results of Tanaka and Taniguchi.

32 Lucas Henrique Silveira Gomes (Univ. of Osaka) On the classification of transverse Calabi–Yau Vaisman manifolds 15

Summary: Vaisman manifolds form a class of non-Kähler manifolds endowed with a natural transversely Kähler foliation. This structure allows one to define transverse analogues of the usual Chern classes on complex manifolds. In this talk, we show that the vanishing of the first basic Chern class for Vaisman manifolds with large enough first Betti number forces the manifold to be diffeomorphic to a Kodaira–Thurston manifold. Moreover, the complex structure is left-invariant, the foliation is regular, and the manifold is a fiber bundle over its Albanese torus.

33 Satoshi Jinnouchi (Univ. of Osaka) The equality condition of the Bogomolov–Gieseker inequality for nef and big classes 15

Summary: The Bogomolov–Gieseker inequality is a Chern class inequality satisfied by slope stable vector bundles. When slope stability is defined with respect to a Kähler class, this result, including the characterization of the equality case, is classically well understood. In this talk, we first present an example in which the equality in the Bogomolov–Gieseker inequality is achieved for the first time with respect to a nef and big class. Next, we introduce a theorem that generalizes both the Bogomolov–Gieseker inequality and its equality condition to slope stable vector bundles with respect to nef and big classes. This theorem provides a unified framework that encompasses the example mentioned above.

34 Natsuo Miyatake (Tohoku Univ.) On the uniqueness of complete solutions and strong Liouville property for weak subsolutions of elliptic equations 15

Summary: Li and Mochizuki proved that, for any Riemann surface and any nonzero holomorphic r-differential q, there exists a unique harmonic metric on the associated cyclic Higgs bundle satisfying a certain asymptotic condition called completeness.
In this talk, I consider the problem of extending the Li–Mochizuki theorem to arbitrary semipositive singular Hermitian metrics, which are not necessarily induced by holomorphic r-differentials. In particular, I will explain a uniqueness theorem under the assumption that the corresponding Hermitian metrics are mutually bounded, together with a criterion showing that this assumption is automatically satisfied when the exponential of the weight function is continuous outside a compact subset. The proof is based on a Liouville-type theorem for weak subsolutions of elliptic equations.

35 Yudai Hateruma (Waseda Univ.) Distinguished bases and the braid group action for solutions of the tt*-Toda equations 15

Summary: The topological-antitopological fusion (tt*) equations were introduced by Cecotti and Vafa. In this talk, we study the braid group action on the Stokes matrices of the tt*-Toda equations. We construct a bilinear form L on the solution space of a certain scalar o.d.e. associated with the tt*-Toda equations. The Stokes matrices arising from the tt*-Toda equations are then realized as matrix representations of L with respect to the canonical solutions. This construction allows us to introduce distinguished bases associated with the tt*-Toda equations and to study their braid group orbits.

36 Hayato Nakanishi (Chiba Univ.)
Yat-Hin Suen (National Cheng Kung Univ.) Multi-valued Morse homotopy for the SYZ mirror of the complex projective plane 15

Summary: We propose a definition of the category $Mo^{\mathrm{mult}}(P)$ of multi-valued Morse homotopy on P consisting of multi-valued functions associated to Lagrangian multi-sections. We then show that a full subcategory $Mo^{\mathrm{mult}}_{\mathcal{E}}(P)$ of $Mo^{\mathrm{mult}}(P)$ is A_∞-equivalent to a full subcategory $DG^{\mathrm{vect}}_{\mathcal{E}}(\mathbb{C}P^2)$ of the category $DG^{\mathrm{vect}}(\mathbb{C}P^2)$ consisting of holomorphic vector bundles over the complex projective plane $\mathbb{C}P^2$. As an application, we study the mirror description for global sections of the holomorphic tangent bundle over $\mathbb{C}P^2$.

37 Masao Jinzenji (Okayama Univ.) Geometrical proof of generalized mirror transformation for multi-point virtual strucutre constants of projective hypersurfaces 15

Summary: In this talk, we propose a geometric proof of the generalized mirror transformation for multi-point virtual structure constants of degree k hypersurfaces in CP^{N-1}.

14:15–16:15

38 Kota Baba (Nagoya Univ.) Multiple zeta values and logarithmic integrals of Kontsevich graphs 15

Summary: Kontsevich graphs and their associated integrals were introduced by Kontsevich in 2003 in his construction of the deformation quantization of Poisson manifolds and his proof of the Formality Theorem. In this talk, we discuss the relationship between logarithmic integrals of Kontsevich graphs and multiple zeta values. In 2020, Banks–Panzer–Pym proved that logarithmic Kontsevich integrals can be expressed as integer linear combinations of normalized multiple zeta values. Moreover, they conjectured that every normalized multiple zeta value can be expressed as an integer linear combination of logarithmic Kontsevich integrals. Motivated by this conjecture, the speaker explicitly constructed integer linear combinations of Kontsevich graph integrals whose values are specific multiple zeta values. We explain the construction of the corresponding Kontsevich graphs and outline the proof of the main result.

Summary: The Godbillon–Vey class is a secondary characteristic classes which is defined for regular foliations and have been studied extensively. On the other hand, extending the Godbillon–Vey class to singular foliations is difficult, and a complete result has not yet been obtained. In this paper, we address this problem by focusing on a geometric object called a Lie algebroid on a manifold. More precisely, we fix a Lie algebroid and relatively define the Godbillon–Vey class for its Lie subalgebroids, and study their properties. We also present several examples.

Summary: An equiaffinite immersion induces a symmetric 2-form h and a Ricci-symmetric, torsion-free connection ∇, where ∇h is totally symmetric. Conversely, Dillen, Nomizu, and Vranken showed that for a non-degenerate h, the existence of such an immersion is equivalent to the projective flatness of the dual connection ∇^*. To extend this result, we investigate the situation where h is degenerate. Previously, the author introduced quasi-Codazzi structures using coherent tangent bundles to allow for metric degeneracy. Since conventional projective flatness cannot be defined on vector bundles, this study extends this concept to coherent tangent bundles and generalizes their existence theorem.

Summary: This talk shows how much information about a statistical model is lost when the model is coarse-grained by a statistic. We present a characterization of δ-almost sufficient statistics in terms of the Kullback–Leibler divergence and show that it is equivalent to the previous definition based on the Fisher metric. Furthermore, we calculate the Kullback–Leibler divergence in examples arising from repeated trials and quantitatively evaluate how well the resulting δ-almost sufficient statistics preserve information about the original model.

Summary: We give a complete classification of doubly totally-umbilical submanifolds in the probability simplex. The probability simplex is one of the most standard statistical manifolds, and information geometry initiated by S. Amari and H. Nagaoka studies the statistical submanifold theory in the probability simplex. On the other hand, H. Furuhata defined doubly totally-umbilical submanifolds in the geometry of statistical manifolds, inspired by totally-umbilical submanifolds of Riemannian geometry.

Summary: We study invariant statistical connections on the space $\mathcal{N}_0^n$ of zero-mean multivariate normal distributions (the multivariate centered Gaussian model) equipped with the Fisher metric g^F. We introduce moduli spaces of invariant statistical connections on homogeneous Riemannian manifolds via two natural equivalence relations arising from a categorical viewpoint, and apply this framework to $(\mathcal{N}_0^n, g^F)$. We explicitly determine the $GL(n,\mathbb{R})$-invariant statistical connections, with particular emphasis on the dually flat case, and describe the corresponding moduli spaces. This talk is based on arXiv:2605.30300.

Complex Analysis

September 1st (Tue) Conference Room V

9:30–11:10

1 Akira Ushijima (Univ. of Hyogo) Toshihiro Nakanishi (Osaka Metro. Univ.) — Determination of Dirichlet fundamental polygons for triangle groups generated by hyperbolic triangles with ultraideal vertices · · · · · · · · · · · · 10

Summary: We study Dirichlet fundamental polygons for triangle groups generated by hyperbolic triangles whose vertices may include ultraideal vertices, that is, vertices lying beyond the circle at infinity in the projective disk model of the hyperbolic plane. Our result shows that a known description of Dirichlet fundamental polygons for ordinary hyperbolic triangles and for triangles with ideal vertices remains valid when some vertices are ultraideal. The proof uses an extension of Ceva's theorem for generalized hyperbolic triangles.

2 Shunji Horiguchi — Newton–Mandelbrot set · 15

Summary: The Wasan (Japanese mathematics in the Edo period (1603–1868: national isolation)) of 1673 leads to the extension of Mandelbrot set, i.e., the Newton–Mandelbrot set. We use the Newton–Mandelbrot set to show that the complex plane continuously transforms the Mandelbrot set and the Multibrot set. This shows the originality of Japanese traditional mathematics (Wasan).

3 Joe Kamimoto (Kyushu Univ.) Hiromichi Mizuno (Kyushu Sangyo Univ.) Toshihiro Nose (Fukuoka Inst. of Tech.) — Analytic continuation of local zeta functions to a slit complex plane · 15

Summary: In this talk, we consider an analytic continuation of local zeta functions associated to general continuous functions in one dimensional case. We will provide a sufficient condition under which the one-dimensional local zeta function admits a holomorphic continuation to the complex plane cut along the negative real axis.

4 Hiroaki Aikawa (Chubu Univ.) — Everywhere divergence of tangential parabolic limits of Gauss–Weierstrass integrals · 15

Summary: We construct a bounded function whose Gauss–Weierstrass integral has a divergent tangential parabolic limit at every initial point. This shows the sharpness of the parabolic approach in the parabolic Fatou theorem. We compare the tangential parabolic approach and the non-nontangetial parabolic approach of Nagel–Stein type.

5 Ikkei Hotta (Yamaguchi Univ.) Sebastian Schleißinger (Univ. of Würzburg) — Problems related to conformal slit-mappings · 15

Summary: Motivated by Loewner's classical theorem on slit mappings, this talk discusses several embedding problems for slit-type mappings.

6 Katsuhiko Matsuzaki (Waseda Univ.), Fei Tao (Waseda Univ.) — Boundary characterizations of little Bloch and VMOA functions on the half-plane 15

Summary: We extend Pommerenke's characterizations of boundary curves by little Bloch and VMOA conditions from the unit disk to the upper half-plane. For a conformal mapping onto an unbounded quasidisk, we consider its boundary extension. In the non-compact setting on the half-plane, smallness on the boundary curve is not necessarily comparable with smallness of the parameter on the real line. To overcome this difficulty, we use relative versions of asymptotic conformality and asymptotic smoothness with respect to the parametrization by the boundary extension. Our theorems show that the disk results remain valid for the half-plane once the correct relative geometric notions are used. The relative formulation of curves is equivalent to the original one for the disk, so our results can be regarded as the generalization of Pommerenke's.

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

Kentaro Hirata (Hiroshima Univ.) — Potential analysis regarding removability of singularities and asymptotic behavior of solutions to semilinear elliptic equations

Summary: This talk concerns the removable singularities and the asymptotic behavior of solutions to semilinear elliptic equations with power-type source or absorption terms. We will introduce previous researches on the removability of singularities on isolated points or compact smooth manifolds of dimension not greater than N-3, and then present my research results regarding the removability of singular sets of dimension at most N-2 that satisfy the Ahlfors regularity condition and the uniform Minkowski condition, as well as the existence of weighted nontangential limits (asymptotic behavior).

15:40–16:50

7 Hiroshige Shiga (Osaka Metro. Univ./Sci. Tokyo*) — Thompson's groups and Teichmüller modular groups of generalized Cantor sets (Part I) 15

Summary: Thompson's groups, which are denoted by F, T and V, were introduced by R. Thompson. IT is known that they have a lot of interesting properties. In the first part of my talk, it is shown that Thompson's groups are algebraically related to subgroups of Teichmüller modular groups of Tiechmüller spaces of generalized Cantor sets.

8 Hiroshige Shiga (Osaka Metro. Univ./Sci. Tokyo*) — Thompson's groups and Teichmüller modular groups of generalized Cantor set (Part II) 15

Summary: In the second part of our talk, it is established that Thompson's groups are realized as subgroups of Teichmüller modular groups of generalized Cantor sets. Moreover, in this sense, we show that Thompson's groups F, T act properly discontinuously on the Teichmüller spaces, but the group V does not.

9 Yoshihiko Shinomiya (Shizuoka Univ.) — On curve graphs of hyperelliptic translation surfaces 15

Summary: The curve graph of a translation surface is a graph whose vertices are homotopy classes of regular closed geodesics. Two vertices are joined by an edge if the corresponding geodesics are disjoint. In general, this graph is not connected. In this talk, we introduce an extension of the curve graph that is connected. We show that the extended curve graphs of hyperelliptic translation surfaces share many of the same properties as the classical curve graphs of surfaces. We also give a characterization of hyperelliptic Veech surfaces in terms of their extended curve graphs.

10 Hiromichi Ono (Kyoto Univ.) Uniform perfectness of the limit sets of conformal tree iterated function systems 15

Summary: A compact subset C of the complex plane is said to be uniformly perfect if there exists a constant $M \geq 1$ such that any annulus A which separates C has the module smaller than M. It was shown by R. Stankewitz that the limit set of a conformal iterated function system on the plane is uniformly perfect except for the obvious exceptions. In this talk, we consider tree iterated function systems which are the generalizations of iterated function systems, and show that the limit set of a such system is uniformly perfect if for any map ϕ in the system, the absolute value of the derivative of ϕ is uniformly bounded from below.

September 2nd (Wed) Conference Room V

9:30–11:10

11 Hidetaka Hamada (Kyushu Sangyo Univ.*)
Tatsuhiro Honda (Senshu Univ.)
Mirela Kohr (Babeş -Bolyai Univ.)
Bohr–Rogosinski radius in complex Banach spaces 15

Summary: In this talk, we investigate the Bohr-Rogosinski radius for holomorphic mappings on the unit ball of a complex Banach space with values in a higher dimensional complex Banach space.

12 Takanori Ayano (Osaka Metro. Univ.) Degenerate limit of the abelian functions associated with a bielliptic hyperelliptic curve of genus 2 15

Summary: Solutions of differential equations in terms of elementary functions can be obtained by the degeneration of solutions in terms of the theta, sigma, and abelian functions. Bernatska and Leykin studied the degeneration of the hyperelliptic sigma function using the theory of the heat equation. Bernatska, Enolski, and Nakayashiki studied it using Sato theory. A curve is called bielliptic if it admits a morphism of degree 2 to an elliptic curve. In our previous work, we described the abelian functions associated with a bielliptic hyperelliptic curve of genus 2 in terms of elliptic functions. In this talk, by using this formula, we will calculate the degenerate limit of the abelian functions associated with the bielliptic hyperelliptic curve of genus 2.

13 Tadashi Takahashi (Hagoromo Univ. of Int. Stud.) ♭ A computer algebraic study on plane sextic curves 15

Summary: In the previous presentation, we demonstrated a computer algebraic method for deriving Yoshihara's defining equation. In this presentation, we report example of double cover of cubic curve in plane sextic curves and we report able to capture the characteristics Yoshihara's defining equation using calculating the Puiseux series.

14 Masanori Adachi (Shizuoka Univ.)
Seungjae Lee (Kyungpook National Univ.)
Aeryeong Seo (Kyungpook National Univ.)
Intermediate pseudoconvexity of fiber bundles 15

Summary: We investigate the pseudoconvexity of locally trivial holomorphic ball bundles over compact Riemann surfaces of genus ≥ 2, as well as the intermediate pseudoconvexity of their complements in the associated projective space bundles. We prove that any such ball bundle is 1-convex, while its complement is n-convex, where n denotes the dimension of the ball fiber, provided that the bundle admits a harmonic section with a regular point.

15 Takayuki Koike (Univ. of Tsukuba) Formal principle for line bundles on neighborhoods of an analytic subset of a compact Kähler manifold 15

Summary: We investigate the formal principle for holomorphic line bundles on neighborhoods of an analytic subset of a complex manifold mainly in the case where it can be realized as an open subset of a compact Kähler manifold. Our approach identifies the obstruction as a global analytic class supported on a neighborhood of Y, and relates its vanishing to the solvability of a $\partial\overline{\partial}$-problem on neighborhoods of Y. As a consequence we obtain cohomological criteria ensuring the formal principle. We also construct a holomorphic family of compact Kähler surfaces containing a curve with topologically trivial normal bundle in which the formal principle holds for almost every fiber but fails for uncountably many fibers, exhibiting an instability phenomenon in families.

16 Takeo Ohsawa (Nagoya Univ.)♭ On complete Kähler Riemann domains 15

Summary: As an application of an extension theorem for holomorphic functions on complete Kähler manifolds, it will be proved that a complete Kähler Riemann domain over $\mathbb{C}^n$ satisfying a kind of boundary condition is holomorphically convex. A well-known result by Diederich and Pflug follows from this as a corollary.

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

Atsushi Atsuji (Keio Univ.) Diffusion processes on Kähler manifolds and the value distribution of holomorphic maps —From the perspective of Itô calculus—

Summary: Any non-constant holomorphic function on the complex plane sends a complex Brownian motion to a time-changed complex Brownian motion. This property is called conformal invariance of Brownian motion. This leads us to a natural idea to study properties of holomorphic functions using Brownian motion, and Itô calculus (stochastic calculus) which is a systematic method for analysis of stochastic processes initiated by Kiyoshi Itô. This conformal invariance property holds not only for complex Brownian motion on the complex plane but also for Brownian motion on Kähler manifolds that is a diffusion process whose generator is the complex Laplacian defined from Kähler metric. In this talk we are discussing some extension of classical value distribution theory of holmorphic functions, especially Nevanlinna theory, using stochastic calculus on Kähler manifolds. Our idea seems applicable for a wider class of functions and domains of functions, like discrete spaces. We will talk about some application of our methods from stochastic calculus to function theoretic objects on discrete spaces if time allows.

Functional Equations

September 1st (Tue) Conference Room II

9:00–12:00

1 Saiei-Jaeyeong Matsubara-Heo (Tohoku Univ.)
Simon Telen (MPI MiS)
Matroid hypergeometric systems 10

Summary: In the late 20th century, Gel'fand, Kapranov, and Zelevinsky (GKZ) developed the modern theory of discriminants and resultants. Central to their theory is the principal A-determinant. We discovered its matroid analog, the principal matroid determinant, for realizable matroids. Although these topics are pure algebraic geometry, GKZ theory originated in the study of the singular locus of a holonomic system (GKZ hypergeometric system). In GKZ's words, "a hypergeometric system is a quantization of a discriminant". Accordingly, we introduce the matroid hypergeometric system as a holonomic system quantizing the principal matroid determinant. Despite its natural definition and integral representations, its analytic properties are yet to be investigated. We welcome any insights at this Functional Equations session.

2 Yasuhisa Saito (Shimane Univ.)
Delay placement and global stability in delayed Lotka–Volterra systems 10

Summary: This talk studies the effect of delay placement on delay-independent global stability in delayed Lotka–Volterra systems. For a symmetric predator-prey system with four discrete delays, a necessary and sufficient condition for global asymptotic stability of the positive equilibrium is presented. This condition differs from the corresponding sharp condition for a two-delay system, revealing a delay-placement discrepancy. We also discuss competitive and cooperative systems. Our analysis suggests that such a discrepancy may disappear over a large parameter region. These results indicate that the influence of delay placement on global stability may depend strongly on the sign structure of species interactions.

3 Tomoyuki Tanigawa (Osaka Metro. Univ.)
Hiroyuki Usami (Gifu Univ.)
Jaroslav Jaroš (Comenius Univ.)
Existence of oscillatory solutions and localization of zeros for forced half-linear differential equations 10

Summary: In this talk, we investigate the existence of oscillatory solutions of the forced second-order half-linear differential equation

$$\big(p(t)|x'|^{\alpha-1}x'\big)' + q(t)|x|^{\alpha-1}x = f(t), \quad t \geqq a.$$

Our main objective is to clarify, by means of the generalized Prüfer transformation, how the forcing term influences the oscillatory behavior of solutions.

4 Hiroyuki Usami (Gifu Univ.*)
Tomoyuki Tanigawa (Osaka Metro. Univ.)
Multiplicities of local solutions of IVP's to forced half-linear ordinary differential equations 10

Summary: We consider initial value problems of nonhomogeneous quasilinear ordinary differential equations including half-linear equations. We give necessary conditions and sufficient conditions for such problems to have multiple local solutions.

Summary: In this talk we are concerned with a linear fractional-order differential equation with two delayed terms. By applying the D-decomposition method to the characteristic equation, we present a stability region as a necessary and sufficient condition for the asymptotic stability of the zero solution.

Summary: In this talk, the asymptotic behavior of linear differential systems incorporating a proportional derivative-type (PD) differential operator is investigated. Building on the classical asymptotic convergence property of Wintner, a generalized Wintner-type asymptotic result for such systems is established. The proposed framework encompasses a wide class of time-varying coefficient matrices and extends classical asymptotic theory to equations governed by a PD operator. An illustrative example is also presented to demonstrate the applicability of the proposed theorem.

Summary: In the theory of linear retarded functional differential equations (RFDEs), the classical bilinear form proposed by J. Hale has long suffered from foundational ambiguities due to its historically *ad hoc* introduction. In this talk, we resolve these long-standing issues by establishing the Green and Lagrange identities associated with an autonomous linear RFDE. We derive a bilinear form B, which is none other than the celebrated Hale bilinear form, thereby clarifying its structural origin from the perspective of differential equations. Furthermore, by utilizing the recent definition of the M^p-space via the memory measure, we demonstrate that B uniquely extends to the product space $M^{*q} \times M^p$, and that the identities still hold in the mild sense.

Summary: We consider fourth order linear partial differential equation in an N-dimensional Euclidean space ($N = 1, 2, 3$), which represents bending of a plate on an elastic foundation under a tension. The best constants of the Sobolev and the Sobolev-type inequalities are found by means of the Green function and the theory of reproducing kernel.

Summary: We consider the one-dimensional nonlocal Kirchhoff type bifurcation problem related to logistic equation of population dynamics. We deal with this equation from a view point of bifurcation problem. The purpose is to establish the precise asymptotic formulas for bifurcation curve $\lambda = \lambda(\alpha)$ as $\alpha \to \infty$ in L^2-framework, where $\alpha := \|u_\lambda\|_2$. Usually, bifurcation problems are considered in L^∞-framework. Therefore, our results here are new and significant.

Summary: We study the best constant of the Sobolev–Poincaré inequality. The best constant $\lambda(p, q, \Omega)$ becomes the first eigenvalue of the differential equation related to the p-Laplace operator. We give the upper and lower estimates for $\lambda(p, q, \Omega)$ in the subcritical case $1 < q < p^*$ when Ω is a bounded open set.

Summary: We study the Hénon equation in unbounded domains Ω. Let G be a closed subgroup of the orthogonal group. The domain Ω is called G invariant if $g(\Omega) = \Omega$ for any $g \in G$. A solution u is called G invariant if $u(gx) = u(x)$ for $g \in G$ and $x \in \Omega$. Let H and G be two closed subgroups of the orthogonal group such that $H \subsetneq G$. For a G invariant unbounded domain Ω, we prove the existence of a positive solution which is H invariant but no G invariant.

Summary: In this talk, I would like to talk about the nonlinear Schrödinger equations with three wave interaction. For large interaction, Pomponio (2010) showed that there exists a ground state which is a vector solution. On the other hand, for small interaction the existence of vector solutions is not even known. The purpose of this talk is to establish the existence and the multiplicity of vector solutions of the system for small three wave interaction. This talk is based on joint work with Yohei Sato(Saitama University).

Summary: We consider the existence of L^2-normalized solutions for a nonlinear Schrödinger system with three wave interaction. This system consists of three components of unknown functions. We consider spatial dimensions $2 \le N \le 5$, and we take the nonlinearities to be of power type $|u_i|^{p_i-2}u_i$, where the exponents satisfy $2 < p_i < 2^*$ for $i = 1, 2, 3$. Here $2^* = \frac{2N}{N-2}$ if $N \ge 3$, $2^* = \infty$ if $N = 2$. In this talk, by classifying the nonlinearities $|u_i|^{p_i-2}u_i$ as L^2-subcritical or L^2-supercritical, we prove the existence of a local minimal positive solution or mountain pass positive solution for small or large $\alpha > 0$.

Summary: In this talk, we give a complete characterization of ground state solutions for the nonlinear Schrödinger–Poisson system with a critical strength of the interaction. Firstly, we prove the existence of an optimizer of the Gagliardo–Nirenberg–Coulomb–Sobolev inequality. Secondly, we give a full correspondence between an optimizer, an energy ground state solution and an action ground state solution. Finally, we obtain an explicit formula of the critical strength by using the optimizer and the best constant of the Gagliardo–Nirenberg–Coulomb inequality.

14:15–16:30

Summary: In this talk we consider the best constant C_N in N-dimensional Hardy-type inequality for test vector fields u in the unit ball whose normal components satisfy Dirichlet boundary condition. Since this condition is not imposed on all the components of u, the best value of C_N turns out to be strictly less than the well-known value $\frac{(N-2)^2}{4}$ when $N \ge 4$.

Summary: We construct positive solutions to a semilinear elliptic equation $-\Delta u = u^p$ in a general bounded domain, with prescribed isolated boundary singularities, with the zero Dirichlet boundary condition away from the singular set. Such solutions were previously constructed when p is sufficiently close to $\frac{N+1}{N-1}$ from above, by del Pino, Musso, and Pacard (2007). Our result extends their result to the range $\left(\frac{N+1}{N-1}, \frac{N+2}{N-2}\right)$ apart from a discrete set of exceptional exponents. A main ingredient is to construct a fast-decay boundary singular solution to the equation $-\Delta u = u^p$ on the half-space and to obtain its nondegeneracy via a global analytic bifurcation theory.

Summary: The bifurcation structure of a supercritical elliptic equation is completely clarified by Joseph and Lundgren (1972/73) for power nonlinearities and the exponential nonlinearity in a ball. For theses nonlinearities, the bifurcation curve has infinitely many turning points when the growth rate of nonlinearity is smaller than Joseph–Lundgren critical, while the bifurcation curve has no turning point when the growth rate is greater than or equal to Joseph–Lundgren critical. In this talk, we give a new type of nonlinearity such that the growth rate is greater than or equal to Joseph–Lundgren critical, while the bifurcation curve has infinitely many turning points. This result shows that the bifurcation structure is not determined solely by the growth rate of the nonlinearity. In fact, we find a general criterion which determines the bifurcation structure.

Summary: We investigate the relaxation dynamics of point vortices described by the Euler–Smoluchowski–Poisson equation. Our study reveals a quantization mechanism for collapse masses and demonstrates that the Hamiltonian of the point vortex system governs the dynamics of sub-collapses, both in finite-time and infinite-time blowup scenarios.

Summary: In this talk, we investigate the existence and nonexistence of global-in-time positive solutions to the Cauchy problem for semilinear heat equations with radially symmetric potentials and spatial weights. We assume that the associated Schrödinger operator L is nonnegative in $L^2(\mathbb{R}^N)$. Under suitable assumptions on the radially symmetric positive harmonic function for the operator L, we establish Fujita-type criteria for the existence and nonexistence of global-in-time solutions to this problem. The present paper extends the previous work in the one-dimensional case to arbitrary dimensions.

Summary: We study the fractional semilinear parabolic system

$$\begin{cases} \partial_t^\alpha u + (-\Delta)^{\frac{\theta_1}{2}} u = |v|^{\frac{\theta_2}{N}} v & \text{in } \mathbb{R}^N \times (0,T), \\ \partial_t^\alpha v + (-\Delta)^{\frac{\theta_2}{2}} v = |u|^{\frac{\theta_1}{N}} u & \text{in } \mathbb{R}^N \times (0,T), \\ u(x,0) = u_0(x), v(x,0) = v_0(x) & \text{in } \mathbb{R}^N, \end{cases}$$

where $0 < \alpha \le 1$, $0 < \theta_1, \theta_2 \le 2$, $N \ge 1$ and $T > 0$. When $0 < \alpha < 1$, the fractional derivative ∂_t^α is meant in a generalized Caputo sense. We mainly consider the case where u_0 and v_0 have a singularity. We obtain integrability conditions on (u_0, v_0) which explicitly determine local in time existence/nonexistence of a solution.

21 Yusuke Yamauchi (Hiroshima Inst. of Tech.) Weighted gap conditions for minimal-time blow-up in semilinear heat equations 10

Summary: We study nonnegative classical solutions to the Cauchy problem for the semilinear heat equation with power nonlinearity. We establish three results concerning the initial data: a sufficient condition for minimal-time blow-up, a necessary condition for non-minimal-time blow-up, and a sufficient condition for non-minimal-time blow-up. To formulate these conditions, we introduce two quantities associated with a ball: a weighted average of the solution using the normalized first Dirichlet eigenfunction, and a weighted gap between the supremum of the solution and this average.

22 Kotaro Hisa (Fukuoka Univ.)
Jin Takahashi (Sci. Tokyo)
Erbol Zhanpeisov (Tohoku Univ.)
Infinite time blow-up and slow decay for the six dimensional energy-critical heat equation with self-similarly decaying initial data 10

Summary: We consider the six dimensional energy-critical semilinear heat equation with self-similarly decaying initial data. Our main result shows the existence of sign-changing solutions that exhibit infinite-time blow-up and nonnegative solutions that decay strictly more slowly than the self-similar rate. Moreover, the blow-up and decay rates are not uniquely determined by the decay rate of the initial data, but exhibit a certain flexibility depending on the construction. The proof is based on gluing suitably rescaled bubbles to forward self-similar solutions.

23 Kotaro Hisa (Fukuoka Univ.)
Yasuhito Miyamoto (Univ. of Tokyo)
Non-uniqueness of positive solutions for supercritical semilinear heat equations without scale invariance 10

Summary: We establish nonuniqueness of solutions for Cauchy problems of semilinear heat equations with a wide class of nonlinearities. We assume that the growth rate of the nonlinearity is less than the Joseph–Lundgren exponent for $N > 10$ and it satisfies certain assumptions guaranteeing the existence of a positive radial singular stationary solution u^*. We prove that the problem with initial value u^* has at least two positive solutions, namely u^* and $u(t)$ which satisfies $u \in L^\infty_{loc}(0, t_0; L^\infty(\mathbb{R}^N))$ for some $t_0 > 0$.

24 Yuri Soga (Tohoku Univ.) A classification of behaviors of solutions to a chemotaxis system in supercritical dimensions 10

Summary: We consider a chemotaxis system in the whole space with emphasis on supercritical dimensions. We establish a sharp threshold phenomenon separating global-in- time existence from finite time blow-up in terms of scaling-critical Morrey norms of the initial data. In particular, we prove the existence of singular stationary solutions and show that their Morrey norm values serve as the critical thresholds determining the long-time behavior of solutions.

25 Yuri Soga (Tohoku Univ.)
Grzegorz Karch (Univ. of Wrocław)
Asymptotic behaviors of solutions for aggregation-diffusion equations with nonlocal interaction 10

Summary: We consider the large-time behavior of aggregation-diffusion equations with nonlocal interaction. First, we assume regular interaction kernels and establish heat kernel asymptotics under weaker assumptions than those imposed by Carrillo, Gómez-Castro, Yao and Zeng (2023). Our proof is based on decay estimates and Duhamel's formula, and does not rely on their entropy method or the use of self-similar variables. We next discuss the critical logarithmic interaction. In this case, the interaction remains visible under the diffusive scaling, and the asymptotic profile is described by a nonlinear self-similar solution. We prove uniqueness of this self-similar solution for every prescribed mass and show convergence toward it after rescaling, based on the repulsive structure of the logarithmic interaction energy. This is a joint work with Grzegorz Karch (University of Wrocław).

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

Kotaro Watanabe (Nat. Defense Acad. of Japan) — Applications of isometries on annuli and spheres to the shape evaluation problem of positive solutions for semilinear elliptic equations

Summary: We define isometries on annuli and spheres and apply them to the shape evaluation problem of positive solutions for semilinear elliptic equations under the Dirichlet boundary condition, specifically focusing on their spherical symmetry and the location of their maximum points. For problems on spheres, we apply this approach to the existence of m-mode solutions. For problems on annuli, we utilize it to evaluate the location of the maximum points of positive solutions to the Henon equation. Furthermore, we attempt to apply these methods to the uniqueness theorems of positive radial solutions for certain types of semilinear elliptic equations under the Dirichlet condition.

September 2nd (Wed) Conference Room II

9:00–12:00

26 Yuta Koizumi (Waseda Univ.) — Space-time analyticity for the parabolic-parabolic Keller–Segel–Navier–Stokes equations ····· 10

Summary: Consider the Cauchy problem of the Keller–Segel–Navier–Stokes equations of parabolic-parabolic type in the whole space with the initial data in scaling invariant homogeneous Besov spaces. We show that the mild solution to the system is analytic jointly in space and time variables. The corresponding error estimates are also established.

27 Yuta Koizumi (Waseda Univ.) — Space-time analyticity for the parabolic-elliptic Keller–Segel–Navier–Stokes equations ····· 5

Summary: Consider the Cauchy problem of the Keller–Segel–Navier–Stokes equations of parabolic-elliptic type in the whole space with the initial data in scaling invariant homogeneous Besov spaces. We show that the mild solution to the system is analytic jointly in space and time variables. The corresponding error estimates are also established.

28 Khadijeh Baghaei (PIAIS), Yutaro Chiyo (Tokyo Univ. of Sci.), Chihaya Machino (Tokyo Univ. of Sci.), Tomomi Yokota (Tokyo Univ. of Sci.) — Boundedness in an indirect chemotaxis-consumption model with signal-dependent sensitivity ····· 10

Summary: This talk deals with global existence and boundedness in an indirect chemotaxis-consumption model with signal-dependent sensitivity. In previous works, global existence and boundedness were obtained in a higher-dimensional case. In this talk, we study a lower-dimensional case.

29 Alessandro Columbu (Univ. of Cagliari), Shohei Kohatsu (Tokyo Univ. of Sci.), Monica Marras (Univ. of Cagliari) — Finite-time blow-up in flux-limited chemotaxis systems with nonlinear signal production ····· 10

Summary: We consider flux-limited chemotaxis systems with nonlinear signal production, and show that under suitable conditions on parameters, there exist initial data with the property that the corresponding classical solutions blow up in finite time. The proof is based on establishing monotonicity of solutions, and we have developed a proof method for monotonicity applicable even in the presence of nonlinear sensitivities.

Summary: We study the Cauchy problem for the two dimensional fully parabolic Keller–Segel system at the critical mass. Global-in-time existence at the critical mass is known under radial symmetry or additional moment assumptions on the initial data. In the absence of moment assumptions, classical energy-based approaches cease to be effective, and the problem becomes substantially more delicate at the critical threshold due to the degeneracy of the underlying energy structure. In this talk, we establish global-in-time existence for general initial data at the critical mass without imposing any symmetry or moment conditions.

Summary: In this paper, we prove the asymptotic stability of the critical constant steady state for a simplified parabolic-elliptic Keller–Segel system in n-dimensional Euclidian space, which admits a one-parameter family of constant steady states. Although the stability threshold for constant steady states is known, the critical case has remained open. We also show that the convergence rate in the critical case differs from the rates obtained for previously studied subcritical constant steady states.

Summary: We study the simplest parabolic-elliptic model of chemotaxis in $\mathbf{R}^N$, and show the optimal criteria for the existence of the infinite time blow-up of solutions with the initial data below the Chandrasekhar singular solution when $N \geq 10$. In particular, we exhibit the differences of the criteria between the cases $N \geq 11$ and $N = 10$.

Summary: We prove global existence of weak solutions to quasilinear Keller–Segel systems with nonlinear mobility by the minimizing movement (JKO scheme) in the product space of the weighted Wasserstein space and L^2 space. In particular, we newly show global existence of weak solutions to the degenerate Keller–Segel system with nonlinear mobility in the critical case. While the minimizing movement for Keller–Segel systems with linear mobility are adapted in the product space of the Wasserstein space and L^2 space, due to the nonlinearity of mobility, we need to use the weighted Wasserstein space instead of the Wasserstein space.

Summary: In this talk, the initial-value problem of three-dimensional Debye–Hückel-type drift-diffusion equation is discussed. Particularly, large-time behavior of solutions are studied. In the preceding work, it was shown that charge-density converges asymptotically to the radially symmetric function. In this talk, it is reported that the unique nonlinear profile describing the electric field effect acts radially symmetrically.

Summary: We study a one-dimensional free boundary problem arising in combustion theory, where the motion of the interface is governed by a prescribed Neumann boundary flux and a zero Dirichlet boundary condition. We treat both the half-line case and the bounded interval case. For both settings, we employ maximal L^p-L^q regularity as our main analytical tool. In the half-line case, the solutions need not decay at infinity, even though the spatial derivatives belong to $L^q(\mathbb{R}_+)$. To handle the evolution law of the free boundary, we introduce a derivative formulation that avoids second-order boundary traces. By combining maximal L^p-L^q regularity and Schauder estimates, we establish local- in-time existence, uniqueness, and regularity of solutions, as well as the evolution law of the free boundary.

Summary: In this talk, we discuss the local-in-time well-posedness of a free-boundary problem arising from a combustion theory. The problem is described by a linear inhomogeneous heat equation posed on the moving domain $(s(t), \infty)$, subject to a homogeneous Dirichlet boundary condition and an inhomogeneous Neumann boundary condition. Our main result establishes the existence and uniqueness of a positive classical solution. In particular, we show that the boundary function $s(t)$ is $\frac{1}{2}$-Hölder continuous in time when the forcing term is singular of order $O(\frac{1}{\sqrt{t}})$. Furthermore, under suitable smoothness assumptions on the initial data and the forcing term, we prove that s enjoys higher regularity than $\frac{1}{2}$-Hölder continuity.

Summary: In this talk, we give results on the unboundedness and explicit form of the minimal speed of traveling wave solutions for a one-dimensional spatial reaction-diffusion equation with an asymptotically linear reaction term and a saturation parameter. By applying a Poincaré-type compactification, we reveal the full dynamics (including infinity) of the two-dimensional system of ordinary differential equations satisfied by traveling wave solutions.

Summary: Consider the Allen–Cahn equation $u_t = \varepsilon u_{xx} + (u - u^3)/\varepsilon$ with a parameter $\epsilon > 0$ posed on the interval $[0, 1]$ with homogeneous Neumann boundary conditions. It is known that the equation possesses for each integer n, a unique (up to sign) steady solution $u_{n,\varepsilon}$ with n distinct zeros. Such solutions are called transition layers, and we study the uniform (with respect to ε) null-controllability of the Allen–Cahn equation linearized around them, with distributed controls of the form $\chi_\omega(x)h(t, x)$, where ω is a finite sum of non-empty open intervals and χ_ω is its indicator function. We show that if and only if the closure of ω contains all the zeros of $u_{n,\varepsilon}$, the system is uniformly null-controllable in finite time. This is a joint work with Vincent Laheurte (Université du Luxembourg) and Franck Sueur (Université du Luxembourg).

39 Masahiko Shimojo (Tokyo Metro. Univ.)
Arnaud Ducrot (Univ. Le Havre Normandie)
Jong-Shenq Guo (Tamkang Univ.)
Stability of traveling waves in non-cooperative systems with nonlocal dispersal of general diffusivities 10

Summary: In this talk, we establish a stability theorem for traveling wave solutions to a class of non-cooperative reaction-diffusion systems with nonlocal dispersal and general diffusivities. The stability condition requires the initial perturbation to yield a bounded and integrable weighted relative entropy functional. Finally, we demonstrate the applicability of our main theorem by analyzing the stability of traveling waves in several non-cooperative ecological models.

40 Ryo Ito (Kanagawa Univ.)
Hirokazu Ninomiya (Meiji Univ.)
Non-global unbounded traveling wave solutions of reaction-diffusion equations 10

Summary: We consider non-global unbounded traveling wave solutions of a one-dimensional reaction-diffusion equation. Previous studies have shown that, under a linear growth condition on the nonlinearity, there exists the minimal wave speed that separates the existence and nonexistence of traveling wave solution. In contrast, traveling wave solutions may fail to exist in the non-global setting. We extend this framework to the non-global case by allowing the minimal wave speed to take the value $+\infty$.

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

Junichi Harada (Akita Univ.)
Asymptotic behavior of solutions to the energy critical Fujita equation in 5D and 6D

Summary: In this talk, we report on our recent results regarding the asymptotic behavior of solutions to the following heat equation:

$$u_t = \Delta_x u + |u|^{p-1}u \qquad (p = \tfrac{n+2}{n-2})$$

Our interest is to clarify the dynamics of solutions to this equation. Generally, in critical-type problems, the set of all stationary solutions plays a major role in determining the dynamics. In the last decade, there has been great progress in the analysis around the Aubin–Talenti solution, and it has been shown that various types of solutions exist. In this talk, we change our perspective slightly and study the movement of the center of mass of the solutions. We will present our results on this problem.

September 3rd (Thu) Conference Room II

9:15–12:00

41 Hilhorst Danielle (Paris-Saclay Univ.)
Yasuhito Miyamoto (Univ. of Tokyo)
Kimie Nakashima (Tokyo Univ. of Marine Sci. and Tech.)
Convergence to a self-similar solutions for a two phase Stefan problem with zero latent heat 10

Summary: We study a two-phase Stefan problem with zero latent heat on the half-line. This problem involves a discontinuous diffusion coefficient. We establish a well-posedness theory for weak solutions, including existence, uniqueness, and a comparison principle, for a broad class of initial data. A central part of the paper is the construction of an explicit stationary solution in self-similar variables, corresponding to a self-similar profile of the original problem. Our main result proves that this self-similar profile is globally asymptotically stable: for any admissible initial data, the corresponding solution converges to the profile in the L^1-sense as time tends to infinity. This provides the first global convergence result in L^1 for the two-phase Stefan problem on the half-line.

Summary: For each $m \in \mathbb{N} \cup \{0\}$, we consider the corresponding area-preserving curvature flow for open curves with general contact angles on skew lines. In the studies of moving boundary problems for geometric gradient flows, the right-angle condition ensures that the endpoints of open curves naturally remain on the boundary lines during the evolution. On the other hand, under general contact angle conditions, it is non-trivial whether the end points remain on the lines, and the solvability of the problem is no longer guaranteed. We construct global-in-time solutions and analyze their asymptotic behavior under such generalized boundary conditions.

Summary: Euler's elastica is a critical point of the bending energy under the fixed-length constraint, and its L^p-counterpart is called p-elastica. In this talk, we consider p-elasticae under the pinned boundary condition and classify the stability of the so-called flat-core p-elasticae, which is the only remaining case. Consequently, we completely classify all pinned p-elasticae in terms of stability.

Summary: We consider the variational problem for the Landau–Lifshitz energy with Dzyaloshinskii–Moriya interaction. We will report our resent result on the energy minimizing problem in general topological degree, which unveils a sort of phase transition phenomena mathematically.

Summary: We study the notion of dynamical stability of minimal surfaces, recently introduced by Stuvard and Tonegawa. It is formulated in terms of Brakke flows, which provide a weak formulation of mean curvature flow. We prove that a minimal surface is dynamically unstable if its scale-invariant L^2-distance to a plane at a singular point is sufficiently small.

Summary: We consider the Hölder continuity of viscosity solutions to fully nonlinear parabolic equations whose gradient terms exhibit superlinear growth slower than any polynomial, referred to as subpolynomial growth. Previous studies have treated specific examples such as logarithmic growth. To handle arbitrary subpolynomial growth conditions, we introduce the notion of a polynomial envelope and combine it with the theory of slowly varying functions developed by Karamata in the 1930s. Based on this framework, we establish a Harnack-type estimate adapted to the growth rate of the gradient term, which leads to interior Hölder estimates for a broader class of equations than existing results.

Summary: We construct Harnack-type estimates for viscosity solutions of fully nonlinear elliptic equations with superlinear gradient terms. More precisely, we establish an intrinsic weak Harnack inequality, originally developed for degenerate and singular parabolic equations. The purpose of this study is to show that this intrinsic estimate remains effective in the elliptic setting when superlinear gradient terms are involved. As consequences, we derive a strong maximum principle and an interior Hölder estimate. In particular, the interior Hölder estimate obtained here is new in the superlinear setting.

Summary: We study higher-order elliptic equations driven by a nonstandard-growth operator, commonly referred to as a double phase operator. For such elliptic equations, we establish a higher integrability result for very weak solutions, whose integrability is lower than standard weak solutions. This result gives a higher-order generalization of the recent work of Baasandorj, Byun, and Kim (Trans. Amer. Math. Soc., 2023). The proof relies on a higher-order Lipschitz truncation and Sobolev–Poincaré inequalities adapted to the double phase structure.

Summary: This talk is concerned with the asymptotic behavior of viscosity solutions to nonlinear parabolic equations involving the p-Laplacian as p tends to infinity.

Summary: We establish an interior $C^{1,\sigma}$ estimate for viscosity solutions to some degenerate Bellman type equations involving p-Laplacian type operators. We prove an equicontinuity estimate of rescaled solutions via doubling argument and weak Harnack inequality, and then apply improvement of flatness iteration to obtain the interior $C^{1,\sigma}$ estimate for some $\sigma \in (0,1)$.

Summary: In this talk, we will discuss the stability of Monge solutions for eikonal equations in metric spaces. A key difficulty is that the classical subslope is not generally preserved under uniform convergence. To address this issue, we develop an equivalent nonlocal formulation of subslope conditions on spheres. This approach complements existing methods based on metric viscosity solutions and enables us to directly establish stability results under uniform convergence and Gromov–Hausdorff perturbations of the domain and the metric, without test functions. By introducing the optical metric, the same strategy can be applied to inhomogeneous eikonal equations. In addition, these ideas lead to a Perron-type construction of Monge solutions on general complete length spaces.

Summary: This talk studies localized waves in a two-dimensional channel containing a semicircular obstacle. The wave satisfies a Dirichlet condition on the channel walls and a Neumann condition on the obstacle boundary, and it decays along the channel. Such a non-radiating solution is called a Dirichlet trapped mode. We prove that no such mode exists below the cut-off frequency (i.e. the bottom of the essential spectrum) when the obstacle radius is sufficiently large. The proof combines variational analysis with certified interval-arithmetic computations using Arb.

Summary: We consider the initial-boundary value problem for the nonlinear Schrödinger equation with a nonlinear Neumann boundary condition in higher-dimensional half-spaces. While local well-posedness in L^2 has been established in two- and three-dimensional half-spaces, the L^2-theory in dimensions four and higher, as well as the corresponding H^1-theory, has remained open. The main difficulty is that the standard representation formula breaks down when one takes derivatives in the normal direction. In this talk, we establish anisotropic boundary Strichartz estimates in higher dimensions and apply them to prove local well-posedness in both L^2 and H^1.

14:15–16:30

Summary: We discuss the global well-posedness and asymptotic behavior of L^2-solutions to stochastic nonlinear Schrödinger equations with multiplicative noise driven by continuous square integrable martingales with density. Our approach relies on a rescaling transformation that converts the stochastic system into a random nonlinear Schrödinger equation with a potential acting as a damping term.

Summary: We consider the instability of stationary solutions to nonlinear Schrödinger equations with double-power nonlinearities. These equations admit both standing waves with positive frequency decaying exponentially at spatial infinity and stationary solutions decaying polynomially. In this talk, we prove the instability of positive, radial, and decreasing stationary solutions under a zero-frequency analogue of the Grillakis–Shatah–Strauss instability criterion.

Summary: We consider the generalized Boussinesq equation in high dimensions. Chen–Shao (2026) proved the scattering of radial solutions below the ground state in the mass-subcritical case. In the proof, they divide solutions below the ground state into two invariant sets, and use the fact that the virial functional is always positive within one of these sets. However, there is a partial error in the proof of the fact. We show that there exists an exponent such that the virial functional is always positive within the invariant set when the power of nonlinearity is greater than or equal to that exponent. On the other hand, the virial functional can be negative within the invariant set when the power of nonlinearity is less than that exponent.

Summary: For nonlinear Schrödinger equations with power-type nonlinearities, the existence and scattering of solutions are established by the general theory developed by Tosio Kato when the exponent of the nonlinearity is above the Strauss exponent. On the other hand, when the exponent is at or below the Strauss exponent, no comparable general theory is available, and finite-time blow-up of solutions with small initial data is known under certain special conditions. In this talk, we show that, one can establish global-in-time existence and scattering even below the Strauss exponent, provided that the nonlinearity satisfies suitable conditions.

Summary: We study a class of nonlinear Schrödinger systems, which are mathematical models used to describe wave phenomena in physics. For critical nonlinear interactions involving derivatives, solutions may develop complicated long-time behavior, and understanding whether they remain stable is a fundamental problem. We introduce a new condition that is significantly weaker than previously known assumptions while still guaranteeing the global existence of small solutions. Under this condition, we also determine the asymptotic behavior of solutions and show that it is governed by a related ordinary differential equation. Our result provides a unified framework that covers several previously studied models and extends earlier theories on long-time dynamics.

Summary: We consider two dimensional Fermi–Pasta–Ulam lattices equation. Friesecke and Pego proved the existence of asymptotically stable solitary waves in one dimensional Fermi–Pasta–Ulam lattices. We regard the one dimensional solitary waves as line solitary waves in two dimensional Fermi–Pasta–Ulam lattices. In this talk, we show the linear stability of the line solitary waves in two dimensional Fermi–Pasta–Ulam lattices.

Summary: We consider the Klein–Gordon–Schrödinger system in 4D. We obtain results about a minimization problem and instability of standing waves of the Klein–Gordon–Schrödinger system. These results are based on joint work with Masaru Hamano (Kyoto University) and Hiroaki Kikuchi (Tsuda University).

Summary: We study local well-posedness for a class of fourth-order nonlinear dispersive systems on the one-dimensional torus. The main difficulty arises from the loss of derivatives in the nonlinear terms. Under relaxed structural conditions, we construct modified energies via gauge-type transformations to eliminate the derivative loss and establish local well-posedness in high-regularity Sobolev spaces.

Summary: We prove a large-data L^2-decay estimate for nonlinear dissipative Schrödinger equations with attractive-dissipative power nonlinearity. The main difficulty is the lack of sign definiteness of the standard energy when $\Re\lambda < 0$, which prevents the usual energy argument from directly yielding a uniform gradient bound.

We introduce an augmented energy, obtained by adding a suitable multiple of the decreasing L^2-norm to the standard energy. This produces an additional dissipative term and gives a direct uniform-in-time H^1 bound without the iteration argument used in previous works. Consequently, for arbitrary initial data in the weighted energy space $\Sigma = H^1 \cap \mathcal{F}H^1$, we obtain the decay rate previously known under the strong dissipative condition throughout the sharp decay range $1 < p \leq 1 + 2/d$.

Summary: We consider the Cauchy problem for quadratic derivative fractional nonlinear Schrödinger equations. We determine the sharp exponents of the fractional derivatives for which the Cauchy problem is well-posed in the Sobolev space.

Summary: The cubic nonlinear Schrödinger equation on the one-dimensional torus is globally well-posed in L^2. In this talk, we discuss an analogue of this result for an infinite system. This system can be formulated as an operator equation with self-adjoint initial data in the Schatten class $\mathfrak{S}^p$. We will first explain that the system is globally well-posed for $p = 1$ and ill-posed for $p > 1$. We will then show that a suitable renormalisation improves this threshold. More precisely, the renormalised system is globally well-posed for $p \leq 2$ and ill-posed for $p > 2$. This is joint work with Andrew Rout (Politecnico di Milano).

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

Summary: In this talk, we consider the Cauchy problem for linear elastic wave equations. We prove the precise long-time behavior of solutions according to the regularity of the initial data. In particular, we obtain estimates that exhibit the interaction among the components as a system.

September 4th (Fri) Conference Room II

9:00–12:00

Summary: In this presentation, we consider the inverse problem of the wave equation for a medium containing cavities and inclusions as scatterers using the enclosure method. The position information of the scatterers obtained from the indicator function is the shortest distance from the observation site, and the information regarding the type of scatterers is a positive or negative sign. In this study, by using asymptotic solutions and examining the leading terms of the asymptotic expansion of the indicator function in detail, we clarified the relationship between the position, shape, and type of the scatterers and the leading terms of the indicator function.

Summary: In inverse problems, waves are frequently used to obtain information about the interior of structures, such as cavities. Mathematically, such problems are formulated as initial and boundary value problems of the wave equation. The incident waves are emanated from a domain $B \subset D$ and reflected waves are measured in the same region B. Active sonar is a typical example for such inverse problems. To analyze these problems, asymptotic solutions provide a good approximation for the ture reflected waves. One of the big problems for asymptotic solutions is to require much regularities. In this talk, we introduce *modified asymptotic solutions* to reduce this issue, and show how we can improve regularities for the boundaries of the cavities.

Summary: We consider the Cauchy problem for systems of semilinear hyperbolic equations of first order with multiple propagation speeds. We obtain a sufficient condition for the global existence of C^1-solutions with small initial data, and also the almost optimal lifespan of C^1-solutions under weaker conditions than this sufficient condition. Application to systems of semilinear wave equations in one space dimension with multiple propagation speeds is discussed, and we obtain the almost optimal lifespan estimate under some condition weaker than the null condition.

Summary: We consider decay estimates for semilinear wave equations with weighted nonlinear terms in one space dimension. In particular, we focus on pointwise estimates and the decay and non-decay properties of the energy, where the weights depend on time and space. We discuss how the weights affect the decay properties of solutions.

Summary: We consider the Cauchy problem for systems of semilinear wave equations. We are interested in the critical cases: The case of quadratic nonlinearity in three space dimensions, and the case of cubic nonlinearity in two space dimensions. A well-known sufficient condition of small data global existence for these critical cases is the null condition. We would like to obtain the small data global existence and the asymptotic behavior of global solutions under a weaker condition than the null condition. Our condition is closely connected to the weak null condition of Lindblad–Rodnianski.

Summary: In proving the energy decay estimates for initial value problems of weakly extinct wave equations, the smoothness and oscillation of the dissipative coefficient are important factors. In this talk, will introduce a result showing that the energy decay estimate holds under weaker assumptions regarding the smoothness of the coefficient than before, made possible by the introduction of a new method.

Summary: In this talk, we consider the initial value problem for the 1D quasilinear wave equation with small initial data. We determine the asymptotic behavior of the lifespan of classical solutions as the parameter characterizing the smallness of the initial data tends to 0. Furthermore, we successfully removed the assumption of strong decay at spatial infinity on the initial data, which was imposed in previous studies

Summary: We consider the dissipative structure and decay properties of the Timoshenko system in the whole space when weak damping terms are introduced into both the displacement and rotational equations. Although the system does not satisfy the Kawashima condition, we uncover a new stabilization mechanism arising from the interaction of the two damping terms. By employing the Fourier energy method, we establish sharp point-wise estimates of the Fourier transform and derive optimal time-decay rates of solutions in L^2-based norms. A feature of our result is that the combined damping eliminates the regularity-loss phenomenon, while a fourth-order degeneracy appears in the low-frequency region. This behavior differs essentially from previously studied single-damping models and provides a new example of effective dissipation beyond the classical Kawashima framework.

Summary: We investigate the scalar viscous conservation law characterized by a time-delayed nonlinearity. For a sufficiently small time delay, we prove the existence of traveling wave solutions corresponding to arbitrary inviscid Burgers' shock profiles. Furthermore, we establish the nonlinear asymptotic stability of these traveling waves and determine their pointwise decay rates in the space-time domain. By exploiting the specific structure of the Green's function for the Burgers' equation linearized around the stationary profile, we derive an effective integral representation of the solution. This explicit Green's function enables us to capture the cancellation of effects induced by the time shift. Consequently, this integral representation yields a constructive method for obtaining exponentially sharp pointwise estimates.

Summary: In this talk, the initial value problem of the Burgers equation with the half Laplacian is concerned. This problem is critical from the viewpoint of well-posedness and has been extensively studied. On the other hand, it is subcritical in terms of the large-time behavior of solutions. Previous studies have shown that the solution converges to the Poisson kernel as time goes to infinity. However, since the derivative order of the equation are balanced, the equation has a first-order hyperbolic structure as well as a parabolic structure and is expected to have a dissipative structure. The main result of this talk clarifies that the diffusive wave emerges in the asymptotic expansion and the diffusive wave is explicitly described, and that asymptotic profiles from the nonlinear terms are uniquely determined by the scaling. In addition, the main result also reveal that the logarithmic shifting term appears in the expansion.

Summary: The spherically symmetric motion of the viscous, heat-conducting, ideal polytropic gas is described by the spherically symmetric compressible full Navier–Stokes equations. The existence of a unique stationary solution for the corresponding outflow problem is obtained by I. Hashimoto and A. Matsumura. In the current presentation, we study the decay property of this stationary solution and we also show that it is time-asymptotically stable for small spherically symmetric initial perturbations.

Summary: Consider the motion of a barotropic compressible viscous fluid in a two-dimensional strip-like domain bounded above by a free boundary and below by a rigid bottom. The density and velocity of the fluid are governed by the two-dimensional compressible Navier–Stokes equations subject to mixed boundary conditions, where the effects of gravity and surface tension are not taken into account. In this talk, in a critical regularity framework, we prove the global well-posedness of the problem near the trivial equilibrium state for small initial data. No compatibility conditions are imposed on the initial data. Furthermore, the corresponding solution converges exponentially to the equilibrium as time tends to infinity. Our approach is based on maximal L_1-regularity for the linearized problem.

77 Masashi Aiki (Tokyo Univ. of Sci.)
Mitsuo Higaki (Kobe Univ.)
Stability of the shape for circular vortex filaments under non-symmetric perturbations 10

Summary: We establish the nonlinear orbital stability of circular vortex filaments governed by the Localized Induction Equation (LIE) under non-symmetric perturbations, within the framework of [Tani-Nishiyama, 1997]. While the circular filaments are known to be Lyapunov unstable due to linear growth of the translational mode, we prove that their shape remains globally stable modulo spatial translations and rotations about the symmetry axis. The crucial ingredient is a geometric stability lemma derived from the conservation of vector fluid impulse, which constrains the low-frequency modulations that are not covered by the relative energy. Finally, we relate the fluid impulse to an isoperimetric inequality, yielding a geometric constraint for closed filaments.

78 Masashi Aiki (Tokyo Univ. of Sci.)
Mitsuo Higaki (Kobe Univ.)
Lyapunov unstable motion bifurcating from a circular vortex filament 10

Summary: This paper investigates the dynamics of closed vortex filaments governed by the Localized Induction Equation. Recently, Aiki and Higaki (2026) established the nonlinear orbital stability of circular vortex filaments, while identifying Lyapunov instability due to the growth of translation modes. Motivated by this result, we prove the existence of a family of closed solutions, which we call axial screw motions, that bifurcate from a circular filament. These solutions remain uniformly close to the orbit of the circle, but drift secularly away from the reference motion because their translation speed along the symmetry axis differs from that of the circular filament. In particular, they provide explicit non-trivial perturbations that satisfy orbital-stability estimates while failing Lyapunov stability.

14:15–16:15

79 Tomoaki Yoshizawa (Univ. of Tokyo)
Global well-posedness and temporal decay estimates for the viscous β-plane equations 10

Summary: We consider the Cauchy problem of the viscous β-plane equations. We first establish the global well-posedness of the system for the initial data sufficiently small compared to the Rossby parameter. We also reveal that under some additional assumptions, the solution decays as fast as the corresponding linear solution and asymptotically behaves like a constant multiple of the integral kernel of the linearized equation. In particular, the decay rate of the solution is faster than expected from the flow of the heat equation.

80 Toi Fujimura (Tokyo Univ. of Sci.)
Motohiro Sobajima (Tokyo Univ. of Sci.)
Asymptotic behavior of solutions to the one-dimensional p-system with time-dependent damping 10

Summary: We consider asymptotic behavior of solutions to the Cauchy problem for the one-dimensional p-system with time-dependent damping under a diffusive condition. By introducing auxiliary functions adapted to the damping coefficient $b(t)$, we extract the diffusive structure of the system without differentiating $b(t)$. Under a low-regularity assumption on $b(t)$, we prove global-in-time existence and derive convergence rates toward an asymptotic profile by energy estimates.

81 Taiki Okazaki (Tohoku Univ.)
Uniqueness of the sub-critical SQG without time-continuity assumption 10

Summary: We consider the uniqueness of the solution of the dissipative surface quasi-geostrophic equation, without assuming time-continuity and smallness of the solutions. We show that the uniqueness holds in the scale-critical Lebesgue spaces. The proof is based on the energy method, inspired by the approach introduced by Lions and Masmoudi (2001) in the study of uniqueness for the Navier–Stokes equations. A key ingredient of the argument is the justification of the energy inequality via the smoothing effect of the fractional heat semigroup together with an iteration scheme based on the structure of the integral equation.

Summary: We consider the incompressible MHD-Boussinesq system in the whole space $\mathbb{R}^3$. We establish the existence and uniqueness of local strong solutions for arbitrary initial data and external forces in scaling invariant Besov spaces. Our method relies on the maximal Lorentz regularity theorem for the linearized equations, which enables us to handle the full nonlinear system within the framework of Lorentz–Besov spaces. Furthermore, we prove that these local solutions can be extended globally in time provided that the initial data and external forces are sufficiently small in the scaling invariant norms.

Summary: We consider the stationary MHD equations in $\mathbb{R}^3$. The aim of this talk is to prove a Liouville-type theorem for the MHD system. We emphasize that the assumptions on the magnetic field can be relaxed compared with those on the velocity field. The key ingredient of the proof is to establish an a priori estimate for the Dirichlet integral in terms of the vorticity and the current density. Furthermore, our theorem covers the result for the Navier–Stokes equations established by Kozono–Terasawa–Wakasugi (2017, J. Funct. Anal.).

Summary: In this talk, we consider a sufficient condition for weak solutions of the ideal magneto-hydrodynamic (MHD) equations in a bounded domain to satisfy the conservation laws for energy and cross-helicity. In 1997, Caflisch, Klapper, and Steele proved the conservation laws for energy and cross-helicity in the whole space when weak solutions possess regularity higher than 1/3. Kang and Lee (2007) studied the critical case, proving the conservation laws in the whole space with 1/3 fractional derivative. For the case of bounded domains, Wang and Zuo (2020) proved the conservation laws under a condition corresponding to that of Caflisch, Klapper, and Steele, by additionally assuming a certain boundedness near the boundary. We show the conservation laws for energy and cross-helicity under a condition corresponding to that of Kang and Lee, by utilizing the Hodge–Stokes operator.

Summary: In this paper, we study the two-dimensional incompressible Navier–Stokes system with external force under homogeneous Dirichlet boundary conditions in a smooth bounded domain. Based on the results of Takeuchi and Winkler, we investigate the uniform L^∞ bounds of solutions with Lebesgue spaces replaced by Lorentz spaces which enable us to obtain more precise information on the scaling critical norm.

Summary: The incompressible Navier–Stokes system on the whole space is considered. By assuming that the small initial data belong to the scaling invariant homogeneous Besov spaces and satisfy an additional condition, we obtain the decay rates of the corresponding global solutions. In particular, we characterize the condition of the initial data for the logarithmic decay. Our decay rate improves up to a certain rate, which is expected to be the maximal decay rate under our conditions.

87 Mikihiro Fujii (Nagoya City Univ.) Non-uniqueness for the Navier–Stokes equations in scaling Besov spaces 10

Summary: It is known that uniqueness of mild solutions to the incompressible Navier–Stokes equations holds in the critical class $C([0,T);L^n(\mathbb{R}^n))$ for $n \geqslant 3$. In this talk, we prove that this result is sharp in the sense that uniqueness fails if $L^n(\mathbb{R}^n)$ is replaced by some scaling critical spaces that are even slightly larger. We achieve this through a complete classification for every pair (p,q) of whether uniqueness of mild solutions in the critical Besov class $C([0,T);\dot{B}^{n/p-1}_{p,q}(\mathbb{R}^n))$ holds or not. Our non-uniqueness mechanism produces infinitely many global solutions emanating even from zero initial state, whose large-time asymptotics are governed by non-trivial stationary flows. To the best of our knowledge, such non-unique solutions provide the first examples of non-dissipative unforced Navier–Stokes flow with critical regularity.

88 Lorenzo Brandolese (Univ. Lyon 1)
Takahiro Okabe (Yokohama Nat. Univ.)
Taku Yanagisawa (Waseda Univ.)
Linear and nonlinear interaction of the incompressible dissipative Navier–Stokes flow 10

Summary: We consider the asymptotic behavior of solutions to the incompressible Navier–Stokes equations. We constructed rapidly decaying solutions for certain initial data that do not necessarily possess symmetry. Moreover, we observe that linear and nonlinear interaction may occur in our situation.

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

Kazuyuki Tsuda (Kyushu Sangyo Univ.) An approach to a moving boundary problem for the Navier–Stokes equations in weighted function spaces

Summary: In this talk, we consider the Navier–Stokes equations in exterior domains in $\mathbb{R}^n$, $n \geq 3$, with a periodically in time moving boundary and external force. For this case we prove the existence of a locally unique mild time periodic solution in weighted function spaces with radially symmetric Muckenhoupt weights.

This type of problem was classically studied by Morimoto (1971) and Miyakawa and Teramoto (1982), after global weak solutions was shown by Fujita and Sauer (1968), and has subsequently been investigated by several authors. We briefly review previous results on fixed or periodically moving boundaries.

To solve our problem, a Muckenhoupt weight approach works well. Indeed, the solutions split into a stationary part controlled by potential theoretic estimates and a purely oscillatory part constructed as mild solution via analytic semigroup theory in weighted spaces. To deal with perturbation terms of even second order—coming from a coordinate transform and the moving boundary—a maximal L^1 type regularity estimate will be used in weighted Lorentz spaces. To control the convective term an H^∞-calculus in weighted spaces of the Stokes operator, its BIP property and embedding estimates of fractional powers are exploited.

Real Analysis

September 3rd (Thu) Conference Room V

9:30–11:45

1 Naoya Hatano (Univ. of Osaka) Local-type estimate for the mean oscillation of rearrangements ····· 15

Summary: An estimate for the mean oscillation, defined as the difference between the decreasing rearrangement and its maximal rearrangement, was established by Alvino, Trombetti, and Lions in 1989. In this study, we obtain a local version of their result by restricting the functions to an arbitrary cube. Moreover, as a corollary, we obtain a local-type Sobolev inequality in the framework of Lorentz spaces.

2 Takashi Miyamoto (Osaka Kyoiku Univ.)
Hiroo Kita (Kagoshima Univ.*)
Naoko Ogata (Kobe Univ.)
On the r-integrability of non-strongly measurable functions taking values in Orlicz spaces ····· 15

Summary: In a presentation given at the 58th Joint Symposium on Real Function Theory and Functional Analysis (Ito Campus, Kyushu University, 2019), we explained the construction of a function defined on the interval [0,1] and taking values in the Orlicz space $L^{\Phi}(\mathbb{R}^n)$. This function is neither strongly measurable, strongly continuous, nor weakly continuous. How can such a function be integrated? In this talk, inspired by the concept of ranked spaces, we introduce the r-integral and demonstrate that r-integration is indeed possible.

3 Ryota Kawasumi (Gunma Univ.) The boundedness of generalized fractional maximal operators on Orlicz and weak Orlicz spaces with respect to Hausdorff capacity ····· 15

Summary: We consider the boundedness of the generalized fractional maximal operator $\mathcal{M}_\rho$ on Orlicz and weak Orlicz spaces with respect to Hausdorff content. Hausdorff content is a set function defined similarly to an outer measure and enables the quantitative measurement of non-integer-dimensional objects. Orlicz and weak Orlicz spaces generalize the classical Lebesgue and weak Lebesgue spaces, respectively, and are defined in terms of Young functions. To establish our main result, we use a modular inequality derived by Deringoz et al. (2018), which serves as a powerful tool for analyzing the boundedness of operators on these spaces. Our result generalizes the results of Adams (1998) and Kawasumi, Nakai, and Shi (2023) concerning the boundedness of the fractional maximal operator $\mathcal{M}_\alpha$.

4 Hiroki Saito (Nihon Univ.) Diagonal trace inequalities in Choquet–Lorentz spaces ····· 15

Summary: We characterize diagonal trace inequalities in Choquet–Lorentz spaces by an isoperimetric inequality. We further show that the corresponding trace inequalities in Choquet spaces are equivalent to an isocapacitary inequality.

5 Gaku Sadasue (Osaka Kyoiku Univ.)
Eiichi Nakai (Ibaraki Univ.)
Satoshi Yamaguchi (Hitotsubashi Univ.)
Gagliardo–Nirenberg inequality for generalized fractional integrals on martingale Musielak–Orlicz and Musielak–Orlicz Hardy spaces ····· 15

Summary: By Mizuta et al, (2012), the classical Gagliardo–Nirenberg inequality for the fractional integral operators was extended to Musierak–Orlicz spaces. In this talk, we give an extension of Gagliardo–Nirenberg inequality for the fractional integral operators in the framework of martingale theory.

6 Yukino Tomizawa (Niigata Inst. of Tech.) A refinement of the triangle inequality in Busemann spaces and its extensions ····· 15

Summary: The refinement of the triangle inequality for two vectors in Banach spaces can be generalized to geodesics in Busemann spaces. Moreover, extension formulas for this refinement involving three or more vectors exist in Banach spaces. In this talk, we consider whether such extensions can be generalized to Busemann spaces.

7 Ryoji Fukuda (Oita Univ.)
Aoi Honda (Kobe Univ.)
Yoshiaki Okazaki
Uniform structure of Shilkret function space $\mathcal{L}^1(Sh)$ 15

Summary: We consider a non-additive measure and non-additive integral due to Shilkret. Uniform structure of Shilkret function space $\mathcal{L}^1(Sh)$ is discussed. We give a necessary and sufficient condition which ensures $\mathcal{L}^1(Sh)$ is a topological vector space.

8 Jun Kawabe (Shinshu Univ.)
Continuous Sugeno integral representation theorems in an abstract setting 15

Summary: The purpose of this talk is to present abstract Sugeno integral representation theorems whose representing measures are simultaneously inner and outer continuous on suitable collections of sets, including open, closed, compact, and measurable sets. Such theorems, which we call continuous Sugeno integral representation theorems, will be developed in a framework sufficiently general to cover a wide range of applications.

14:15–15:25

9 Kotaro Inami (SUSTech)
Strichartz estimates for quasi-periodic functions: An arithmetic perspective 15

Summary: Besicovitch quasi-periodic functions are generalizations of periodic functions. We consider the Strichartz type estimate for the Schrödinger equation with quasi-periodic initial data. Unlike the Euclidean setting and the periodic setting, neither the dispersive estimate nor the Weyl-type bound is known. In 2025, Schippa overcame this difficulty and established Strichartz type estimates via the decoupling estimate. In this talk, we improve the Strichartz estimates on a long time interval by focusing on the arithmetic properties of frequencies.

10 Yanhan Chen (Kyoto Univ.)
Weighted inequalities for variation operators associated with fractional Schrödinger semigroups 15

Summary: Let $\{e^{-tL^\alpha}\}_{t>0}$ be the fractional Schrödinger semigroup associated with $L=-\Delta+V$, where V is a non-negatvie potential belonging to the reverse Hölder class. In this work, we establish weighted boundedness properties of the variation operator related to $\{e^{-tL^\alpha}\}_{t>0}$, including weighted L^p-L^q quantitative inequalities and mixed weak-type inequalities, from which the weighted weak type $(1,1)$ inequality also follows as a special case.

11 Isamu Ohnishi (Hiroshima Univ.)
A variational proof of the Ryu–Takayanagi formula in non-compact gauge theories from Lie-algebraic observable-dependent renormalization 15

Summary: We present the first variational proof of the Ryu Takayanagi formula for holographic entanglement entropy in non compact gauge theories without the Einstein equations or background metric. Working in SL three R times SL three R Chern Simons theory we embed the modular Hamiltonian of a boundary region as a target observable in a dynamical Lie algebra with Lie algebraic observable dependent renormalization flow. This generates a Krylov tower whose invariance under the maximal Lie observable dependent symmetry subalgebra selects entanglement wedge preserving symmetries. We establish variational equivalence between the boundary modular flow and the normal variation of the bulk minimal surface in Iwasawa coordinates. Lions concentration compactness principle applied to minimizing sequences in the Sobolev space on the non compact manifold proves the existence of a minimizer satisfying the minimal surface equation. Thus the entanglement entropy equals the area of the minimizer divided by four Newtons constant plus an ultraviolet constant term as a theorem in the calculus of variations. The result extends to Sp two n R lattice gauge theories. This bridges operator algebraic renormalization with geometric variational calculus and opens a pathway toward non perturbative derivations of holographic dualities from gauge theory first principles.

12 Isamu Ohnishi (Hiroshima Univ.) The universal bridge theorem: Spectral-geometric norm-expectation correspondence in compressed LA-ODR algebras 15

Summary: We prove a rigorous model independent Norm Expectation Correspondence in compressed Lie algebraic observable dependent renormalization algebras. The correspondence equates the Hilbert Schmidt norm of the projected temporal drift generator to the deviation from the synchronized stationary state up to a curvature controlled remainder. By integrating the Wedderburn decomposition of the output algebra, the spectral theory of primitive quantum dynamical semigroups with contractivity and spectral gap estimates, and the Riemannian geometry of the quantum statistical manifold equipped with the Hilbert Schmidt metric and Amari Nagaoka connections, we elevate the observed Bridge Relation to the Universal Bridge Theorem. The remainder vanishes exactly under quantum detailed balance or flat alpha one connection, conditions satisfied in all Time Twisted Universe LA ODR models. The theorem completes the algebraic geometric closure of the TTU LA ODR synthesis, furnishes explicit synchronization rates and curvature diagnostics for quantum networks trapped ions and superconducting circuits, and supplies the first rigorous algebraic pathway from observable dependent renormalization to a fully geometric theory of emergent spacetime. It unifies spectral theory information geometry and quantum control.

15:40–16:40 Talk Invited by Real Analysis Section

Naohito Tomita (Univ. of Osaka) On the boundedness of bilinear pseudo-differential operators

Summary: In this talk, we consider the boundedness of bilinear pseudo-differential operators. We first determine the optimal conditions on symbols that ensure boundedness on unweighted Lebesgue spaces. We then discuss more general symbol classes and weighted estimates for bilinear pseudo-differential operators.

September 4th (Fri) Conference Room V

10:00–12:00

13 Daisuke Kubota (Chiba Univ.)
Naotaka Ukai (Chiba Univ.)
Ken Shirakawa (Chiba Univ.)
Daiki Mizuno
(Waseda Senior High School)
Large-time behavior for inhomogeneous pseudo-parabolic KWC systems with time-dependent coefficients 15

Summary: In this study, we investigate the large-time behavior of solutions to an inhomogeneous pseudo-parabolic KWC system with time-dependent coefficients. Our system extends previous studies by incorporating an inhomogeneous term and time-dependent damping coefficients. Under suitable assumptions, we establish the existence and uniqueness of global-in-time solutions and characterize their asymptotic behavior as time tends to infinity. The asymptotic limits of the solutions are expected to be closely related to the corresponding steady-state system, which may admit non-smooth BV solutions. Our aim is to clarify the process by which smooth global-in-time solutions approach such non-smooth steady-state solutions. This study is expected to provide theoretical insight into the validity of the pseudo-parabolic KWC system as a model for grain-boundary motion.

Summary: In this talk, we study a relaxed coupled PDE system arising as the constrained gradient flow of an orientation-adaptive anisotropic energy motivated by color image denoising. A characteristic feature of the system is the incorporation of an anisotropic function $\gamma \in C^{1,1}(\mathbb{R}^{3\times 2})$ and a rotation matrix $R \in C^{\infty}(\mathbb{R};\mathbb{R}^{2\times 2})$ into the energy functional. This structure enables automatic orientation adaptation, but it also gives rise to essential analytical difficulties in the study of the constrained problem. Under suitable assumptions on the anisotropic function γ, we prove the existence of solutions satisfying an energy dissipation inequality. The proof is based on a time-discretization scheme without range constraints and a limiting procedure recovering solutions to the constrained system.

Summary: In this talk we consider a one-dimensional free boundary problem describing a bread baking process. For this problem, the domain is assumed to be occupied by the bread consisting of crumb, crust and the evaporation front, and the unknown functions are the position of the front, the temperature field, and the water mass distribution. Our previous work established that the crust region never vanishes by constructing stationary solutions and applying the comparison principle under the high regularity condition for initial data. Now, we aim to show that the crumb region vanishes, namely, bread is baked completely.

Summary: We consider the long-time behavior of the dissipation function of the free energy in a nonlinear Fokker–Planck model with inhomogeneous spatial diffusion, subjected to the natural boundary condition. The model is based on a continuity equation and the law of energy dissipation associated with the free energy. By assuming that the spatial derivative of the gradient of log d(x) is sufficiently small, we show the exponential decay of the dissipation function. We next numerically examine whether the gradient of log d(x) affects the decay rate of the dissipation function in the one-dimensional Fokker–Planck model.

Summary: We consider a Cauchy–Neumann problem for a porous medium type equation. In this talk, we establish existence of weak solutions to the problem when the initial data belongs to $H^1(\Omega)^*$.

Summary: We consider volume-filling chemotaxis systems with source terms. The purpose of this talk is to show global existence and uniqueness of weak solutions.

Summary: We consider a viscous Burgers equation with time delay. In this talk, we prove global existence, boundedness and large-time behavior.

14:15–15:45

Summary: We consider the initial and boundary value problem for the beam equation as a mathematical model for representing motions of the elastic curve. In our model, an unknown function from the interval $(0,1)$ to the cartesian product $(0,T)\times(0,1)$, where T is a positive constant, represents the position on the plane. We have already introduced the stress function having the singular point. In previous work, we have proved the solvability and obtained the lower bound of the strain. In this talk, we introduce the mathematical model by the free energy including the curvature. Thanks to the Galerkin method and the Aubin compact theorem, we can prove the existence of weak solutions.

Summary: This paper discusses a quasi-variational inequality arising in an elasto-plastic model coupled with a Kelvin–Voigt-type equation of motion. From a physical perspective, it is natural that the admissible stress region depends on the unknown stress itself through the plastic strain. This model is designed to describe plastic deformation through translation of the convex constraint by a hardening operator, which differs from perfect plasticity models in that the constraint depends on the solution itself. To establish the existence of a solution, we recast the self-dependent inclusion as an equivalent evolution inclusion whose constraint depends only on the external state, reducing the problem to known results. The key point is a change of variables that absorbs the self-dependence into a transformed leading operator, whose positivity is guaranteed by the structural assumptions.

Summary: We study a system in which the Cahn–Hilliard system is imposed in the bulk domain and the Allen–Cahn type boundary equation is prescribed, connected through a Robin type condition characterized by a permeability parameter. This setting is closely related to the theory of transmission problems, and the Robin type condition can be viewed as a remnant of a thin-boundary description, with the permeability parameter controlling the degree of coupling between the bulk and the boundary. The main objective is to perform a rigorous asymptotic analysis with respect to the permeability parameter.

23 Isamu Ohnishi (Hiroshima Univ.) A universal constraint for relaxation rates in infinite-dimensional quantum Markov semigroups: Gaussian systems and complete positivity beyond finite dimensions 15

Summary: We prove that a universal upper bound on the maximal relaxation rate of finite dimensional quantum Markov generators extends rigorously to the full class of Gaussian quantum Markov semigroups on infinite dimensional bosonic Fock space with any number of modes. The original bound was established algebraically by applying the Bendixson Hirsch theorem in the KMS inner product induced by the invariant state and holds under conditional two positivity. The key step is to reduce the second moment dynamics of Gaussian states exactly to a classical Ornstein Uhlenbeck process on finite dimensional phase space. This reduction permits us to lift the same algebraic argument via the KMS inner product constructed from the invariant covariance matrix without truncation or ultraviolet cutoff. The resulting inequality states that the fastest relaxation rate is bounded above by the sum of all relaxation rates divided by an effective symplectic dimension given by the trace of the unique invariant covariance matrix solving the Lyapunov equation. The bound is saturated for the damped harmonic oscillator and remains valid under conditional two positivity alone. We discuss applications to Lie algebraic dynamical decoupling on the symplectic Lie algebra and to dynamical renormalization group flows for controlling individual relaxation channels and obtaining scaling forms in the thermodynamic limit. The result provides the first rigorous generalization of the finite dimensional relaxation rate constraint to unbounded operators on bosonic Fock space.

24 Naoki Tanaka (Shizuoka Univ.) Mild solutions for dissipative operators in metric spaces with an admissible family of geodesics 15

Summary: We develop a nonlinear dissipative operator theory in metric spaces equipped with admissible geodesic structures, including Hadamard spaces and spaces with conical, consistent, reversible geodesic bicombings. Using tangent cones, directional derivatives, and opposition maps, we formulate a metric analogue of Kobayashi's Banach space framework. Under appropriate convexity and subadditivity assumptions, mild solutions are characterized by a local Euler approximation condition and enjoy uniqueness and continuous dependence on initial data. The theory thus unifies Banach space results with metric-space settings governed by geodesic bicombings and CAT(0)-type convexity.

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

Yuya Tanaka (Kwansei Gakuin Univ.) Behavior of solutions to chemotaxis systems with growth and damping terms

Summary: In this talk, we consider behavior of solutions to chemotaxis systems with growth and damping terms. We first review results on finite-time blow-up for chemotaxis systems with density-dependent sensitivity and logistic-type source. In particular, we discuss how the growth effect induced by density-dependent sensitivity competes with the damping effect of logistic-type source. We also present several related results. In the latter part of this talk, we focus on a result on boundedness and stability in a model for tuberculosis granuloma formation, which can be regarded as a type of chemotaxis systems. Although the model has a chemotaxis-consumption structure, the analysis of behavior of solutions is complicated by the presence of a growth term describing replication of bacteria. We explain how this growth effect can be controlled in order to derive boundedness of solutions and stability of equilibrium. We also discuss some recent progress of this problem.

Functional Analysis

September 1st (Tue) Conference Room I

9:30–10:30

Summary: We obtained the BCS-Bogoliubov gap equation with a uniform external magnetic field under the restriction that the potential is a constant. In this talk, we remove the restriction and study the BCS-Bogoliubov gap equation with a function potential. From the viewpoint of operator theory, we show that there is a unique nonnegative solution (the gap function) to the BCS-Bogoliubov gap equation with a uniform external magnetic field and that there is also a unique magnetic field (the critical magnetic field). We point out several properties of the solution and the critical magnetic field such as smoothness with respect to both the temperature and the external magnetic field. On the basis of these results, we show that the transition from normal conductivity to superconductivity in a type I superconductor is of the first order. Moreover, we obtain the explicit expression for the entropy gap.

Summary: A formulation of quantum electrodynamics in terms of sums over histories i.e. Feynman path integrals is well known for the effectiveness of its intuitive picture. However, because of the ambiguity in how to compute the sums over histories, it has not been adopted as the standard theory of quantum electrodynamics. In the present paper, we show that the propagator approach to quantum electrodynamics developed by Feynman can be formulated in a mathematically rigorous manner on the basis of Feynman path integrals. As an application, results for Compton scattering and related processes are derived.

Summary: This presentation focuses on a rigged Hilbert space (RHS) formulation that describes Dirac's bra-ket formalism for quasi-Hermitian quantum composite systems. Based on the RHS obtained as the tensor product of the RHSs with a positive-definite metric introduced in our previous presentation, we develop the bra-ket formalism. In particular, we formulate the spectral decomposition of quasi-Hermitian operators within this framework. We show that the resulting bra-ket descriptions are fully represented in the dual spaces and demonstrate how these dual spaces provide a suitable setting for addressing the problem of defining the adjoint of quasi-Hermitian operators in non-Hermitian composite systems.

Summary: We discuss the uniqueness of a solution to the Helmholtz equation associated with the massless Dirac operator with long-range perturbations. In the Schrödinger case, it is well-known that a solution is generally not unique, but becomes so under Sommerfeld's radiation condition. This condition selects the purely outgoing or incoming solution. In this talk, we present an algebraic version of such a condition for the Dirac case with a characterization of the solution in terms of the limiting resolvent. The proof depends on an elementary commutator method of Ito–Skibsted (2020), avoiding advanced functional analysis, pseudodifferential calculus, or even reduction to the Schrödinger equation. A first-order operator appears in the commutator, and bounding it is key, although it is unbounded.

14:20–15:30

5 Itaru Sasaki (Shinshu Univ.)
Akito Suzuki (Komatsu Univ.)
Yasumichi Matsuzawa (Shinshu Univ.)
Representation theory of canonical commutation relations arising from the quantization of the Klein–Gordon equation with an external potential · · · · · 15

Summary: We investigate the Weyl representation of the canonical commutation relations for a model describing a quantized massive scalar field under the influence of an external potential. We determine whether the Weyl representation remains equivalent to or becomes inequivalent to the original one when the mass and/or potential are changed. This problem is reduced to the study of Schrödinger operators.

6 Masaki Kawamoto (Okayama Univ.)
Atsuhide Ishida (Tokyo Univ. of Sci.)
On Schrödinger operators with an inverse-square potential and a time-dependent harmonic oscillator · · · · · 15

Summary: In this talk, we will present results on the unique existence of the propagator, asymptotic completeness, and Strichartz estimates for a Hamiltonian with an inverse-square potential and a time-dependent harmonic oscillator. In particular, the strong singularity of the inverse-square potential prevents the direct application of existing theories for constructing the propagator. we will discuss the difficulties arising from this singularity and the methods used to overcome them.

7 Masato Ito (Ritsumeikan Univ.)
Splitting of low-lying eigenvalues for a wedge-shaped symmetric double well · · · · · 15

Summary: We discuss the eigenvalue problem of the Schödinger operator with a symmetric double well potential with the wedge-shaped bottom. The symmetric double well potential causes so-called eigenvalue splitting, that is the distance between the nearest eigenvalues is exponentially small as a semiclassical parameter tends to zero. We give the asymptotic expansion of the eigenvalue splitting for the two smallest eigenvalues with explicit leading term. In particular, we show that the polynomial order of the leading term except exponential decay factor is characterized by the shape of the bottom. The proof relies on Yafaev's solutions, which provide the quantization conditions. The asymptotic expansions of the two eigenvalues are derived from these conditions.

8 Yuta Kawamura (Ritsumeikan Univ.)
Propagation of semiclassical wave front sets for non-self-adjoint matrix-valued pseudo-differential operators · · · · · 15

Summary: We study the propagation of semiclassical wavefront sets for solutions of systems of pseudo-differential equations with non-self-adjoint matrix-valued symbols. The propagation of singularities theorem of Duistermaat and Hörmander has a semiclassical analogue describing the propagation of semiclassical wavefront sets along Hamiltonian flows. We extend this theory to matrix-valued operators whose principal symbols satisfy a generalized microhyperbolicity condition and have nonnegative imaginary parts.

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

Setsuro Fujiie (Ritsumeikan Univ.)
A remark on the Weyl law of the quantum resonances

Summary: The Weyl asymptotic formula for the eigenvalues of the Dirichlet Laplacian on a bounded domain has been refined and extended in various direction. A pioneering work by J. Sjostrand in 1990 gives an upper bound in the semiclassical limit of the density of quantum resonances near a fixed real energy in terms of the dimension of the trapped set of the underlying classical mechanics. It was a question if it also gives a lower bound. In the talk, we will show a counterexample of a matrix Schrödinger operator, for which the density of quantum resonances is small while the dimension of the trapped set is high. This is a joint work with J.-F. Bony, T. Ramond and M. Zerzeri.

September 2nd (Wed) Conference Room I

10:00–10:30

9 Kenji Taniguchi (Aoyama Gakuin Univ.) Self-adjoint properties of the standard Whittaker $(\mathfrak{g}, K)$-modules ····· 15

Summary: The structure of the standard Whittaker $(\mathfrak{g}, K)$-module is examined in the case when the group in question is a real split reductive linear Lie group. This module is an injective object in the category of Harish-Chandra $(\mathfrak{g}, K)$-modules which admit a fixed infinitesimal character. The global character of this module is determined. The main theorem of this presentation is that it has a self-adjoint property.

10 Toshihisa Kubo (Ryukoku Univ.) On the K-type decomposition of the kernel of Kable's Heisenberg operator ····· 15

Summary: In 2012, Kable introduced a one-parameter family $\mathcal{D}_n(s)$ of $SL(n,\mathbb{R})$-intertwining differential operators between parabolically induced representations for the pair $(SL(n,\mathbb{R}), P_{\mathrm{Heis}})$. As such, the space $\mathcal{S}ol(n;s)$ of smooth solutions to $\mathcal{D}_n(s)f = 0$ in the induced representation is a representation space of $SL(n,\mathbb{R})$. To date, the K-type decomposition of the space $\mathcal{S}ol(n;s)_K$ of K-finite solutions have been determined only for $n = 3$. In this talk, we classify the K-type decomposition of $\mathcal{S}ol(n;s)_K$ for $n \geq 4$ by realizing a certain Smith algebra as an algebra of differential operators.

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

Yosuke Morita (Kyushu Univ.) Geometry of proper actions on homogeneous spaces

Summary: Let G/H be a homogeneous space and Γ be a discrete subgroup of G. If the Γ-action on G/H is proper and free, the quotient space becomes a manifold locally modelled on G/H and called a Clifford–Klein forms. When H is a noncompact closed subgroup of G (and thus, there is no G-invariant Riemannian metric on G/H), not every discrete subgroup of G acts properly on G/H, and there are many interesting phenomena which does not occur in the classical, Riemannian setting. In the last 40 years or so, the study of proper actions on non-Riemannian homogeneous spaces has been one of the fertile areas in mathematics to which various methods (Lie-theoretic, dynamical, homotopical, etc.) had been applied and produced partially overlapping but different results. In this talk, I will review important results and present some recent progress in this area.

13:00–14:00

11 Ayoub Hafid (Univ. of Tokyo) Notions of a noncommutative coarse metric geometry ····· 15

Summary: We look at how notions of coarse geometry can be ported to the noncommutative setting. In particular we introduce the setting of quantum metric spaces (in two different forms), and show how one can construct Roe algebras for these spaces. We show how a higher index taking value in the K-groups of a Roe algebra can be constructed for locally compact metric spaces under some mild conditions on the commutators of their elements, and introduce some examples where this could be applied.

12 Akihiro Miyagawa (Kyoto Univ.) The spectra of polynomials in free random variables ····· 15

Summary: This talk concerns the spectra of polynomials in free semicircular and circular random variables, which are not necessarily self-adjoint operators. We prove that every noncommutative rational function in free semicircular variables that is square-integrable is automatically a bounded operator. As a consequence, the usual spectrum coincides with the L^2-spectrum for rational functions. Using this observation, we develop a method to determine spectra through L^2-resolvent expansions and apply it to several classes of polynomials in free circular variables, including homogeneous, random-walk-type, and quadratic polynomials. The results provide explicit spectral descriptions and suggest connections with strong convergence phenomena in non-Hermitian random matrix theory.

13 Naoto Fujitsu (Univ. of Osaka) Singular value functions for C*-algebras · · · · · 15

Summary: We introduce *singular value functions* for C*-algebras, generalizing the singular values of compact operators on Hilbert spaces. We also establish several fundamental properties of these singular value functions and present examples of singular value functions for certain classes of C*-algebras.

14 Hyuga Ito (Nagoya Univ.) NC functions over the nc Grassmannian · · · · · 15

Summary: We formulate Voiculescu's non-commutative Riemann sphere theory of fully matricial functions within the nc function theory of Kaliuzhnyi-Verbovetskyi and Vinnikov. We then extend this theory to Grassmannians and, more generally, to flag manifolds. We further introduce a Grassmannian generalization of Voiculescu's non-commutative resolvent and investigate the corresponding resolvent equation. Finally, we explain how the classical spectral theory of unbounded operators can be incorporated into this framework.

September 3rd (Thu) Conference Room I

9:30–12:00

15 Masatoshi Ito (Maebashi Inst. of Tech.) On weighted means including the weighted power difference and Stolarsky means · · · · · 15

Summary: Recently, we discussed the weighted power difference mean of two positive numbers or operators on a Hilbert space. In this talk, we generalize representing functions of operator means introduced in our former argument, and also we obtain results on generalizations of the weighted power difference and Stolarsky means.

16 Hiroki Shudo (Ritsumeikan Univ.) Some inequalities for matrix means and positive linear maps · · · · · 15

Summary: We study data-processing type inequalities for the Bures–Wasserstein mean under unital positive linear maps and derive explicit reverse bounds under uniform spectral constraints. Moreover, we introduce a class of alternative quasi-means generated by two-sided functional calculus and obtain corresponding inequalities under unital positive maps.

17 Yuki Seo (Osaka Kyoiku Univ.) Estimation of bounds among three rescaled Rényi divergences · · · · · 15

Summary: Takahashi and Fujiwara defined the rescaled sandwiched α-Rényi divergence. According to the idea due to Takahashi and Fujiwara, we consider the rescaled version of $\natural_\alpha$-Rényi divergence due to Hiai. Also, similarly, we define the rescaled version of α-Rényi divergence due to Petz. In this talk, we estimate the bounds of the difference among three rescaled Rényi divergence in terms of the generalized Kantorovich constants.

18 Takeaki Yamazaki (Toyo Univ.)
Yuki Seo (Osaka Kyoiku Univ.)
Shuhei Wada
(Nat. Inst. of Tech., Kisarazu Coll.)
On the Ando–Hiai property for spectral geometric means · · · · · 15

Summary: In this talk, we shall introduce that weighted spectral geometric means satisfy the Ando–Hiai property. Related example and problem will be introduced.

19 Rui Okayasu (Osaka Kyoiku Univ.) Geometric mean of completely positive maps · · · · · 15

Summary: We introduce the geometric mean of completely positive (CP) maps on von Neumann algebras, based on the Pusz–Woronowicz theory of positive sesquilinear forms. We provide a concrete characterization via a block matrix positivity condition and establish their fundamental properties.

20 Rui Okayasu (Osaka Kyoiku Univ.) Lebesgue-type decomposition of completely positive maps · · · · · · · · · · · 15

Summary: We introduce the parallel sum of completely positive (CP) maps on von Neumann algebras, based on the Pusz–Woronowicz theory of positive sesquilinear forms. We establish a Lebesgue-type decomposition of CP maps via a parallel sum construction, thereby providing a unified framework that simultaneously generalizes Ando's decomposition of bounded positive operators and Kosaki's decomposition of normal positive functionals on von Neumann algebras.

21 Takuya Takeishi (Kyoto Inst. Tech.) Boundary actions of outer automorphism groups of Thompson-like groups · 15

Summary: This talk presents a recent result of the speaker on the C*-simplicity of $\mathrm{Out}(V_{n,r})$, where $V_{n,r}$ is any Higman–Thompson group. More generally, for every Cuntz–Krieger groupoid, there is a topologically free boundary action of the outer automorphism group of its topological full group on the Hilbert cube. This is a joint work with C. Bruce and X. Li.

22 Fuyuta Komura (Kyushu Inst. of Tech.) Cartan-preserving *-automorphism groups: realization and obstructions for compact abelian groups · 15

Summary: Cartan subalgebras play a central role in the study of operator algebras. In this talk, we investigate automorphism groups preserving Cartan subalgebras of C*-algebras. We describe these groups in terms of automorphisms and 1-cocycles of twisted groupoids. In particular, we show that the group of Cartan-fixing automorphisms can be identified with the 1-cocycle group. This result can be viewed as a C*-algebraic analogue of the Feldman–Moore theorem. We then investigate compact abelian subgroups of Cartan-fixing automorphism groups. We show that every Kirchberg algebra satisfying the UCT has a Cartan subalgebra such that its Cartan-fixing automorphism group contains every second countable compact abelian group. Conversely, we establish an obstruction showing that not every Cartan subalgebra satisfies this property. As an application, we obtain the existence of inequivalent Cartan subalgebras.

12:15–12:45 Presentation Ceremony for the 2026 MSJ Analysis Prize

14:15–16:30

23 Yosuke Kubota (Kyoto Univ./RIKEN) Second quantization and invertible topological phases · · · · · · · · · · · · · · · 15

Summary: In the theory of topological phases of matter, one studies the set of homotopy classes of families of quantum systems parametrized by a space M. For free-fermion systems, this set is known to be described by the real or complex K-theory of M. On the other hand, recent work of the speaker has shown that the classification of interacting fermionic systems also defines a generalized cohomology theory. Although these two classifications concern fermionic systems and appear to yield similar conclusions, their mathematical foundations are different. In this talk, I explain a functional-analytic construction of the so-called "free-to-interacting" map that compares the two classifications.

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

Summary: We study cocycle perturbations of state preserving actions on type III_1 factors. Extending the theorem of Marrakchi and Vaes for type II_1 factors, we show that a state preserving outer $\mathbb{Z}$-action on a type III_1 factor with trivial bicentralizer admits a unitary cocycle whose perturbation becomes an ergodic action. This partially answers a question of Marrakchi and Vaes. A major difference from the type II case is that the modular automorphism group naturally appears as part of the action, making the construction of the required cocycle more delicate.

Summary: We study the selfless W* probability spaces and the triviality of the bicentralizer algbera for type III_1 factors from model theoretic viewpoint. That equivalence of a diffuse W*-probability spaces and the triviality of the associated bicentralizer $\mathrm{B}(M,\varphi)$ was shown in a recent work of Houdayer and Marrakchi. We extend their equivalence to arbitrary (M,φ), which is then used to show that the class of III_1 factors with trivial bicentralizers is axiomatizable. We also deduce several permanence properties of seflessness.

Summary: Let X and Y be locally compact Hausdorff spaces. We denote by $C_0^+(X)$ the positive cone of all real-valued continuous functions on X vanishing at infinity. In this paper, we consider a bijection $T\colon C_0^+(X)\to C_0^+(Y)$ satisfying the following two norm conditions for all $f,g\in C_0^+(X)$:

$$\|T(f+g)\|=\|T(f)+T(g)\|,\qquad \|T(fg)\|=\|T(f)T(g)\|.$$

The main result of this paper is that such a map T is a composition operator of the form $T(f)=f\circ\tau$, induced by a homeomorphism $\tau\colon Y\to X$.

Summary: We show that every bijection $T\colon C_0^+(X)\to C_0^+(Y)$ between the positive cones of $C_0(X)$ and $C_0(Y)$ satisfying

$$\|T(f+g)\|=\|T(f)+T(g)\|$$

for all $f,g\in C_0^+(X)$ admits a representation of the form

$$T(f)(y)=h(y)f(\tau(y)),$$

where $\tau: Y\to X$ is a homeomorphism and h is a bounded continuous function from Y to $(0,\infty)$.

Summary: In this talk, an affirmative answer to a variant of Tingley's problem on the space of continuous functions vanishing at infinity is presented. Let $S(C_0(X))^+$ and $S(C_0(Y))^+$ denote the positive parts of the unit spheres of $C_0(X)$ and $C_0(Y)$, where X and Y are locally compact Hausdorff spaces. We prove that every surjective isometry from $S(C_0(X))^+$ onto $S(C_0(Y))^+$ is a composition operator induced by a homeomorphism between X and Y. As a consequence, such a map extends to a surjective real-linear isometry from $C_0(X)$ onto $C_0(Y)$. We also characterize surjective phase-isometries on the positive unit sphere.

Summary: In this talk, we shall establish Banach–Stone type theorems on function spaces with the sup-norm consisting of uniformly continuous and Lipschitz continuous pseudometrics on uniform spaces and metric spaces.

Summary: In this talk, we shall show that isometries between the unit spheres of spaces consisting of bounded pseudometrics on compact metrizable spaces are composition operators by homeomorphisms between the underlying spaces, and solve a variant of Tingley's problem for spaces of metrics.

16:45–17:45 Talk Invited by Functional Analysis Section

Isao Ishikawa (Kyoto Univ.)♭ Dynamical rigidity of maps inducing bounded composition operators

Summary: A composition operator is a linear operator induced by the pull-back of a map on the underlying domain. More generally, one may also consider weighted composition operators. Although these operators act linearly on spaces of functions, their operator-theoretic properties often reflect, and sometimes strongly restrict, the geometry and dynamics of the inducing maps. In this talk, we will discuss several rigidity results for composition operators on function spaces, including reproducing kernel Hilbert spaces, Morrey-type spaces, Besov and Sobolev spaces, and spaces of holomorphic functions. A common theme is that boundedness, compactness, and related operator-theoretic conditions impose strong restrictions on the inducing maps. These restrictions may appear as geometric constraints, affine-type rigidity, or obstructions coming from local dynamics. A main focus will be on the interaction between composition operators and local dynamical systems. In the holomorphic setting, the action on jets along periodic orbits gives finite-dimensional obstructions to boundedness and compactness of weighted composition operators. This leads to rigidity results for local holomorphic dynamics and, in certain cases, forces the inducing maps to be affine. These results illustrate a broader functional-analytic principle: nonlinear maps can be studied through the linear operators that they induce, and analytic properties of these operators can reveal hidden dynamical constraints on the maps.

Statistics and Probability

September 1st (Tue) Conference Room VI

9:30–12:00

1 Yoshihiro Tawara (Naragakuen Univ.) On the tightness of resolvents satisfying intrinsic ultracontractivity ··· 15

Summary: We investigate the relationship between intrinsic ultracontractivity (IUC) and the resolvent tightness property for symmetric Hunt processes. For example, consider Schrödinger operators with power-function potentials, such as those associated with Brownian motion. In this setting, the resolvent tightness property holds for any positive power, whereas IUC holds if and only if the power is greater than 2. This suggests that IUC is a stronger condition than the resolvent tightness property. In this talk, we prove this conjecture.

2 Kaneharu Tsuchida (Nat. Defense Acad. of Japan) Critical spectral behavior and large deviations for geometric α-stable processes ····· 15

Summary: This study investigates the Schrödinger-type operator associated with geometric α-stable processes (GSP) on $\mathbb{R}^d$, focusing on the differentiability of its spectral function $C(\theta)$. Because the GSP exhibits severe local singularities in its Lévy measure, its transition semigroup lacks ultracontractivity. This unique property invalidates classical methods for proving differentiability. To overcome this obstacle, we use recent findings on the absolute continuity and the strong Feller property of the GSP, along with the existence of ground states. Consequently, we prove that $C(\theta)$ is differentiable under the condition $\alpha < d \leq 2\alpha$. Furthermore, as an application of this differentiability, we apply the Gärtner–Ellis theorem to establish a large deviation principle for the positive continuous additive functional associated with a smooth measure.

3 Toshihiro Uemura (Kansai Univ.) Non-symmetric perturbation of a lower bounded closed form ····· 15

Summary: In this talk, we consider the semigroup generation under a broad class of non-symmetric perturbations. To illustrate the validity of our main theorem, we present a specific example of non-local operators subjected to perturbations characterized by non-symmetric jump kernels.

4 Takumu Ooi (Tokyo Univ. of Sci.)
Motohiro Sobajima (Tokyo Univ. of Sci.) Subcriticality of subordinated Schrödinger operators and their application to wave equations ····· 15

Summary: We provide a probabilistic characterization of criticality, subcriticality, and supercriticality for subordinated Schrödinger operators. We also investigate the relationship between the subcriticality of these operators and the uniform boundedness of solutions to the associated wave equation.

5 Masanori Hino (Kyoto Univ.)
Kanji Inui (Doshisha Univ.)
Kohei Nitta Regularity and irregularity of energy densities on Sierpinski gaskets ····· 15

Summary: We study the pointwise regularity of energy densities associated with harmonic functions on the Sierpinski gasket with respect to the Kusuoka measure. For any nonconstant harmonic function, we prove that every Borel representative of the density is discontinuous at every point of a set of full Kusuoka measure. In sharp contrast, on each one-dimensional edge of the gasket the density admits a canonical pointwise version, which is γ_N-Hölder continuous on that edge with the explicit and optimal exponent $\gamma_N = \log_2\{(\sqrt{4N+5}+1)/(\sqrt{4N+5}-1)\}$.

Summary: Applebaum extended the Elworthy–Malliavin construction to obtain Lévy-type processes on Riemannian manifolds by projecting the solution to Marcus-type stochastic differential equations defined on the orthonormal frame bundle. In this talk, we focus on such processes, and present exit time estimates derived from a lower bound of the sectional curvature. We also explain how these estimates imply conservativeness and the Feller property.

Summary: The γ-Liouville Brownian motion (γ-LBM) is the canonical diffusion process on a γ-Liouville quantum gravity (γ-LQG) surface, where $\gamma \in (0, 2)$ is a parameter. The $\sqrt{8/3}$-LQG sphere, considered as (the isomorphism class of) a random compact metric measure space, has been proved by Miller and Sheffield (2021) to have the same law as the Brownian sphere, which in turn was proved by Le Gall (2013) and Miermont (2013) to appear as the scaling limit of a uniform random n-face quadangulation of the sphere as $n \to \infty$.

This talk will present the main result of `arXiv:2507.13269` establishing, for the heat kernel of the $\sqrt{8/3}$-LBM on the $\sqrt{8/3}$-LQG sphere, two-sided off-diagonal sub-Gaussian bounds which are sharp up to polylogarithmic factors in the exponential.

Summary: We study deterministic translations of the Gaussian rough path acting purely on the second level, leaving the underlying Gaussian process unchanged. We show that any non-trivial such translation yields a law that is mutually singular with the law of the canonical Gaussian rough path lift. Next, we show a stronger infinitesimal obstruction: in such a second-level direction, the law of the Gaussian rough path admits no L^1-logarithmic derivative. Thus, although the differential structure of rough path space allows one to define directional derivatives in these directions, the corresponding integration-by-parts weight function does not exist in L^1. We further show that this obstruction is in fact more fundamental, that is, the integration-by-parts functional cannot be represented even as a Watanabe distribution in the framework of Malliavin calculus.

Summary: We consider the self-intersection local time of two or three dimensional Brownian motion at bounded away from the diagonal. We show that it is strictly positive if the Brownian motion intersects itself in the domain. This confirms that the set of self-intersection times coincides with the support of the self-intersection local time.

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

Hayate Suda (Tohoku Univ.) Scaling limits of solitons in the randomized box-ball system

Summary: The box-ball system (BBS) is a cellular automaton with a rich mathematical structure. Although its time evolution is simple to define, particles form solitons, and solitons interact through phase shifts. In recent years, with the rapid progress in the study of hydrodynamics of integrable systems, there has been a growing interest in the BBS with random initial distribution.
In this talk, we consider scaling limits of solitons in the BBS starting from certain stationary distributions. First we discuss the law of large numbers, the central limit theorem and large deviation principles for a tagged soliton. Then we discuss the fluctuations of the empirical measure of solitons around its generalized hydrodynamic limit. This talk is based on joint works with Pablo A. Ferrari, Stefano Olla and Makiko Sasada.

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

Stefan Junk (Gakushuin Univ.) The phase transition for the directed polymer model in higher dimensions

Summary: I will review recent progress in joint work with Hubert Lacoin (IMPA) about the phase transition of the directed polymer model in spatial dimensions $d \geq 3$.
This model describes a random path (called polymer in this context) affected by a random environment of i.i.d. weights and has received much attention recently because of its (partly conjectural) relationship to the KPZ universality class. It is known that in dimensions $d \geq 3$, the model undergoes a phase transition from a weak disorder, high temperature phase (where the polymer converge to Brownian motion under the usual scaling) to a strong disorder, low temperature phase where the polymer localize into small, favorable regions and is expected to scale superdiffusively. This phase transition is characterized through the positivity (or not) of an associated martingale.
In a number of works, we have studied the nature of this phase transition: first, we showed that the phase transition is sharp in the sense that above the critical disorder intensity, the associated martingale converges to zero exponentially fast. As a consequence, we found that weak disorder persists at the critical intensity itself. Recently, we were able to show that the phase transition is smooth in the sense that its free energy decays faster than any polynomial around the critical point.

September 2nd (Wed) Conference Room VI

9:10–12:00

Summary: This talk is concerned with two-sided weighted integrability estimates, often referred to as a norm equivalence result, for stochastic differential equations (SDEs). Such norm equivalence results are frequently used in the study of connections between forward-backward stochastic differential equations and partial differential equations (PDEs), particularly when PDE solutions are understood as weak solutions in the Sobolev sense. I will present a norm equivalence result for SDEs with locally Lipschitz coefficients, extending earlier results in the literature.

Summary: We are concerned with a noncausal calculus approach to the comparison theorem for solutions of SDEs, that are driven by Brownian motion. The aim of the talk is two folded: first we show that in the framework of the noncausal stochastic calculus (Ogawa, S., "Noncausal Stochastic Calculus", 2017 Springer) the subject can be treated in a much simpler way, second we show that this approach permits us to establish similar comparison theorems for solutions of genuine noncausal SDEs that is the SDE with noncausal initial data.

Summary: In this talk, we provide the strong rate of convergence for the Euler–Maruyama scheme for multi-dimensional stochastic differential equations with uniformly locally (unbounded) Hölder continuous drift and multiplicative noise. Our technique is based on Itô–Tanaka trick (Zvonkin transformation) for unbounded drift. Moreover, in order to apply the stochastic sewing lemma, we use the heat kernel estimate for the density function of the Euler–Maruyama scheme.

Summary: For a general perturbation of the Black–Scholes model, we prove that the Black–Scholes implied variance is approximately the conditional expectation of the cumulative variance given that the underlying asset price at the maturity is the strike price.

Summary: In this talk, let us focus on the limit theorem that the scaled sequence of the discrete subordinations of random walks converges to the subordinate Brownian motion. Moreover, the rate of the convergence on the Kolmogorov distance is also studied.

Summary: We introduce an elephant random walk on a class of graphs that includes the hexagonal lattice and, more generally, coverings of dipole graphs. We show that the model exhibits a phase transition and establish limit theorems in the corresponding regimes.

Summary: In this talk, we study the Lyapunov exponent of quadratic maps. The Lyapunov exponent is a quantity that measures the chaotic behavior of a dynamical system. As a fundamental concept in dynamical systems theory, it has attracted great attention. Since the Lyapunov exponent is defined as the limit of a time average, it is important to investigate its existence. In this talk, we show that, for every quadratic map, there exists a constant λ such that for Lebesgue-almost every point x the Lyapunov exponent along the orbit of x exists and is equal to λ, even though it is known that some quadratic maps exhibit non-statistical dynamics.

Summary: In this talk, we discuss a t-deformed extension of finite free convolution and finite free cumulants to the ring of formal power series. We explain how this framework gives rise to probabilistic structures and limit-type phenomena in the t-deformed setting, and how $\boxplus^t$-continuous semigroups admit infinitesimal generators with explicit representation formulas. We also describe how the case $t = d$ recovers finite free probability, while the case $t = -1$ is connected to classical convolution and Lévy–Khintchine-type generators.

Summary: In classical probability theory, selfsimilar stable processes were well studied in the 1980s. Among others, the so-called linear fractional stable motion is a typical example of selfsimilar stable processes, including the well-known fractional Brownian motion as a special case. In this paper, the linear fractional stable motion and selfsimilar stable processes with stationary increments are studied within the framework of free probability.

19 Yoshinori Kamijima (Toyo Univ.) Akira Sakai (Hokkaido Univ.) Lace expansion for the quantum Ising model 15

Summary: The lace expansion is a powerful tool for analyzing critical phenomena. It has been successful in establishing mean-field behavior for a variety of models in statistical mechanics. One of our objectives is to obtain a lace expansion for the quantum (transverse-field) Ising model. It is defined by applying a transverse field to the classical Ising model. The transverse field yields the non-commutativity and makes the system occur a different type of phase transition.
In this talk, I will show a lace expansion for the quantum Ising model and upper bounds on the expansion coefficients. The derivation is based on the random-current representation on space-time. We obtain upper bounds on the expansion coefficients by separating a connected component into several events.

20 Shuta Nakajima (Keio Univ.) Uniqueness of replica-symmetric saddle point in perceptron model 10

Summary: The Ising perceptron is a fundamental model in statistical learning and spin glass theory. In this talk, I will mainly discuss mathematical progress on this model. As a recent development, I will present recent results on the uniqueness of the replica symmetric saddle point.

12:00–12:30 Research Section Assembly

September 3rd (Thu) Conference Room VI

9:20–12:00

21 Shintaro Hashimoto (Hiroshima Univ.) On invariant moment matching priors for prediction problem 15

Summary: This paper derives objective priors that asymptotically match the mean of the Bayesian predictive distribution with that of the frequentist plug-in predictive distribution. This moment matching criterion was originally proposed by Ghosh and Liu (2011, Sankhya A) for estimation problems; the resulting priors are referred to as moment matching priors. In the predictive context, while the derived priors take a slightly different form from those for estimation, they exhibit a desirable invariance property under one-to-one parameter transformations. This is a feature not typically attained in estimation frameworks. Furthermore, this study characterizes asymptotically unbiased priors for point prediction.

22 Yuzo Maruyama (Chiba Univ.) Akimichi Takemura (Shiga Univ.) Strictly positive-part James–Stein estimators with guaranteed dominance 15

Summary: This paper presents genuine James–Stein Positive-Part estimators which dominate the classical James–Stein estimator under the quadratic loss for p-variate normal means for $p \geq 3$. Particularly, the Positive-Part estimator $\max(1/\sqrt{p}, 1-(p-2)/\|x\|^2)x$ dominates the classical James–Stein estimator.

23 Naoki Nakada (Tokyo Univ. of Sci.) Satoru Sinoda (Yokohama City Univ.) Kouji Tahata (Tokyo Univ. of Sci.) Sadao Tomizawa (Tokyo Univ. of Sci.) A measure of departure from independence for intraclass contingency tables 15

Summary: Consider an $r \times r$ intraclass contingency table with common row and column categories. Ishii (1960) proposed the independence model H_I for such tables. We introduce a measure that quantifies the degree of departure from H_I. The measure is constructed from the power divergence and takes values in $[0, 1]$, where 0 corresponds to independence, and 1 corresponds to complete association. It provides a useful tool for comparing the strength of association across multiple intraclass contingency tables.

Summary: When a pairwise comparison matrix contains missing values, various methods have been proposed to complete them. In this talk, we focus on the third coefficient of the characteristic polynomial of the pairwise comparison matrix. Since maximizing this coefficient and making it close to zero is expected to improve the degree of consistency, this criterion is adopted. The resulting problem can be naturally formulated as a convex minimization problem. In this study, we investigate the uniqueness of the solution. Although our approach relies on an exhaustive analysis, we show that, for low-dimensional cases the uniqueness of the solution is equivalent to the connectedness of the graph generated by the incomplete matrix.

Summary: We consider optimal stopping problems for discrete time multiparameter stochastic processes. We introduce a randomized class of tactics and a sufficient class of tactics with respect to a given filtration, and prove that the optimal value remains unchanged for both classes.

Summary: We consider a max-add criterion in a stochastic decision process model with a diverging branch system. As the objective function in the stochastic environment, we adopt a posterior conditional expectation. For this decision process model, we use dynamic programming to derive a recursive formula.

Summary: Structural vector autoregressive (SVAR) models are widely used for describing simultaneous dependence structures among multivariate time series. Most existing identification methods rely on strong assumptions on the structural innovations. We consider a class of SVAR models with correlated structural innovations and propose an identification procedure based on LU decomposition under suitable zero restrictions on the coefficient matrices. Combining the asymptotic normality of reduced-form estimators with the delta method, we derive the asymptotic distributions of estimators for structural coefficients and impulse responses.

Summary: This talk studies parameter estimation for continuously observed open quantum systems. We consider a stochastic master equation describing the conditional state dynamics under continuous measurement, where unknown parameters enter both the Hamiltonian and the measurement operator. The likelihood-based estimation generally requires solving the filtering equation for each candidate parameter. To reduce this computational burden, we construct a contrast estimator by replacing the filter-dependent drift with a quantity computed from the deterministic averaged state. In the asymptotic regime where the number of independent trajectories tends to infinity, we establish consistency, asymptotic normality, and consistent estimation of the asymptotic variance.

29 Masaaki Fukasawa (Univ. of Osaka)
Haruki Tomita (Univ. of Osaka)
A quasi maximum likelihood estimation method for Bergomi-type volatility models 15

Summary: We consider the problem of estimating the parameters of Bergomi-type volatility models from high-frequency option-price time series. By introducing the cumulative forward variance, which can be approximately reconstructed from option prices, we reformulate the problem as parameter estimation for an infinite-dimensional stochastic differential equation. Unlike classical high-frequency inference for finite-dimensional diffusions, the resulting observation system is highly degenerate. To overcome this difficulty, we construct a contrast function based on a nondegenerate proxy distribution and prove consistency and asymptotic mixed normality of the proposed estimator.

30 Shogo Nakakita (Univ. of Osaka)
Pierre Alquier (ESSEC Business School)
Masaaki Imaizumi (Univ. of Tokyo)
Dimension-free statistical bounds on dynamic guidance scale learning for diffusion models 15

Summary: Classifier-free guidance (CFG) is a widely used strategy to control the tradeoff between sample fidelity and diversity in diffusion models. Recent studies have extended this paradigm to incorporate dynamic and adaptive guidance scales; however, theoretical guarantees for such adaptive strategies remain scarce. In this work, we establish statistical guarantees for adaptive guidance schedules. Specifically, we analyze the uniform concentration of empirical reward functions around their population counterparts and derive dimension-free bounds for them.

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

Shun Matsuura (Keio Univ.) Best equivariant estimation in seemingly unrelated regression models

Summary: Seemingly unrelated regression model (SUR model) is a multivariate multiple regression model with both multiple explanatory variables and response variables, where errors in response variables are correlated. In this presentation, best equivariant estimation of regression coefficients and error variance-covariance matrix in the SUR model is discussed. Best equivariant estimators are derived under several types of loss functions. Differences of best equivariant estimators under different loss functions are studied. Connection to feasible generalized least squares estimator is also presented.

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

Kengo Fujisawa (Tokyo Univ. of Sci., Yamaguchi) Recent developments in modeling for multi-way contingency tables

Summary: Contingency tables are usually used to analyze the association of categorical variables. When the independence model does not hold, we are interested in applying an association model. If two variables take the same categories, the table is called a square contingency table. For square contingency tables, many observations tend to concentrate on the diagonal cells. Consequently, the analysis of square contingency tables is often focused on symmetric structures. A multi-way contingency table is a fundamental tool for analyzing associations among multiple categorical variables. In this talk, we focus on two major approaches to the analysis of multi-way contingency tables: modeling marginal distributions and association structures.

September 4th (Fri) Conference Room VI

9:30–12:00

31 Riku Hosonuma (Tokyo Univ. of Sci.) A test for sub-mean vectors in high dimension 15
Tamae Kawasaki (Aoyama Gakuin Univ.)
Takashi Seo (Tokyo Univ. of Sci.)

Summary: This study considers the hypothesis testing problem for a sub-mean vector in a high-dimensional normal population. Rao's U-statistic is a classical procedure for testing a sub-mean vector, but it requires the inverse of the sample variance-covariance matrix and is therefore inapplicable when the dimension exceeds the sample size. To overcome this difficulty, we propose a new test statistic based on the L^2-norm statistic of Zhang and Xu (2009). Under a high-dimensional asymptotic framework, the null distribution of the proposed statistic is approximated by an F-distribution. The resulting test procedure is applicable even when $p > N$. Its performance is examined by Monte Carlo simulations in terms of Type I error.

32 Kou Fujimori (Shinshu Univ.) Asymptotically normal estimators in high-dimensional linear regression
Koji Tsukuda (Kyushu Univ.) 15

Summary: We study a two-step OLS estimator after variable selection in a high-dimensional linear model. The centered and scaled estimator is embedded into the sequence space ℓ^2, and its weak convergence is established, yielding asymptotic normality and enabling standard asymptotic tools such as the continuous mapping theorem. Our framework allows the number of nonzero coefficients to diverge with the sample size under a suitable growth condition. As an application, we construct a test for linear hypotheses with asymptotically correct size control.

33 Tetsuya Umino (Univ. of Tsukuba) Data transformation method using automatic sparse PCA under the
Kazuyoshi Yata (Univ. of Tsukuba) strongly spiked eigenvalue model 15
Makoto Aoshima (Univ. of Tsukuba)

Summary: In this talk, we consider a data transformation method for high-dimensional data under the strongly spiked eigenvalue model. Focusing on the eigenstructure of the covariance matrix, we first discuss the asymptotic properties of sample eigenvectors, noting that they suffer from severe high-dimensional noise. To overcome this difficulty, we combine an existing data transformation technique with automatic sparse PCA to propose a new transformation methodology. We establish the asymptotic properties of the proposed methodology under high-dimensional settings and, finally, consider its application to the two-sample problem.

34 Kento Egashira (Tokyo Univ. of Sci.) Asymptotic properties of kernel hierarchical clustering for high-dimensional
Yota Takao (Tokyo Univ. of Sci.) data 15

Summary: Hierarchical clustering is a widely used unsupervised learning method for exploring latent structures in high-dimensional data. Although asymptotic properties of conventional hierarchical clustering have been studied under the high-dimension, low-sample-size setting, the effect of kernelization on dendrogram structures has not been clarified. In this talk, we introduce kernel versions of single linkage, average linkage, and Ward's method and investigate their asymptotic properties. Focusing on the Gaussian kernel, we derive conditions under which desirable dendrogram structures appear. We show that kernelization relaxes these conditions and enlarges the parameter region where such structures are obtained. The theoretical findings are supported by numerical experiments and real data analyses, demonstrating the effectiveness of the proposed kernel hierarchical clustering methods.

Summary: In this presentation, we investigate the asymptotic properties of hierarchical clustering under high-dimensional and multiclass settings. It is currently known that dendrograms based on data obtained from two independent high-dimensional populations can be classified into two patterns asymptotically under appropriate conditions. On the other hand, when there are three or more independent high-dimensional populations, the method is not known to represent the structure of dendrogram, with a few exceptions. Therefore, we propose notations for systematically representing patterns of dendrogram obtained by hierarchical clustering on high-dimensional data. Using our proposed notations, we infer the relationships among parameters of each population from the structural patterns that appear in dendrograms under high-dimensional and multiclass settings.

Summary: The Bradley–Terry model is a well-established mathematical model for estimating latent rankings based on paired comparison data under the assumption of stochastic transitivity. However, empirical data sometimes exhibit cyclic dominance, thereby violating this assumption. To quantify the extent of cyclic dominance, we propose a minimal extension of the Bradley–Terry model by introducing just a single nonnegative parameter. When this additional parameter is zero, the proposed model reduces to the classical model. This parameter provides a simple and interpretable measure of departure from transitivity.

Summary: Shannon entropy is a widely used measure of uncertainty and diversity across various scientific disciplines. For distributions with infinitely many categories, entropy estimation is influenced by rare or unobserved symbols. In this study, we consider an occupancy model under regular variation and investigate the asymptotic bias of the plug-in estimator of Shannon entropy. Utilizing Poissonization techniques and asymptotic results for occupancy counts, we derive the asymptotic behavior of the bias and express it in terms of the tail index. Our results clarify the effect of power-law tails on entropy estimation.

Summary: We consider the test for adequacy in growth curve model when the data set has a two-step monotone pattern of missing observations. In this talk, based on the results for complete data (see, Fujikoshi, Ulyanov, and Shimizu, 2010) and the asymptotic expansion of the T^2-type test statistic (see, Kawasaki and Seo, 2016), we discuss the problem of testing the adequacy in growth curve models using the T^2-type test statistic with two-step monotone missing data. We propose a T^2-type test statistic and provide approximate upper percentile of this statistic for its null distribution. Furthermore, we investigate the accuracy of the approximation by Monte Carlo simulation. We also discuss the case where the likelihood ratio test statistic is used as the test statistic.

Summary: We discuss a multivariate normality test based on Mardia's multivariate sample skewness defined under monotone missing data. We propose a novel sample skewness statistic that incorporates a 2-step monotone missing data structure and generalizes the classical Mardia's skewness to incomplete observations. We establish the asymptotic distribution of the proposed statistic under elliptical populations. The proof is completed with handling nontrivial dependence induced by the missingness structure via the covariance of hyperspherical harmonics generated from different dimensions. We show that the limiting distribution reduces to the classical complete-data result when there is no missingness.

Applied Mathematics

September 1st (Tue) Conference Room IX

9:00–12:10

Summary: In this talk, we consider a quantum walk induced by an edge cut set. For a simple connected graph, we assign weight $\epsilon \geq 0$ to each edge in the edge cut set, and weight 1 to all other edges. Here, ϵ can be regarded as the strength of the connectivity between the connected components. In this setting, we show that the behavior of the quantum walker is described by the weighted Laplacian associated with the graph and the edge cut set.

Summary: We calculate the characteristic polynomials of the time evolution matrices of the bipartite walks on an even-star as a generalization of a star graph and an even cycle graph. We also calculate the characteristic polynomials of the time evolution matrices of a bipartite walk on a double star, a $2k$ ($k \geq 3$)-star and a 4-star, and present their spectra. Furthermore, we present a relation between the transition probability matrix $\mathbf{T}$ and the specified matrix $\mathbf{F} = \hat{\mathbf{P}}_0^T \hat{\mathbf{P}}_1 \hat{\mathbf{P}}_1^T \hat{\mathbf{P}}_0$ appearing in the characteristic polynomial of the time evolution matrix of a bipartite walk on a bipartite graph. As its application, we calculate the spectra of $\mathbf{F}$ for a double star, a $2k$ ($k \geq 3$)-star and a 4-star, and so present the spectra of $\mathbf{T}$ for them.

Summary: In our previous papers [1] and [2], we investigated a period and a group structure of the n state Grover walk on a complete graph with n vertices and a self-loop at each vertex. In this talk, using the above method, we show that the n state Grover walk on the complete bipartite graph $K_{n,n}$ has period $2n$ if n has an odd factor, and period n otherwise.

Summary: In this talk, we discuss a persistence version of Quillen's Theorem A for persistence finite posets. We establish an estimate for the homotopy commutative interleaving distance between persistence finite posets induced by a map whose homotopy fibers are ε-contractible.

Summary: In this talk, we introduce an equivariant version of characteristic quasi-polynomials of root systems. We will present some of computation and show equivariant-theoretic refinements of the beautiful properties of characteristic quasi-polynomials of root systems. If time permits, we will also discuss the relationship with root systems obtained by folding of the extended Dynkin diagrams.

Summary: Hausdorff used Gauss–Hermite quadrature to simplify the construction of the Hilbert identity in classical Waring's problem. In this talk, we introduce a generalization of this Hausdorff construction from Hermite polynomials to other classical orthogonal polynomials. More precisely, we apply the construction to the moments associated with Laguerre polynomials, Chebyshev polynomials of the first and second kinds, and Bessel polynomials. As a result, we obtain polynomial identities connecting classical combinatorial coefficients, such as binomial coefficients and Narayana numbers, with analytic data coming from zeros of orthogonal polynomials and Christoffel numbers. We call these identities combinanalytic identities.

Summary: In classical Waring's problem, Hausdorff gave a simplified construction of the Hilbert identity. In a previous talk, we generalized the Hausdorff construction to several families of orthogonal polynomials beyond the Hermite case, thereby obtaining a new class of polynomial identities, which we call "combinanalytic identities." A combinanalytic identity is a polynomial identity connecting combinatorial quantities involving binomial coefficients and analytic quantities associated with orthogonal polynomials. In this talk, we introduce the resulting identities involving binomial coefficients and discuss a convex algebro-geometric interpretation of Narayana polynomials.

Summary: We introduce *wildcard codes*, a variation of standard q-ary codes incorporating the symbol $*$. Wildcards represent coordinates that are intentionally left unspecified, extending classical equidistant codes in a geometric framework naturally suited to isometric graph embeddings. We characterize such codes via an equivalent matrix formulation and derive a general upper bound $M \leq d(q-1)+1$ for their size. In the binary case, we show that codes equivalent to normalized Hadamard matrices. We further apply 2-distant codes to isometric embedding problems, particularly for complete multipartite graphs, odd cycles, and obtain bounds on embedding numbers. This work highlights structural properties of wildcard codes and their applications in combinatorial design and graph embeddings.

Summary: In the theory of error-correcting codes, the minimum weight and the weight enumerator play a crucial role in evaluating the error-correcting capacity. In this talk, by viewing the weight enumerator as a quasi-polynomial, we reduce the calculation of the minimum weight to that of a code over a smaller integer residue ring. We also give a transformation formula between the Tutte quasi-polynomial and the weight enumerator. Furthermore, we compute the number of maximum weight codewords for the codes related to the matroids N_k and Z_k. This is equivalent to computing the characteristic quasi-polynomial of the hyperplane arrangements related to N_k and Z_k.

Summary: Lee codes are error-correcting codes defined with respect to the Lee metric. As perfect Lee codes are known to be highly restricted and difficult to construct, quasi-perfect Lee codes have emerged as an important relaxation that preserves strong packing and covering properties.
In this talk, we present a new explicit construction of 2-quasi-perfect Lee codes. The proof relies on a characterization of quasi-perfect Lee codes via diameters of the associated Ramanujan graphs, together with algebraic-geometric estimates for rational points on cubic curves.

Summary: This talk focuses on antipodal rational 5-designs for the Chebyshev measure $(1-t^2)^{-1/2}dt/\pi$ on $(-1,1)$. We show that an antipodal rational 5-design with $2N+1$ points exists if and only if $N \geq 17$. The key new ingredient is an explicit 37-point example. Together with known 35- and 39-point examples and an infinite family of 6-point designs, this gives explicit constructions for every odd number of points at least 35. We also describe how the 37-point example is obtained by a meet-in-the-middle computer search combined with elementary number-theoretic restrictions.

Summary: We introduce FLIP, a relation-finding puzzle constructed from block designs arising from difference sets. By assigning related pieces of information to points in the design, one can construct card sets and polyhedral puzzles in which any two objects share a prescribed number of matching or corresponding information pairs.
Motivated by this construction, we investigate a covering problem for the symmetric design arising from a $(21,5,1)$ difference set. We determine the structure of all 6-block coverings of the 21-point set and show that the result extends to projective-plane designs with parameters $(q^2+q+1, q+1, 1)$. The talk presents both the puzzle construction and the associated combinatorial covering theorem.

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

Hirotake Kurihara (Yamaguchi Univ.) Finite combinatorial structures underlying multivariate orthogonal polynomials

Summary: Classical P- and Q-polynomial association schemes provide finite combinatorial models for one-variable orthogonal polynomials, and Leonard's theorem is central to this theory. This talk explores how the classical framework extends to multivariate orthogonal polynomials. I explain recent definitions of bivariate and multivariate P- and Q-polynomial association schemes, emphasizing a viewpoint based on a small number of generators, monomial orders, and vanishing conditions on intersection and Krein numbers. Examples include direct products, nonbinary Johnson schemes, and schemes from attenuated spaces. I also discuss connections with m-distance-regular graphs, elimination theory, higher-dimensional analogues of Leonard theory, and codes and designs, and indicate several open problems.

15:25–16:50

13 Kumi Kobata (Kindai Univ.)
Tatsushi Tanaka (Kyoto Sangyo Univ.)
Noriko Wakabayashi (Osaka Electro-Comm. Univ.)
Rooted tree polylogarithms 15

Summary: This presentation introduces multiple polylogarithms indexed by rooted forests, which we call rooted tree polylogarithms. Rooted tree polylogarithms are functions in one variable defined as certain nested sums associated with rooted forests. By definition, one finds that each of them is expressed as a linear combination of the ordinary multiple polylogarithms. We extract their algebraic characterization and show that almost all primitive elements give relations among rooted tree polylogarithms.

14 Naoki Kimura (Tokyo Univ. of Sci.)
Complexity of non-intrinsically knotted graphs and Legendrian spatial embeddings 15

Summary: A graph G is said to be intrinsically knotted if for any spatial embedding f of G, $f(G)$ contains a non-trivial knot. In this talk, we introduce a numerical invariant of non-intrinsically knotted graphs in terms of Legendrian spatial embeddings. We also present calculation results of the invariant for several graphs.

15 Kazuhiro Ichihara (Nihon Univ.)
Yuha Tamura (Nihon Univ.)
The half-monochromatic colorings of plane graphs with even polygonal faces 10

Summary: An upper bound was given by Enami–Ozeki–Yamaguchi on the maximum number of colors for proper anti-rainbow colorings on a planar quadrangulation in terms of its independence number. In this talk, as an extension, we introduce the half-monochromatic coloring on a plane graph with even polygonal faces, and give an upper bound on the maximum number of colors for such colorings in terms of the independence number.

16 Kenta Noguchi (Tokyo Univ. of Sci.)
The thickness of the Cartesian product of a complete graph and a path 15

Summary: In this talk, we determine the thickness of the Cartesian product $K_{6p+4} \,\square\, P_2$ for $p \geq 0$ and of the Cartesian product $K_8 \,\square\, P_m$ for $m \geq 1$, where K_n and P_m denote the complete graph on n vertices and the path on m vertices, respectively.

17 Kiyoshi Yoshimoto (Nihon Univ.)
Yuya Iwazaki (Nihon Univ.)
Properly colored Hamilton paths and spanning trees in edge-colored multipartite graphs 15

Summary: A 1-path-cycle factor is a spanning subgraph consisting of pairwise disjoint one path and several cycles. The results of Bang-Jensen and Gutin and Feng et al. imply that an edge-colored complete graph has a properly colored Hamilton path if and only if it has a properly colored 1-path-cycle factor. In this paper, we investigate extensions of the result for complete multipartite graphs.

17:00–18:00 Award Lecture for the 2025 Applied Mathematics Prize

Akira Saito (Nihon Univ.) Preorder induced by rainbow forbidden subgraphs

Summary: A subgraph H of an edge-colored graph G is rainbow if all the edges of H receive distinct colors. If G does not contain a rainbow subgraph isomorphic to H, we say that G is rainbow H-free. For connected graphs H_1 and H_2, we write $H_1 \leq H_2$ if every rainbow H_1-free complete graph edge-colored with sufficiently many colors is rainbow H_2-free. The binary relation $\leq$ is a preorder. It is easy to see that if H_1 is a subgraph of H_2, then $H_1 \leq H_2$. However, the converse does not hold. In this talk, we give an overview of the status of research on $\leq$.

September 2nd (Wed) Conference Room IX

9:00–12:00

18 Takahiro Ueoro (Yokohama Nat. Univ.) On graphs without cycles of length 0 modulo 3 or 4 modulo 6 ····· 15

Summary: This talk concerns an extremal problem for graphs with forbidden cycle lengths. We study graphs containing no cycle whose length is congruent to 0 modulo 3 or to 4 modulo 6. We prove that every n-vertex graph with no such cycles has at most $11n/8 - 7/4$ edges, and we determine all extremal graphs attaining equality. This result is nontrivial in the sense that, if one of the forbidden residue classes is removed, the maximum number of edges becomes larger. Thus, forbidding these two families of cycles together imposes a genuinely stronger structural restriction. A key ingredient of the proof is that every graph with no cycles of length congruent to 0 modulo 3 or 4 modulo 6 is planar.

19 Masaki Kashima (Keio Univ.)
Kenta Ozeki (Yokohama Nat. Univ.)
Leilei Zhang (Yokohama Nat. Univ.) Grünbaum's conjecture on longest cycles of graphs ····· 15

Summary: Grünbaum defined a class $\Gamma(k,k)$ as the set of graphs whose circumference is exactly its order minus k, and the deletion of every k of whose vertices results in a Hamiltonian graph. While there are infinitely many graphs in the class $\Gamma(1,1)$, which are called hypohamiltonian graphs, Grünbaum conjectured that $\Gamma(k,k)$ is empty for $k \geq 2$. Motivated by the conjecture, we consider the class of graphs in $\Gamma(k,k)$ with the specified order n, and give an upper bound on the maximum degree of such graphs in terms of n and k. This provides a lower bound on the number of vertices of graphs in $\Gamma(k,k)$ for every fixed k.

20 Masahiro Sanka (Tokyo Univ. of Sci.) Toughness, collections of cycles covering all vertices and Hamiltonian k-factors in split graphs ····· 15

Summary: For a real number $t > 0$, a graph G is said to be t-tough if for every $S \subset V(G)$, if $G - S$ is disconnected, then the number of components of $G - S$ is at most $|S|/t$. A graph G is said to be a split graph if $V(G)$ can be partitioned into an independent set and a clique of G. It is known that every 3/2-tough split graph has a Hamiltonian cycle. In this talk, we extend the known hamiltonicity theorem for tough split graphs as follows: every $(1 + \frac{1}{2k})$-tough split graph has a collection of at most k cycles covering all vertices. Moreover, we show that every $(k - 1 + \frac{1}{k})$-tough split graph has a k-factor admitting a Hamiltonian cycle.

21 Kenta Ozeki (Yokohama Nat. Univ.)
Leilei Zhang (Yokohama Nat. Univ.) A domination number condition for line graphs of 3-hypergraphs to have a Hamiltonian cycle ····· 10

Summary: Thomassen conjectured that every 4-connected line graph has a Hamiltonian cycle. Motivated by this conjecture, Zheng, Broersma, Wang, Zhang, and Vrána, Zhan, and Zhang studied domination number conditions that guarantee Hamiltonian properties of line graphs. In this talk, we extend their results to line graphs of 3-hypergraphs. We prove that the line graph $L(H)$ of a 3-hypergraph H has a Hamiltonian cycle whenever $L(H)$ is 3-connected and has domination number at most 4. This domination number bound is best possible and coincides with the corresponding bound for line graphs of ordinary graphs.

Summary: Let $k \geq 2$ and $b \geq 2$ be integers. It was proved by Brandt (unpublished) for b being even that every k-connected graph with independence number at most $bk/2$ contains a 2-connected $[2, b]$-factor. In this talk, we prove that the same result also holds when b is odd. Moreover, we show the existence of a 2-connected $[2, b]$-factor with small number of edges.

Summary: We show that Ihara zeta functions of certain digraphs have determinant formulas written in terms of simple cycles on their line digraphs without backtrack. While the Hashimoto expression implies the existence of such cycles, we observe that the inverse of the Ihara zeta function can be expressed as a vertex-weighted clique polynomial by utilizing trace monoids. In this talk, we introduce a method to construct a "good" graph whose adjacencies yields this polynomial.

Summary: We study determinant zeta functions for reflected random walks and Szegedy walks on finite path graphs. By introducing the discrete reflection group $\mathcal{G}_{0,N+1}$ generated by the endpoint reflections, we obtain an exact spatial trace formula decomposing each finite determinant into local factors indexed by reflection words. After a symmetrizing similarity transform, this decomposition yields a termwise Konno–Sato correspondence between the classical and quantum factors. As $N \to \infty$, the normalized zeta functions converge uniformly on compact subsets of $|u| < 1$ to the local return zeta functions of the corresponding free walks on $\mathbb{Z}$. We also prove distributional trace limits in the symmetric case and a double-scaling determinant limit to a one-dimensional massive Dirac-type zeta function.

Summary: In this talk, we analyze the eigenspaces of a cycle graph with self-loops and a long range edge. By exploiting the symmetry of the graph, we apply the notion of equitable partition that reduces the original graph to a simpler weighted graph. This reduction allows us to derive the eigenvalues of its adjacency matrix and investigate the structure of the corresponding eigenspaces. We would like to discuss further about the application of the structure we found including quantum walks.

Summary: Fraile et al. introduced and studied two dimensional prime walks. We investigate the prime walk in one, two, and three dimensions. In particular, we consider the comparison of behavior of the prime walk and corresponding random walk.

Summary: In this study, we investigated, both numerically and theoretically, the behavior and transition probability distributions of random walks that reproduce the probability distributions of quantum walks, particularly those employing coin operators with defects.

Summary: Krapivsky and Redner (2004) introduced the Golden random walk, in which the step length changes with time. Unlike ordinary random walks, the walker may return to the starting vertex after three steps, and therefore standard path-counting methods cannot be applied directly. In this study, we consider both the Golden random walk and its quantum counterpart, the Golden quantum walk. In either case, the key to the analysis is an equivalence relation on paths determined by the coincidence of the associated vertices. By recursively determining the corresponding equivalence classes, we obtain explicit expressions for the probability distributions.

Summary: Recently, beginning with the pioneering work of Ambainis, Kempe, and Rivosh, the fundamental theory and analytical methods of quantum search algorithms based on quantum walks have been extensively developed. In this talk, we revisit these methods from the perspective of underlying classical random walks rather than quantum walks. Our approach can be viewed as a modern reformulation and extension of Szegedy's framework. The connection between classical random walks and quantum walks is provided by the spectral mapping theorem established by Segawa and Suzuki. In the context of quantum search algorithms, Fuda, Narimatsu, Saito, and Suzuki further investigated this theorem for quantum walks on d-dimensional lattices.

13:00–14:00

Summary: This study reports on the dynamics of the Grover walk on a complete graph with a self-loop at each vertex, and its application to the absolute zeta function. It is well known that the Grover walk on a standard complete graph generally lacks periodicity for integers greater than or equal to 4. However, on the complete graph, where a single self-loop is added to each vertex, the dynamics change fundamentally, exhibiting a finite period of 2n. In this presentation, we perform a rigorous spectral analysis by block-diagonalizing the time-evolution matrix using the Fourier transform. Based on this analysis, we demonstrate that the corresponding absolute zeta function can be explicitly expressed as a finite product of multiple gamma functions.

Summary: The Deza graph is a generalization of a strongly regular graph. It is a k-regular graph with n vertices such that, for any pair of distinct vertices, the number of common neighbors takes exactly two values, a and b ($a < b$). Associated with a Deza graph are two children graphs, $G_A$and G_B, where two vertices are adjacent whenever they have exactly a or b common neighbors, respectively. A Deza graph is called a strongly Deza graph if both children graphs are strongly regular. In this study, we investigate the periodicity of Grover walk on strongly Deza graphs. By combining spectral analysis with techniques from algebraic number theory, we examine the existence or nonexistence of periodicity.

Summary: The spectrum of the Grover matrix on a finite regular graph can be reduced to that of the simple random walk via the Konno–Sato formula. In this study, we consider random lifts of fixed 3-regular base graphs (K_4 and the Petersen graph). By applying an exact compression, we remove the deterministic old sector inherited from the base graph and focus on the positive Grover eigenangle process in the new sector. We establish a Kesten–McKay-type global law for this sector. Furthermore, our numerical analysis of local statistics, using nearest-neighbor spacings and spacing ratios, demonstrates strong consistency with the orthogonal random-matrix benchmark.

33 Sho Kubota (Aichi Univ. of Edu.) Kiyoto Yoshino (Toho Univ.) Arc search in graphs via Szegedy walks 15

Summary: In this talk, we study the search for a single arc in a graph using the Szegedy walk. Arc search can be interpreted as finding a quantum particle not only in its position but also with a specific internal state. The quantum walk employed here is essentially the model proposed by Segawa and Yoshie for edge search. First, we investigate how graph symmetry is reflected in the time evolution matrix, and provide a sufficient condition under which the success probability is independent of the marked arc. In particular, if a graph is arc-transitive, this probability is independent of the choice of the marked arc. Next, we analyze path and cycle graphs and complete bipartite graphs, showing that the search is ineffective for path and cycle graphs but performs well for complete bipartite graphs.

September 3rd (Thu) Conference Room IX

9:30–12:00

34 Isamu Ohnishi (Hiroshima Univ.) Algebraic variational framework for robust entanglement in driven-dissipative Kerr resonators: Foundations for integrated photonic quantum technologies 10

Summary: We present a variational framework for robust entanglement in driven dissipative multi mode Kerr resonators for integrated photonic quantum technologies. Treating Wigner negativity volume as target observable in the quantized Lugiato Lefever equation, we apply super symmetric Lie observable dependent renormalization together with Golden Fractal Topology introducing golden ratio scaling nested couplings. After high order renormalization group reduction to quadratic model and super symmetric pairing between Kerr nonlinearity and dissipative jumps, the Lindblad dynamics shows variational equivalence between protected negativity flow and normal variation of nested minimal surface on the Golden Fractal manifold. We prove that entanglement measure equals fractal area of the minimal surface plus ultraviolet counterterm. This establishes a fractal generalization of the Ryu Takayanagi formula purely from algebraic and variational principles without Einstein equations or bulk metric. The framework unifies Wigner negativity theorems in open quantum optics with variational holographic principles and delivers predictions for quantum frequency comb stabilization and cat encoded photonic qubits. Simulations confirm the fractal area law.

35 Isamu Ohnishi (Hiroshima Univ.) Lie-algebraic observable-dependent renormalization with transactional handshakes: Advanced/retarded observable sectors and bidirectional RG flows in open quantum systems 10

Summary: We develop a bidirectional extension of Lie algebraic observable dependent renormalization incorporating advanced and retarded observable sectors on equal footing. Motivated by the Wheeler Feynman absorber theory and recent experiments on advanced electromagnetic radiation, we introduce a transactional Lie bracket on the direct sum of retarded and advanced algebras to encode emitter absorber handshakes. We construct a bidirectional renormalization map satisfying direct sum compatibility, transactional covariance, and complete positivity preservation. Under a Lipschitz condition on the transactional beta operator, we prove the existence of a unique transactional fixed point invariant under the renormalization flow and establish trace norm convergence to this fixed point. The framework provides a consistent setting for advanced boundary conditions in observable dependent renormalization without violating complete positivity. Applications include non Markovian open quantum dynamics, symmetry protected subspaces in quantum error correction, and extensions of holographic entanglement entropy with future directed contributions. Open questions on unbounded observables and experimental implications are discussed.

Summary: Experimentally, we understand that one cannot keep adding electrons to an atomic or a molecular system indefinitely and expect it to bind them. However, proving this mathematically is challenging. One way forward is to consider a reduced space of systems; for this talk, we will consider the Hartree–Fock model. Even then, our current proofs do not disallow the possibility of very strongly negatively charged ions. This talk will discuss the proof for the maximum charge a negative ion may have in the Hartree–Fock setting.

Summary: The Gauss circle problem concerns the error term $E(t) = A(t) - \pi t$, where $A(t)$ denotes the number of lattice points inside the circle $x^2 + y^2 \leq t$. A famous conjecture of Hardy states that $E(t) = O(t^{1/4+\varepsilon})$ for every $\varepsilon > 0$. In this talk, we report large-scale numerical computations of $E(t)$ carried out on a supercomputer. Extending previous computations, we evaluate $E(t)$ for values of t up to 1.22×10^{18}. Using a least-squares analysis of the computed data, we estimate the growth exponent θ in the relation $E(t) = O(t^{\theta})$ and obtain the numerical value $\theta \approx 0.26$. This value is close to the exponent $1/4$ predicted by Hardy conjecture. The computed data therefore provide further numerical support for the validity of Hardy conjecture.

Summary: We consider a three-layer neural network with two hidden units as the statistical model. Watanabe resolved the singularities and defined the learning coefficient [1]. Amari analyzed the learning dynamics in singular regions by applying coordinate transformations [2]. We computed the true parameter set and the singularity set that realizes the true distribution [3]. When the number of hidden units decreases from two to one, the Kullback information between the statistical model and the true distribution is known to be expressible as a finite sum of squares of polynomials. In this presentation, for the singular points that realize the true distribution, we repeatedly apply blow-ups in the singular regions and compute the learning coefficient using Mathematica.

Summary: This study investigates periodic solutions of a differential-difference equation derived from the Optimal Velocity (OV) model for traffic flow. Numerical results indicate that the periodic solution consists of two flat regions, corresponding to the free-flow and congested phases, connected by transition layers. The purpose of this study is to construct a periodic solution by combining two monotone functions characterized by a limit equation. Due to analytical difficulties in directly applying the contraction mapping principle, we introduce a modified equation under a density conservation constraint. This modification ensures the invertibility of the linearized operator. We rigorously prove the existence of the periodic solution for sufficiently large parameters, providing a mathematical justification for the structural profile of traffic congestion.

40 Masato Kimura (Kanazawa Univ.)
Oussama Ounissi (Kanazawa Univ.)
Hirofumi Notsu (Kanazawa Univ.)
Hidden symmetry and positive definiteness of spring-block approximations derived from P1-FEM for 2D/3D linear elasticity 15

Summary: This talk presents a mathematical study of hidden symmetry and positive definiteness of tensor-valued spring constants arising in spring-block approximations of linear elasticity derived from P1-FEM. The hidden symmetry refers to the matrix symmetry $K_{ij} = K_{ij}^T$, which does not follow directly from the classical major and minor symmetries of the elasticity tensor but emerges from the structure of the finite element discretization. While this property was previously established in two dimensions, its extension to three dimensions is highly nontrivial. Using an identity involving jumps of finite element gradients, we provide a unified 2D/3D proof of the hidden symmetry. We also derive necessary and sufficient conditions for positive definiteness and discuss implications for spring-block fracture models.

41 Hirofumi Notsu (Kanazawa Univ.)
Kharisma Surya Putri (Kanazawa Univ.)
Niklas Kolbe (RWTH Aachen Univ.)
Tasuku Suzuki (Kanazawa Univ.)
Error estimates for Lagrange–Galerkin moving mesh methods for the one-dimensional convection-diffusion equation 15

Summary: We present first- and second-order Lagrange–Galerkin moving mesh schemes for a one-dimensional convection-diffusion equation. The mesh movement is governed by a discretized dynamical system that allows the mesh nodes to follow the transport and diffusion of the solution. We prove mesh validity, discrete mass conservation, stability, and optimal convergence for both schemes. A key ingredient is a new estimate for a time-dependent interpolation operator on moving finite element spaces. Numerical experiments confirm the theoretical results and demonstrate that the proposed method can significantly improve the accuracy of conventional fixed-mesh Lagrange–Galerkin schemes for solutions with sharp gradients or concentration phenomena.

42 Yixuan Chen (Univ. of Osaka)
Qiran Shao (Univ. of Osaka)
Yoshie Sugiyama (Univ. of Osaka)
A GPU-accelerated micropolar δ^+-SPH framework with enhanced particle shifting for complex fluid dynamics 15

Summary: We present a weakly-compressible micropolar δ^+-SPH framework for complex fluid dynamics. At usable resolutions, standard SPH dissipates vorticity rapidly and develops irregular particle distributions. Our solver addresses both: an enhanced particle-shifting technique maintains a uniform distribution while suppressing spurious scattering near free surfaces, and a micropolar formulation preserves vorticity through a two-way coupling between the velocity and an independent micro-rotation field. The entire pipeline runs on the GPU via cross-vendor OpenGL compute shaders, enabling real-time visualization on NVIDIA, AMD, and Intel hardware. We validate against lid-driven cavity, elliptical-cylinder, and NACA0015-airfoil benchmarks, agreeing with published reference data. On a single RTX 5090, the solver exceeds 300 fps for one million particles.

14:15–16:15

Summary: Recently, Umezu et al. have designed a spatially high-accuracy structure-preserving scheme based on the discrete variational derivative (DVD) method by Furihata and Matsuo, using the SBP operator, which corresponds to the discrete space derivative, and a projection matrix. However, constructing such a projection matrix is difficult for complex boundary conditions, such as dynamic boundary conditions that include the time derivative of an unknown function. Thus, in this study, instead of using a projection matrix, we incorporated a simultaneous approximation term corresponding to the residual of the boundary conditions. This enabled us to design a spatially high-accuracy DVD scheme for the Allen–Cahn equation under dynamic boundary conditions. Indeed, through numerical examples, we confirmed that the proposed scheme achieves high spatial accuracy.

Summary: We construct a system with a nonlinear interaction term for the Klein–Gordon equation for a scalar field and the Proca equation for a vector field, and aim to apply structure-preserving numerical computation. Furthermore, we construct initial values that satisfy the constraints and present the results of applying this structure-preserving numerical computation.

Summary: The existence of time-periodic solutions of fully nonlinear second-order parabolic equations with bilateral obstacles is studied. For a given pair of time-periodic bilateral obstacles and a viscosity solution of the obstacle problems for mean curvature flow, we construct a time-periodic viscosity solution. This result is established with the comparison principle of time periodic solutions and Barles–Perthame's limit procedure by an approximating equation for the mean curvature flow equation. Several numerical simulations in this study are also presented in this talk.

Summary: This study proposes a numerical scheme for Hamilton–Jacobi–Bellman (HJB) equations in a setting where the Hamiltonian is prescribed directly. Most existing HJB solvers rely on Lagrangian-based formulations, with semi-Lagrangian schemes being a representative example. Such schemes must solve many minimization problems, which can make them computationally costly. In contrast, when the Hamiltonian is available, the HJB equation can be discretized directly, avoiding such minimization problems. We then construct a monotone scheme inspired by the monotone scheme of Crandall and Lions. As a key feature, despite the presence of diffusion terms, the CFL condition for the proposed explicit scheme remains comparable to that for first-order PDEs. We further derive error estimates for viscosity solutions and present numerical results.

47 Tetsuya Ishiwata (Shibaura Inst. of Tech.)
Junya Nishiguchi (Setsunan Univ./Tohoku Univ.)
Blow-up of solutions induced by state-dependent delays ····· 15

Summary: State-dependent delays introduce additional nonlinear effects into delay differential equations. In this talk, we discuss the role of such nonlinearities in the finite-time blow-up of solutions. Focusing on the dependence of the delay on the solution, we derive sufficient conditions under which positive solutions blow up in finite time. The results indicate that the state dependence of the delay itself can act as a mechanism leading to blow-up. We also present numerical experiments illustrating the theoretical results and discuss several cases in which the sufficient conditions are not satisfied.

48 Hiroshi Ishii (Hokkaido Univ.)
Boundary-induced nonlocal kernels generated by reaction-diffusion systems on the half-line ····· 15

Summary: This talk addresses time-evolution equations with nonlocal interactions on a domain with a boundary and investigates how boundary conditions determine the form of the nonlocal kernel. As a fundamental setting, we consider the half-line and derive nonlocal interactions from reaction-diffusion systems with boundary conditions at the origin. We characterize a class of nonlocal kernels that finite linear combinations of the Green functions of the corresponding elliptic problem can approximate. This provides a characterization of a class of nonlocal kernels generated by reaction-diffusion dynamics with boundary effects.

49 Yui Nagayama (Hokkaido Univ.)
Masaharu Nagayama (Hokkaido Univ.)
Hiroshi Ishii (Hokkaido Univ.)
Bifurcation and multistability in a reaction-diffusion equation with nonlocal advection ····· 15

Summary: We investigate bifurcation and multistability in a reaction-diffusion equation with nonlocal advection by combining local and numerical bifurcation analysis. The nonlocal advection term represents interaction effects through convolution with a kernel; the kernel shape characterizes aggregation or repulsion, while a model parameter controls the interaction strength. By local bifurcation analysis, we rigorously prove the existence of pitchfork bifurcations from the trivial solution and show that their direction is determined by the unstable Fourier mode and the Fourier transform of the kernel. We further prove that the bifurcation is subcritical for kernels satisfying a suitable condition. Finally, numerical bifurcation analysis for several kernels reveals multistability associated with such subcritical bifurcations, including coexistence of the trivial solution with nontrivial stationary or periodic solutions.

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

Sohei Tasaki (Hokkaido Univ.) Mathematics of bacterial community formation

Summary: Microbial communities organize into colonies and, under specific environmental conditions, mature into robust biofilms through complex self-organization. Despite their prevalence, standard methodologies for bridging the gap between single-cell behaviors and tissue-level emergent patterns remain elusive. In this talk, we present mathematical advances in bacterial community formation, focusing on how evolutionarily shaped motility responses to resources drive these processes. By examining optimization problems for diffusive motility and chemotaxis, we have established a robust modeling framework to identify primary response functions. We further utilize this framework to analyze the existence and dynamics of traveling fronts and pulses, demonstrating the principles underlying pattern selection. Finally, we discuss a multilevel modeling approach to predict the diverse collective morphologies of *Echerichia coli* and *Bacillus subtilis*, aiming to uncover the universal principles by which individual cells transition into complex multicellular systems.

September 4th (Fri) Conference Room IX

9:30–12:00

50 Yoshitaka Watanabe (Kyushu Univ.)
Kenta Kobayashi (Hitotsubashi Univ.)
Efficient numerical verification procedure of norm bound for infinite-dimensional differential operator with singular term 15

Summary: This talk presents a numerical verification procedure for a norm bound on an infinite-dimensional differential operator. The operator comes from a nonlinear ordinary differential equation involved with self-similar blowup in wave equations and has a singular term. Our procedure was inspired by a result of Buenger and Rump (Inter. Equ. Oper. Theory, 2019), which it generalizes. Concrete verification examples reveal the effectiveness of the proposed approach.

51 Shinya Miyajima (Tohoku Univ.)
Amir Sadeghi (Islamic Azad Univ.)
Numerical computation of the complementary error matrix function 15

Summary: A solution to systems of partial differential equations can be written by using the complementary error matrix function. In this talk, we propose three numerical algorithms for computing the matrix function. The first, second, and third algorithms are based on the truncation of the Taylor expansion, Gauss–Legendre quadrature, and quadrature based on the double exponential formula, respectively. The first algorithm is designed such that the truncation error is equal or smaller than a given tolerance. The second and third algorithms are constructed so that the sum of truncation and discretization errors is equal or smaller than the tolerance. Numerical experiments showed that the proposed algorithms improve upon the use of general purpose alternatives when the input matrix is unsymmetric or the norm of the matrix is not large.

52 Takuya Tsuchiya (Osaka Univ./Ehime Univ.*)
Kenta Kobayashi (Hitotsubashi Univ.)
Error analysis of Raviart–Thomas interpolation on anisotropic simplicial elements 15

Summary: In this presentation, we provide an error estimation of Raviart–Thomas interpolation of degree 0 on anisotropic simplices without imposing any geometric condition on the elements. Although the results are known, we present an alternative proof using a unified approach based on the Babuska–Aziz trick.

53 Shoya Motonaga (Kyushu Inst. of Tech.)
Akitoshi Takayasu (Univ. of Tsukuba)
Computer-assisted existence proofs for star-shaped periodic solutions of a system of delay differential equations 15

Summary: This talk presents computer-assisted existence proofs for star-shaped periodic solutions of a system of delay differential equations introduced by Hara et al. The system extends classical scalar delayed feedback equations and exhibits rich dynamics, including circular periodic orbits and conjectured star-shaped solutions. We focus on specific parameter values and prove the existence of the corresponding star-shaped solutions. The key idea is an ansatz $z(t) = e^{i\mu t}w(t)$, where $w(t)$ is 2-periodic, which reduces the problem to a validated Fourier spectral computation. Using rigorous a posteriori estimates for a Newton-type operator, we prove the existence of these star-shaped periodic solutions.

54 Koichi Anada (Waseda Univ. Senior High School)
Tetsuya Ishiwata (Shibaura Inst. of Tech.)
Takeo Ushijima (Tokyo Univ. of Sci.)
A Remark on radially symmetric self-similar solutions of a quasilinear parabolic partial differential equation 15

Summary: In this talk, we consider radially symmetric self-similar solutions to a quasi-linear parabolic partial differential equation, known as the curvature equation in the curve shortening problem for convex curves, and as the equation governing the resistive diffusion model of a force-free magnetic field in plasma confined between two walls. We first prove the existence of nontrivial, radially symmetric self-similar solutions. Next, we investigate their properties by introducing special radial functions defined in terms of Bessel functions. This motivation is connected to earlier work on finite-time blow-up in a quasi-linear parabolic partial differential equation.

55 Kaname Matsue (Kyushu Univ./Kyushu Univ.)
Correspondence between dynamics at infinity and asymptotic-expansion structures for oscillatory blow-up solutions 15

Summary: We study type-I oscillatory blow-up solutions of ordinary differential equations. Previous studies showed that periodic orbits on the boundary of a compactified phase space induce periodic blow-up solutions, and that stationary blow-up admits a correspondence between the balance law from asymptotic expansions and dynamics at infinity. In this talk, we extend this correspondence to periodic blow-up using Floquet theory and invariant subbundles for linear differential equations. In particular, we show that a hyperbolic periodic orbit of the balance law yields a finite-time blow-up solution with oscillatory behavior.

56 Kazuyuki Yagasaki (Kyoto Univ.*)
Definition of integrability of diffeomorphisms 15

Summary: Motivated by Bogoyavlenskij's definition of integrability for systems of differential equations, we propose a notion of integrability for diffeomorphisms that need not be symplectic. We further prove a Liouville–Arnold type theorem and discuss its relations to the standard definition of integrability for symplectic diffeomorphisms.

57 Kazuyuki Yagasaki (Kyoto Univ.*)
Linearization and integrability of diffeomorphisms 15

Summary: We extend previous results for ordinary differential equations to discrete dynamical systems generated by diffeomorphisms. In particular, adopting a recently introduced definition of integrability, we show that many diffeomorphisms are linearizable and integrable on suitable regions of the phase space.

58 Yuki Ishihara (Teikyo Univ.)
Masaki Nakamiya (Teikyo Univ.)
Reconsidering the structure of rotation: From systems to processes 12

Summary: In the conventional rotation representations such as SO(3) and SU(2), the rotation process is specified by an initial system and a final system. Within this framework, the initial and final systems are considered primary because the process is characterized by the system. On the other hand, the intermediate rotation process through which the system reaches its final system is typically regarded as secondary. However, rotation can also be reconsidered as a relational structure of rotation processes when the relations among the processes are treated as primary. Therefore, this perspective may provide a basis for reexamination rotation theory in terms of how process structures are organized by rotation relations.

14:15–16:15

Summary: In this study, we examine the conditional Ulam stability of the von Bertalanffy model incorporating the Allee effect. The von Bertalanffy model is known as a model that describes fish weight growth. The Allee effect refers to the phenomenon whereby survival and reproduction become more difficult as the population size of an organism decreases. Furthermore, Ulam stability means that the difference between the exact solution and the approximate solution is at most bounded. In other words, Ulam stability is a concept that guarantees the stability of the model itself.

Summary: The purpose of this study is to construct a mathematical model that describes the colony formation process of Bacillus subtilis and to reproduce the experimentally reported morphological phase diagram. In particular, this study focuses on the formation of concentric-ring patterns and proposes a new mathematical model that incorporates recent biological findings on cell-state transitions in Bacillus subtilis.

Summary: This study investigates bacterial chemotactic ring formation driven by nutrient consumption. By analyzing a one-dimensional nonlinear reaction-diffusion system where nutrient diffusion is negligible, we mathematically prove the existence of classical traveling wave solutions connecting two equilibria via phase-plane analysis. We also derive specific conditions for monotonic density profiles of bacteria. Numerical simulations reveal two distinct traveling wave types: front waves and pulse waves. Further numerical result analyze how key parameters govern wave speed and amplitude. This demonstrated partial agreement between the theoretical analysis and the numerical results regarding the traveling wave speed.

Summary: We investigate the spectral structure of a nonlocal linearized eigenvalue problem arising from a one-dimensional phase-field model. Because of the nonlocal term, Sturm–Liouville theory cannot be applied, and additional ideas are required to understand the spectral structure. Miyamoto–Mori–Tasaki–Tsujikawa–Yotsutani (JDE, 2025) considered the case in which the coefficient multiplying the nonlocal term is small. They determined the spectral structure around symmetric solutions and described the behavior of the eigenvalues. In this talk, we consider the case in which this coefficient is large. We prove that the monotonicity of the two eigenvalues arising from the nonlocal term changes as the diffusion coefficient varies, and that both eigenvalues are monotone in the diffusion coefficient when the parameter multiplying the nonlocal term exceeds 4.

63 Riku Watanabe (Hokkaido Univ.) Geometry-induced pulse dynamics in a bulk-surface reaction-diffusion system for cell polarization 15

Summary: This talk is about a bulk-surface reaction-diffusion system modelling cell polarization in a two-dimensional domain. Using singular perturbation methods, we formally derive reduced ordinary differential equations describing the wave-pinning dynamics on a fast time scale and the subsequent slow drift of pulse solutions induced by domain geometry. The resulting slow dynamics is a gradient flow of a potential function whose geometry-dependent part is expressed in terms of the Neumann Green's function. We then analyze the reduced dynamics in several concrete geometries, including dumbbell-shaped domains and perforated disks. In these examples, we characterize stationary pulse positions, their stability, and the bifurcation structures arising from changes in geometric parameters.

64 Takashi Teramoto (Kyoto Women's Univ.) Localized radially symmetric spot solutions in a singularly perturbed FitzHugh–Nagumo model 10

Summary: We investigate stationary localized spot solutions in a singularly perturbed FitzHugh–Nagumo-type model. Using an action functional approach, we derive existence conditions for radially symmetric spot solutions with N interfaces in two and three dimensions.

65 Yoshihisa Morita (Ryukoku Univ.*), Harunori Monobe (Osaka Metro. Univ.) Nonconstant stable solutions to the bistable reaction-diffusion equation on metric tree graphs 15

Summary: The purpose of this study is to construct nonconstant stable solutions to a bistable reaction-diffusion equation on metric tree graphs subject to the Kirchhoff condition at the nodes and the Neumann condition at the endpoints. A metric tree graph is a connected graph without cycles and can be viewed as being composed of star graphs. Using the stable solutions on star graphs established in our previous work, we develop a gluing procedure for constructing stable solutions on metric tree graphs.

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

Tadashi Tokieda (Stanford Univ.) Calculation that involves neither numbers nor formulas

Summary: Friction, viscosity, jamming, . . . we tend to pooh-pooh at these conditions as spoilers which dull life. This talk, however, will perform a few table-top demos and share a diversity of counter-intuitive phenomena that pop out of these conditions, and to understand them via minimal, widely applicable models.

Topology

September 1st (Tue) Conference Room VII

9:30–12:00

Summary: The Teichmüller space of a finite-type surface S is the space of marked complex structures on S. For each simple closed curve on S, the corresponding thin part consists of Riemann surfaces on which the curve has sufficiently small length. The electric Teichmüller space is obtained by collapsing these thin parts. Masur and Minsky proved that the curve graph is quasi-isometric to the electric Teichmüller space. In this talk, we discuss a generalization of their result to k-multicurve graphs and describe the large-scale geometry of electric Teichmüller spaces.

Summary: In this talk, I will introduce a quandle structure induced by an augmented rack arising from a gauge transformation group. I will explain how to construct a quandle from a principal bundle and its discrete generalization. When we see a group as a (discrete) principal bundle over a point, this quandle becomes equivalent to the generalized Alexander quandle for its inner automorphism. Moreover, I will introduce a Lie and Noether quandle structure from a smooth gauge transformation.

Summary: We study two variants of Coxeter quandles, especially their inner automorphism groups. One is the quandle obtained by pulling back a Coxeter quandle to the Pin group. The other one is obtained as a subset consisting of right angle rotations in a Spin group.

Summary: One of the fundamental questions in four-dimensional differential topology in which intersection forms can be realized by smooth 4-manifolds whose boundary is a homology 3-sphere. In this talk, we focus on the generalized w-invariant, which was introduced by Fukumoto and Furuta by applying an orbifold version of the 10/8-inequality arising from Seiberg–Witten theory. It is known that, for Seifert homology 3-spheres, the w-invariant agrees with the Neumann–Siebenmann $\bar{\mu}$-invariant. On the other hand, the generalized w-invariant has aspects analogous to the Fintushel–Stern invariant arising from Donaldson theory, and its behavior with respect to Spin-c structures is not well understood. In this talk, we discuss to what extent the known relation between the w-invariant and the $\bar{\mu}$-invariant extends to the generalized w-invariant.

Summary: The Turaev cobracket is a Lie cobracket defined on the free module generated by free homotopy classes of loops on a surface. Chas and Krongold proved that, for surfaces with boundary and negative Euler characteristic, the vanishing of the Turaev cobracket of α^n $(n \geq 3)$ is equivalent to α being a power of a simple closed curve. They also showed that, for $n \geq 4$, the self-intersection number of α is determined by the number of terms appearing in the Turaev cobracket of α^n. In this talk, we prove that both results remain valid for closed orientable surfaces. In particular, the corresponding statements hold for $n \geq 3$ and $n \geq 12$, respectively.

6 Aoi Wakuda (Univ. of Tokyo) Centralizers of simple closed curves in the Goldman Lie algebra ····· 15
Arpan Kabiraj
(Indian Inst. of Tech. Palakkad)

Summary: The Goldman Lie algebra is a Lie algebra defined on the free module generated by free homotopy classes of loops on a surface. Goldman proved that, for a simple closed curve x and a loop y, the Goldman bracket $[x, y]$ vanishes if and only if the geometric intersection number of x and y is zero. We extend this result from individual loops to arbitrary linear combinations by determining the centralizers of simple closed curves in the Goldman Lie algebra. More precisely, the centralizer of x is generated by free homotopy classes having zero geometric intersection number with x. As an application, we determine the center of the Goldman Lie algebra for surfaces of negative Euler characteristic other than pairs of pants. We also obtain analogous results for the homotopy skein algebra.

7 Takatoshi Hama (Nihon Univ.) CAT(0) property and hyperbolicity of affine cactus groups ····· 15

Summary: In this presentation, we will first review the definition of affine cactus groups and then introduce our two main theorems.

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

Summary: We consider refinements of the groups Γ_n^4 defined by S. Kim and V. O. Manturov. We investigate the structure of these refinements from a group-theoretic point of view and compare them with the original groups.

14:20–15:20 Talk Invited by Topology Section

Masaki Taniguchi (Kyoto Univ.)♭ Four-dimensional cobordisms and Floer theory

Summary: The topology of smooth four-dimensional manifolds is deeply influenced by the behavior of their three-dimensional boundaries. I will discuss several problems in four-dimensional topology from this point of view: when a homology 3-sphere bounds a smooth homology 4-ball, when a boundary diffeomorphism extends over a 4-manifold, when a boundary (four dimensional) Dehn twist is smoothly isotopic to the identity, when a knot bounds a smoothly embedded disk in the 4-ball, and when two slice disks bounded by the same knot are exotically knotted.
In joint work with several groups of collaborators, we have developed variants of gauge-theoretic Floer theory to give partial answers to these problems. The main theories appearing in this talk are: filtered instanton Floer homology for 3-manifolds, filtered singular instanton Floer homology for knots, $\mathbb{Z}/p\mathbb{Z}$-equivariant Seiberg–Witten Floer homotopy types for equivariant 3-manifolds, real Seiberg–Witten Floer homotopy types for knots. I will explain how these theories have been developed and survey several applications to four-dimensional cobordisms, diffeomorphisms, and knot concordance.

15:40–17:40

9 Jumpei Yasuda (Osaka Metro. Univ.) On the classification of 2-plat 2-knots ····· 10

Summary: An oriented 2-knot is called n-plat if it is isotopic to the plat closure of 2-dimensional 2n-braid. Every 1-plat 2-knot is a trivial 2-knot. In this talk, we classify 2-plat 2-knots up to ambient isotopy. To classify them, we introduce a new invariant of 2-knots. Furthermore, we show that it is an obstruction to invertibility of 2-knots.

10 Teruhisa Kadokami (Kanazawa Univ.) The half Alexander polynomials of amphicheiral 2-bridge knots ····· 15

Summary: For a negative amphicheiral knot, the Alexander polynomial of the knot decomposes into $f(t)f(t^{-1})$. Then we call $f(t)$ the half Alexander polynomial. We compute the half Alexander polynomial of an amphicheiral two bridge knot.

Summary: This talk concerns a volume conjecture for colored Jones invariants with sequences of colors corresponding to deformations of hyperbolic structures of link complements. I will discuss the cases of the figure-eight knot and the Borromean rings, and explain how certain asymptotic limits of the colored Jones invariants are related to the volumes of hyperbolic cone manifolds. The proof uses explicit finite-sum formulae, potential functions, volume formulae involving the Lobachevsky function, and the Poisson summation formula.

Summary: Changing 2 half twists to (-2) half twists in a knot, and its inverse operation, is called a 4-move. Since it remains an open problem whether the 4-move is an unknotting operation, we define the 4-move distance as the minimum number of 4-moves required to transform one knot into another, allowing for infinity. In particular, the 4-move distance to the unknot is called the 4-move unknotting number. While lower bound estimation methods (1) through (6) had been previously obtained, we have now successfully established new lower bound estimation methods (7) through (10). As a result, we improve the table of 4-move unknotting numbers for knots with up to 9 crossings, as well as the table of 4-move distances for knots with up to 7 crossings.

Summary: Using the rational surgery formula for the Casson–Walker–Lescop invariant of links in the 3-sphere,we show that any null-homologous knot in a rational homology sphere admits at most two pairs of integral purely cosmetic surgeries.

Summary: The trisection genus is an integer-valued invariant of a smooth 4-manifold and can be considered a 4-dimensional analogue of the Heegaard genus of a 3-manifold. In this talk, we study the trisection genus of knot traces. We classify knot traces with trisection genus at most 2. In addition, we show that there exist infinitely many torus knots whose traces have trisection genus 3, as well as infinitely many hyperbolic knots whose traces have trisection genus 4.

Summary: A basic open question motivated by the study of ribbon knot diagrams asks whether every ribbon knot can be presented as a symmetric union. In this talk, we give a negative answer to this question by exhibiting a ribbon Montesinos knot which does not admit a symmetric union presentation.

September 2nd (Wed) Conference Room III

10:00–10:15 Presentation Ceremony for the 2026 MSJ Geometry Prize

10:20–11:20 Award Lecture for the 2026 MSJ Geometry Prize

Shinpei Baba (Univ. of Osaka) Complex projective structures on a Riemann surface and representations of the surface group

Summary: Complex projective structures on a surface provide a rich interplay between Riemann surface structures, hyperbolic geometry, and representations of its fundamental group into $PSL(2, C)$. In particular, their holonomy representations are not necessarily discrete, and projective structures provide geometric meaning to such general representations. In this talk, we discuss various relations between complex projective structures and their holonomy represenetations.

13:00–14:00 Award Lecture for the 2026 MSJ Geometry Prize

Kouichi Yasui (Univ. of Osaka) Exotic smooth structures on 4-manifolds and genus functions

Summary: A central problem in 4-dimensional topology asks whether a given smooth 4-manifold admits an exotic smooth structure (i.e., another smooth 4-manifold homeomorphic but not diffeomorphic to the given one), and if so, whether it admits infinitely many pairwise non-diffeomorphic exotic smooth structures. To approach this problem, various methods for constructing and distinguishing exotic smooth structures have been developed over the past four decades. In this talk, I will survey some of these methods, focusing on the roles of handlebodies, corks, and genus functions. I will also discuss closely related topics such as exotically knotted submanifolds in 4-manifolds.

September 3rd (Thu) Conference Room VII

9:30–12:00

16 Hiroki Kodama (Hiroshima Univ.) Structural oscillatority criterion of Boolean networks ····· 15

Summary: A Boolean dynamical system is a discrete dynamical system determined by a map

$$f\colon \{0,1\}^N \to \{0,1\}^N$$

on the finite set $\{0,1\}^N$. When each component function f_i is monotone with respect to every variable, the system can be represented by a signed directed graph, called a Boolean network. Boolean networks have been extensively studied as models of gene regulatory networks and biochemical reaction systems.
In this talk, we present a graph-theoretic criterion for determining whether a Boolean network has no fixed points—that is, whether the associated dynamical system is oscillatory—using only the structure of the underlying network.

17 Sakumi Sugawara (Hokkaido Univ.) Topology of topological line arrangements: Combinatorial description of the cohomology ring ····· 10

Summary: It is known that the cohomology ring of the complement of a hyperplane arrangement is isomorphic to the Orlik–Solomon algebra. This means the cohomology ring of the complement is determined by its combinatorial structure. In this talk, we generalize this result to topological line arrangements, which are defined as a union of embedded 2-spheres in the complex projective space. Since we cannot apply classical methods to prove, we developed a new homological method.

Summary: The complement of a complex hyperplane arrangement is an intersecting object from a topological viewpoint; for example, it yields many Eilenberg–MacLane spaces. It is known that the complement is homotopy equivalent to a minimal CW complex, a CW complex whose number of k-cells equals the k-th Betti number for each k. In this talk, we consider the minimality of the complements of topological line arrangements. We show that the complement of a symplectic line arrangement has a minimality. Also, we provide an example of topological line arrangement whose complement fails to the minimality.

Summary: The farthest point map on the boundary of the regular n-simplex is a piecewise rational multimap. If n is greater than four, every farthest point is a vertex of the simplex. If we assume $n = 4$ and consider a farthest point q of some point p, then either q itself or its farthest point is a vertex. The ratio of the intrinsic radius to the intrinsic diameter decreases monotonically with respect to the dimension n.

Summary: In the context of geometric measure theory, Llorente–Winter introduced the (average) fractal Euler number as a notion of the Euler characteristic for fractals embedded in Euclidean space. However, the class of fractals to which it is applicable remains very limited. In fact, their approach excludes even classical fractals such as the Cantor dust and the Menger sponge. In this talk, we present a modification of their definition by applying perspectives of persistent homology and partly the theory of magnitude, which have recently come from applied topology and category theory. We then demonstrate concrete calculation of our average ph-fractal Euler number for some classically well-known fractals, especially the Cantor dust and the Menger sponge.

Summary: A CW complex is called minimal if all boundary homomorphisms in its cellular chain complex are zero maps. Minimal CW complexes are important because they realize a given homotopy type with the smallest possible number of cells. Lofano and Paolini proved that the complements of the complexifications of locally finite real hyperplane arrangements are minimal. It is also known, by work of Adiprasito, that the complements of finite 2-arrangements are minimal. In this talk, the speakers will present a common generalization of these two previous results: the complement of a locally finite 2-arrangement restricted to a convex open set is minimal.

Summary: We study the family of subcomplexes of the order complexes of finite graded posets, defined via its rank function. Especially, we describe the general topological properties in relation to magnitude homology of graded posets. We also present some results on posets related to the triangulation of manifolds, and the intersection posets of hyperplane arrangements.

Summary: T. Leinster introduced the notion of metric fibration, and proved that the magnitude of a metric fibration with finitely many points is equal to product of those of the base and the fiber. We proved the same is true for the magnitude homology using Algebraic Morse theory.

14:20–15:20 Talk Invited by Topology Section

Yasuhiko Asao (Kyushu Univ.) Graph homology viewed from magnitude homology

Summary: Category theory and Euler characteristic are two fundamental ideas that play important roles throughout modern mathematics in different ways. Magnitude is a concept that emerged from an attempt to bring these ideas together, providing a common framework for studying seemingly different objects such as categories, graphs, and metric spaces.
In this talk, I will focus on magnitude homology, a categorification of magnitude, and introduce its definition and basic properties. I will then survey its connections with geometric group theory, path homology, and the representation theory of quivers. Through these connections, I hope to illustrate how the perspective of magnitude theory sheds new light on a variety of mathematical structures and problems.

15:40–17:10

24 Naoki Kuroda (Univ. of Tokyo)♭ A refinement of the Pontryagin–Thom theorem for unstable Thom spectra and its applications ····· 15

Summary: The Pontryagin–Thom construction relates cobordism groups to the homotopy groups of Thom spectra. This talk presents a refinement of this construction for unstable Thom spectra. The refinement gives a concrete geometric interpretation of the relevant homotopy groups and allows certain cobordism groups to be realized as homotopy groups of unstable Thom spectra. As an application, I discuss the existence problem for Spin manifolds whose boundary is S^n and which are equipped with a line subbundle orthogonal to the boundary, and determine exactly for which values of n such manifolds exist.

25 Yuya Koike (Univ. of Osaka) On 3-dimensional locally standard T-pseudomanifolds ····· 15

Summary: In our previous work, we introduced locally standard T-pseudomanifolds, which are topological stratified pseudomanifolds equipped with torus actions. Their equivariant homeomorphism types were classified by characteristic data under a certain homotopy equivalence condition. Up to torus-equivariant homeomorphism, this class contains complete toric varieties and quasitoric manifolds (introduced by Davis and Januszkiewicz). In this talk, we show that this homotopy equivalence condition can be removed when the dimension is at most three.

26 Masaki Taho (Univ. of Tokyo) Diffeological spaces with a non-smooth derivation ····· 15

Summary: We show that on certain diffeological spaces there exist linear derivations that satisfy the Leibniz rule but are not smooth with respect to the given diffeology. This reveals that the notion of tangent space defined via all such derivations is strictly larger than the one defined using only smooth derivations, showing that smoothness cannot be recovered from the Leibniz rule alone.

27 Ryo Horiuchi (Bukkyo Univ.) On the Witt vectors in the Lawvere quantale ····· 15

Summary: Categories enriched over the Lawvere quantale $\mathbb{L}$ have been studied as generalized metric spaces. In this talk, we consider the monoidal category $\mathbb{W}(\mathbb{L})$ of Witt vectors in $\mathbb{L}$ and explore some basic properties of categories enriched over $\mathbb{W}(\mathbb{L})$. We also construct a monoidal functor from $\mathbb{L}$ to $\mathbb{W}(\mathbb{L})$, which induces a fully faithful functor from the category of $\mathbb{L}$-enriched categories to that of $\mathbb{W}(\mathbb{L})$-enriched categories, and investigate the relationship between them.

Infinite Analysis

September 1st (Tue) Conference Room VIII

9:30–10:30

1 Kazuya Matsugashita (Kindai Univ.)
Takao Suzuki (Kindai Univ.)
Initial value space of the four dimensional Painlevé system with $(A_5 + A_1)^{(1)}$ symmetry 15

Summary: The initial value spaces of the Painlevé equations are proposed by Okamoto. They are symplectic manifolds in which the Painlevé equations are described as polynomial Hamiltonian systems on all coordinates. In this talk, we construct an initial value space of the four dimensional Painlevé system with affine Weyl group symmetry of type $(A_5 + A_1)^{(1)}$.

2 Kanehisa Takasaki (Kyoto Univ.*/Osaka Metro. Univ.)
Direct linearization and Sato Grassmannian 15

Summary: Fu and Nijhoff proposed an infinite matrix formalism for the direct linearization of Fokas and Ablowitz, and applied it to the KP hierarchy and its relatives as well as their reductions and special solutions. In this talk, I will point out that the Sato Grassmannian is hidden in the infinite matrix formalism of the direct linearization. To this end, I construct a matrix from the fundamental matrix U of the Fu–Nijhoff formalism, and show that it represent a point of the Sato Grassmannian that encodes the KP hierarchy.

3 Masaki Kato (Ritsumeikan Univ.)
Multiple polylogarithms and discrete integrable systems 15

Summary: This talk introduces an analogue of Schur-type quasisymmetric function defined using a two-parameter deformation L of multiple polylogarithms and explains its connection with discrete integrable systems. Analogous to the classical Jacobi–Trudi formula, this function admits a determinant representation. By combining this representation with q-difference relations satisfied by L, we derive a system of bilinear difference equations. In special cases, these equations reduce to the bilinear forms of known discrete integrable systems, including the R_I lattice and the discrete relativistic Toda lattice.

4 Toyo Taniguchi (Univ. of Tokyo)
The universal framed KZB connection in higher genera 15

Summary: The Knizhnik–Zamolodchikov (KZ) connection is a flat connection on the configuration space of points in the complex plane. Its associated monodromy is described by multi-zeta values, and gives rise to an important example of a Drinfel'd associator. In particular, the pentagon relation, a non-linear equation automatically satisfied by the monodromy above, implies the double shuffle relation by the work of Furusho. The higher genus version of the KZ connection was introduced by Enriquez, leading to the definition of higher genus multi-zeta values, but may not have clear identities just like the pentagon relation. The talker introduces the framed KZB connection, which is an enhancement of Enriquez's connection and satisfies a set of relations coming from surface braid groups.

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

Shin-ichiro Seki (Nagahama Inst. of Bio-Sci. and Tech.)
Generalizations of Euler's identity for harmonic numbers

Summary: Euler's identity for harmonic numbers, involving binomial coefficients, has been generalized in many directions. From the viewpoint of "multiple" analogues, one definitive formulation is the identity due to Hoffman and Kawashima, which itself can be further generalized in various directions. In this talk, I will present several generalizations obtained so far, including polylogarithmic, q-Ohno, and diamond versions, and then discuss their applications to multiple zeta values and finite multiple zeta values. The content of this talk is based on several joint works with Kenji Sakugawa, Shuji Yamamoto, Minoru Hirose, Takumi Maesaka, and Taiki Watanabe.

14:30–16:30

5 Masato Okado (Osaka Metro. Univ.) Decoration functions for geometric crystals associated to Kirillov–Reshetikhin modules 15

Summary: For an affine quantum group $U_q(\mathfrak{g})$ and a non-zero vertex of the Dynkin diagram of $\mathfrak{g}$, there exists a sequence of Kirillov–Reshetikhin modules and KR crystals $\{B^{r,l}\}_{l\geq 1}$, and correspondingly, a geometric crystal in the sense of Berenstein–Kazhdan. We report that we found a decoration function for the geometric crystal when $\mathfrak{g}$ is of the ADE type and r is a vertex corresponding to a minuscule representation. By ultradiscretization (tropicalization), an integral polyhedral representation of $B^{r,l}$ can be obtained for any l.

6 Ryota Akagi (Nagoya Univ.) Structure of G-fans associated with rank 3 cluster-cyclic exchange matrices 15

Summary: In cluster algebra theory, G-fans are among the most important objects that express the periodicity of cluster patterns. In spite of this importance, their explicit structures are not well known due to the complexity of the fans. In this talk, I will explain the structures of the G-fans associated with cluster-cyclic exchange matrices and some corollaries. This talk is based on joint work with Zhichao Chen.

7 Mizuki Yamaguchi (Univ. of Tokyo)
Naoto Shiraishi (Univ. of Tokyo)
Fuga Ishii (Univ. of Tokyo) A direct criterion for Yang–Baxter integrability in quantum spin systems 15

Summary: We present a direct criterion for Yang–Baxter integrability of quantum spin systems. For a nearest-neighbor Hamiltonian density h, the Reshetikhin condition is a necessary condition written solely in terms of h. It arises as the first nontrivial consistency condition in the expansion of the regular difference-form Yang–Baxter equation. We prove that this condition is also sufficient: if h satisfies the Reshetikhin condition, then there exists a regular difference-form R-matrix with $R(0) = P$ and $R'(0) = Ph$. The proof is based on an analysis of the Yang–Baxter defect. We also discuss its relation to a quantum Liouville–Arnold type problem.

8 Hisatoshi Kodani (Kyushu Univ.)
Yuta Nozaki (Hokkaido Univ.) The Kontsevich invariant and the action of the Grothendieck–Teichmüller group on 2-component string links 15

Summary: The Kontsevich invariant of links is independent of the choice of associator, whereas for tangles this is not the case in general. In this talk, we focus on 2-component string links and investigate to what extent the Kontsevich invariant depends on the choice of associator. As an application, we show that the action of the unipotent part of the Grothendieck–Teichmüller group on the algebra of proalgebraic 2-component string links is non-trivial, which provides a partial answer to a problem posed by Furusho.

9 Tatsushi Shimazaki (Nat. Inst. of Tech., Akashi Coll.) Staircase hook-length ratios and special values of Jacobi polynomials 15

Summary: We study semistandard Young tableaux associated with staircase partitions. The ratio of the numbers of tableaux for adjacent staircase partitions is expressed as a special value of a Jacobi polynomial. We extend this result to the K-theoretic setting using Grothendieck polynomials and GP polynomials. Under the specialization corresponding to set-valued tableaux, we obtain a divisibility property by powers of 3 and discuss its combinatorial interpretation via excited Young diagrams.

10 Taikei Fujii (Ochanomizu Univ.)
Takahiko Nobukawa (Kogakkan Univ.) Integral transform for eigenproblem of deformed Noumi–Sano operator 15

Summary: The deformed Noumi–Sano operator $H_{n,m}(x, y; u)$ of trigonometric case is a difference operator with respect to x and y, given by power series of u. It is well-known that the super-Macdonald polynomials are eigenfunctions of $H_{n,m}(x, y; u)$. In special cases, the operator $H_{n,m}(x, y; u)$ reduces to the Macdonald–Ruijenaars operator and Noumi–Sano operator. In this talk, we construct an integral transform associated with eigenvalue problem for $H^R_{n,m}(x, y)$, where $H_{n,m}(x, y; u) = \sum_{R=0}^{\infty} H^R_{n,m}(x, y)u^R$.

11 Satoshi Tsuchimi (Kindai Univ.)
Genki Shibukawa (Kitami Inst. of Tech.)
A generalization of the μ-function associated with the Kontsevich function 15

Summary: In this talk, we introduce the big μ-function that is a one-parameter deformation of the (generalized) μ-function [ST], and show that it coincides with the q-Borel summation of a divergent series solution of the q-Kummer equation. Also, We present several identities satisfied by the big μ-function such as q-difference relations, connection formulas and symmetric properties. Furthermore, we describe its connection with the big q-Hermite polynomials.

September 2nd (Wed) Conference Room VIII

9:20–10:45

12 Toshio Oshima (Univ. of Tokyo*)
A classification of linear differential equations on the Riemann sphere 15

Summary: Linear differential equations on the Riemann sphere are classified by their Riemann schemes, or spectral types. We consider irreducible equations admitting unramified irregular singularities and study transformations generated by Möbius transformations, additions, Laplace transformations, confluences and unfoldings. We show that complete representatives of equivalence classes defined by these transformations are given by Fuchsian equations with E_8-fundamental spectral type.

13 Kazuya Matsugashita (Kindai Univ.)
Takao Suzuki (Kindai Univ.)
Satoshi Tsuchimi (Kindai Univ.)
A degeneration of the four dimensional q-Garnier system arises from confluences in quivers 15

Summary: The q-Garnier system was first proposed by Sakai and its other directions of discrete time evolutions were given by Nagao and Yamada. Afterward, all of those directions of discrete time evolutions were derived from a birational representation of an extended affine Weyl group which arises from the cluster algebraic construction established by Masuda, Okubo and Tsuda. In this talk, we investigate a degeneration structure of the four dimensional q-Garnier system by using confluences in quivers.

14 Hidehito Nagao (Gifu Shotoku Gakuen Univ.)
Multivariable generalization of the degeneration diagram of discrete Painlevé equations 15

Summary: Elliptic Garnier systems are known as multivariable analogues of the elliptic difference Painleve equation. In this talk, we discuss a multivariable generalization of the degeneration diagram of discrete Painleve equations, focusing on the degeneration from e-E8 type to q-E8 type and then to q-E7 type. In the discrete case, the increase of shiftable parameters can be regarded as an increase of independent variables, corresponding to the increase of dependent variables. We study whether the resulting multivariable Garnier-type systems can be described by birational transformations.

15 Takahiko Nobukawa (Kogakkan Univ.)
Shunya Adachi (Utsunomiya Univ.)
A q-analog of middle Laplace transform and q-Painlevé equation of type $A_4^{(1)}$ 15

Summary: Recently, the middle Laplace transform $\mathcal{ML}$ for linear differential equations is constructed as a Laplace transform analog of Katz's middle convolution. In this talk, we introduce a q-analog of $\mathcal{ML}$ and show its several properties. We also apply the q-middle Laplace transform to a Lax linear equation for q-Painlevé equation of type $A_4^{(1)}$.

16 Genki Shibukawa (Kitami Inst. of Tech.)
Three-term relations and some specializations of the μ function 15

Summary: We derive explicit formulas for three-term relations of the μ function by the Al-Salam–Ismail polynomial. As an application, we provide explicit formulas for specializations of the μ function.

11:00–12:00 Talk Invited by Infinite Analysis Special Session

Luc Vinet (Univ. de Montreal) Algebras and bispectrality

Summary: Superintegrable systems provide a rich source of connections between mathematical physics, algebra, and special functions. This lecture will discuss symmetry and dynamical algebras of superintegrable models, with emphasis on the generic system on the two-sphere. It will also present recent links with quadratic algebras and orthogonal polynomials, including bivariate Jacobi polynomials.