

✿ 日本数学会  
2025年度秋季総合分科会

英 文 サ マ リ 集

2025年9月  
於 名古屋大学



# 2025 日本数学会

---

## 秋季総合分科会プログラム

---

期 日 2025年9月16日(火)～9月19日(金)

会 場 名古屋大学東山キャンパス  
愛知県名古屋市千種区不老町

連絡先 名古屋大学大学院多元数理科学研究科  
〒464-8602

愛知県名古屋市千種区不老町

E-mail [nagoya25sept@mathsoc.jp](mailto:nagoya25sept@mathsoc.jp)

一般社団法人 日本数学会

	第Ⅰ会場 C13	第Ⅱ会場 C15	第Ⅲ会場 C23	第Ⅳ会場 C25	第Ⅴ会場 S2X	第Ⅵ会場 S30	第Ⅶ会場 C33	第Ⅷ会場 C35	第Ⅸ会場 C43
16日 (火)	函数方程式論 9:00～12:00 14:15～16:30	函数解析学 9:30～10:30	函 数 論 9:30～11:10 15:40～16:30	統計数学 9:00～12:00	応用数学 9:30～11:45 15:30～16:35	幾 何 学 9:30～11:45 14:15～16:45	無限可積分系 9:30～11:45 14:15～15:20	トポロジー 9:30～12:00 14:30～16:00	代 数 学 9:00～12:00 15:30～17:15
	企画特別講演 13:00～14:00								
	特別講演 17:00～18:00	特別講演 10:45～11:45	特別講演 14:20～15:20	特別講演 14:15～15:15 15:30～16:30	特別講演 14:15～15:15 16:50～17:50		特別講演 15:30～16:30	特別講演 16:30～17:30	特別講演 14:15～15:15
17日 (水)	函数方程式論 9:15～12:00	函数解析学 10:00～10:45	函 数 論 9:30～11:10	統計数学 9:20～11:20	応用数学 9:00～11:50 13:10～14:00		無限可積分系 9:30～10:35		代 数 学 9:00～12:00
	特別講演 13:00～14:00	特別講演 11:00～12:00	特別講演 13:00～14:00			特別講演 10:20～11:20 12:50～13:50	特別講演 10:45～11:45		特別講演 13:00～14:00
	日本数学会賞授賞式(豊田講堂ホール)..... (14:30～15:00) 総 合 講 演 ( " ) 日本数学会賞秋季賞受賞者..... (15:15～16:15) 玉川安騎男(京大数理研)..... (16:30～17:30) 懇 親 会(レストラン花の木)..... (18:00～20:00)								
18日 (木)	函数方程式論 9:15～12:00 14:30～16:30	函数解析学 10:00～11:10 14:15～14:55	実函数論 10:00～11:30 14:15～15:30	統計数学 9:30～11:45	応用数学 10:00～12:00 14:15～16:00	幾 何 学 9:30～11:45 14:15～17:45	数学基礎論 および歴史 10:00～11:55 15:30～16:45	トポロジー 9:30～11:30 14:15～16:00	代 数 学 9:30～12:00 15:30～17:30
	企画特別講演 13:00～14:00								
	特別講演 17:00～18:00	特別講演 15:10～16:10	特別講演 15:45～16:45	特別講演 14:15～15:15 15:30～16:30	特別講演 16:15～17:15		特別講演 14:15～15:15	特別講演 16:30～17:30	特別講演 14:15～15:15
19日 (金)	函数方程式論 9:15～12:00 14:15～16:30		実函数論 10:00～12:00 14:15～15:45	統計数学 10:00～11:45	応用数学 10:00～12:00 14:15～16:00	幾 何 学 9:30～10:45	数学基礎論 および歴史 9:30～10:30 14:15～15:30	トポロジー 9:30～12:00 14:15～16:30	代 数 学 9:30～12:00 15:30～17:30
	企画特別講演 13:00～14:00								
	特別講演 17:00～18:00		特別講演 16:00～17:00		特別講演 16:15～17:15	特別講演 11:00～12:00	特別講演 10:45～11:45		特別講演 14:15～15:15



## 目次

総合講演	1
企画特別講演	2
数学基礎論および歴史	5
9月18日(木)	5
9月19日(金)	7
代数学	10
9月16日(火)	10
9月17日(水)	13
9月18日(木)	17
9月19日(金)	21
幾何学	25
9月16日(火)	25
9月17日(水)	29
9月18日(木)	30
9月19日(金)	34
函数論	35
9月16日(火)	35
9月17日(水)	37
函数方程式論	40
9月16日(火)	40
9月17日(水)	46
9月18日(木)	50
9月19日(金)	55
実函数論	63
9月18日(木)	63
9月19日(金)	65
函数解析学	69
9月16日(火)	69
9月17日(水)	70
9月18日(木)	71
統計数学	73
9月16日(火)	73
9月17日(水)	76
9月18日(木)	78

9月19日(金) . . . . .	81
応用数学 . . . . .	84
9月16日(火) . . . . .	84
9月17日(水) . . . . .	88
9月18日(木) . . . . .	92
9月19日(金) . . . . .	95
トポロジー . . . . .	100
9月16日(火) . . . . .	100
9月17日(水) . . . . .	103
9月18日(木) . . . . .	104
9月19日(金) . . . . .	107
無限可積分系 . . . . .	111
9月16日(火) . . . . .	111
9月17日(水) . . . . .	114

## 総 合 講 演

9月17日(水) 総合講演会場

2025年度日本数学会賞秋季賞受賞講演

日本数学会賞秋季賞受賞者 ..... (15:15～16:15)

Autumn Prize Winner

玉川 安 騎 男 (京 大 数 理 研) 遠アーベル幾何学の過去・現在・未来 ..... (16:30～17:30)

Akio Tamagawa (Kyoto Univ.) Anabelian geomerty —past, present and future

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

## 企 画 特 別 講 演

9月16日(火)

## 第Ⅲ会場

野口潤次郎 (東大\*・東京科学大\*) 値分布と有理点分布 III ..... (13:00~14:00)  
 Junjiro Noguchi Value distribution and distribution of rational points III  
 (Univ. of Tokyo\*/Sci. Tokyo\*)

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

## 第Ⅳ会場

種村秀紀 (千葉大\*) 相互作用を持つ無限粒子系の確率解析 ..... (13:00~14:00)  
 Hideki Tanemura (Chiba Univ.\*) Stochastic analysis of infinite particle systems with interactions

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

## 第Ⅵ会場

特別招待講演(大韓数学会)

Cheol-Hyun Cho (Seoul National Univ.) Geometric models of simple Lie algebras via singularity theory ..... (13:00~14:00)  
 Cheol-Hyun Cho (Seoul National Univ.) Geometric models of simple Lie algebras via singularity theory

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



9月18日(木)

## 第II会場

西 山 享 (青 学 大 理 工) 旗多様体上の軌道と表現論 ..... (13:00~14:00)

Kyo Nishiyama (Aoyama Gakuin Univ.) Orbits on flag varieties and representation theory: An overview

概要 Let  $G$  be a reductive algebraic group and  $B$  one of its Borel subgroups. The homogeneous space  $G/B$  is called the full flag variety; it plays a central role in representation theory, geometry, and combinatorics. I will summarize the rich theory mainly from the representation-theoretic point of view. The topics include the Borel–Weil theorem, Beilinson–Bernstein localization, and the KGB classification of Harish-Chandra modules. A resolution of singularities of nilpotent varieties is given by the cotangent bundle over the flag variety and the moment map. The Springer–Steinberg theory ultimately relates the characteristic varieties and associated varieties of Harish-Chandra modules in this geometric setting.

In the latter half of the talk, I will focus on the theory of multiple flag varieties developed over the past two decades. If there are only finitely many orbits, it gives rise to rich combinatorics, such as the well-known Robinson–Schensted–Knuth correspondence, based on a generalization of the Springer–Steinberg theory. Recently, we have begun studies on real double flag varieties, where the orbits are related to intertwining operators realized as integral transforms with kernel functions related to relative invariants of prehomogeneous vector spaces.

## 第VI会場

北 川 義 久 (宇 都 宮 大\*) 3次元球面内の平坦トーラスの構成法とその応用 ..... (13:00~14:00)

Yoshihisa Kitagawa Construction of flat tori in the 3-sphere and its applications  
(Utsunomiya Univ.\*)

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

In this talk, we explain the above method for constructing flat tori in  $S^3$  and its applications to embedded flat tori in  $S^3$ . Furthermore, we discuss an open problem on the extrinsic diameter of flat tori in  $S^3$ .

9月19日(金)

## 第I会場

足 立 匡 義 (京大人間環境) 空間的に一様な電磁場中の量子散乱 ..... (13:00~14:00)

Tadayoshi Adachi (Kyoto Univ.) Quantum scattering in spatially homogeneous electromagnetic fields

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

## 第IX会場

伊 山 修 (東 大 数 理) 自由性と単純性: 傾理論再訪 ..... (13:00~14:00)

Osamu Iyama (Univ. of Tokyo) Freeness and simplicity: Tilting theory revisited

概要 A central goal in representation theory is to understand modules over a given ring. Among them, free modules and simple modules are particularly fundamental. While every module is both free and semisimple over a field, these classes become exceptional over general rings and have been widely generalized.

In this talk, I will revisit tilting theory, a foundational framework for the study of derived categories. A highlight of recent developments involves semibricks and silting complexes, which can be viewed as far-reaching generalizations of semisimple modules and free modules, respectively. These notions give rise to unexpectedly rich structures, such as the complete lattice of torsion classes and the non-singular fan in the real Grothendieck group, and they have found applications in various mathematical contexts, including cluster algebras, Cohen–Macaulay modules, and cDV singularities.

# 数 学 基 礎 論 お よ び 歴 史

9月18日(木) 第VII会場

10:00~11:55

- 1 米田郁生(徳山工高専) Quasi-geometric elimination of imaginaries and modular law in the real sort ..... 15  
 Ikuo Yoneda Quasi-geometric elimination of imaginaries and modular law in the real  
 (Nat. Inst. of Tech., Tokuyama Coll.) sort

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

- 2 米田郁生(徳山工高専) No implications between CF-property and elimination of imaginaries · 15  
 Ikuo Yoneda No implications between CF-property and elimination of imaginaries  
 (Nat. Inst. of Tech., Tokuyama Coll.)

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

- 3 大倉昂貴(筑波大数理物質) Dp-finite groups expanded by closed sets ..... 15  
 Koki Okura (Univ. of Tsukuba) Dp-finite groups expanded by closed sets

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

- 4 桔梗宏孝(神戸大システム情報) いくつかの可算構造の彩色数について ..... 15  
 坪井明人(筑波大\*)  
 Hirotaka Kikyo (Kobe Univ.) Chromatic number of several countable graphs  
 Akito Tsuboi (Univ. of Tsukuba\*)

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

- 5 池田宏一郎(法政大経営) タイプが tree property をもつ理論について ..... 15  
 Koichiro Ikeda (Hosei Univ.) On theories having a type with tree property

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

- 6 坪井明人 (筑波大\*) Applying HF to finite model theory: The power of proactive use ..... 10  
Akito Tsuboi (Univ. of Tsukuba\*) Applying HF to finite model theory: The power of proactive use

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

- 7 中浦鯉太郎 (東大数理) On the chromatic numbers of stable and unstable graphs ..... 15  
Koitaro Nakaura (Univ. of Tokyo) On the chromatic numbers of stable and unstable graphs

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

#### 14:15~15:15 特別講演

- 藤田雅人 (海上保安大) 位相的に従順な順序構造  
Masato Fujita Topologically tame ordered structures  
(Japan Coast Guard Academy)

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

#### 15:30~16:45

- 8 小暮晏佳 (神戸大システム情報) 部分的な保存性を満たす文について 1 ..... 15  
倉橋太志 (神戸大システム情報)  
Haruka Kogure (Kobe Univ.) On partially conservative sentences 1  
Taishi Kurahashi (Kobe Univ.)

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

- 9 小暮晏佳 (神戸大システム情報) 部分的な保存性を満たす文について 2 ..... 15  
倉橋太志 (神戸大システム情報)  
Haruka Kogure (Kobe Univ.) On partially conservative sentences 2  
Taishi Kurahashi (Kobe Univ.)

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

- 10 佐藤 雄太 (神戸大システム情報) 命題化とカット除去による  $\mathbf{N}^+\mathbf{A}_{m,n}$  の一様 Lyndon 補間定理の証明 .. 15  
Yuta Sato (Kobe Univ.) Uniform Lyndon interpolation theorem for  $\mathbf{N}^+\mathbf{A}_{m,n}$  through propositionalization and cut elimination

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

- 11 関 隆宏 (新潟大経営戦略本部) Residual 公理と結合性, 可換性 ..... 15  
Takahiro Seki (Niigata Univ.) Associativity and commutativity of variations of residual axioms

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

- 12 鹿島 亮 (東京科学大情報理工) 様相ミュー計算の無限証明体系の完全性について ..... 15  
Ryo Kashima (Sci. Tokyo) On the completeness of infinitary proof systems for the modal mu-calculus

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

## 9月19日(金) 第VII会場

### 9:30~10:30

- 13 木原 貴行 (名大情報) 実効トポスの部分トポスと Katětov 順序 ..... 15  
Ming Ng (名大情報)  
Takayuki Kihara (Nagoya Univ.) Subtoposes of the effective topos and the Katětov order  
Ming Ng (Nagoya Univ.)

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

- 14 只木 孝太郎 (中部大工) 典型性原理によるウィグナーの友人の解析 ..... 15  
Kohtaro Tadaki (Chubu Univ.) An analysis of Wigner's friend in the framework of the principle of typicality

概要 The notion of probability plays a crucial role in quantum mechanics. It appears as the Born rule. In modern mathematics which describes quantum mechanics, however, probability theory means nothing other than measure theory, and therefore any operational characterization of the notion of probability is still missing in quantum mechanics. In our former works, based on the toolkit of algorithmic randomness, we presented an operational refinement of the Born rule, called the principle of typicality, for specifying the property of the results of quantum measurements in an operational way. In this talk, we make an analysis of the Wigner's friend paradox and its variant in the framework of quantum mechanics based on the principle of typicality.

- 15 津久浦 健太 (水産大) (†) の解剖 ..... 15  
Kenta Tsukuura (Nat. Fisheries Univ.) The dissection of (†)

概要 The principle (†), which asserts that every  $\omega_1$ -stationary preserving poset is semiproper, has several characterizations, such as the semistationary reflection principle and the strong Chang's conjecture. It is well known that (†) holds when a strongly compact cardinal is collapsed to  $\omega_2$  in a standard way. On the other hand, even when the target of the collapse is not  $\omega_2$ , strong compactness still implies parts of (†). In this talk, we introduce an approach to studying aspects of (†) by counting how many Namba forcings are semiproper, and we discuss the validity of this method.

- 16 山添 隆志 (神戸大システム情報) Cardinal invariants of products of ideals ..... 15  
Takashi Yamazoe (Kobe Univ.) Cardinal invariants of products of ideals

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

#### 10:45~11:45 特別講演

- 青木 悠史郎 (東京工高専) A discontinuous homomorphism on  $C(X)$  and a fragment of Martin's axiom  
Yushiro Aoki A discontinuous homomorphism on  $C(X)$  and a fragment of Martin's axiom  
(Tokyo Nat. Coll. of Tech.) axiom

概要 We show the consistency, relative to ZFC, of the following statement: a discontinuous homomorphism from  $C(X)$  to a Banach algebra exists, the continuum hypothesis holds, and a forcing axiom weaker than Martin's axiom holds. Our forcing axiom is Martin's axiom restricted to two new properties denoted  $\text{EPC}_{\aleph_1}$  and  $\text{ProjCes}(E)$ , where  $E$  is a fixed stationary and co-stationary subset of  $\omega_1$ . The result provides a partial positive answer to a question raised by Woodin. In our model, every ladder system coloring can be uniformized on the complement of  $E$ ; in particular, Whitehead's conjecture fails. Finally, we discuss how the property  $\text{EPC}_{\aleph_1}$  differs from other well-known properties of forcing posets.

#### 12:00~12:15 数学基礎論および歴史分科会総会

#### 14:15~15:30

- 17 小川 束 『起術解路法』五巻の成立について ..... 15  
(四日市大関孝和数学研)  
田中 紀子 (奈良学園大人間教育)  
Tsukane Ogawa (Yokkaichi Univ.) On the completion of the five volumes of the *Kijutsu Kairo Hou*  
Tanaka Noriko (Naragakuen Univ.)

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

- 18 田 中 紀 子 (奈良学園人間教育) 宅間流岡之只「起術解路法」5巻と「資棄起術」の数学の特徴 ..... 15  
 小 川 束  
 (四日市大関孝和数学研)

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

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

- 19 平 田 浩 一 (松山大情報・愛媛大\*) 算変座標による廉術 ..... 15  
 Koichi Hirata Renjutsu: from the viewpoint of inversive coordinates of circles  
 (Matsuyama Univ./Ehime Univ.\*)

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

- 20 脇 克 志 (山 形 大 理) 〃 NDL\_Layout を用いた和算書画像のレイアウト解析 ..... 15  
 Katsushi Waki (Yamagata Univ.) Layout analysis of WASAN documents using NDL\_Layout

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

- 21 真 島 秀 行 (お茶の水女大\*) 立円率について ..... 15  
 Hideyuki Majima (Ochanomizu Univ.\*) On the sphere volume ratio

概要 We discuss on articles and books about the Sphere Volume ratio in Edo era, especially linkouki and Katsuyousanpou.

## 代 数 学

9月16日(火) 第IX会場

9:00~12:00

- 1 鍋 島 克 輔 (東京理大理) 包括的グレブナー基底系を用いた有理関数写像の像に関する Chevalley の  
 田 島 慎 一 (新潟大\*) 定理の証明および計算 ..... 15  
Katsusuke Nabeshima Comprehensive Gröbner systems approach to Chevalley's theorem on  
 (Tokyo Univ. of Sci.) image of rational morphisms  
 Shinichi Tajima (Niigata Univ.\*)

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

- 2 谷 光 一 郎 (阪大情報) 標準的多重次数付き日比環と Cartwright–Sturmfels イデアルについて . 15  
 松 下 光 虹 (東大数理)  
Koichiro Tani (Univ. of Osaka) Standard multigraded Hibi rings and Cartwright–Sturmfels ideals  
 Koji Matsushita (Univ. of Tokyo)

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

- 3 松 下 光 虹 (東大数理) 安定集合凸多面体に付随する次数付き環の不変量について ..... 15  
 土 谷 昭 善 (東邦大理)  
Koji Matsushita (Univ. of Tokyo) Invariants of graded rings associated with stable set polytopes  
 Akiyoshi Tsuchiya (Toho Univ.)

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

- 4 前 田 恭 佑 (日大文理) Ulrich ideals on rational triple points ..... 15  
 吉 田 健 一 (日大文理)  
Kyosuke Maeda (Nihon Univ.) Ulrich ideals on rational triple points  
 Ken-ichi Yoshida (Nihon Univ.)

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

- 5 吉 田 健 一 (日大文理) Ulrich ideals on 2-dimensional quotient singularities ..... 15  
 前 田 恭 佑 (日大文理)  
Ken-ichi Yoshida (Nihon Univ.) Ulrich ideals on 2-dimensional quotient singularities  
 Kyosuke Maeda (Nihon Univ.)

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



## 6 渡辺 敬一      2次元正規特異点の canonical trace ideal と nearly Gorenstein 性 ..... 15

(日大文理・明大研究・知財)

奥 間 智 弘 (山 形 大 理)

吉 田 健 一 (日 大 文 理)

Kei-ichi Watanabe

(Nihon Univ./Meiji Univ.)

Tomohiro Okuma (Yamagata Univ.)

Ken-ichi Yoshida (Nihon Univ.)

The canonical trace ideal and nearly Gorenstein property for 2 dimensional normal local rings

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

## 7 宮下 空 (阪大情報)      When do pseudo-Gorenstein rings become Gorenstein? ..... 15

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

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

## 8 宮崎 充弘 (阪大数学研)      ゴーレンシュタイン性とコーエン・マコーレー性の間の新たな可換環論的性質 ..... 15

Mitsuhiro Miyazaki

(Osaka Metro. Univ.)

A new property between Gorenstein and Cohen–Macaulay properties of commutative rings

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

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

## 9 遠藤 直樹 (明大政治経済)      Deformation of the quasi-Gorenstein property in extended Rees algebras ..... 15

Naoki Endo

(Meiji Univ.)

Deformation of the quasi-Gorenstein property in extended Rees algebras

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

- 10 伊城 慎之介 (群馬工高専) Perfectoid towers and  $\lim$  Cohen–Macaulay sequences ..... 15  
 下 元 数 馬 (東京科学大理)  
 Shinnosuke Ishiro Perfectoid towers and  $\lim$  Cohen–Macaulay sequences  
 (Gunma Nat. Coll. of Tech.)  
 Kazuma Shimomoto (Sci. Tokyo)

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

#### 14:15～15:15 特別講演

- 上 山 健 太 (信 州 大 理) Tilting theory for Artin–Schelter Gorenstein algebras  
 Kenta Ueyama (Shinshu Univ.) Tilting theory for Artin–Schelter Gorenstein algebras

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

#### 15:30～17:15

- 11 三 船 裕 輝 (名大多元数理) 特異圏の次元の上界について ..... 15  
 Yuki Mifune (Nagoya Univ.) On upper bounds for the dimension of the singularity category

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

- 12 木 村 海 渡 (名大多元数理) 特異軌跡の定義イデアルについて ..... 15  
 Kaito Kimura (Nagoya Univ.) On defining ideals of singular loci

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

- 13 飯 間 圭 一 郎 (奈良工高専) 完備超曲面上の Cohen–Macaulay 加群圏の拡大閉部分圏 ..... 15  
 高 橋 亮 (名大多元数理)  
 Kei-ichiro Iima Extension-closed subcategories of Cohen–Macaulay module category over  
 (Nat. Inst. of Tech., Nara Coll.) a complete local hypersurfaces  
 Ryo Takahashi (Nagoya Univ.)

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

- 14 南 木 秋 (東京理大理) 重み付き down-up algebra の Beilinson algebra の Hochschild コホモロ  
 板 場 綾 子 (東京理大教養教育) ジー群の次元と Lie 代数構造 ..... 10  
 Shu Minaki (Tokyo Univ. of Sci.) Group and Lie algebra structure of Hochschild cohomology of Beilinson  
 Ayako Itaba (Tokyo Univ. of Sci.) algebra of weighted down-up algebras

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

- 15 井 上 翔 太 (東京理大理) 三角双代数の対称コホモロジー ..... 15  
 板 場 綾 子 (東京理大教養教育)  
 Shota Inoue (Tokyo Univ. of Sci.) Symmetric cohomology of triangular bialgebras  
 Ayako Itaba (Tokyo Univ. of Sci.)

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

- 16 小 原 ま り 子 (富山県立大工) A stable model category and Hopfological invariant ..... 15  
 Mariko Ohara (Toyama Pref. Univ.) A stable model category and Hopfological invariant

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

## 9月17日(水) 第IX会場

### 9:00~12:00

- 17 若 尾 亮 太 (岡山理大理) On R-matrices constructed from Hopf superalgebras of low dimension  
 ..... 10  
 Ryota Wakao (Okayama Univ. of Sci.) On R-matrices constructed from Hopf superalgebras of low dimension

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

- 18 浅尾 泰彦 (福岡大理) Minimal projective resolution and magnitude homology of geodetic metric spaces ..... 15  
 若月 駿 (名大多元数理)  
 Yasuhiko Asao (Fukuoka Univ.) Minimal projective resolution and magnitude homology of geodetic metric spaces  
 Shun Wakatsuki (Nagoya Univ.)

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

- 19 浅井 聡太 (東大数理) 簾表現での semibrick の拡張定理 ..... 15  
 Sota Asai (Univ. of Tokyo) An extension theorem of semibricks in quiver representations

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

- 20 西中 祐介 (名大多元数理) Costello–Gwilliam factorization algebras and vertex algebras ..... 15  
 Yusuke Nishinaka (Nagoya Univ.) Costello–Gwilliam factorization algebras and vertex algebras

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

- 21 藤野 秀司 (東京理大理) Generalized Brauer tree 多元環の両側傾複体の構成 ..... 15  
 小境 雄太 (東京理大理)  
 高村 航平 (東京理大理)  
 Shuji Fujino (Tokyo Univ. of Sci.) How to construct two-sided tilting complexes for generalized Brauer tree  
 Yuta Kozakai (Tokyo Univ. of Sci.) algebras  
 Kohei Takamura (Tokyo Univ. of Sci.)

概要 Rickard constructed a tree-to-star one-sided tilting complex for Brauer tree algebras in 1989. Kozakai–Kunugi constructed explicitly a two-sided tilting complex that corresponds to the Rickard’s one-sided tilting complex in 2018.

On the other hand, Membrillo–Hernández constructed a tree-to-star one-sided tilting complex for generalized Brauer tree algebras in 1997. We construct explicitly a two-sided tilting complex that corresponds to the Membrillo–Hernández’s one-sided tilting complex for generalized Brauer tree algebras.

- 22 奥山真吾 (香川高専) 対称群の 2-thick でない既約表現の例 ..... 15  
 面田康裕 (明石工高専)  
 中本和典 (山梨大医)  
Shingo Okuyama An example of a non-2-thick irreducible representation of the symmetric  
 (Nat. Inst. of Tech., Kagawa Coll.) group  
 Yasuhiro Omoda  
 (Nat. Inst. of Tech., Akashi Coll.)  
 Kazunori Nakamoto  
 (Univ. of Yamanashi)

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

- 23 M. Ferrara On orders whose arithmetical properties determine the structure of skew  
 (Univ. Campania Luigi Vanvitelli) braces ..... 15  
 M. Trombetti  
 (Univ. Napoli Federico II)  
ツァンシンイー (お茶の水女大基幹)  
 Maria Ferrara On orders whose arithmetical properties determine the structure of skew  
 (Univ. Campania Luigi Vanvitelli) braces  
 Marco Trombetti  
 (Univ. Napoli Federico II)  
Sin Yi Tsang (Ochanomizu Univ.)

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

- 24 柳川浩二 (関西大システム理工) Transposes in the  $q$ -deformed modular group and their applications to  
 任 鑫 (阪公大数学研)  $q$ -deformed rational numbers ..... 15  
Kohji Yanagawa (Kansai Univ.) Transposes in the  $q$ -deformed modular group and their applications to  
 Xin Ren (Osaka Metro. Univ.)  $q$ -deformed rational numbers

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

- 25 辻 栄 周 平 (北 教 大 旭 川) 正標数における2次元空間の3本の直線からなる多重配置について . . . . 15  
 内 海 凌 (阪 大 理)  
 Shuhei Tsujie (Hokkaido Univ. of Edu.) On 2-multiarrangements of three lines over fields of positive character-  
 Ryo Uchiumi (Univ. of Osaka) istic

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

- 26 木 村 俊 一 (広 島 大 理) Ending partizan games . . . . . 15  
 井 上 博 裕 (広 島 大 理)  
 門 脇 慎 之 介 (広 島 大 理)  
 Shun-ichi Kimura (Hiroshima Univ.) Ending partizan games  
 Hiyu Inoue (Hiroshima Univ.)  
 Shin-nosuke Kadowaki  
 (Hiroshima Univ.)

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

- 27 木 村 俊 一 (広 島 大 理) 組合せゲームの K-ring としての超現実数 . . . . . 15  
 Shun-ichi Kimura (Hiroshima Univ.) Surreal numbers as the K-ring of some combinatorial games

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

### 13:00~14:00 特別講演

- 足 田 辰 之 (京 大 数 理 研) Stanley–Stembridge 予想について  
 Tatsuyuki Hikita (Kyoto Univ.) On the Stanley–Stembridge conjecture

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

## 9月18日(木) 第IX会場

## 9:30~12:00

- 28 前 原 将 太 (九 大 J G M I) 直線配置による最小領域分割数の代数的研究 ..... 15  
 Shota Maehara (Kyushu Univ.) An algebraic research on minimum number of chambers for line arrangements

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

- 29 島 崎 達 史 (神 戸 大 理) 集合値半標準盤の個数と Grothendieck 多項式の特殊値 ..... 15  
 信 川 喬 彦 (皇 學 館 大 教 育)  
 藤 井 大 計 (神 戸 大 理)  
 Tatsushi Shimazaki (Kobe Univ.) The number of set-valued semistandard tableaux and special values of  
 Takahiko Nobukawa (Kogakkan Univ.) Grothendieck polynomials  
 Taikei Fujii (Kobe Univ.)

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

- 30 鳥 居 猛 (岡 山 大 理) 3 次行列環の部分代数のモジュライ (4) ..... 15  
 中 本 和 典 (山 梨 大 医)  
 Takeshi Torii (Okayama Univ.) The moduli of subalgebras of the full matrix ring of degree 3 (4)  
 Kazunori Nakamoto  
 (Univ. of Yamanashi)

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

- 31 青 山 昂 平 (阪 大 理) 与えられたスタックの Deligne–Mumford 性が, 付随する warping スタックに遺伝しないことについて ..... 15  
 Kohei Aoyama (Univ. of Osaka) The property of being a Deligne–Mumford stack is not preserved by the warping stack

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



- 32 沖 泰裕 (立教大理) The rationality problem for multinorm one tori ..... 15  
 金井和貴 (呉工高専)  
 Yasuhiro Oki (Rikkyo Univ.) The rationality problem for multinorm one tori  
 Kazuki Kanai (Kure Nat. Coll. of Tech.)

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

- 33 岩見智宏 (九工大工) Certain mixed motivic sheaves for extensions of symmetric 2-forms related to three-dimensional Miyaoka–Yau type inequality with third Chern classes ..... 15  
 Tomohiro Iwami (Kyushu Inst. of Tech.) Certain mixed motivic sheaves for extensions of symmetric 2-forms related to three-dimensional Miyaoka–Yau type inequality with third Chern classes

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

- 34 佐野太郎 (神戸大理) On Hodge structures of compact complex manifolds with semistable degenerations ..... 15  
 Taro Sano (Kobe Univ.) On Hodge structures of compact complex manifolds with semistable degenerations

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



- 35 松川 寿人 (北海道大) 作用付き三角圏のスペクトラム ..... 15  
 Hisato Matsukawa (Hokkaido Univ.) The spectrum of triangulated categories with actions

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

- 36 仁村 州 (名古屋大) Derived McKay correspondence for real reflection groups of rank three  
 石井 亮 (名古屋大) ..... 15  
 Shu Nimura (Nagoya Univ.) Derived McKay correspondence for real reflection groups of rank three  
 Akira Ishii (Nagoya Univ.)

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

#### 12:00~12:30 代数学分科会総会

#### 14:15~15:15 特別講演

- 伊藤 敦 (筑波大数理物質) アーベル多様体上の M 正則性と直線束が定める有理写像について  
 Atsushi Ito (Univ. of Tsukuba) On M-regularity and rational maps defined by line bundles on abelian varieties

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

#### 15:30~17:30

- 37 北川 夏芽 (名古屋大) The standard models of del Pezzo fibrations of degree 4 ..... 15  
 Natsume Kitagawa (Nagoya Univ.) The standard models of del Pezzo fibrations of degree 4

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

- 38 阿部 秀斗 (名古屋大) 3次元ファノ多様体の自己同型群 ..... 15  
 Shuto Abe (Nagoya Univ.) Automorphism groups of Fano threefolds

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

- 39 渡 邊 究 (中 大 理 工) Quadratic varieties of small codimension ..... 15  
 Kiwamu Watanabe (Chuo Univ.) Quadratic varieties of small codimension

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

- 40 藤 野 修 (京 大 理) On non-projective complete toric varieties ..... 10  
 佐 藤 拓 (福 岡 大 理)  
 Osamu Fujino (Kyoto Univ.) On non-projective complete toric varieties  
 Hiroshi Sato (Fukuoka Univ.)

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

- 41 瀧 真 語 (東 海 大 理) Galois 点と K3 曲面 ..... 15  
 三 浦 敬 (山 口 大 創 成)  
 Shingo Taki (Tokai Univ.) Galois points and K3 surfaces  
 Kei Miura (Yamaguchi Univ.)

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

- 42 佐 藤 謙 (東京科学大理) K3 曲面のシンプレクティック自己同型の高次 Chow サイクルへの作用  
 について ..... 15  
 Ken Sato (Sci. Tokyo) On symplectic actions on higher Chow cycles on  $K3$  surfaces

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

- 43 山 岸 日 出 (東京電機大理工) 図形数から生じる漸化式と楕円曲面 ..... 15  
 Hizuru Yamagishi (Tokyo Denki Univ.) Recurrence formulas with figurate numbers and elliptic surfaces

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

## 9月19日(金) 第IX会場

## 9:30~12:00

- 44 津野 祐司 (和歌山工高専)  $\mathbb{F}_p$  代数の上のある有限平坦非可換群スキームの群環の単数群スキームについて ..... 15  
 Yuji Tsuno On the unit group scheme of the group algebra of a certain non-commutative  
 (Nat. Inst. of Tech., Wakayama Coll.) finite flat group scheme over an  $\mathbb{F}_p$ -algebra

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

- 45 加藤 裕基 (久留米工高専) Goodwille approximation of algebraic cobordism ..... 15  
 Yuki Kato (Kurume Nat. Coll. of Tech.) Goodwille approximation of algebraic cobordism

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

- 46 吉田 学 (大和大理工)  $\mathbb{Q}_p$  上の楕円曲線の  $p$  捩れ点の定義体について ..... 15  
 小関 祥康 (神奈川大理)  
 Manabu Yoshida (Yamato Univ.) On the  $p$ -torsion fields of elliptic curves over  $\mathbb{Q}_p$   
 Yoshiyasu Ozeki (Kanagawa Univ.)

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

- 47 中川 彬雄 (金沢大理工) 有限体上の合流型超幾何関数と Artin-Schreier 曲線 ..... 15  
 Akio Nakagawa (Kanazawa Univ.) Confluent hypergeometric functions over finite fields and Artin-Schreier curve

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

- 48 森下 昌紀 (九大数理) Deninger の葉層力学系と Connes-Consani のアデリック空間の関係について ..... 15  
 Masanori Morishita (Kyushu Univ.) On a relation between Deninger's foliated dynamical systems and Connes-Consani's adelic spaces

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

- 49 片岡 武典 (東京理大理) Kida's formula for graphs with ramifications ..... 15  
 Takenori Kataoka (Tokyo Univ. of Sci.) Kida's formula for graphs with ramifications

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

- 50 伊藤 遙来 (名大多元数理) ベクトル群の同変コンパクト化上の Darmon 点についての Manin 予想 ..... 15  
 Haruki Ito (Nagoya Univ.) Semi-integral points of bounded height on vector group compactifications

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

- 51 加藤 正輝 (立命館大情報理工) Macdonald 対称関数と多重対数関数 ..... 15  
 Masaki Kato (Ritsumeikan Univ.) Macdonald symmetric functions and multiple polylogarithms

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

- 52 野崎 寛 (愛知教育大) 四元数有限群に対応する球面デザインと保型形式への応用 ..... 15  
 平尾 将剛 (愛知県立大情報)  
 田坂 浩二 (近畿大理工)  
 Hiroshi Nozaki (Aichi Univ. of Edu.) Spherical designs associated with finite quaternionic groups and their  
 Masatake Hirao (Aichi Pref. Univ.) applications to modular forms  
 Koji Tasaka (Kindai Univ.)

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

## 14:15~15:15 特別講演

松坂俊輝 (九大数理)  $q$  級数の (モック) モジュラー性Toshiki Matsusaka (Kyushu Univ.) (Mock) modular nature of  $q$ -series

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

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

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

## 15:30~17:30

53 飯高茂 (放送大・学習院大\*) オイラー関数の多重化とその応用 ..... 10

梶田光

(Crimson Global Academy)

Shigeru Iitaka

Double Euler functions and a kind of perfect numbers

(Open Univ. of Japan/Gakushuin Univ.\*)

Hikaru Kajita

(Crimson Global Academy)

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

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

We shall study them.

54 堂本陽輝 (山口大創成) On the average of  $\sigma_a(n)$  for square-free integers ..... 10

井川祥彰

南出真 (山口大理)

谷川好男

Haruki Domoto (Yamaguchi Univ.)

On the average of  $\sigma_a(n)$  for square-free integers

Tadaaki Igawa

Makoto Minamide (Yamaguchi Univ.)

Yoshio Tanigawa

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

55 岩田英人 (群馬工高専) A relation to a remainder terms in an asymptotic formula for the associated Euler totient function ..... 15

Hideto Iwata

A relation to a remainder terms in an asymptotic formula for the asso-

(Gunma Nat. Coll. of Tech.)

ciated Euler totient function

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

- 56 荻原 芙美 (上智大理工) Square-full 数に関する表現関数の短区間における和の評価について ... 15  
 Fumi Ogihara (Sophia Univ.) On the short interval average of the representation function related to square-full numbers

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

- 57 戸潤 勇一郎 (名大多元数理) Dirichlet  $L$  関数の負のモーメントについて ..... 15  
 Iu-Iong Ng (早大理工)  
 Yuichiro Toma (Nagoya Univ.) On negative moments of Dirichlet  $L$ -functions  
 Iu-Iong Ng (Waseda Univ.)

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

- 58 篠原 健 (名大多元数理) Stirling 数を用いた多重ゼータ (スター) 関数の非正整数点における特殊値の明示式 ..... 15  
 Takeshi Shinohara (Nagoya Univ.) Explicit values of multiple zeta functions at non-positive integers using Stirling numbers

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

- 59 安沢 拓真 (名大多元数理) 一般化対称多重ゼータ値にまつわる Lie 代数について ..... 15  
 Takumi Anzawa (Nagoya Univ.) A Lie algebra associated with both generalized symmetric multiple zeta values and parity results

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

- 60 范 谷 瑜 (名大多元数理) 樹形化多重ゼータ値の間の写像 ..... 15  
 Ku-Yu Fan (Nagoya Univ.) A map between arborifications of multiple zeta values

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

## 幾 何 学

9月16日(火) 第VI会場

9:30~11:45

- 1 林 弘 幸 (神 戸 大 理) 有限重複度を持つ線織面の締括線について ..... 15  
 Hiroyuki Hayashi (Kobe Univ.) On striction curves of ruled surfaces with finite multiplicities

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

- 2 阿 賀 岡 芳 夫 (広 島 大\*) 左不変計量のリッチ曲率と不変式 —3次元の場合— ..... 15  
 Yoshio Agaoka (Hiroshima Univ.\*) Ricci curvature of left invariant metrics and invariants —the 3-dimensional case—

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

- 3 中 津 山 希 (室蘭工大理工) Caustics and involutes of framed surfaces in Euclidean 3-space ..... 15  
 高 橋 雅 朋 (室蘭工大理工)  
Nozomi Nakatsuyama Caustics and involutes of framed surfaces in Euclidean 3-space  
 (Muroran Inst. of Tech.)  
 Masatomo Takahashi  
 (Muroran Inst. of Tech.)

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



- 4 熊谷 駿 (八戸工大) 等積幾何における自己アフィン性をもつ平面曲線 ..... 15  
 梶原 健司 (九大IMI)  
 Shun Kumagai Planar curves with self-affinity in equiaffine geometry  
 (Hachinohe Inst. of Tech.)  
 Kenji Kajiwara (Kyushu Univ.)

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

- 5 森本 真弘 (都立大理) 平行移動写像と弱鏡映部分多様体のアフィン微分幾何学 ..... 15  
 Masahiro Morimoto Affine differential geometry of parallel transport maps and weakly re-  
 (Tokyo Metro. Univ.) flective submanifolds

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

- 6 松本 洵 (東京科学大理) 特異点付きアフィン極大曲面の特別なクラスと極小曲面論との関係 .. 15  
 Jun Matsumoto (Sci. Tokyo) A special class of affine maximal surfaces with singularities and its re-  
 lationship with minimal surface theory

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

- 7 佐藤 健治 (玉川大工) 球面三角形と双曲三角形の Fermat–Torricelli 点 ..... 15  
 Kenzi Satô (Tamagawa Univ.) Fermat–Torricelli points of a spherical or hyperbolic triangle

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



## 14:15~16:45

- 8 加藤 直樹 (中京大教養教育院) 左不変アファイン葉層構造と左対称代数構造の一般化 ..... 15  
 Naoki Kato (Chukyo Univ.) Left-invariant transversely affine foliations and a generalization of left-symmetric structures

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

- 9 出口 仁理 (都立大理) Maximal antipodal sets of oriented flag manifolds ..... 15  
 Masamichi Deguchi Maximal antipodal sets of oriented flag manifolds  
 (Tokyo Metro. Univ.)

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

- 10 孫 立杰 (山口大創成) Notes on the geometry of quaternionic Heisenberg group ..... 15  
 Lijie Sun (Yamaguchi Univ.) Notes on the geometry of quaternionic Heisenberg group

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

- 11 L. H. Silveira Gomes Vaisman solvmanifolds as finite quotients of Kodaira–Thurston nilmanifolds ..... 15  
 (阪大理) ifolds  
 Lucas Henrique Silveira Gomes Vaisman solvmanifolds as finite quotients of Kodaira–Thurston nilmanifolds  
 (Univ. of Osaka) ifolds

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

- 12 井 川 治 (京都工繊大工芸) 複素旗多様体内の二つの実旗多様体の交叉とコンパクト対称三対の標準形  
大 野 晋 司 (日 大 文 理) ..... 15  
馬 場 蔵 人 (東京理大創域理工)

Osamu Ikawa (Kyoto Inst. Tech.) The intersection of two real flag manifolds in a complex flag manifold,  
Shinji Ohno (Nihon Univ.) and the canonical form of a compact symmetric triad  
Kurando Baba (Tokyo Univ. of Sci.)

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

- 13 下 地 泰 斗 (阪 大 理) リー代数の次数付けと非特異複素代数多様体の冪零な基本群 ..... 15  
Taito Shimoji (Univ. of Osaka) Gradings on nilpotent Lie algebras and the fundamental groups of smooth  
complex algebraic varieties

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

- 14 田 崎 博 之  $Pin^c$  群および関連するコンパクト Lie 群の極地 II ..... 15  
(都立大理・筑波大数理物質)  
Hiroyuki Tasaki Polars of  $Pin^c$  groups and related compact Lie groups. II  
(Tokyo Metro. Univ./Univ. of Tsukuba)

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

- 15 藤 井 忍 (千歳科学技術大理工) 実 Grassmann 多様体の  $s$ -可換集合と Clifford 代数の表現について ..... 15  
Shinobu Fujii On  $s$ -commutative sets in real Grassmannian manifolds and represen-  
(Chitose Inst. of Sci. and Tech.) tations of Clifford algebras

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

9月17日(水) 第VI会場

**10:00~10:15 2025年度日本数学会幾何学賞授賞式****10:20~11:20 2025年度日本数学会幾何学賞受賞特別講演 (トポロジー分科会と合同)**

松村 慎一 (東北大理) 非負曲率を持つ多様体に対する構造定理

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

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

**12:50~13:50 2025年度日本数学会幾何学賞受賞特別講演 (トポロジー分科会と合同)**

永野 幸一 (筑波大数理物質) 曲率が上に有界な距離空間の幾何学について

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

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

## 9月18日(木) 第VI会場

9:30~11:45

- 16 古賀 勇 (九州国際大現代ビジネス) 四元数射影空間からグラスマン多様体へのシンプレクティック群同変調和写像の分類 ..... 15  
 長友 康行 (明大理工)  
 高橋 正郎 (久留米工高専)  
 Isami Koga (Kyushu Int. Univ.) Equivariant harmonic maps of quaternion projective spaces into Grassmannians  
 Yasuyuki Nagatomo (Meiji Univ.)  
 Masaro Takahashi (Kurume Nat. Coll. of Tech.)

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

- 17 竹内 有哉 (筑波大数理物質) CR Paneitz operator on non-embeddable CR manifolds ..... 15  
 Yuya Takeuchi (Univ. of Tsukuba) CR Paneitz operator on non-embeddable CR manifolds

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

- 18 村上 怜 (東大理) 複素 Hessian 方程式と正値性 ..... 15  
 Rei Murakami (Tohoku Univ.) Complex Hessian equations and positivity

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

- 19 長谷川 和志 (金沢大人間社会) Intrinsic characterization of projective special complex manifolds ..... 15  
 V. Cortés (Univ. of Hamburg)  
 Kazuyuki Hasegawa (Kanazawa Univ.) Intrinsic characterization of projective special complex manifolds  
 Vicente Cortés (Univ. of Hamburg)

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

- 20 佐藤 弘 康 (日本工大共通教育) Conformal vector fields on complex hyperbolic space ..... 15  
 Hemangi M. Shah  
 (Harish-Chandra Res. Inst.)  
 Hiroyasu Satoh (Nippon Inst. of Tech.) Conformal vector fields on complex hyperbolic space  
 Hemangi M. Shah  
 (Harish-Chandra Res. Inst.)

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

- 21 勝田 宗 平 (名大多元数理) Nevanlinna 理論における組み合わせ論的構造について ..... 15  
 Shuhei Katsuta (Nagoya Univ.) Combinatorial structure in Nevanlinna theory

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

- 22 足立 真 訓 (静岡大理) Harmonic measures and rigidity for transverse foliations on Seifert 3-  
 松田 能 文 (青学大理工) manifolds ..... 15  
 野澤 啓 (立命館大理工)  
 Masanori Adachi (Shizuoka Univ.) Harmonic measures and rigidity for transverse foliations on Seifert 3-  
 Yoshifumi Matsuda manifolds  
 (Aoyama Gakuin Univ.)  
 Hiraku Nozawa (Ritsumeikan Univ.)

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

#### 14:15~17:45

- 23 黒田 直 樹 (東大数理) Spin-Sp(4), Spin-SU(8), Spin-Spin(16) 同境界群の 7 次元までの計算 ..... 15  
 Naoki Kuroda (Univ. of Tokyo) Computations of Spin-Sp(4), Spin-SU(8), and Spin-Spin(16) bordism  
 groups in dimensions up to 7

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

- 24 本間 泰史 (早大理工) Eigenvalue estimates and stability on positive quaternion Kähler manifolds ..... 15  
 Yasushi Homma (Waseda Univ.) Eigenvalue estimates and stability on positive quaternion Kähler manifolds

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

- 25 宇田川 衷 (早大理工) Classification of the  $\mathrm{tt}^*$ -Toda equation with the anti-symmetry condition ..... 15  
 Tadashi Udagawa (Waseda Univ.) Classification of the  $\mathrm{tt}^*$ -Toda equation with the anti-symmetry condition

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

- 26 濱中 翔太 (阪大理) スカラー曲率に関してある意味で特異な計量について ..... 15  
 Shota Hamanaka (Univ. of Osaka) Extremal metrics involving in scalar curvature

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

- 27 川村 昌也 (椋山女学園大教育) 概 Hermitian 多様体上の  $t$ -Gauduchon 接続について ..... 15  
 Masaya Kawamura On the  $t$ -Gauduchon connection on almost Hermitian manifolds  
 (Sugiyama Jogakuen Univ.)

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

- 28 稲垣 真郷 (名大多元数理) リッチ曲率とリーマン多様体および非崩壊極限のラプラシアンに対するグラフ近似の誤差評価について ..... 15  
 Masato Inagaki (Nagoya Univ.) Spectral convergence of graph Laplacians with Ricci curvature bounds and in non-collapsed Ricci limit spaces

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

- 29 N. Evseev (沖縄科学技術大) Rellich–Kondrachov theorem for mappings in metric spaces ..... 15  
 Nikita Evseev Rellich–Kondrachov theorem for mappings in metric spaces  
 (Okinawa Inst. of Sci. and Tech. Grad. Univ.)

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

- 30 百 野 巧 真 (関西大理工) コンパクト距離空間列からなる空間の Gromov–Hausdorff 空間への等距離埋め込み ..... 15  
 Takuma Byakuno (Kansai Univ.) An isometric embedding from a space of sequences of compact metric spaces into the Gromov–Hausdorff space

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

- 31 石 倉 宙 樹 (東大数理) Stallings–Swan’s theorem for Borel graphs ..... 15  
 Hiroki Ishikura (Univ. of Tokyo) Stallings–Swan’s theorem for Borel graphs

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

- 32 田 代 賢 志 郎 (沖縄科学技術大) グルシン平面の亜種と  $RCD$  条件 ..... 15  
 S. Borza (Univ. Vienna)  
 Kenshiro Tashiro Varieties of the Grushin plane and the  $RCD$  condition  
 (Okinawa Inst. of Sci. and Tech. Grad. Univ.)  
 Samuël Borza (Univ. Vienna)

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



## 9月19日(金) 第VI会場

## 9:30~10:45

- 33 池田 憲明 (立命館大理工) Poisson maps in Hamilton Lie algebroids ..... 15  
 廣田 祐士 (麻布大獣医)

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

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

- 34 新井 匠 (京大理) Guillermou–Kashiwara–Schapira kernels of geodesic flows ..... 15  
 Takumi Arai (Kyoto Univ.) Guillermou–Kashiwara–Schapira kernels of geodesic flows

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

- 35 馬場 伸平 (阪大理) Bending Teichmüller spaces and character varieties ..... 15  
 Shinpei Baba (Univ. of Osaka) Bending Teichmüller spaces and character varieties

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

- 36 早見 峻 (長野大共創情報) Cotangent path  $n$ -rackoids ..... 15  
 Ryo Hayami (Nagano Univ.) Cotangent path  $n$ -rackoids

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

## 11:00~12:00 特別講演

大須賀 けん斗 b Volumes of moduli spaces of bordered Klein surfaces  
 (名大素粒子宇宙起源研・名大多元数理)  
 Kento Osuga Volumes of moduli spaces of bordered Klein surfaces  
 (Nagoya Univ./Nagoya Univ.)

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



# 函数論

9月16日(火) 第Ⅲ会場

9:30~11:10

- 1 宮 武 夏 雄 (東北大MathCCS) 完備調和計量の拡張とその存在と一意性と近似について ..... 15  
 Natsuo Miyatake (Tohoku Univ.) On the existence, uniqueness, and approximation of the extended complete harmonic metrics

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

- 2 宮 武 夏 雄 (東北大MathCCS) 調和計量と劣調和関数とエントロピーと自由エネルギー ..... 15  
 Natsuo Miyatake (Tohoku Univ.) Harmonic metrics, subharmonic functions, entropy, and free energy

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

- 3 宮 武 夏 雄 (東北大MathCCS) エントロピーと自由エネルギーと双曲計量と冗長性 ..... 15  
 Natsuo Miyatake (Tohoku Univ.) Entropy, free energy, hyperbolic metrics, and redundancy

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

- 4 大野 貴雄 (大分大教育福祉) Maximal and Riesz potential operators on Musielak–Orlicz spaces over  
下村 哲 (広島大教育) unbounded metric measure spaces ..... 15  
Takao Ohno (Oita Univ.) Maximal and Riesz potential operators on Musielak–Orlicz spaces over  
Tetsu Shimomura (Hiroshima Univ.) unbounded metric measure spaces

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

- 5 堀田 一敬 (山口大理工) Nonlinear resolvents and decreasing Loewner chains ..... 15  
S. Schleißinger (Univ. of Würzburg)  
須川 敏幸 (東北大情報)  
Ikkei Hotta (Yamaguchi Univ.) Nonlinear resolvents and decreasing Loewner chains  
Sebastian Schleißinger  
(Univ. of Würzburg)  
Toshiyuki Sugawa (Tohoku Univ.)

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

- 6 笠尾 俊輔 (芝浦工大柏中高) Bloch–Ros principle とその応用について ..... 15  
川上 裕 (金沢大理工)  
Shunsuke Kasao Bloch–Ros principle and its application  
(Shibaura Inst. of Tech. Kashiwa Junior & Senior High School)  
Yu Kawakami (Kanazawa Univ.)

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

#### 14:20~15:20 特別講演

- 熊谷 駿 (八戸工大) Galois action on Teichmüller curves and related combinatorial objects  
Shun Kumagai Galois action on Teichmüller curves and related combinatorial objects  
(Hachinohe Inst. of Tech.)

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

## 15:40~16:30

- 7 成田 淳一郎 (大同大教養・大同大\*) Hardy 族による平面領域の分類に関する Hasumi の定理について ..... 15  
 林 実樹 廣 (北 大\*)  
 瀬川 重男 (大 同 大\*)  
Junichiro Narita On Hasumi's theorem for the classification of plane domains by Hardy  
 (Daido Univ./Daido Univ.\*) classes  
 Mikihiro Hayashi (Hokkaido Univ.\*)  
 Shigeo Segawa (Daido Univ.\*)

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

- 8 松崎 克彦 (早大教育) Characterization of asymptotically smooth curve ..... 15  
 陶 菲 (早大教育)  
Katsuhiko Matsuzaki (Waseda Univ.) Characterization of asymptotically smooth curve  
 Fei Tao (Waseda Univ.)

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

- 9 奥山 裕介 (京都工繊大基盤) 複素力学系に現れる有理型関数の一般化シュワルツ微分について ..... 15  
 Yūsuke Okuyama (Kyoto Inst. Tech.) Schwarzian derivatives and their generalizations of meromorphic functions appearing in complex dynamics

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

## 9月17日(水) 第Ⅲ会場

## 9:30~11:10

- 10 綾野 孝則 (阪公大数学研) 次数2の超楕円関数による KP 方程式の解 ..... 15  
 V. M. Buchstaber (Steklov Math. Inst.)  
Takanori Ayano (Osaka Metro. Univ.) Solution to the KP equation in terms of a hyperelliptic function of degree  
 Victor M. Buchstaber 2  
 (Steklov Math. Inst.)

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

- 11 大 沢 健 夫 (名大多元数理)b An example of holomorphically nonconvex locally pseudoconvex analytic set in  $\mathbb{C}^3$  ..... 15  
 Takeo Ohsawa (Nagoya Univ.) An example of holomorphically nonconvex locally pseudoconvex analytic set in  $\mathbb{C}^3$

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

- 12 阿 部 誠 (広 島 大\*)  $\mathbb{C}^n$  上の不分岐リーマン領域の境界距離関数 ..... 15  
 本 田 竜 広 (専 修 大 商)  
 Makoto Abe (Hiroshima Univ.\*) Boundary distance functions of unramified Riemann domains over  $\mathbb{C}^n$   
 Tatsuhiro Honda (Senshu Univ.)

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

- 13 高 橋 正 (羽衣国際大現代社会) 吉原の定義式に関する数式处理的考察 ..... 15  
 Tadashi Takahashi A computer algebraic study on Yoshihara's defining equation  
 (Hagoromo Univ. of Int. Stud.)

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

- 14 厚 地 淳 (慶 大 理 工) 過渡的ケーラー多様体上の有理型関数に対するネヴァンlinna理論 .... 15  
 Atsushi Atsuji (Keio Univ.) Nevalinna theory for meromorphic functions on transient Kähler manifolds

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

- 15 松 本 和 子 (東京理大理工)  $\mathbb{CP}^2$  の非特異複素曲線までの対数的 Fubini–Study 距離の Levi form の固有値 ..... 15  
 Kazuko Matsumoto Eigenvalues of the Levi form of logarithmic Fubini–Study distance to a non-singular complex curve in  $\mathbb{CP}^2$   
 (Tokyo Univ. of Sci.)

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

**13:00～14:00 特別講演**稲山 貴大 (東京理大理工)  $L^2$  評価式,  $L^2$  拡張定理と曲率の正値性Takahiro Inayama (Tokyo Univ. of Sci.)  $L^2$  estimates,  $L^2$  extension theorems, and positivity of curvature

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

# 函数方程式論

9月16日(火) 第I会場

9:00~12:00

- 1 安達 駿 弥 (宇都宮大教育) 線形 Pfaff 系に対する middle Laplace transform とその応用 ..... 10  
Shunya Adachi (Utsunomiya Univ.) Middle Laplace transform for linear Pfaffian systems and its application

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

- 2 高山 信 毅 (神戸大\*) 超幾何系の同型分類アルゴリズム ..... 10  
中山 洋 将 (日大生物資源)  
Nobuki Takayama (Kobe Univ.\*) Algorithm to classify hypergeometric systems to isomorphic classes  
Hiromasa Nakayama (Nihon Univ.)

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

- 3 石橋 和 葵 (広島工大工) PD 制御型微分演算子をもつ線形微分方程式の Hille–Kneser 型振動判定法 ..... 10  
Kazuki Ishibashi  
(Hiroshima Inst. of Tech.) A Hille–Kneser type oscillation criterion for linear differential equations with a PD-based operator

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

- 4 宇佐美 広 介 (岐阜大\*) 半線形常微分方程式が指数関数的漸近挙動の解を持つための必要条件  
内藤 学 (愛媛大\*) ..... 10  
Hiroyuki Usami (Gifu Univ.\*) Necessary conditions for half-linear ordinary differential equations in  
Manabu Naito (Ehime Univ.\*) order that they have solutions behaving exponentially

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

- 5 谷川 智幸 (阪 公 大 理) 半分線形微分方程式の振動解の振幅と零点における勾配について ..... 10  
 草野 尚 (広 島 大\*)  
 J. Jaroš (Comenius Univ.)  
 宇佐美 広介 (岐 阜 大\*)  
 Tomoyuki Tanigawa (Osaka Metro. Univ.) On the amplitude and the slope at zeros of oscillatory solutions of half-linear differential equations  
 Takaši Kusano (Hiroshima Univ.\*)  
 Jaroslav Jaroš (Comenius Univ.)  
 Hiroyuki Usami (Gifu Univ.\*)

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

- 6 齋藤 保久 (島 根 大 理 工) 優線型減衰を伴う遅延微分方程式の大域吸収性 ..... 10  
 Yasuhisa Saito (Shimane Univ.) Global attractivity for a general delay differential equation with super-linear damping

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

- 7 矢ヶ崎 一幸 (京 大 情 報) Solvability of integrable partial differential equations under meromorphic initial conditions by quadrature ..... 10  
 Kazuyuki Yagasaki (Kyoto Univ.) Solvability of integrable partial differential equations under meromorphic initial conditions by quadrature

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

- 8 柴田 徹太郎 (広 島 大\*) Global bifurcation curves of nonlocal elliptic equations with oscillatory nonlinear term ..... 10  
 Tetsutaro Shibata (Hiroshima Univ.\*) Global bifurcation curves of nonlocal elliptic equations with oscillatory nonlinear term

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



- 9 田中 敏 (東 北 大 理) Uniqueness and multiplicity of positive radial solutions to the super-critical Brezis–Nirenberg type problem in an annulus ..... 10  
 渡辺宏太郎 (防 衛 大)  
 塩 路 直 樹 (横 浜 国 大 工)  
 Satoshi Tanaka (Tohoku Univ.) Uniqueness and multiplicity of positive radial solutions to the super-critical Brezis–Nirenberg type problem in an annulus  
 Kotaro Watanabe  
 (Nat. Defense Acad. of Japan)  
 Naoki Shioji (Yokohama Nat. Univ.)

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

- 10 眞 崎 聡 (北 大 理) 常微分方程式系における 4 次保存量について ..... 10  
 Satoshi Masaki (Hokkaido Univ.) On quartic conserved quantity for a class of nonlinear ODE system

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

- 11 梶 木 屋 龍 治 1 次元  $p$  ラプラシアン の第 1 固有値 に対する 評価 ..... 10  
 (大阪電通大共通教育機構)  
 竹 内 慎 吾  
 (芝浦工大システム理工)  
 Ryuji Kajikiya Estimate for the first eigenvalue of the one-dimensional  $p$ -Laplacian  
 (Osaka Electro-Comm. Univ.)  
 Shingo Takeuchi  
 (Shibaura Inst. of Tech.)

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

- 12 梶 木 屋 龍 治 点対称及び面対称な非有界領域における Hénon 方程式の最小エネルギー解 ..... 10  
 (大阪電通大共通教育機構)  
 Ryuji Kajikiya Least energy solutions of the Hénon equation in reflectionally symmetric or point symmetric unbounded domains  
 (Osaka Electro-Comm. Univ.)

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



- 13 S. Ibrahim (Univ. of Victoria) Global perturbation of isolated equivariant chiral skyrmions from the  
清水 一慶 (京大 理) harmonic maps ..... 10  
Slim Ibrahim (Univ. of Victoria) Global perturbation of isolated equivariant chiral skyrmions from the  
Ikkei Shimizu (Kyoto Univ.) harmonic maps

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

- 14 甘利 悠貴  $SU(3)$  Yang–Mills 理論における鞍点解: 双曲空間上のモノポール–反モノ  
(慶大自然科学研究教育センター) ノポール結合状態 ..... 10  
Yuki Amari (Keio Univ.) Saddle point solutions in  $SU(3)$  Yang–Mills theory: Hyperbolic monopole–  
antimonopole bound state

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

#### 14:15~16:30

- 15 勝呂 剛志 (熊本大先端) ある  $p$ -Laplace 方程式に関する Sobolev 型関数不等式の安定性評価につ  
いて ..... 10  
Takeshi Suguro (Kumamoto Univ.) Stability estimates for the Sobolev type functional inequality for a  $p$ -  
Laplace equation

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

- 16 濱本 直樹 (阪公大 理) 球体上の渦無し場に対する Poincaré–Wirtinger 定数 ..... 10  
Naoki Hamamoto (Osaka Metro. Univ.) The Poincaré–Wirtinger constant for curl-free fields on the ball

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

- 17 林 道 問 (沖縄科学技術大) Best constant and extremal functions for a class of Hardy–Sobolev–  
Xinan Ma Mazya inequalities ..... 10  
(Univ. of Sci. and Tech. of China)  
Daowen Lin Best constant and extremal functions for a class of Hardy–Sobolev–  
(Okinawa Inst. of Sci. and Tech. Grad. Univ.) Mazya inequalities  
Xinan Ma  
(Univ. of Sci. and Tech. of China)

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

- 18 鈴木 貴 (阪大 M M D S) 高次元 Smoluchowski–Poisson 方程式の爆発集合 ..... 5  
Takashi Suzuki (Osaka Univ.) Blowup set of the Smoluchowski–Poisson equation in higher dimension

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

- 19 豊田 洋平 (奈良工高専) Behavior of ground state solutions for semilinear elliptic equation associated with critical Sobolev exponent ..... 10  
Yohei Toyota Behavior of ground state solutions for semilinear elliptic equation associated with critical Sobolev exponent  
(Nat. Inst. of Tech., Nara Coll.)

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

- 20 熊谷 健太 (東京科学大理) 二次元における特異性を持つ重み付き半線形楕円型方程式の分岐構造 .. 10  
Kenta Kumagai (Sci. Tokyo) Bifurcation structure of semilinear elliptic equations with singular weights in two dimensions

概要 We consider the bifurcation structure of radial solutions for the semilinear elliptic equations with singular weights in the unit ball. We deal with the exponential nonlinearity and power-type nonlinearities. In the un-weighted case, it is well-known that the bifurcation curve exhibits three different types depending on the dimension and the exponent of power, for higher dimensions. On the other hand, the curve exhibits only one type in two dimensions.

In this talk, we succeed in realizing a phenomenon such that the bifurcation curve exhibits all of the three types in two dimensions by choosing the weight suitably.

- 21 張 彥 瀟 (広島大先進理工) Higher-order boundary estimates for large solutions to semilinear Poisson equations with exponential nonlinearities ..... 10  
Yuxiao Zhang (Hiroshima Univ.) Higher-order boundary estimates for large solutions to semilinear Poisson equations with exponential nonlinearities

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

- 22 片山 翔 (東大数理) Infinite multiplicity of positive solutions of an inhomogeneous supercritical elliptic equation on  $\mathbb{R}^N$  ..... 10  
 宮本 安人 (東大数理)  
 Sho Katayama (Univ. of Tokyo) Infinite multiplicity of positive solutions of an inhomogeneous supercritical elliptic equation on  $\mathbb{R}^N$   
 Yasuhito Miyamoto (Univ. of Tokyo)

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

- 23 長田 祐輝 (東京理大理) 点相互作用を伴う連立非線形シュレディンガー方程式系に対する変分解析 ..... 10  
 A. Pomponio (Politecnico di Bari)  
 Yuki Osada (Tokyo Univ. of Sci.) Variational analysis for coupled nonlinear Schrödinger equations with  
 Alessio Pomponio (Politecnico di Bari) point interaction

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

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

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

- 24 深谷 法良 (早大理工) 点相互作用を持つ2次元非線形スカラー場方程式の基底状態の一意性と非退化性 ..... 10  
 Noriyoshi Fukaya (Waseda Univ.) Uniqueness and nondegeneracy of ground states for 2d-nonlinear scalar field equations with point interaction

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

- 25 荒木 康太 (日大理工) 空間不均一な拡散を持つ非線形 Fokker–Planck 方程式の解のアプリオリ ..... 10  
 水野 将司 (日大理工) 評価  
 Kouta Araki (Nihon Univ.) A priori estimates for solutions of nonlinear Fokker–Planck equations  
 Masashi Mizuno (Nihon Univ.) with inhomogeneous spatial diffusion

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

## 17:00~18:00 特別講演

- 平 良 晃 一 (九 大 数 理) Essential selfadjointness and spectral theory for the d'Alembertian on Lorentzian manifolds
- Kouichi Taira (Kyushu Univ.) Essential selfadjointness and spectral theory for the d'Alembertian on Lorentzian manifolds

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

## 9月17日(水) 第I会場

## 9:15~12:00

- 26 M. Fazly ( UTSA ) Linear-coupling effect in the 1D Gross-Pitaevskii system: Exact solutions and eigenvalue problems ..... 10
- 宮 本 安 人 (東 大 数 理)
- Mostafa Fazly (UTSA) Linear-coupling effect in the 1D Gross-Pitaevskii system: Exact solutions and eigenvalue problems
- Yasuhito Miyamoto (Univ. of Tokyo)

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

- 27 松 澤 寛 (神 奈 川 大 理) 三波相互作用と臨界指数を含む非線形 Schrödinger 方程式系の基底状態
- 國 府 方 秀 謙 (神奈川県立鶴見高) の存在について ..... 10
- Hiroshi Matsuzawa (Kanagawa Univ.) Ground state for a system of nonlinear Schrödinger equations with three
- Hidenori Kokufukata waves interaction and critical nonlinearities
- (Tsurumi Senior High School)

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

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

- 28 宮本 怜里 (東京理大創域理工) The critical Fujita exponent for one-dimensional semilinear heat equations with potentials and space-dependent nonlinearities ..... 10  
 側島 基宏 (東京理大創域理工) .....  
 Reiri Miyamoto (Tokyo Univ. of Sci.) The critical Fujita exponent for one-dimensional semilinear heat equations with potentials and space-dependent nonlinearities  
 Motohiro Sobajima (Tokyo Univ. of Sci.)

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

- 29 原田 潤一 (秋田大教育文化) 空間六次元藤田型方程式の振動解の存在性の考察 ..... 6  
 Junichi Harada (Akita Univ.) Remarks on the oscillating solutions to the 6D Fujita equation

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

- 30 小島 瑞輝 (神奈川大情報) 時間非整数階微分を含む半線形熱方程式の自己相似解について ..... 10  
 Mizuki Kojima (Kanagawa Univ.) On self-similar solutions of time-fractional semilinear heat equations

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

- 31 宮本 安人 (東大数理) Solvability of the Cauchy problem for fractional semilinear parabolic equations in critical and doubly critical cases ..... 10  
 鈴木 将満 (明大研究・知財) .....  
 Yasuhito Miyamoto (Univ. of Tokyo) Solvability of the Cauchy problem for fractional semilinear parabolic equations in critical and doubly critical cases  
 Masamitsu Suzuki (Meiji Univ.)

概要 Let  $0 < \theta \leq 2$ ,  $N \geq 1$  and  $T > 0$ . We are concerned with the Cauchy problem for the fractional semilinear parabolic equation

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

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

- 32 波多野修也 (阪大情報) Hardy–Hénon 放物型方程式に対する Herz 空間上の解の無条件一意性に  
池田正弘 (阪大情報) ついて ..... 10  
Naoya Hatano (Univ. of Osaka) Unconditional uniqueness of Hardy–Hénon parabolic equations on Herz  
Masahiro Ikeda (Univ. of Osaka) spaces

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

- 33 郭紀源 (東京理大理) Global existence of weak solutions in a three-dimensional flux-limited  
小波津晶平 (東京理大理) Keller–Segel–Navier–Stokes system involving superlinear production · · 10  
横田智巳 (東京理大理)  
Jiyuan Guo (Tokyo Univ. of Sci.) Global existence of weak solutions in a three-dimensional flux-limited  
Shohei Kohatsu (Tokyo Univ. of Sci.) Keller–Segel–Navier–Stokes system involving superlinear production  
Tomomi Yokota (Tokyo Univ. of Sci.)

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

- 34 和久井洋司 (福井大工) Stability and large time behavior in a drift-diffusion equation with an  
山田哲也 (福井工高専) attractive drift term ..... 10  
Hiroshi Wakui (Univ. of Fukui) Stability and large time behavior in a drift-diffusion equation with an  
Tetsuya Yamada attractive drift term  
(Fukui Nat. Coll. of Tech.)

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

- 35 曾我悠利 (東北大理) 間接的シグナルをもつ走化性モデルの無限時刻における解の集中現象 · · 10  
Yuri Soga (Tohoku Univ.) Concentration phenomena to a chemotaxis system with indirect signal  
production

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

- 36 大枝和浩 (九州産大) Stationary solutions of a prey-predator model with directed population flux and a protection zone ..... 10  
久藤衡介 (早大理工)  
Kazuhiro Oeda (Kyushu Sangyo Univ.) Stationary solutions of a prey-predator model with directed population flux and a protection zone  
Kousuke Kuto (Waseda Univ.)

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

- 37 兼子裕大 (関東学院大理工) ディリクレ境界条件を伴う反応拡散方程式の自由境界問題に現れる伝播  
山田義雄 (早大理工) 形態 ..... 10  
Yuki Kaneko (Kanto Gakuin Univ.) Asymptotic behaviors and propagating terrace for a free boundary problem of a positive bistable reaction-diffusion equation under Dirichlet boundary conditions  
Yoshio Yamada (Waseda Univ.)

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

- 38 塚本悠暉 (東京理大理) 反応拡散近似における定常界面の形成 ..... 10  
Yuki Tsukamoto (Tokyo Univ. of Sci.) Appearance of stationary interfaces in the fast reaction limit

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

- 39 中村誠 (阪大情報) Global solutions for the Allen–Cahn type equation in de Sitter spacetime  
江口主紗 (阪大情報) under a quartic potential ..... 10  
立花健人 (阪大情報)  
Makoto Nakamura (Univ. of Osaka) Global solutions for the Allen–Cahn type equation in de Sitter spacetime  
Kazusa Eguchi (Univ. of Osaka) under a quartic potential  
Kento Tachibana (Univ. of Osaka)

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



## 13:00~14:00 特別講演

- 渡辺達也 (京都産大理) 非線形シュレディンガー・ポアソン方程式系に付随する非局所楕円型方程式の基底状態解について  
 Tatsuya Watanabe (Kyoto Sangyo Univ.) Ground state solutions for nonlocal elliptic problems associated with the nonlinear Schrödinger–Poisson system

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

9月18日(木) 第I会場

## 9:15~12:00

- 40 相原真生 (北大理) A game interpretation for the weighted  $p$ -Laplace equation ..... 10  
 Mamoru Aihara (Hokkaido Univ.) A game interpretation for the weighted  $p$ -Laplace equation

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

- 41 佐藤卓弥 (東大数理) 異方的外力付き平均曲率流方程式の自由境界問題に対するゲーム的手法 ..... 10  
 Takuya Sato (Univ. of Tokyo) A game approach to free boundary problems of anisotropic forced mean curvature flow equations

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

- 42 三竹大寿 (東大数理) 接触角条件付き Hamilton–Jacobi 方程式の均質化問題の最適収束率 ... 10  
 Panrui Ni (東大数理)  
 Hiroyoshi Mitake (Univ. of Tokyo) Optimal rate of convergence for homogenization of Hamilton–Jacobi equations with prescribed contact boundary conditions  
 Panrui Ni (Univ. of Tokyo)

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



- 43 三 竹 大 寿 (東 大 数 理) 非線形弱結合 Hamilton–Jacobi 方程式系の均質化問題の収束率 ..... 10  
 Panrui Ni (東 大 数 理)  
 Hiroyoshi Mitake (Univ. of Tokyo) Rate of convergence for homogenization of nonlinear weakly coupled  
 Panrui Ni (Univ. of Tokyo) Hamilton–Jacobi systems

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

- 44 藤 田 安 啓 (富 山 大 理) 病的函数を初期値とする Hamilton–Jacobi flow の滞在時間 ..... 10  
 山 口 範 和 (富 山 大 教 育)  
 Yasuhiro Fujita (Univ. of Toyama) Residence time for a Hamilton–Jacobi flow starting from a pathological  
 Norikazu Yamaguchi (Univ. of Toyama) function

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

- 45 可 香 谷 隆 (室 蘭 工 大 工) 発散型ディリクレ境界条件付き完全非線形放物型方程式に対する可解性 ..... 10  
 Takashi Kagaya Solvability for fully nonlinear parabolic equations with a singular Dirich-  
 (Muroran Inst. of Tech.) let boundary condition

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

- 46 Qing Liu (沖縄科学技術大) Monge solutions of time-dependent Hamilton–Jacobi equations in met-  
 M. B. P. Wiranata ric spaces ..... 10  
 (沖縄科学技術大)  
 Qing Liu Monge solutions of time-dependent Hamilton–Jacobi equations in met-  
 (Okinawa Inst. of Sci. and Tech. Grad. Univ.) ric spaces  
 Made Benny Prasetya Wiranata  
 (Okinawa Inst. of Sci. and Tech. Grad. Univ.)

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

- 47 茂 木 響 太 郎 (東京科学大理) 三重点に近い integral varifold の正則性定理 ..... 10  
 Kotaro Motegi (Sci. Tokyo) A regularity theorem for integral varifolds close to triple junction

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

- 48 田代紀一 (東京科学大理) 接触角構造付き平均曲率流の弱解の存在性について ..... 10  
 Kiichi Tashiro (Sci. Tokyo) On existence of weak mean curvature flow with prescribed contact angle

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

- 49 F. Gruen (京大理) Regularity and structure of non-planar  $p$ -elasticae ..... 10  
 三浦達哉 (京大理)  
 Florian Gruen (Kyoto Univ.) Regularity and structure of non-planar  $p$ -elasticae  
 Tatsuya Miura (Kyoto Univ.)

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

- 50 森龍之介 (明大MIMS) 空間周期的な障害物をもつ2次元帯領域における外力項付き曲率流の伝播 ..... 10  
 Ryunosuke Mori (Meiji Univ.) Propagation and blocking of a curvature flow with driving force in two-dimensional cylinders with periodically arrayed obstacles

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

- 51 眞崎聡 (北大理) 強圧的な保存量をもたないNLS方程式系の解の漸近挙動の解析について ..... 10  
 Satoshi Masaki (Hokkaido Univ.) On the asymptotic behavior of solutions to NLS systems without coercive conserved quantities

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

- 52 平 山 浩 之 (宮 崎 大 教 育) 2 次の 3 波相互作用を伴う非線形シュレディンガー方程式系の進行波解に  
池 田 正 弘 (阪 大 情 報) ついて ..... 10  
Hiroyuki Hirayama (Univ. of Miyazaki) On traveling waves for the nonlinear Schrödinger system with quadratic  
Masahiro Ikeda (Univ. of Osaka) three wave interaction

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

#### 14:30~16:30

- 53 佐 川 侑 司 (岐 阜 工 高 専) Asymptotic behavior of small solutions to a two-component system of  
cubic nonlinear Schrödinger equations in one space dimension ..... 10  
Yuji Sagawa (Gifu Nat. Coll. of Tech.) Asymptotic behavior of small solutions to a two-component system of  
cubic nonlinear Schrödinger equations in one space dimension

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

- 54 李 春 花 (Yanbian Univ.) Remarks on  $L^2$ -decay of small solutions to derivative nonlinear Schrödinger  
佐 川 侑 司 (岐 阜 工 高 専) equations with weakly dissipative structure ..... 10  
砂 川 秀 明 (阪 公 大 理)  
鷲 尾 慎 平 (夙 川 中 高)  
Chunhua Li (Yanbian Univ.) Remarks on  $L^2$ -decay of small solutions to derivative nonlinear Schrödinger  
Yuji Sagawa (Gifu Nat. Coll. of Tech.) equations with weakly dissipative structure  
Hideaki Sunagawa  
(Osaka Metro. Univ.)  
Shinpei Washio  
(Shukugawa Junior High School & High School)

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

- 55 水 谷 治 哉 (阪 大 理) Modified scattering for the final state problem of the 1D cubic NLS with  
川 本 昌 紀 (岡山大学異分野基礎研) long-range potential ..... 10  
Haruya Mizutani (Univ. of Osaka) Modified scattering for the final state problem of the 1D cubic NLS with  
Masaki Kawamoto (Okayama Univ.) long-range potential

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

- 56 渡 邊 南 (津田塾大学芸) Scattering for the nonlinear Schrödinger equation with exponential non-linearity ..... 10  
 Minami Watanabe (Tsuda Coll.) Scattering for the nonlinear Schrödinger equation with exponential non-linearity

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

- 57 波 多 間 備 (京大数理研) 散乱状態の半古典極限: Hartree 方程式から Vlasov 方程式へ ..... 10  
 Sonae Hadama (Kyoto Univ.) Semi-classical limit of scattering states: from the Hartree equation to the Vlasov equation

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

- 58 岡 本 葵 (広島大先進理工) 周期境界条件におけるエネルギー臨界確率非線形 Schrödinger 方程式の大域解 ..... 10  
 Guopeng Li (Beijing Inst. of Tech.)  
 Liying Tao (China Acad. of Eng. Phys.)  
 Mamoru Okamoto (Hiroshima Univ.) Global solution to the periodic energy-critical stochastic nonlinear Schrödinger equation  
 Guopeng Li (Beijing Inst. of Tech.)  
 Liying Tao (China Acad. of Eng. Phys.)

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

- 59 井 波 虎 太 郎 (名大多元数理) Smoothing property of the Schrödinger equation in modulation spaces ..... 10  
 Kotaro Inami (Nagoya Univ.) Smoothing property of the Schrödinger equation in modulation spaces

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

- 60 林 雅 行 (京大人間環境) Uniqueness of solutions for the logarithmic Schrödinger equation ..... 10  
 Masayuki Hayashi (Kyoto Univ.) Uniqueness of solutions for the logarithmic Schrödinger equation

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

- 61 小林 伸 達 (東京理大理) Global well-posedness for a generalized Zakharov system in a higher  
 太田 雅 人 (東京理大理) energy space ..... 10  
 Nobutatsu Kobayashi Global well-posedness for a generalized Zakharov system in a higher  
 (Tokyo Univ. of Sci.) energy space  
 Masahito Ohta (Tokyo Univ. of Sci.)

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

### 17:00~18:00 特別講演

- 吉 川 周 二 (広島大先進理工) 微分方程式の構造を引き継ぐ離散化とその応用  
 Shuji Yoshikawa (Hiroshima Univ.) Structure-preserving discretization of differential equations and its ap-  
 plications

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

9月19日(金) 第I会場

### 9:15~12:00

- 62 吉 住 拓 真 (阪大情報) Blowup for semi-linear Klein–Gordon equations with positive initial en-  
 中 村 誠 (阪大情報) ergy in FLRW spacetimes ..... 10  
 Takuma Yoshizumi (Univ. of Osaka) Blowup for semi-linear Klein–Gordon equations with positive initial en-  
 Makoto Nakamura (Univ. of Osaka) ergy in FLRW spacetimes

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

- 63 和田 康 司 (北 大 理) Blow-up of solutions for discrete semilinear wave equation with the  
 若 狭 恭 平 (室 蘭 工 大 工) scale-invariant damping ..... 10  
Koji Wada (Hokkaido Univ.) Blow-up of solutions for discrete semilinear wave equation with the  
 Kyouhei Wakasa scale-invariant damping  
 (Muroran Inst. of Tech.)

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

- 64 北 村 駿 介 (東 北 大 理) 非コンパクト台の初期値を持つ空間変数重み付き微分型半線形波動方程式の時間局所解の非存在 ..... 10  
 Shunsuke Kitamura (Tohoku Univ.) Non-existence of time-local solutions of derivative type with spatial weights and non-compactly supported data in one space dimension

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

- 65 側 島 基 宏 (東京理大創域理工) A weighted energy method for wave equations with time-dependent damping ..... 10  
 Motohiro Sobajima A weighted energy method for wave equations with time-dependent damping  
 (Tokyo Univ. of Sci.)

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

- 66 陳 逸 昆 (国 立 台 湾 大) On the existence and regularity of weakly nonlinear stationary Boltzmann equations ..... 10  
 夏 俊 雄 (国 立 台 湾 大)  
 川 越 大 輔 (京 大 情 報)  
 I-Kun Chen (Nat. Taiwan Univ.) On the existence and regularity of weakly nonlinear stationary Boltzmann equations  
 Chun-Hsiung Hsia (Nat. Taiwan Univ.)  
 Daisuke Kawagoe (Kyoto Univ.)

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



- 67 Dingqun Deng (秋田大理工) Shock wave stability for the 3D Boltzmann equation: Bridging kinetic theory and fluid dynamics ..... 10

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

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

- 68 出口直人 (東京科学大理) 3次元外部領域における圧縮性 Navier–Stokes 方程式の時間周期解の安定性について ..... 10

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

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

- 69 沖田匡聡 (久留米工高専) On the asymptotic behavior of solutions to the compressible Navier–  
 隠居良行 (東京科学大理) Stokes equations with the non-slip boundary condition in the half space  
 小林孝行 (阪大基礎工) ..... 10  
 中里亮介 (信州大工)

Masatoshi Okita On the asymptotic behavior of solutions to the compressible Navier–  
 (Kurume Nat. Coll. of Tech.) Stokes equations with the non-slip boundary condition in the half space

Yoshiyuki Kagei (Sci. Tokyo)

Takayuki Kobayashi (Univ. of Osaka)

Ryosuke Nakasato (Shinshu Univ.)

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

- 70 小林孝行 (阪大基礎工) Analyticity and asymptotic behavior of solutions to the compressible  
 中里亮介 (信州大工) Navier–Stokes–Korteweg equations with the zero sound speed in critical  
 spaces ..... 10

Takayuki Kobayashi (Univ. of Osaka) Analyticity and asymptotic behavior of solutions to the compressible

Ryosuke Nakasato (Shinshu Univ.) Navier–Stokes–Korteweg equations with the zero sound speed in critical spaces

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

- 71 鈴木政尋 (名工大) 摂動半空間における熱伝導圧縮粘性流体の定常流 ..... 10  
 Mingjie Li  
 (Minzu Univ. of China)  
 Katherine Zhiyuan Zhang  
 (Northeastern Univ.)  
 Masahiro Suzuki (Nagoya Inst. of Tech.) Stationary flows for viscous heat-conductive fluid in a perturbed half-  
 Mingjie Li (Minzu Univ. of China) space  
 Katherine Zhiyuan Zhang  
 (Northeastern Univ.)

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

- 72 鈴木政尋 (名工大) 凸領域における Vlasov–Poisson 方程式の解の漸近挙動 ..... 10  
 Wenrui Huang (Brown Univ.)  
 B. Pausader (Brown Univ.)  
 Masahiro Suzuki (Nagoya Inst. of Tech.) The asymptotic behavior of solutions to the Vlasov–Poisson equation in  
 Wenrui Huang (Brown Univ.) convex domains  
 Benoît Pausader (Brown Univ.)

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

- 73 岡崎大輝 (東北大理) 分数冪ラプラシアンを有する表面準地衡方程式の解の一意性 ..... 10  
 岩瀨 司 (東北大理)  
 Taiki Okazaki (Tohoku Univ.) On the uniqueness of the surface quasi-geostrophic equation with the  
 Tsukasa Iwabuchi (Tohoku Univ.) fractional Laplacian

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

- 74 藤井幹大 (名古屋市大理) Sharp well-posedness and ill-posedness of the stationary quasi-geostrophic  
 岩瀨 司 (東北大理) equation ..... 10  
 Mikihiro Fujii (Nagoya City Univ.) Sharp well-posedness and ill-posedness of the stationary quasi-geostrophic  
 Tsukasa Iwabuchi (Tohoku Univ.) equation

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



- 75 飯田 祥樹 (早大理工) 滑らかでない境界を持つ線形化 primitive 方程式に対するレゾルベント問題 ..... 10

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

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

#### 14:15~16:30

- 76 須部 絢斗 (早大理工) Well-posedness and analyticity of solutions to the stationary MHD equations ..... 10

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

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

- 77 大山 広樹 (京大理) Asymptotics for the inviscid rotating stably stratified Boussinesq equations in a 3D layer ..... 10

Junha Kim (Ajou Univ.)

Hiroki Ohyama (Kyoto Univ.) Asymptotics for the inviscid rotating stably stratified Boussinesq equations in a 3D layer

Junha Kim (Ajou Univ.)

Ryo Takada (Univ. of Tokyo)

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

- 78 大山 広樹 (京大理) Long-time solvability and asymptotics for the 3D rotating MHD equations ..... 10

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

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

- 79 山本 征法 (群馬大理工) 非圧縮性 Navier–Stokes 流の対数的時間発展と移流項の対称構造 ..... 10  
 Masakazu Yamamoto (Gunma Univ.) Logarithmic time evolution of incompressible Navier–Stokes flow and symmetric structure of its drift term

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

- 80 小泉 祐太 (早大理工) On analyticity in time of Koch–Tataru solutions to the Navier–Stokes equations ..... 10  
 Yuta Koizumi (Waseda Univ.) On analyticity in time of Koch–Tataru solutions to the Navier–Stokes equations

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

- 81 大石 健太 (香川高専) 非圧縮性 Navier–Stokes 方程式の 1 相問題の Lagrange 形式における時間周期解 ..... 10  
 Kenta Oishi Time-periodic solutions for the Lagrangian formulation of the one-phase problem for the incompressible Navier–Stokes equations  
 (Nat. Inst. of Tech., Kagawa Coll.)

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

- 82 武内 太貴 (九大 I M I) Unique existence of solutions to the Navier–Stokes system with singular external forces ..... 10  
 Taiki Takeuchi (Kyushu Univ.) Unique existence of solutions to the Navier–Stokes system with singular external forces

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

- 83 青木基記 (京大理) 2次元半空間における外力付きナビエ・ストークス方程式の解の非一意性について ..... 10  
 前川泰則 (京大理)  
 Motofumi Aoki (Kyoto Univ.) On the non-uniqueness of solutions to the two-dimensional forced Navier–Stokes equations in the half space  
 Yasunori Maekawa (Kyoto Univ.)

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

- 84 朝見陽介 (名大多元数理) Regularity properties of a generalized Oseen evolution operator in exterior domains, with applications to the Navier–Stokes initial value problem ..... 10  
 菱田俊明 (名大多元数理)  
 Yosuke Asami (Nagoya Univ.) Regularity properties of a generalized Oseen evolution operator in exterior domains, with applications to the Navier–Stokes initial value problem  
 Toshiaki Hishida (Nagoya Univ.)

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

- 85 渡邊圭市 (諏訪東京理大工) Unique strong solution to the stationary Navier–Stokes equations around a uniform flow in the whole plane ..... 10  
 Keiichi Watanabe (Suwa Univ. of Sci.) Unique strong solution to the stationary Navier–Stokes equations around a uniform flow in the whole plane

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

- 86 津田和幸 (九州産大) Critical decay rate of stability for stationary solutions to the Navier–Stokes equations in exterior domains ..... 10  
 R. Farwig (TU Darmstadt)  
 Kazuyuki Tsuda Critical decay rate of stability for stationary solutions to the Navier–Stokes equations in exterior domains  
 (Kyushu Sangyo Univ.)  
 Reinhard Farwig (TU Darmstadt)

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

**17:00~18:00 特別講演**

檜 垣 充 朗 (神戸大 理) 非定常ストークス方程式に対するルンゲ型の近似定理

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

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

# 実 函 数 論

9月18日(木) 第Ⅲ会場

10:00~11:30

- 1 北 島 雅 也 (名大多元数理) 変形 Bessel 関数の微分公式による星芒型  $p$ -circle の格子点誤差評価への応用 ..... 15

Masaya Kitajima (Nagoya Univ.) Application of differential formulas for generalized Bessel functions to the evaluation of lattice point errors for astroid-type  $p$ -circles

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

- 2 松 岡 勝 男 (東 邦 大 理) Boundedness of some sublinear operators in power-weighted Herz spaces at indices beyond critical index ..... 15

Katsuo Matsuoka (Toho Univ.) Boundedness of some sublinear operators in power-weighted Herz spaces at indices beyond critical index

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

- 3 齋 藤 洋 樹 (日 大 理 工) Weighted trace inequality with Hausdorff capacity ..... 15

Hiroki Saito (Nihon Univ.) Weighted trace inequality with Hausdorff capacity

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

- 4 安 辰 乾 (Univ. of Basel) Second order estimates for a free boundary phase transition ..... 15

Jingdon An (Univ. of Basel) Second order estimates for a free boundary phase transition

概要 It is well known that minimizers of the Allen–Cahn-type functional  $J_\epsilon(u) := \int_\Omega \frac{\epsilon |\nabla u|^2}{2} + \frac{W(u)}{\epsilon}$ , where  $W$  is a double-well potential, resemble minimal surfaces in the sense that their level sets converge to a minimal surface as  $\epsilon \rightarrow 0$ . In this work, we consider the indicator potential  $W(t) = \chi_{(-1,1)}(t)$ , which leads

to the Bernoulli-type free-boundary problem 
$$\begin{cases} \Delta u = 0 & \text{in } \{|u| < 1\} \\ |\nabla u| = \epsilon^{-1} & \text{on } \partial\{|u| < 1\}. \end{cases}$$
 We prove that the transition

layers are uniformly  $C^{2,\alpha}$  regular, up to the free boundary. We interpret the family of level surfaces as a geometric flow, where time coincides with the level. This results in a closed system of equations from which uniform estimates readily follow.

- 5 Haesung Lee (Kumoh National Inst. of Tech.) Local elliptic regularity for solutions to stationary Fokker–Planck equations via Dirichlet forms and resolvents ..... 15  
 Haesung Lee (Kumoh National Inst. of Tech.) Local elliptic regularity for solutions to stationary Fokker–Planck equations via Dirichlet forms and resolvents

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

#### 14:15～15:30

- 6 伊 東 由 文 (徳 島 大\*) 物理現象の様相の実相 ..... 15  
 Yoshifumi Ito (Tokushima Univ.\*) Reality of showing signs of physical phenomena

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

- 7 伊 東 由 文 (徳 島 大\*) 水素原子のスペクトルの現象 ..... 15  
 Yoshifumi Ito (Tokushima Univ.\*) Phenomena of spectra of the hydrogen atoms

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

- 8 三 谷 健 一 (岡山県立大情報工) Skewness and modulus of smoothness in Banach space ..... 15  
 Kenichi Mitani (Okayama Pref. Univ.) Skewness and modulus of smoothness in Banach space

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

- 9 松 下 慎 也 不動点問題に対する慣性射影アルゴリズム ..... 15  
 (秋田県立大システム科学技術)  
 Shin-ya Matsushita (Akita Pref. Univ.) Inertial projection algorithm for fixed point problem

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

#### 15:45～16:45 特別講演

- 野 ケ 山 徹 (東京理大理) 混合ノルムを用いた関数空間の解析  
 Toru Nogayama (Tokyo Univ. of Sci.) A study of function spaces with mixed norm

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

## 9月19日(金) 第Ⅲ会場

## 10:00~12:00

- 10 小波津晶平 (東京理大理) Global existence and boundedness of weak solutions to a Keller–Segel system with flux dependent sensitivity and superlinear production ... 15

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

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

- 11 鵜飼直孝 (千葉大融合理工) 未知変数に依存するエネルギー勾配系に基づく擬放物型システムの可解性  
水野大樹 (千葉大融合理工) ..... 15

白川 健 (千葉大教育)  
H. Antil (George Mason Univ.)

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

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

- 12 垣内花 (日本女大理) 放物型方程式の連立系に対する2相ステファン問題の自由境界の挙動に  
愛木豊彦 (日本女大理) ついて ..... 15

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

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



- 13 水野大樹 (千葉大融合理工) 熱交換と変数依存型駆動力を伴う結晶粒界運動の最適制御問題 ..... 15  
白川健 (千葉大教育)  
Daiki Mizuno (Chiba Univ.) Optimal control problem for grain boundary motion with heat exchange  
Ken Shirakawa (Chiba Univ.) and variable-dependent mobility

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

- 14 森村晃子 (日本女大理) 楕円-放物型方程式を含む多孔質媒体への水分浸透を表す方程式系の弱解  
愛木豊彦 (日本女大理) の存在 ..... 15  
Akiko Morimura Existence of weak solutions to a system describing moisture transport  
(Japan Women's Univ.) in porous media with an elliptic-parabolic equation  
Toyohiko Aiki (Japan Women's Univ.)

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

- 15 田中悠也 (関西学院大理) Boundedness and asymptotic behavior of classical solutions to a model  
水上雅昭 (京都教育大) for tuberculosis granuloma formation ..... 15  
Yuya Tanaka (Kwansei Gakuin Univ.) Boundedness and asymptotic behavior of classical solutions to a model  
Masaaki Mizukami for tuberculosis granuloma formation  
(Kyoto Univ. of Edu.)

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

- 16 千代祐太郎 (東京理大理) Global existence and boundedness in a one-dimensional quasilinear parabolic-  
長谷川和輝 (東京理大理) elliptic-elliptic chemotaxis system with flux limitation ..... 15  
小波津晶平 (東京理大理)  
横田智巳 (東京理大理)  
Yutaro Chiyo (Tokyo Univ. of Sci.) Global existence and boundedness in a one-dimensional quasilinear parabolic-  
Kazuki Hasegawa (Tokyo Univ. of Sci.) elliptic-elliptic chemotaxis system with flux limitation  
Shohei Kohatsu (Tokyo Univ. of Sci.)  
Tomomi Yokota (Tokyo Univ. of Sci.)

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



## 14:15~15:45

- 17 小杉千春 (山口大理) 特異性をもつ応力関数を伴う弾性体の伸縮運動を記述する初期値境界値問題のエネルギー保存系での可解性 ..... 15

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

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

- 18 村瀬勇介 (名城大理工) 風上法を適用した水分輸送過程モデルの数値計算と数値的安定性について ..... 15

Yusuke Murase (Meijo Univ.) Numerical analysis of mathematical modeling for moisture transport with upwind difference scheme

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

- 19 加納理成 (高知大教育) 静電状態における圧電効果を持つ Bernoulli–Euler 梁モデルの境界条件について ..... 15  
山中貴博 (高知県立宿毛高)

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

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

- 20 渡邊 紘 (大分大理工) 異方性を伴う結晶粒界現象を記述する 3 次元モデルの解の存在 ..... 15  
白川 健 (千葉大教育)

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

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

- 21 深 尾 武 史 (龍谷大先端理工) 厚み 0 極限としての動的境界条件の特徴付けと正則性の回復について . . 15  
 Takeshi Fukao (Ryukoku Univ.) Characterization of dynamic boundary conditions in the zero-thickness limit

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

#### 16:00~17:00 特別講演

- 赤 川 佳 穂 (京 都 教 育 大) 時間非局所未知関数依存性をもつ変分不等式の移動硬化問題への応用  
 Yoshiho Akagawa (Kyoto Univ. of Edu.) Variational inequality with time-nonlocal unknown dependence for kinematic hardening

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

# 函数解析学

9月16日(火) 第II会場

9:30~10:30

- 1 渡辺 秀 司 (三条市大工) 外部磁場のあるときの超伝導の BCS 理論における Bogoliubov 変換とギャップ方程式 II ..... 15

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

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

- 2 酒 匂 宏 樹 (新潟大工) 量子ウォーク間の繋絡作用素 ..... 15

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

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

- 3 廣 島 文 生 (九大数理) Fiber decomposition of NcHO by 2pQRM ..... 15

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

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

- 4 岩 田 順 敬 (大阪経法大経営) Besov 空間における高階双曲型発展方程式の初期値問題 ..... 15  
野 井 貴 弘 (追手門学院大理工)

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

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

## 10:45~11:45 特別講演

和 田 健 志 (島根大総理工) Maxwell-Schrödinger 方程式の初期境界値問題について

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

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

9月17日(水) 第II会場

## 10:00~10:45

5 洞 彰 人 (北 大 理) 環積のユーツイス・マーフィー元と動的ランダムマルチヤング図形 . . . . 15

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

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

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

概要 Let  $\mathfrak{g} = \mathfrak{sl}(n+1, \mathbb{C})$  for  $n \geq 2$ . We write  $\mathfrak{p} := \mathfrak{p}_{1,n}$  for the maximal parabolic subalgebra of  $\mathfrak{g}$  corresponding to the partition  $(1, n)$  of  $n+1$ . We write  $M_{\mathfrak{p}}^{\mathfrak{g}}(\xi, s)$  for the generalized Verma module for  $(\mathfrak{g}, \mathfrak{p})$  induced from the simple  $\mathfrak{p}$ -module  $(\xi, s) \in \text{Irr}(\mathfrak{p})_{\text{fin}} \simeq \text{Irr}(\mathfrak{sl}(n, \mathbb{C}))_{\text{fin}} \times \mathbb{C}$ . Let  $\mathfrak{g}'$  be a subalgebra of  $\mathfrak{g}$  such that  $\mathfrak{g}' = \{\text{diag}(X', 0) : X' \in \mathfrak{sl}(n, \mathbb{C})\} \simeq \mathfrak{sl}(n, \mathbb{C})$  and put  $\mathfrak{p}' := \mathfrak{p} \cap \mathfrak{g}'$ . We define a generalized Verma module  $M_{\mathfrak{p}'}^{\mathfrak{g}'}(\sigma, r)$  for  $(\mathfrak{g}', \mathfrak{p}')$  similarly.

In this talk we shall determine the branching laws of  $M_{\mathfrak{p}}^{\mathfrak{g}}(\text{triv}, s)|_{\mathfrak{g}'}$  and  $\text{Im}(\varphi)|_{\mathfrak{g}'}$  for a  $\mathfrak{g}$ -homomorphism  $\varphi \in \text{Hom}_{\mathfrak{g}}(M_{\mathfrak{p}}^{\mathfrak{g}}(\tau, u), M_{\mathfrak{p}}^{\mathfrak{g}}(\text{triv}, s))$ . In relation to these branching laws, the factorization identities of a  $\mathfrak{g}'$ -homomorphism  $\Phi \in \text{Hom}_{\mathfrak{g}'}(M_{\mathfrak{p}'}^{\mathfrak{g}'}(\sigma, r), M_{\mathfrak{p}}^{\mathfrak{g}}(\text{triv}, s))$  will be also discussed.

7 笹 木 集 夢 (東 海 大 理) 実直線型簡約実球等質空間の Weyl 群 . . . . . 15

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

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

**11:00~12:00 特別講演**

堀 永 周 司 ( NTT-IFM ) ユニタリ群上のユニタリ最低ウェイト表現を含む局所  $A$  パラメータの分類とその応用

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

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

9月18日(木) 第II会場

**10:00~11:10**

- 8 山 崎 丈 明 (東 洋 大 理 工) On numerical range of generalized Aluthge trnasforms ..... 10  
 C. Benhida (Univ. de Lille)  
 Takeaki Yamazaki (Toyo Univ.) On numerical range of generalized Aluthge trnasforms  
 Chafiq Benhida (Univ. de Lille)

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

- 9 瀬 尾 祐 貴 (大阪教育大教育) 行列幾何平均を用いた行列トレース不等式について ..... 15  
 Yuki Seo (Osaka Kyoiku Univ.) Matrix trace inequalities related to matrix geometric means

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

- 10 古 市 茂 (日 大 文 理) ブロック行列に関する不等式 ..... 15  
 Shigeru Furuichi (Nihon Univ.) Matrix inequalities via block matrices

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

- 11 藤 井 淳 一 (大阪教育大\*) 作用素ダイバージェンスの基準 ..... 15  
 Junichi Fujii (Osaka Kyoiku Univ.\*) A criterion of operator divergence

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

- 12 保 科 暖 迪 (木更津工高専) 多変数作用素平均における ALM 手法の一般化 ..... 15

和 田 州 平 (木更津工高専)

Dante Hoshina

ALM-framework in the theory of multivariate operator means

(Nat. Inst. of Tech., Kisarazu Coll.)

Shuhei Wada

(Nat. Inst. of Tech., Kisarazu Coll.)

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

#### 14:15~14:55

- 13 越 野 克 久 (神 奈 川 大 工) Isometries between spaces of metrics ..... 15

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

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

- 14 守 屋 創 (金 沢 大 理 工)<sup>b</sup> Graded tensor-product extension of KMS states ..... 10

Hajime Moriya (Kanazawa Univ.) Graded tensor-product extension of KMS states

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

- 15 曾 我 部 太 郎 (京 大 理 工)<sup>b</sup> Ergodic automorphisms on unital Kirchberg algebras ..... 15

松 本 健 吾 (上 越 教 育 大)

Taro Sogabe

(Kyoto Univ.) Ergodic automorphisms on unital Kirchberg algebras

Kengo Matsumoto

(Joetsu Univ. of Edu.)

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

#### 15:10~16:10 特別講演

森 迪 也 (東 大 数 理) Wigner の定理のいろいろな拡張

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

概要 I will survey generalizations of Wigner’s unitary-antiunitary theorem and Uhlhorn’s theorem.

# 統計数学

9月16日(火) 第IV会場

9:00~12:00

- 1 大野 玄道 (京大人間環境) ツリー型反復関数系の極限集合の Hausdorff 次元について ..... 15  
Hiromichi Ono (Kyoto Univ.) Hausdorff dimension of the limit sets of tree iterated function systems

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

- 2 藤江 克徳 (京大理) 摂動項付きランダム行列と  $B'$  型自由確率論 ..... 15  
長谷部 高広 (北大理)

Katsunori Fujie (Kyoto Univ.) Perturbed Random Matrices and Free Probability of Type  $B'$   
Takahiro Hasebe (Hokkaido Univ.)

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

- 3 田代 賢志郎 (沖縄科学技術大) Bakry-Émery の勾配評価とダイソnbブラウン運動 ..... 15  
鈴木 康平 (Durham Univ.)

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

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

- 4 稲吉 凌 (名城大理工) An operator information quantity of a semigroup and associated differential equations ..... 15

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

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



- 5 深澤正彰 (阪大基礎工) Limit distribution of errors in discretization of stochastic Volterra equations with multidimensional kernel ..... 15  
 北條美那人 (阪大基礎工) .....  
 Masaaki Fukasawa (Univ. of Osaka) Limit distribution of errors in discretization of stochastic Volterra equations with multidimensional kernel  
 Minato Hojo (Univ. of Osaka) .....

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

- 6 深澤正彰 (阪大基礎工) Liquidity provision of utility indifference type in decentralized exchanges  
 B. Maire (Quantena AG) ..... 15  
 M. Wunsch  
 (ZHAW School of Management and Law)  
 Masaaki Fukasawa (Univ. of Osaka) Liquidity provision of utility indifference type in decentralized exchanges  
 Basile Maire (Quantena AG)  
 Marcus Wunsch  
 (ZHAW School of Management and Law)

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

- 7 野場啓 (阪大理) 加法汎関数により消滅する負スペクトラル Lévy 過程のスケール関数 .. 15  
 J. L. Pérez (CIMAT)  
 Kei Noba (Univ. of Osaka) Scale functions for spectrally negative Lévy processes killed by additive  
 José Luis Pérez (CIMAT) functionals

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

- 8 野田涼一郎 (京大理) 正值連続加法汎関数に対する Kac のモーメント公式の一般化 ..... 15  
 梶野直孝 (京大数理研)  
 Ryoichiro Noda (Kyoto Univ.) Generalized Kac's moment formula for positive continuous additive func-  
 Naotaka Kajino (Kyoto Univ.) tionals

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



- 9 大井 拓夢 (東京理大理工) Homeomorphism of the Revuz correspondence for finite energy integrals ..... 15
- Takumu Ooi (Tokyo Univ. of Sci.) Homeomorphism of the Revuz correspondence for finite energy integrals

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

- 10 塩沢 裕一 (同志社大理工) Volume growth, big jump, and essential spectrum for regular Dirichlet forms ..... 15
- Yuichi Shiozawa (Doshisha Univ.) Volume growth, big jump, and essential spectrum for regular Dirichlet forms

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

- 11 上木 直昌 (京大人間環境) A definition of self-adjoint operators derived from the Schrödinger operator with the white noise potential on the plane ..... 15
- Naomasa Ueki (Kyoto Univ.) A definition of self-adjoint operators derived from the Schrödinger operator with the white noise potential on the plane

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

#### 14:15~15:15 特別講演

- 世良 透 (阪大基礎工) 間欠力学系と一次元拡散過程における分布極限定理
- Toru Sera (Univ. of Osaka) Distributional limit theorems for intermittent dynamical systems and one-dimensional diffusion processes

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

**15:30~16:30 特別講演**

清 水 良 輔 (京 大 情 報) フラクタル上の Sobolev 空間とエネルギー測度に関する特異性現象

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

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

**9月17日(水) 第IV会場****9:20~11:20**

- 12 田 中 輝 雄 (広島市大情報) 多次元離散時間変数をもつマルコフ過程に対する最適停止問題に付随する非線形半群 ..... 15

Teruo Tanaka (Hiroshima City Univ.) Nonlinear semigroups associated with optimal stopping problems for discrete time multiparameter Markov processes

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

- 13 藤 田 敏 治 (九 工 大 工) 分岐型マルコフ決定過程における最大加法型評価について ..... 10

Toshiharu Fujita (Kyushu Inst. of Tech.) Max-add criterion in diverging Markov decision process

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

- 14 川 崎 英 文 (九 大 数 理) ハムサンドウィッチ定理の弱い拡張: 等分割以外の比率 ..... 15

Hidefumi Kawasaki (Kyushu Univ.) Weak extension of the ham-sandwich theorem: some ratio not in half

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

- 15 橋本 真太郎 (広島大先進理工) Robust Bayesian inference for censored survival data ..... 15  
 Shintaro Hashimoto (Hiroshima Univ.) Robust Bayesian inference for censored survival data

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

- 16 丸山 祐造 (千葉大理) A new perspective on dominating the James–Stein estimator ..... 15  
 竹村 彰通 (滋賀大)  
 Yuzo Maruyama (Chiba Univ.) A new perspective on dominating the James–Stein estimator  
 Akimichi Takemura (Shiga Univ.)

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

- 17 前園 宜彦 (中大理工) カーネル型分位点回帰推定量の別表現について ..... 10  
 秋葉 翔太 (中大理工)  
 Yoshihiko Maesono (Chuo Univ.) Another representation of kernel quantile regression  
 Shota Akiba (Chuo Univ.)

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

- 18 柿沢 佳秀 (北大経済) 非対称カーネルを用いたノンパラメトリック回帰 ..... 15  
 コイク テイ  
 Yoshihide Kakizawa (Hokkaido Univ.) Nonparametric regression using asymmetric kernels  
 Gu Yuting

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

- 19 佃 康 司 (九大数理) Allometric 回帰モデルにおける推定量の MSE 上界: 誤差が楕円対称分布  
松 浦 峻 (慶大理工) に従う場合 ..... 15  
Koji Tsukuda (Kyushu Univ.) Upper bounds for the MSE of estimators in allometric regression model:  
Shun Matsuura (Keio Univ.) cases of elliptically symmetric error distributions

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

- 20 林 佑 樹 (南山大理工) Jones–Pewsey 分布の適応推定について ..... 10  
塩 濱 敬 之 (南山大理工)  
Yuki Hayashi (Nanzan Univ.) Adaptive estimation for the parameters of Jones–Pewsey distribution  
Takayuki Shiohama (Nanzan Univ.)

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

11:30~12:00 統計数学分科会総会

9月18日(木) 第IV会場

9:30~11:45

- 21 藤 森 洸 (信州大経法) Sparse estimators for multivariate integer-valued autoregressive models  
白 石 博 (慶大理工) with applications to estimations for Hawkes processes ..... 15  
蛭 川 潤 一 (南山大理工)  
K. Fokianos (Univ. of Cyprus)  
Kou Fujimori (Shinshu Univ.) Sparse estimators for multivariate integer-valued autoregressive models  
Hiroshi Shiraishi (Keio Univ.) with applications to estimations for Hawkes processes  
Junichi Hirukawa (Nanzan Univ.)  
Konstantinos Fokianos  
(Univ. of Cyprus)

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

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

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

- 23 仲北 祥悟 (東大総合文化) Lipschitz 集中による 2 値線形分類問題の汎化誤差解析 ..... 15  
 Shogo Nakakita (Univ. of Tokyo) Generalization error analysis of binary linear classification problems by Lipschitz concentration

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

- 24 仲北 祥悟 (東大総合文化) 反復観測による高次元 Ornstein–Uhlenbeck 過程のスパース推定 ..... 15  
 Shogo Nakakita (Univ. of Tokyo) Sparse estimation of high-dimensional Ornstein–Uhlenbeck processes with repeated observations

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

- 25 山田 隆行 欠測を伴う高次元データにおける分散共分散行列の対角性の検定 ..... 15  
 (京都女大データサイエンス)  
 姫野 哲人  
 (滋賀大データサイエンス)  
 Takayuki Yamada Testing the diagonality of the covariance matrix in high-dimensional  
 (Kyoto Women's Univ.) data with missing values  
 Tetsuto Himeno (Shiga Univ.)

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

- 26 海野哲也 (筑波大数理物質) 高次元共分散行列の自動スパース推定について ..... 15  
矢田和善 (筑波大数理物質)  
青嶋誠 (筑波大数理物質)  
Tetsuya Umino (Univ. of Tsukuba) Automatic sparse estimation of the high-dimensional covariance matrix  
Kazuyoshi Yata (Univ. of Tsukuba)  
Makoto Aoshima (Univ. of Tsukuba)

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

- 27 江頭健斗 (東京理大創域理工) 単一強スパイク固有値モデルにおける高次元変化点検知 ..... 15  
矢田和善 (筑波大数理物質)  
青嶋誠 (筑波大数理物質)  
Kento Egashira (Tokyo Univ. of Sci.) Change point detection for high dimensional data under a strongly  
Kazuyoshi Yata (Univ. of Tsukuba) spiked eigenvalue model  
Makoto Aoshima (Univ. of Tsukuba)

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

- 28 Yujie Xue (統計数理研) Higher-order investigation of general time series divergences ..... 10  
A. C. Monti (Univ. of Sannio)  
谷口正信 (早大\*)  
Yujie Xue (Inst. of Stat. Math.) Higher-order investigation of general time series divergences  
Anna Clara Monti (Univ. of Sannio)  
Masanobu Taniguchi (Waseda Univ.\*)

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

**12:15～12:45 2025 年度日本数学会解析学賞授賞式****14:15～15:15 特別講演**

江 村 剛 志 (広島大先進理工)  $\hookrightarrow$  従属打ち切りの下での治療効果推定のための要因計画・要因分析とその漸近理論

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

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

**15:30～16:30 特別講演**

井 本 智 明 (静岡県立大経営情報) 柔軟な円周上分布, トーラス上分布, シリンダー上分布の構成とその応用

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

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

9月19日(金) 第IV会場

**10:00～11:45**

29 井 上 公 人 (西日本工大工)  $F$ - $t$  同時分布とその2標本問題への応用 ..... 15

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

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



- 30 一箭凜太郎 (早大理工) Detection of chaotic behaviors in stochastic systems ..... 15  
 佐川凜華 (早大理工)  
 劉言 (早大理工)  
 Rintaro Ichiya (Waseda Univ.) Detection of chaotic behaviors in stochastic systems  
 Rinka Sagawa (Waseda Univ.)  
 Yan Liu (Waseda Univ.)

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

- 31 野村莉佳子 (早大理工) Normalizing transformation of the Hill estimator ..... 15  
 劉言 (早大理工)  
 Rikako Nomura (Waseda Univ.) Normalizing transformation of the Hill estimator  
 Yan Liu (Waseda Univ.)

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

- 32 野村昇 (高知大理工) 正規分布に基づくコンジョイントモデルの推定法 ..... 15  
 Noboru Nomura (Kochi Univ.) Estimation in conjoint analysis based on Gaussian distribution

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



- 33 篠田 寛 (横浜市大医) 多元分割表における  $h$  次周辺対称モデルからの隔たりを測る尺度 ..... 15  
 吉本 拓矢 (中外製薬・横浜市大医)  
 田畑 耕治 (東京理大創域理工)  
 Satoru Shinoda (Yokohama City Univ.) A measure of departure from  $h$ th-order marginal symmetry for multi-  
 Takuya Yoshimoto way contingency tables  
 (Chugai Pharmaceutical Co./Yokohama City Univ.)  
 Kouji Tahata (Tokyo Univ. of Sci.)

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

- 34 駒場 敦 (山梨大医) Kolmogorov–Smirnov 検定, Kuiper 検定と OVL- $q$  検定 ..... 15  
 城野 悠志 (山梨大医)  
 中本 和典 (山梨大医)  
 Atsushi Komaba (Univ. of Yamanashi) Kolmogorov–Smirnov test, Kuiper test and OVL- $q$  test  
 Hisashi Johno (Univ. of Yamanashi)  
 Kazunori Nakamoto  
 (Univ. of Yamanashi)

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

- 35 中川 智之 正方分割表における対称性の適合度検定統計量の分割の情報幾何的な解釈 ..... 15  
 (明星大データサイエンス・理化学研)  
 松田 孟留  
 (東大情報理工・理化学研)  
 田畑 耕治 (東京理大理工)  
 Tomoyuki Nakagawa An information-geometric interpretation of the partitioning of goodness-  
 (Meisei Univ./RIKEN) of-fit test statistics for symmetry in square contingency tables  
 Takeru Matsuda  
 (Univ. of Tokyo/RIKEN)  
 Kouji Tahata (Tokyo Univ. of Sci.)

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

# 応 用 数 学

9月16日(火) 第V会場

9:30~11:45

- 1 松 田 一 徳 (北 見 工 大 工) 誘導マッチング数が  $p$ , 最小マッチング数が  $q$ , マッチング数が  $r$  となる  
連結単純グラフの辺数の最小値について ..... 15
- Kazunori Matsuda The minimum number of edges of connected graphs with  $\text{ind-match}(G) =$   
(Kitami Inst. of Tech.)  $p$ ,  $\text{min-match}(G) = q$  and  $\text{match}(G) = r$

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

- 2 藤 田 慎 也 グラフにおける高連結性を維持するパスについて ..... 10  
(横浜市大データサイエンス)

Shinya Fujita (Yokohama City Univ.) High connectivity keeping paths in graphs

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

- 3 中 本 敦 浩 (横浜国大環境情報) 4-Polychromatic 5-coloring of subcubic plane graphs ..... 15

松 本 直 己 (琉 球 大 教 育)

若 山 響 介 (横浜国大環境情報)

A. A. Aradais (ミンダナオ州立大)

Atsuhiko Nakamoto

(Yokohama Nat. Univ.)

Naoki Matsumoto (Univ. of Ryukyus)

Kyosuke Wakayama

(Yokohama Nat. Univ.)

Alkajim Ahadi Aradais

(Mindanao State Univ.)

4-Polychromatic 5-coloring of subcubic plane graphs

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

- 4 佐 竹 翔 平 On the embeddability of the Markoff mod  $p$  graph ..... 15

(熊本大半導体・デジタル研究教育機構)

山 崎 義 徳 (愛 媛 大 理)

Shohei Satake (Kumamoto Univ.)

Yoshinori Yamasaki (Ehime Univ.)

On the embeddability of the Markoff mod  $p$  graph

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

- 5 E. G. Escolar (神戸大人間発達環境) Barcoding invariants and their equivalent discriminating power ..... 15  
Woojin Kim (KAIST)  
Emerson Gaw Escolar (Kobe Univ.) Barcoding invariants and their equivalent discriminating power  
Woojin Kim (KAIST)

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

- 6 松村英樹 (都立大理) 楕円デザインと Prouhet–Tarry–Escott 問題 ..... 15  
澤正憲 (神戸大システム情報)  
Hideki Matsumura Ellipsoidal designs and the Prouhet–Tarry–Escott problem  
(Tokyo Metro. Univ.)  
Masanori Sawa (Kobe Univ.)

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

- 7 田丸智稀 (神戸大システム情報) Barnes–Wall 格子および shorter Leech 格子における subdesign problem  
澤正憲 (神戸大システム情報) ..... 15  
平尾将剛 (愛知県立大情報)  
Tomoki Tamaru (Kobe Univ.) The subdesign problem in the Barnes–Wall and shorter Leech lattices  
Masanori Sawa (Kobe Univ.)  
Masatake Hirao (Aichi Pref. Univ.)

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

- 8 坂内 英一 (九大\*)  $m$ -stiff 配置の存在・非存在について ..... 15  
 栗原 大武 (山口大創成)  
 野崎 寛 (愛知教育大教育)  
 Eiichi Bannai (Kyushu Univ.\*) On the existence and non-existence of spherical  $m$ -stiff configurations  
 Hirotake Kurihara (Yamaguchi Univ.)  
 Hiroshi Nozaki (Aichi Univ. of Edu.)

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

#### 14:15~15:15 特別講演

- 平尾 将剛 (愛知県立大情報) 球面上のデザイン理論とその応用  
 Masatake Hirao (Aichi Pref. Univ.) Spherical design theory and its applications

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

#### 15:30~16:35

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

**概要** A combinatorial  $3-(v, 4, 1)$  design is also called a Steiner quadruple system (SQS) of order  $v$ . Given an SQS, *nested pairings* arise by partitioning each block into two unordered pairs. Such a pairing is *completely uniform* if every possible pair of points appears with the same multiplicity. This talk presents an explicit construction of completely uniform nested pairings in Boolean SQSs of order  $2^m$  for all odd  $m \geq 3$ , together with analogous existence results for even  $m$ . These results resolve two open problems posed by Chee et al. (2025) on the existence of such designs.

- 10 稲垣 宗矩 (神戸大工) 多次元 PTE 問題と組合せデザイン I ..... 15  
 内田 幸寛 (都立大理)  
 澤 正憲 (神戸大工)  
 松村 英樹 (都立大理)  
 Munenori Inagaki (Kobe Univ.) The multidimensional Prouhet–Tarry–Escott problem and combinato-  
 Yukihiro Uchida (Tokyo Metro. Univ.) rial designs I  
 Masanori Sawa (Kobe Univ.)  
 Hideki Matsumura  
 (Tokyo Metro. Univ.)

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

- 11 宮本 暢子 (東京理大創域理工) Mutually orthogonal block sequences and spreads in a finite projective  
 地 寄 頌 子 (大阪工大情報) space ..... 15  
 藤原 良 (筑波大\*)  
 Nobuko Miyamoto (Tokyo Univ. of Sci.) Mutually orthogonal block sequences and spreads in a finite projective  
 Shoko Chisaki (Osaka Inst. of Tech.) space  
 Ryoh Fuji-Hara (Univ. of Tsukuba\*)

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

- 12 松原 和樹 (埼玉大教育) A construction of regular rectangular designs ..... 15  
 地 寄 頌 子 (大阪工大情報)  
 藤原 良 (筑波大\*)  
 宮本 暢子 (東京理大創域理工)  
 Kazuki Matsubara (Saitama Univ.) A construction of regular rectangular designs  
 Shoko Chisaki (Osaka Inst. of Tech.)  
 Ryoh Fuji-Hara (Univ. of Tsukuba\*)  
 Nobuko Miyamoto (Tokyo Univ. of Sci.)

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

**16:50~17:50 特別講演**

萩田 真理子 (お茶の水女大理) 離散数学の印象評価への応用

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

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

9月17日(水) 第V会場

**9:00~11:50**

- 13 穂坂 大 将 (横浜国大環境情報) 橋を持つグラフ上の量子ウォークの拍動現象 ..... 15

瀬川 悦 生 (横浜国大環境情報)

Taisuke Hosaka (Yokohama Nat. Univ.) Pulsation of quantum walk on graph with bridge

Etsuo Segawa (Yokohama Nat. Univ.)

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

- 14 釣井 達也 (東京情報大総合情報) 発展行列から得られる群構造を用いた Fourier walk の周期性に関する研究

伊藤 直 治 (奈良教育大教育)

川端 一 輝 (高槻市立柳川中)

Tatsuya Tsuri (Tokyo Univ. of Information Sci.) A study on periodicity of Fourier walk using group structures obtained from its evolution matrix

Naoharu Ito (Nara Univ. of Edu.)

Itsuki Kawabata

(Takatsuki Yanagawa Junior High School)

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

- 15 関 藤 寛 人 (横浜国大環境情報) カバーリンググラフから定まる量子グラフウォークの周期性 ..... 15  
 瀬 川 悦 生 (横浜国大環境情報)  
 Hiroto Sekido (Yokohama Nat. Univ.) Periodicity of quantum graph walks defined by covering graphs  
 Etsuo Segawa (Yokohama Nat. Univ.)

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

- 16 齋 藤 湊 (日 大 文 理) 量子探索アルゴリズムのスペクトル写像定理 ..... 15  
 井 手 勇 介 (日 大 文 理)  
 今 野 紀 雄 (日 大 文 理)  
 齊 藤 和 広 (KDDI 総合研)  
 渡 邉 聡 (KDDI 総合研)  
 Kei Saito (Nihon Univ.) A spectral mapping theorem for the quantum searching algorithm via  
 Yusuke Ide (Nihon Univ.) quantum walks  
 Norio Konno (Nihon Univ.)  
 Kazuhiro Saito (KDDI Research, Inc.)  
 Satoshi Watanabe  
 (KDDI Research, Inc.)

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

- 17 鷲 野 朋 広 (奈 良 工 高 専) 真のパラメータ集合の定義方程式 ..... 15  
 高 橋 正 (羽衣国際大現代社会)  
 Tomohiro Washino Defining equations of the set of true parameters  
 (Nat. Inst. of Tech., Nara Coll.)  
 Tadashi Takahashi  
 (Hagoromo Univ. of Int. Stud.)

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



- 18 谷口 礼偉 (三重 大\*) 2 回の  $(n \text{ ビット}) \times (n \text{ ビット})$  乗算による非再帰型  $n \text{ ビット}$  擬似乱数の生成 ( $n = 64, 128, 192, \dots, 16384$ ) ..... 15
- Hirotake Yaguchi (Mie Univ.\*) Generation of nonrecursive  $n$ -bit pseudorandom numbers by two times  $(n\text{-bit}) \times (n\text{-bit})$  multiplication ( $n = 64, 128, 192, \dots, 16384$ )

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

- 19 永野 哲也 (長崎県立大\*) フィンスラー暗号に基づくデジタル署名システムの偽造不可能性に向けて ..... 15
- Tetsuya Nagano (Univ. of Nagasaki\*) Note on unforgeability of a digital signature scheme based on Finsler encryption

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

This work is conducted in collaboration with Mr. Masayuki Fukumitsu of the University of Nagasaki.

- 20 鹿島 柁 (慶大理工) Claw-free グラフにおける連結成分数の小さい 2-因子の存在を保証する最小次数和条件 ..... 15
- Masaki Kashima (Keio Univ.) Degree sum condition for claw-free graphs to have a 2-factor with few components

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

- 21 藤沢 潤 (慶大商) 非 2 部正則グラフにおけるマッチング拡張問題 ..... 15
- Jun Fujisawa (Keio Univ.) Matching extension in regular non-bipartite graphs

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

- 22 野口 健太 (東京理大創域理工) HIST をもつ/もたない 4-連結グラフ ..... 15
- Kenta Noguchi (Tokyo Univ. of Sci.) 4-connected graphs with and without HISTs

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



## 13:10~14:00

- 23 佐藤 巖 (小山工高専) A characteristic polynomial for the transition probability matrix of a  
 小松 堯 (山梨大工) correlated random walk on a graph ..... 15  
 今野 紀雄  
 (立命館大理工・横浜国大\*)

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

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

- 24 渡邊 康聖 (名大多元数理) ハイパーグラフの Bartholdi ゼータ関数に対する被覆の分解公式 ..... 15  
 Kosei Watanabe (Nagoya Univ.) A decomposition formula of a Bartholdi zeta function of some covering  
 of a hypergraph

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

- 25 小松 堯 (山梨大工) 被覆グラフ上の行列ゼータ関数 ..... 15  
 今野 紀雄  
 (立命館大理工・横浜国大\*)

佐藤 巖 (小山工高専)  
 三橋 秀生 (法政大理工)  
 Takashi Komatsu (Univ. of Yamanashi) Matrix zeta function on covering graphs  
 Norio Konno  
 (Ritsumeikan Univ./Yokohama Nat. Univ.\*)  
 Iwao Sato (Oyama Nat. Coll. of Tech.)  
 Hideo Mitsuhashi (Hosei Univ.)

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

## 9月18日(木) 第V会場

## 10:00~12:00

- 26 池田 幸太 (明大総合数理) 最適速度モデルから導出される差分微分方程式における周期解の特徴づけ  
 宮路 智行 (京大 理) ..... 15  
Kota Ikeda (Meiji Univ.) Characterization of a periodic solution in a differential-difference equation derived from the optimal velocity model  
Tomoyuki Miyaji (Kyoto Univ.)

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

- 27 井倉(参納)弓彦 (明大総合数理) Greenberg–Hastings セルオートマトンがつくる 周期解について ..... 15  
 二宮 広和 (明大総合数理)  
Yumihiko S. Ikura (Meiji Univ.) On periodic solutions generated by Greenberg–Hastings cellular automata  
Hirokazu Ninomiya (Meiji Univ.)

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

- 28 武村 一雄 (日大理工一般数学)  $(-1)^M(d/dx)^{2M}$  型線形常微分方程式に対する非局所多点境界値問題のグリーン関数 ..... 15  
Kazuo Takemura (Nihon Univ.) Green's function for nonlocal multipoint boundary value problems of the linear differential operator  $(-1)^M(d/dx)^{2M}$

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

- 29 石 渡 哲 哉 (芝浦工大システム理工) 分布型遅延の解の爆発に与える影響についての考察 ..... 15  
 市 田 優 (関西学院大理)  
 中 田 行 彦 (青学大理工)  
Tetsuya Ishiwata (Shibaura Inst. of Tech.) On the effects of distributed delays on blow-up of solutions  
 Yu Ichida (Kwansei Gakuin Univ.)  
 Yukihiro Nakata (Aoyama Gakuin Univ.)

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

- 30 穴 田 浩 一 (早大高等学院) 曲線短縮問題に現れる準線形放物型偏微分方程式の Type II 爆発解の振  
石 渡 哲 哉 (芝浦工大システム理工) る舞いに関する一考察 ..... 15  
 牛 島 健 夫 (東京理大理工)  
Koichi Anada (Waseda Univ. Senior High School) Remarks on behavior for Type II blow-up solutions of a quasilinear  
Tetsuya Ishiwata (Shibaura Inst. of Tech.) parabolic equation in the curve shortening problems  
 Takeo Ushijima (Tokyo Univ. of Sci.)

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

- 31 村 川 秀 樹 (龍谷大先端理工) 細胞選別現象における走触性と走化性の関係 ..... 15  
 田 中 吉 太 郎 (公立はこだて未来大)  
Hideki Murakawa (Ryukoku Univ.) A relationship between haptotaxis and chemotaxis in cell sorting phe-  
 Yoshitaro Tanaka (Future Univ.-Hakodate) nomena

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

- 32 近藤真純 (岡山理大理工) Conditional Ulam stability for the Gompertz model ..... 15  
 鬼塚政一 (岡山理大理) .....  
 Masumi Kondo (Okayama Univ. of Sci.) Conditional Ulam stability for the Gompertz model  
 Masakazu Onitsuka  
 (Okayama Univ. of Sci.)

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

#### 14:15~16:00

- 33 市田 優 (関西学院大理) マイクロマシン挙動の数理モデルにおけるプルインとタッチダウン現象  
 山根大輔 (立命館大理工) ..... 15  
 Yu Ichida (Kwansei Gakuin Univ.) Pull-in and touchdown phenomena in mathematical models of micro-  
 Daisuke Yamane (Ritsumeikan Univ.) machine behavior

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

- 34 河原一幾 (名大多元数理) Operator splitting を用いた遅延微分方程式の fractional domain におけ  
 る数値解の近似誤差評価について ..... 15  
 Hideki Kawahara (Nagoya Univ.) Numerical approximation of delay differential equations via operator  
 splitting in fractional domains

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

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

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

- 35 渡部善隆 平行円板間の層流を記述する Elkhouch 問題に対する精度保証付き数値計算  
 (九大情報基盤研究開発センター) ..... 15  
 Shuting Cai  
 (Fujian Jiangxia Univ.)  
 Yoshitaka Watanabe (Kyushu Univ.) Numerical verification for Elkhouch's problem representing fluid flow be-  
 Shuting Cai (Fujian Jiangxia Univ.) tween parallel circular disks

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

- 36 土 屋 拓 也 (明治学院大経済) あるベクトル場の波動方程式における構造保存数値計算について ..... 15  
 Takuya Tsuchiya (Meiji Gakuin Univ.) On structure-preserving numerical calculation of wave equation for a vector field

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

- 37 高 安 亮 紀 (筑波大システム情報) Swift–Hohenberg 方程式におけるサドル・サドル型不安定接続軌道の計算機援用証明 ..... 15  
 Akitoshi Takayasu (Univ. of Tsukuba) Computer-assisted proof of a saddle-to-saddle connection in the Swift–Hohenberg equation

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

- 38 奥 村 真 善 美 (甲南大知能情報) 平方差分を用いた動的境界条件下の Cahn–Hilliard 方程式に対する差分スキーム ..... 15  
 Makoto Okumura (Konan Univ.) A finite difference scheme for the Cahn–Hilliard equation with dynamic boundary conditions using a nonlinear difference

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

#### 16:15～17:15 2024年度日本数学会応用数学賞受賞特別講演

- 木 村 正 人 (金 沢 大 理 工) 不可逆破壊フェーズフィールドモデル: エネルギー散逸構造と応用展開  
 Masato Kimura (Kanazawa Univ.) Irreversible fracture phase field models: Energy dissipation structure and applications

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

9月19日(金) 第V会場

#### 10:00～12:00

- 39 堀 口 俊 二 Extended Schröder’s method ..... 10  
 Shunji Horiguchi Extended Schröder’s method

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

- 40 堀 口 俊 二 Relations between Newton's method, the extended Newton's method, Schröder's method and interior, exterior division points ..... 7  
 Shunji Horiguchi Relations between Newton's method, the extended Newton's method, Schröder's method and interior, exterior division points

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

- 41 坂 口 文 則 (福 井 大 工) 連分数・ユークリッド互除法と微分方程式整数型解法 ..... 15  
 Fuminori Sakaguchi (Univ. of Fukui) Continued fractions, Euclidean algorithm and an integer-type algorithm for solving ODEs

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

- 42 中 安 淳 (東 大 工) On a calculation method of the thickness via partial differential equations ..... 15  
 山 田 崇 恭 (東 大 工) Atsushi Nakayasu (Univ. of Tokyo) On a calculation method of the thickness via partial differential equations  
 Takayuki Yamada (Univ. of Tokyo)

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

- 43 菅 徹 (阪 公 大 理) Asymmetric front propagation in the bistable reaction-diffusion equation on a metric graph ..... 15  
 森 田 善 久 (龍 谷 大\*) Toru Kan (Osaka Metro. Univ.)  
 中 村 健 一 (明大研究・知財) Yoshihisa Morita (Ryukoku Univ.\*)  
 Chang-Hong Wu Ken-Ichi Nakamura (Meiji Univ.)  
 (National Yang Ming Chiao Tung Univ.)  
 Chang-Hong Wu  
 (National Yang Ming Chiao Tung Univ.)

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

- 44 矢ヶ崎 一幸 (京大情報) Bifurcations of synchronized solutions in the Kuramoto model with two-mode interaction depending on two graphs ..... 15

Kazuyuki Yagasaki (Kyoto Univ.) Bifurcations of synchronized solutions in the Kuramoto model with two-mode interaction depending on two graphs

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

- 45 古屋 貴士 (同志社大生命医) Transformers are universal in-context learners ..... 15

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

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

- 46 川 澄 亮 太 Orlicz ノルムに基づく neural ODE の普遍近似性について ..... 15

(群馬大数理データ科学教育研究センター)

池 田 正 弘 (阪大情報)

Ryota Kawasumi (Gunma Univ.) Universal approximation property of neural ODEs via Orlicz norms

Ikeda Masahiro (Univ. of Osaka)

概要 In this talk, we investigate the class of continuous functions representable by invertible neural networks based on Neural ODE architectures. Orlicz spaces are a class of function spaces that generalize classical Lebesgue spaces. Here, we assume that the Orlicz spaces under consideration, such as the  $L \log L$  space, satisfy the  $\Delta_2$ -condition. To this end, we first introduce the notion of an Orlicz universal approximator. Next, we prove the smooth Orlicz approximation theorem, using the properties of mollifiers in Orlicz spaces. Finally, we demonstrate the compatibility of composition and approximation in Orlicz spaces, and establish the Orlicz-universal approximation property for the images of Lipschitz functions under ODE flow maps.



## 14:15~16:00

- 47 劉 恩 豪 (京 大 理) Interval multiplicities of persistence modules ..... 15  
 浅 芝 秀 人 (静 岡 大\*)

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

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

- 48 竹 田 航 太 (名 大 工) ノイズを含む部分観測に対する ensemble Kalman filter の誤差解析 ..... 15  
 Kota Takeda (Nagoya Univ.) Error analysis of the ensemble Kalman filter with partial and noisy observations

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

- 49 鍛 治 俊 輔 (名城大理工) An inverse problem of partial differential equation for the future of interest rate ..... 15  
 大 田 靖 (桃山学院大経営)  
 Shunsuke Kaji (Meijo Univ.) An inverse problem of partial differential equation for the future of interest rate  
 Yasushi Ota (St. Andrew's Univ.)

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

- 50 大 西 勇 (広島大理) Comparative analysis of control strategies for a linear system with noise ..... 15  
 Isamu Ohnishi (Hiroshima Univ.) Comparative analysis of control strategies for a linear system with noise

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



- 51 大西 勇 (広島大理) Stochastic model predictive control of cheer spikes and low-frequency noise in outdoor festivals ..... 15
- Isamu Ohnishi (Hiroshima Univ.) Stochastic model predictive control of cheer spikes and low-frequency noise in outdoor festivals

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

- 52 岡本 陸希 (立命館大理工) 量子ウォークに対する条件付き最大値の分布について ..... 15  
今野 紀雄  
(立命館大理工・横浜国大\*)  
赤堀 次郎 (立命館大理工)  
小山 翔平 (立命館大理工)  
Rikuki Okamoto (Ritsumeikan Univ.) On the distribution of conditional maxima for quantum walks  
Norio Konno  
(Ritsumeikan Univ./Yokohama Nat. Univ.\*)  
Jiro Akahori (Ritsumeikan Univ.)  
Syoei Koyama (Ritsumeikan Univ.)

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

#### 16:15～17:15 特別講演

- 関坂 歩幹 (明大総合数理) 進行波の線形安定性と数学的構造: 領域の次元と有界性の観点から  
Ayuki Sekisaka (Meiji Univ.) Spectral stability of traveling waves and mathematical structure: A perspective from domain dimensionality and boundedness

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

## トポロジー

9月16日(火) 第VIII会場

9:30~12:00

- 1 高橋典寿 (立命館大理工) On certain irreducible finite group actions on surfaces ..... 10  
 野澤啓 (立命館大理工)  
 Norihisa Takahashi (Ritsumeikan Univ.) On certain irreducible finite group actions on surfaces  
 Hiraku Nozawa (Ritsumeikan Univ.)

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

- 2 門田直之 (岡山大理) On Nielsen equivalence classes of two-elements generators of mapping  
 廣瀬進 (東京理大理工) class groups ..... 15  
 Naoyuki Monden (Okayama Univ.) On Nielsen equivalence classes of two-elements generators of mapping  
 Susumu Hirose (Tokyo Univ. of Sci.) class groups

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

- 3 河澄響矢 (東大数理) 写像類群の共変係数安定コホモロジー群について ..... 15  
 A. Soulié  
 (Univ. Caen Normandie•CNRS)  
 Nariya Kawazumi (Univ. of Tokyo) On stable covariantly twisted cohomology of the mapping class group  
 Arthur Soulié for surfaces  
 (Univ. Caen Normandie/CNRS)

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

- 4 河澄響矢 (東大数理) Teichmüller 空間上の Weil–Petersson シンプレクティック形式について ..... 15  
 Nariya Kawazumi (Univ. of Tokyo) On the Weil–Petersson symplectic form on the Teichmüller space

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

- 5 逆井 卓也 (東大数理) A variant of groups defined by Kim and Manturov ..... 10  
 田所 勇樹 (東京理大理)  
 田中 心 (東京学大教育)  
 Takuya Sakasai (Univ. of Tokyo) A variant of groups defined by Kim and Manturov  
 Yuuki Tadokoro (Tokyo Univ. of Sci.)  
 Kokoro Tanaka (Tokyo Gakugei Univ.)

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

- 6 大家 佳奈子 (奈良女大人間文化) On the spectrum of the number of geodesics and tight geodesics in the  
 志賀 啓成 (東京科学大\*) curve complex ..... 15  
 松田 凌 (京大理)  
 Kanako Oie (Nara Women's Univ.) On the spectrum of the number of geodesics and tight geodesics in the  
 Hiroshige Shiga (Sci. Tokyo\*) curve complex  
 Ryo Matsuda (Kyoto Univ.)

概要 Let  $S$  be an oriented surface of type  $(g, n)$ , and let  $\mathcal{C}(S)$  be its curve complex. While there are typically infinitely many geodesics between two vertices in  $\mathcal{C}(S)$ , the set of tight geodesics is always finite, and in some cases, even all geodesics can be finite.

We consider the spectrum  $\mathfrak{Sp}_d(S)$  of the number of geodesics of length  $d \geq 2$  in  $\mathcal{C}(S)$ , and the corresponding spectrum  $\mathfrak{Sp}_d^T(S)$  for tight geodesics. We show that  $\mathfrak{Sp}_d(S) \subset \mathfrak{Sp}_d^T(S)$  in general, but  $\mathfrak{Sp}_2(S) = \mathfrak{Sp}_2^T(S)$ . Moreover, we show that  $\mathfrak{Sp}_2(S)$  and  $\mathfrak{Sp}_2^T(g, n)$  are completely determined in terms of  $(g, n)$ .

- 7 和久 田 葵 (東大数理) 向き付け可能曲面上の2つのループの分離判定法と Goldman 括弧積 .. 15  
 Aoi Wakuda (Univ. of Tokyo) A separability criterion for two loops on an orientable surface and the  
 Goldman bracket

概要 In this talk, we give an algebraic criterion, via the Goldman bracket, for when two (not necessarily simple) free homotopy classes of loops on an oriented surface have disjoint representatives. As an application, we determine the center of the Goldman Lie algebra of a pair of pants. We extend Kabiraj's method, which was originally limited to oriented surfaces filled by simple closed geodesics, and show that in this case, the center is generated by the class of loops homotopic to a point, and the classes of loops winding multiple times around a single puncture or boundary component.

- 8 石橋 典 (東北大理) Cyclic quantum Teichmüller theory ..... 15  
 Tsukasa Ishibashi (Tohoku Univ.) Cyclic quantum Teichmüller theory

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

## 14:30~16:00

- 9 藪 口 怜 央 (岡山大環境生命) Knot surgered elliptic surfaces for a  $(2, 2h + 1)$ -torus knot ..... 15  
 門 田 直 之 (岡 山 大 理)  
 Reo Yabuguchi (Okayama Univ.) Knot surgered elliptic surfaces for a  $(2, 2h + 1)$ -torus knot  
 Naoyuki Monden (Okayama Univ.)

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

- 10 高 橋 夏 野 (阪 大 情 報) 種数 2 の相対トライセクションを許容する平面的 3 次元接触多様体の  
 浅 野 喜 敬 (津 山 工 高 専) Stein 充填 ..... 15  
 Natsuya Takahashi (Univ. of Osaka) Stein fillings of planar contact 3-manifolds admitting genus-2 relative  
 Nobutaka Asano trisections  
 (Tsuyama Nat. Coll. of Tech.)

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

- 11 鈴 木 龍 正 (明大研究・知財) 4 次元球面の非単連結な Price ツイスト ..... 15  
 磯 島 司  
 (慶大自然科学研究教育センター)  
 Tatsumasa Suzuki (Meiji Univ.) The non-simply connected Price twist for the 4-sphere  
 Tsukasa Isoshima (Keio Univ.)

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

- 12 丹 下 基 生 (筑波大数理物質) 1-ハンドルを持たないエキゾチック  $E(n)$  について ..... 15  
 Motoo Tange (Univ. of Tsukuba) Exotic  $E(n)$  without 1-handles

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

## 16:30~17:30 特別講演

- 丸 山 修 平 (金 沢 大 理 工) 葉層球面束の Euler 類について  
 Shuhei Maruyama (Kanazawa Univ.) On the Euler class of foliated sphere bundles

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

9月17日(水) 第VI会場

**10:00~10:15 2025年度日本数学会幾何学賞授賞式****10:20~11:20 2025年度日本数学会幾何学賞受賞特別講演 (幾何学分科会と合同)**

松村 慎一 (東北大理) 非負曲率を持つ多様体に対する構造定理

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

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

**12:50~13:50 2025年度日本数学会幾何学賞受賞特別講演 (幾何学分科会と合同)**

永野 幸一 (筑波大数理物質) 曲率が上に有界な距離空間の幾何学について

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

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

## 9月18日(木) 第VIII会場

9:30~11:30

- 13 北澤直樹 (阪公大数学研) Reconstructing Morse functions with prescribed preimages of single points ..... 15

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

概要 We present a fundamental and natural problem on Morse functions, reconstruction of Morse functions with prescribed preimages of single points containing no critical points, which are closed manifolds. This was essentially started by the speaker.

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

- 14 北澤直樹 (阪公大数学研) Reconstructing Morse functions on 3-dimensional compact and connected manifolds with prescribed preimages of single points ..... 10

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

概要 We present the following fundamental and natural problem on Morse functions, essentially started by the speaker: reconstructing Morse functions with prescribed preimages of single points containing no critical points, which are closed manifolds. The speaker has affirmatively solved the case where the dimensions of the manifolds of the domains of the functions are 3-dimensional, completely.

This has been solved in certain situations where connected components of these preimages are boundaries of compact and connected manifolds of a certain class, by the speaker around 2020: especially, in the surface case and the 3-dimensional case before with the preimages being orientable surfaces, this was solved previously.

- 15 北澤直樹 (阪公大数学研) 値域の空間に余次元 0 ではめ込まれたコンパクト多様体を像とするような最も自然な special generic 写像と定義域多様体のコホモロジー環 ... 15

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

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

- 16 加藤 楽人 (日大総合基礎) 3次元多様体から平面への安定写像の構成について ..... 10

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

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

- 17 松原 幸栄 (東北大情報) Euler 標数を判別する ..... 15  
 Saiei-Jaeyeong Matsubara-Heo Distinguishing Euler characteristics  
 (Tohoku Univ.)

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

- 18 平田 康史 (神奈川大工) Irreducible 空間の中への閉部分空間としての埋め込み ..... 15  
 矢島 幸信 (神奈川大\*)  
 Yasushi Hirata (Kanagawa Univ.) Embeddings as closed subspaces into irreducible spaces  
 Yukinobu Yajima (Kanagawa Univ.\*)

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

- 19 友安 一夫 (都城工高専) Gartside's problem and hereditarily normal compactifications of metrizable spaces ..... 15  
 H. Junnila (Univ. of Helsinki)  
 Kazuo Tomoyasu Gartside's problem and hereditarily normal compactifications of metrizable spaces  
 (Nat. Inst. of Tech., Miyakonojo Coll.)  
 Heikki Junnila (Univ. of Helsinki)

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

#### 14:15~16:00

- 20 瀧脇 迪哲 (京大理) An isometry theorem induced by the Radon transform between the convolution and interleaving distances ..... 15  
 Michiaki Takiwaki (Kyoto Univ.) An isometry theorem induced by the Radon transform between the convolution and interleaving distances

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



- 21 栗林勝彦 (信州大理) Algebraic interleavings of spaces over the classifying space of the circle  
 内藤貴仁 (日本工大共通教育) ..... 15  
 若月駿 (名大多元数理)  
 山口俊博 (高知大教育)

Katsuhiko Kuribayashi (Shinshu Univ.) Algebraic interleavings of spaces over the classifying space of the circle  
 Takahito Naito (Nippon Inst. of Tech.)  
 Shun Wakatsuki (Nagoya Univ.)  
 Toshihiro Yamaguchi (Kochi Univ.)

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

- 22 田中康平 (信州大経法) Directed homotopy theory on stratified spaces and small categories ... 15  
 Kohei Tanaka (Shinshu Univ.) Directed homotopy theory on stratified spaces and small categories

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

- 23 多寶雅樹 (東大数理) 距離に類似した関数族に基づく位相とディフェオロジー ..... 15  
 Masaki Taho (Univ. of Tokyo) Topology and diffeology via metric-like functions

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

- 24 原口忠之 (奈良学園人間教育) 微分空間の随伴空間に関すること ..... 15  
 島川和久 (岡山大\*)

Tadayuki Haraguchi Adjunction spaces of diffeological spaces  
 (Naragakuen Univ.)  
 Kazuhisa Shimakawa (Okayama Univ.\*)

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

#### 16:30~17:30 特別講演

秋田利之 (北大理) カンドルの付随群, Wirtinger 表示, 群のホモロジー

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

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



## 9月19日(金) 第VIII会場

## 9:30~12:00

- 25 姫野圭佑 (広島大先進理工) トーラス結び目のバンド解消数 ..... 10  
 Keisuke Himeno (Hiroshima Univ.) The unoriented band unknotting number of torus knots

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

- 26 伊藤哲也 (京大理) Slice Cromwell inequality of homogeneous knots ..... 10  
 Tetsuya Itoh (Kyoto Univ.) Slice Cromwell inequality of homogeneous knots

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

- 27 三木裕次郎 2成分絡み目に対する4移動と河内の予想 ..... 10  
 和田康載 (神戸大理)  
 Yujiro Miki 4-moves and Kawauchi's conjecture for 2-component links  
 Kodai Wada (Kobe Univ.)

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

- 28 伊藤昇 (信州大工) Arnold strangeness of surface immersions ..... 15  
 水野弘基 (信州大総合医理工)  
 Noboru Ito (Shinshu Univ.) Arnold strangeness of surface immersions  
 Hiroki Mizuno (Shinshu Univ.)

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

- 29 櫻井みぎ和 (芝浦工大工) Infinitely many virtual knots which have any given sequence of  $n$ -writhes  
 大山淑之 (東京女大数理) ..... 10  
Migiwa Sakurai Infinitely many virtual knots which have any given sequence of  $n$ -writhes  
 (Shibaura Inst. of Tech.)  
 Yoshiyuku Ohyama  
 (Tokyo Woman's Christian Univ.)

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

- 30 佐藤 進 (神戸大理) 2次元リボン結び目の  $\alpha_2$ -不変量とガウス図式 ..... 10  
 Shin Satoh (Kobe Univ.) The  $\alpha_2$ -invariant of a ribbon 2-knot and a Gauss diagram

概要 Let  $K$  be a ribbon 2-knot, and  $R$  a ribbon disk presentation of  $K$ . Then we prove that the  $\alpha_2$ -invariant of  $K$  is coincident with the sum of signs of interleaved pairs of ribbon intersections of  $R$ . This is related to the  $v_{2,1}$ -invariant of a long virtual knot due to Goussarov-Polyak-Viro by identifying a linear ribbon disk and a diagram of a long virtual knot.

- 31 中村伊南沙 (佐賀大理工) Dotted diagrams の変形と reduced diagrams ..... 10  
 Inasa Nakamura (Saga Univ.) Deformations of dotted diagrams and reduced diagrams

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

- 32 中村伊南沙 (佐賀大理工) トーラス被覆結び目の結び目群の既約なメタベリアン  $SU(2)$ -表現 ..... 10  
 Inasa Nakamura (Saga Univ.) Torus-covering knot groups and their irreducible metabelian  $SU(2)$ -representations

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

- 33 石川 勝巳 (京大数理研) 結び目の TAV 群について ..... 10  
 鈴木 正明 (明大総合数理)  
森 藤 孝之 (慶大経済)  
 Katsumi Ishikawa (Kyoto Univ.) On TAV groups of knots  
 Masaaki Suzuki (Meiji Univ.)  
Takayuki Morifuji (Keio Univ.)

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

- 34 松嶋 柚希 (都立大理)  $r^2$  周期をもつ結び目の HOMFLY 多項式について ..... 15  
 Yuki Matsushima (Tokyo Metro. Univ.) On the HOMFLY polynomial of an  $r^2$ -periodic knot

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

- 35 中兼 啓太 Twists on Frobenius algebra and link homology ..... 10  
 吉田 純 (理化学研)  
 伊藤 昇 (信州大工)  
 Keita Nakagane Twists on Frobenius algebra and link homology  
 Jun Yoshida (RIKEN)  
 Noboru Ito (Shinshu Univ.)

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

#### 14:15~16:30

- 36 久保田 肇 (京大理) Diagonal knot の grid homology について ..... 15  
 Hajime Kubota (Kyoto Univ.) On grid homology for diagonal knots

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

- 37 土見 怜史 (近畿大総合理工) Kontsevich 関数と Zwegers  $\mu$  関数 ..... 15  
 Satoshi Tsuchimi (Kindai Univ.) The Kontsevich function and the Zwegers'  $\mu$ -function

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

- 38 菅原 朔見 (北大理) 組合せ的直線配置から定まる 3 次元多様体のコホモロジー環について .. 15  
 Sakumi Sugawara (Hokkaido Univ.) The comology ring of the 3-manifold defined from a combinatorial line arrangement

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

- 39 古宇田 悠哉 (慶大経済・広島大SKCM2) Heegaard 分解の強既約性と Goeritz 群の有限性の判定条件 ..... 15  
 高尾 和人 (東北大情報)  
 Yuya Koda (Keio Univ./Hiroshima Univ.) Diagrammatic criteria for strong irreducibility of Heegaard splittings  
 and finiteness of Goeritz groups  
 Kazuto Takao (Tohoku Univ.)

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

- 40 堤 康嘉 (神戸親和大教育) Lescop invariants of both the Brieskorn–Hamm manifolds obtained by  
 Dehn surgeries on knots in an integral homology 3-sphere ..... 10  
 Yasuyoshi Tsutsumi (Kobe Shinwa Univ.) Lescop invariants of both the Brieskorn–Hamm manifolds obtained by  
 Dehn surgeries on knots in an integral homology 3-sphere

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

- 41 市原 一裕 (日大文理) 結び目補空間予想と矯飾の手術について ..... 15  
 斎藤 敏夫 (上越教育大)  
 鄭 仁大 (近畿大理工)  
 Kazuhiro Ichihara (Nihon Univ.) On the knot complement conjecture and cosmetic surgery  
 Toshio Saito (Joetsu Univ. of Edu.)  
 Jong In Dae (Kindai Univ.)

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

## 無 限 可 積 分 系

9月16日(火) 第VII会場

9:30~11:45

- 1 重 富 尚 太 (九 大 I M I) カライドサイクルの存在証明 ..... 15  
 梶 原 健 司 (九 大 I M I)  
 鍛 冶 静 雄 (九大IMI・京大理)  
Shota Shigetomi (Kyushu Univ.) A proof of existence of Kaleidocycle  
Kenji Kajiwara (Kyushu Univ.)  
Shizuo Kaji  
 (Kyushu Univ./Kyoto Univ.)

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

- 2 S. M. Mihalache (東 大 数 理) From polygon equations to simplex equations ..... 15  
 持 田 知 朗 (東 北 大 理)  
Serban Matei Mihalache From polygon equations to simplex equations  
 (Univ. of Tokyo)  
Tomoro Mochida (Tohoku Univ.)

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

- 3 澁 川 陽 一 (北 大 理) 籐上のヤン・バクスター方程式とガーサイド理論 (1) ..... 15  
D. Ferri (Univ. of Turin)  
Youichi Shibukawa (Hokkaido Univ.) Quiver-theoretic Yang-Baxter equation and Garside theory (1)  
Davide Ferri (Univ. of Turin)

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

- 4 澁 川 陽 一 (北 大 理) 籐上のヤン・バクスター方程式とガーサイド理論 (2) ..... 15  
D. Ferri (Univ. of Turin)  
Youichi Shibukawa (Hokkaido Univ.) Quiver-theoretic Yang-Baxter equation and Garside theory (2)  
Davide Ferri (Univ. of Turin)

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

- 5 河本陽介 (岡山大環境生命) Boundary Feller–Dynkin processes associated with Laguerre processes  
 A. I. Bufetov ..... 15  
 (Steklov Math. Inst. RAS, etc.)
- Yosuke Kawamoto (Okayama Univ.) Boundary Feller–Dynkin processes associated with Laguerre processes  
 Alexander I. Bufetov  
 (Steklov Math. Inst. RAS, etc.)

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

- 6 大久保勇輔 (摂南大工)  $N=1$  超対称 Virasoro 代数と自由 fermion 代数の直和の  $q$ -変形における  
 Kac 行列式 ..... 15
- Yusuke Ohkubo (Setsunan Univ.) Kac determinant for a  $q$ -deformation of the direct sum of the  $N=1$  super  
 Virasoro algebra and the free fermion algebra

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

- 7 井上玲 (千葉大理) トーラス上の量子化 6 頂点模型 ..... 15  
 国場敦夫 (東大総合文化)  
 寺嶋侑二 (東北大理)  
 八木絢彌 (清華大)
- Rei Inoue (Chiba Univ.) Quantized six-vertex model on a torus  
 Atsuo Kuniba (Univ. of Tokyo)  
 Yuji Terashima (Tohoku Univ.)  
 Junya Yagi (Tsinghua Univ.)

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

- 8 大島利雄 (東大\*) 超平面配置に対数的特異点をもつ Pfaff 系の変換 ..... 15
- Toshio Oshima (Univ. of Tokyo\*) Transformations of Pfaffian systems with logarithmic singularities along  
 hyperplane arrangements

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

## 14:15~15:20

- 9 渋川元樹 (北見工大工) A degeneration of the generalized Zwegers'  $\mu$ -function according to the  
 土見怜史 (近畿大総理工) Ramanujan difference equation ..... 15  
Genki Shibukawa A degeneration of the generalized Zwegers'  $\mu$ -function according to the  
 (Kitami Inst. of Tech.) Ramanujan difference equation  
 Satoshi Tsuchimi (Kindai Univ.)

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

- 10 大山陽介 (徳島大理工) Connection problems on  $q$ -Lommel functions ..... 15  
 Yousuke Ohyama (Tokushima Univ.) Connection problems on  $q$ -Lommel functions

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

- 11 新井由美 On  $q$ -middle convolution and generalized  $q$ -hypergeometric equation .. 15  
 (お茶の水女大人間文化)  
 Yumi Arai (Ochanomizu Univ.) On  $q$ -middle convolution and generalized  $q$ -hypergeometric equation

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

- 12 藤井大計 (神戸大理) Kajihara の  $q$  超幾何関数  $\Phi_{1,1}^m, \Phi_{2,0}^m$  の線形関係式 ..... 15  
 信川喬彦 (皇學館大教育)  
Taikei Fujii (Kobe Univ.) Linear relations for Kajihara's  $q$ -hypergeometric series  $\Phi_{1,1}^m$  and  $\Phi_{2,0}^m$   
 Nobukawa Takahiko (Kogakkan Univ.)

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

**15:30~16:30 特別講演**

間瀬 崇史 (東大数理) Exact calculation of degrees for lattice equations  
 Takafumi Mase (Univ. of Tokyo) Exact calculation of degrees for lattice equations

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

## 9月17日(水) 第VII会場

**9:30~10:35**

- 13 島崎 達史 (神戸大理) Grothendieck 多項式の特殊値と超幾何関数との関係 ..... 15  
 信川 喬彦 (皇學館大教育)  
 藤井 大計 (神戸大理)  
 Tatsushi Shimazaki (Kobe Univ.) PECIAL values of Grothendieck polynomials in terms of hypergeometric  
 Takahiko Nobukawa (Kogakkan Univ.) functions  
 Taikei Fujii (Kobe Univ.)

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

- 14 新川 恵理子 (東北大MathCCS) Virasoro action on Schur Q-functions and Pfaffian identities ..... 15  
 青影 一哉 (有明工高専)  
 山田 裕史 (立教大理)  
 Eriko Shinkawa (Tohoku Univ.) Virasoro action on Schur Q-functions and Pfaffian identities  
 Kazuya Aokage  
 (Ariake Nat. Coll. of Tech.)  
 Hirofumi Yamada (Rikkyo Univ.)

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



- 15 濱 中 真 志 (名大多元数理) 4次元 Wess–Zumino–Witten 模型のソリトン解と共鳴 ..... 15  
 Shangshuai Li (上 海 大)  
 Shan-Chi Huang (名大多元数理)  
 Da-Jun Zhang (上 海 大)  
 Masashi Hamanaka (Nagoya Univ.) Four-dimensional Wess–Zumino–Witten model and soliton resonances  
 Shangshuai Li (Shanghai Univ.)  
 Shan-Chi Huang (Nagoya Univ.)  
 Da-Jun Zhang (Shanghai Univ.)

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

- 16 高 崎 金 久 (阪公大数学研・京大\*) Large BKP vs. B-Toda in Lax–Sato form ..... 15  
 Kanehisa Takasaki Large BKP vs. B-Toda in Lax–Sato form  
 (Osaka Metro. Univ./Kyoto Univ.\*)

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

#### 10:45～11:45 特別講演

- 児 玉 裕 治 (Ohio State Univ.)<sup>b</sup> KP solitons and the Schottky uniformization  
 Yuji Kodama (Ohio State Univ.) KP solitons and the Schottky uniformization

概要 Real and regular soliton solutions of the KP hierarchy have been classified in terms of the totally nonnegative (TNN) Grassmannians. These solitons are referred to as KP solitons, and they are expressed as singular (tropical) limits of shifted Riemann theta functions.

In the talk, for each element of the TNN Grassmannian, we construct a Schottky group, which uniformizes the Riemann surface associated with a real and regular finite-gap solution. Then we show that the KP solitons are obtained by degenerating these finite-gap solutions.

This talk is based on a collaborative work with Takashi Ichikawa (Saga University)