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The Mathematical Society of Japan

2022 Autumn Meeting

Titles and Short Summaries of the Talks

September, 2022

at Hokkaido University

2022 The Mathematical Society of Japan

AUTUMN MEETING

Dates: September 13th (Tue)–16th (Fri), 2022

Venue: Institute for the Advancement of Higher Education
Hokkaido University
Kita 17, Nishi 8, Kita-Ku, Sapporo
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The Mathematical Society of Japan

	I E208	II E310	III N304	IV N2	V E301	VI N1	VII N302	VIII E214	IX E308
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Plenary Talks

September 14th (Wed) Daikodo, 1F, Inst. for the Adv. of Higher Edu.

Award Lecture for the 2022 MSJ Autumn Prize

Autumn Prize Winner ..... (15:50–16:50)

Osamu Saeki (Kyushu Univ.) Global singularity theory of generic differentiable maps ... (17:10–18:10)

Summary: One of the most popular methods to study the topological structure of a given differentiable manifold is to use Morse functions. Such functions can be regarded as generic differentiable maps into the real line. Then, what happens if we consider generic maps into general dimensional Euclidean spaces or manifolds? This might have been a motivation of Whitney or Thom around the middle of the 20th century for studying singularities of differentiable maps between manifolds. In this talk, following such an idea, the speaker will survey some studies of structures of manifolds by using generic differentiable maps, and some global studies of generic differentiable maps with singularities themselves, including recent developments.

Featured Invited Talks

September 13th (Tue)

Conference Room IV

Tôru Umeda (Osaka Metro. Univ.)♭ The Capelli identities, past, present, and the future ····· (13:00–14:00)

Summary: The Capelli identities have been useful tools in the classical invariant theory. A notable use, aside from the works by Capelli himsels, is seen in the famous book by Hermann Weyl, The Classical Groups. But, their representation theoretic meaning were not so clear, and acturally clarified, for example, by Roger Howe's paper "Remarks on Classical Inveriant Theory". Also, some generalization were given by a paper by Howe-Umeda around 1990. Since then, many investigations came up in many directions.
I would like to explain, for geneneral audience, the basic ideas to look at these identities, including the proofs. We have still some open problems relating them. I will give some hints to grasp those problems. Also, there are many interesting facts, especially in relation to hypergeometric series.
I am afraid that I could have time to explain all those things. I will pick up some charming side of Capelli identities as far as possible.

Conference Room VI

Hiroshi Yanagihara (Yamaguchi Univ.) Loewner theory on analytic universal covering maps ····· (13:00–14:00)

Summary: The classical Loewner theory deals with time evolution of univalent functions f_t in the unit disk $\mathbb{D}$. Therefore each image domain $\Omega_t := f_t(\mathbb{D})$ is necessary simply connected, i.e., Ω_t has no holes. In this talk, instead of univalent functions, we consider evolution families of analytic universal covering maps, and generalize Loewner theory. In this case we show that the connectivity order of Ω_t (= the number of holes in Ω_t) is non decreasing in t.

Plenary Talks

Guest Talk from Taiwan Mathematical Society

Jungkai Chen (Nat. Taiwan Univ.) Explicit birational geometry of threefolds, after Mori, Kawamata and Kawakita ····· (13:00–14:00)

Summary: One of the highlights of modern algebraic geometry is the minimal model program in dimension three, thanks to the work of Mori, Kawamata, Kollar, Reid, Shokurov, and many others. After that, there are then many more works to understand 3fold MMP explicitly. Other than above-mentioned mathematicians, main contributors along this direction includes Hayakawa, Kawakita, Tziolas, and Prokhorov. In this talk, we will present some results and expectations in understanding and classifying birational maps in 3fold MMP. Particularly, we will explain ideas toward the classification of divisorial contractions to curves. If time permits, we will also demonstrate some geometric applications.

September 15th (Thu)

Conference Room IV

Tohru Ozawa (Waseda Univ.)♭ Modified Energy Method for Nonlinear Dispersive Equations ····· (13:00–14:00)

Summary: We introduce the modified energy method for the proof of the existence of strong solutions to the Cauchy problem for nonlinear dispersive equations such as nonlinear Schrödinger equations, coupled Klein-Gordon-Schrödinger equations, and the Zakharov system.

Conference Room VI

Makoto Aoshima (Univ. of Tsukuba) Statistical mathematics for high-dimensional phenomena ·· (13:00–14:00)

Summary: The theory of conventional statistics does not hold for high-dimensional data such as genomes. When the number of dimensions exceeds the number of samples, various high-dimensional phenomena appear as a curse of dimensionality, which hinders the establishment of the theory. Our research group pioneered the theory and methodology of high-dimensional statistical analysis and developed statistical mathematics for high-dimensional phenomena. In this talk, we explain various high-dimensional phenomena and introduce statistical mathematics to deal with high-dimensional data at high speed and with high accuracy even for small samples of only a few tens. As practical examples, we give analysis examples of next-generation sequencing data with millions of dimensions and the latest high-dimensional data in space physics and advanced materials. Papers and analysis tools related to this talk are available from the following site: https://www.math.tsukuba.ac.jp/ aoshima-lab/jp/

September 16th (Fri)

Conference Room IV

Hiromu Tanaka (Univ. of Tokyo) On minimal model program ························· (13:00–14:00)

Summary: Minimal model program is classification theory of algebraic varieties. It is based on the theory of algebraic surfaces established in the early 20th century. The 3-dimensional minimal model program was completed in the 1980s, however its main conjecture for the general case still remains to be an open problem. In this talk, we overview the current status of the minimal model program.

Conference Room VI

Ko Honda (UCLA) Contact structures, convex hypersurfaces, and open book decompositions ·· (13:00–14:00)

Summary: Contact structures, alongside symplectic structures (their even-dimensional siblings), play a central role in modern geometry and have many connections to dynamical systems, low-dimensional topology, representation theory, algebraic geometry, and mathematical physics.

This talk is concerned with the fundamental question of how to decompose contact manifolds, especially in higher dimensions, into smaller, easier-to-understand pieces. The key result — a highly nontrivial one — is to perturb a given hypersurface in a contact manifold into a nice hypersurface called a "convex" hypersurface. (This was already possible for contact 3-manifolds and was successfully applied to many classifications problems.) We also explain the relationship to open book decompositions as articulated by Emmanuel Giroux about 20 years ago. This is joint work with Yang Huang and also with Joseph Breen.

Foundation of Mathematics and History of Mathematics

September 15th (Thu) Conference Room IX

10:35–12:00

1 Kohtaro Tadaki (Chubu Univ.) A refinement of quantum information theory by algorithmic randomness VI ····· 15

Summary: The notion of probability plays a crucial role in quantum mechanics. It appears as the Born rule. In modern mathematics which describes quantum mechanics, however, probability theory means nothing other than measure theory, and therefore any operational characterization of the notion of probability is still missing in quantum mechanics. In our former works, based on the toolkit of algorithmic randomness, we presented an operational refinement of the Born rule, called the principle of typicality, for specifying the property of the results of quantum measurements in an operational way. In this talk, we refine and reformulate the Holevo–Schumacher–Westmoreland theorem based on the principle of typicality, in order to demonstrate how properly our framework works in practical problems in quantum mechanics.

2 Kenshi Miyabe (Meiji Univ.) Subclasses of weakly computable reals that form real closed fields ···· 15

Summary: We give some examples of subclasses of weakly computable reals that form real closed fields. Some known examples are the class of computable reals, that of weakly computable reals, and that of non-random weakly computable reals. We extend these results by introducing strong Solovay reducibility.

3 Koichiro Ikeda (Hosei Univ.) On regular generic structures ····· 15

Summary: A generic structure M is said to be regular, if whenever A is a finite set of M and $a \in M$, then $a \in acl(A)$ implies $d(a/A) = 0$. Known generic structures are regular, and we do not have any example of non-regular generic structures. In this talk, we want to explain that various properties of generic structures can be simply expressed in regular generic structures, and that known examples of generic structures are usually regular.

4 Hirotaka Kikyo (Kobe Univ.) On generic structures defined by log-like functions ····· 15

Summary: Hrushovski introduced log-like functions in his 1988 paper to refute a conjecture by Lachlan. He defined classes $\mathbf{K}_f$ depending on log-like functions f defined using some approximation of some real number. The class $(\mathbf{K}_f, <)$ has the free amalgamation property and the one point graph is closed in any non-empty graph belonging to $\mathbf{K}_f$ for the original f. We can modify the definition of the log-like functions in the way that the classes have the free amalgamation property while the one point graph may not be closed in other graphs in the class. Still, the generic structures of the class will have model complete theories if f is unbounded, and the automorphism group of the generic structure will be simple if the real number used to define f is a rational number.

5 Akito Tsuboi (Univ. of Tsukuba*) Some comments on the difference between forking and dividing ····· 10

Summary: The two notions dividing and forking are important in model theory, especially in stability theory. By definition, dividing is clearly a stronger condition than forking. But Shelah has shown that they are the same in stable theories. Kim and Pillay showed the equivalence in the case of simple theories. Of course, there are some examples that show the difference. One of the best known has the strict order property. However, this example is not satisfactory, because a simple theory does not have the strict order property. We give a (possibly) new example, which may be of interest.

14:15–14:30 Research Section Assembly

14:45–16:15

6 Kenta Tsukuura (Univ. of Tsukuba) Huge cardinal and Prikry forcing · 15

Summary: The models of many kinds of saturated ideals over the successor of regular cardinals are known and have been used to solve some questions for combinatorics on the successors of regular cardinals, for example, polarized partition relations, reflection principle for graph chromatic number, and Chang's conjecture. Our interest is accomplishing these on the successors of singular cardinals. Using a huge cardinal, we can obtain some models in which the successor of large cardinals carries a saturated ideal and satisfies some of the combinatorial properties. Then we can define Prikry forcing, which is a forcing that changes a large cardinal into a singular cardinal. In this talk, we see that Prikry forcing preserves the centeredness of ideals but kills the layeredness. We also investigate some of the polarized partition relations and the reflection principle for graph chromatic number after Prikry forcing.

7 Tatsuya Goto (Kobe Univ.) Goldstern's principle about unions of measure 0 sets · · · · · · · · · · · · · · · · 15

Summary: In his 1993 paper, Martin Goldstern showed that the union of a family of Lebesgue measure zero sets that is parametrized by ω^ω and is increasing has also Lebesgue measure zero provided that the sets are uniformly analytic. Our aim is to study to what extent we can drop the analytic assumption. We show that Goldstern's principle for the pointclass of all subsets is independent from ZFC. Also we prove that Goldstern's principle for the pointclass of all subsets holds both under ZF + AD and in Solovay models.

8 Diego A. Mejía (Shizuoka Univ.) Cardinal characteristics associated with the ideal of strong measure zero sets · 15

Summary: We prove new results about the combinatorics of strong measure zero sets of reals, particularly under hypothesis involving cardinal characteristics. Expanding results of Yorioka (2002) and Cardona (2022), we show that $\mathrm{cov}(\mathcal{M}) = \mathfrak{d} = \lambda$ implies $\mathrm{cof}(\mathcal{SN}) > \lambda$ where $\mathcal{SN}$ denotes the strong measure zero ideal. Moreover, under further assumptions with λ regular, we guarantee that $\mathrm{cof}(\mathcal{SN}) > \mathfrak{d}_\lambda$.
We use this result to force in ZFC that the four cardinal characteristics (additivity, covering, uniformity and cofinality) associated with $\mathcal{SN}$ are pairwise different. Previous recent work with Cardona and Rivera-Madrid proves partial results, but it was unknown how to force the additivity smaller than everything else. We now overcome this obstacle by using forcings with finitely additive measures. This is a joint work with Jörg Brendle and Miguel Cardona.

9 Rin Miyauchi (Waseda Univ.) The continuum function on the countable unions of countable sets · · · 15
Toshimichi Usuba (Waseda Univ.)

Summary: We construct a model of ZF in which the following hold: 1. For every cardinal $\aleph_\alpha$, there is a countable union of countable sets $\bigcup_n A_n$ and a surjection from $P(\bigcup_n A_n)$ onto $\aleph_\alpha$, and 2. There is a set X such that for every countable union of countable sets $\bigcup_n A_n$, there is no surjection from $P(\bigcup_n A_n)$ onto X.

10 Daisuke Ikegami (Shibaura Inst. of Tech.) Preservation of AD via forcings · 15

Summary: It is well-known that forcings preserve ZFC, i.e., any set generic extension of any model of ZFC is again a model of ZFC. How about the Axiom of Determinacy (AD) under ZF? It is not difficult to see that Cohen forcing always destroys AD, i.e., any set generic extension of a model of ZF+AD via Cohen forcing is not a model of AD. Actually it is open whether there is a forcing which adds a new real while preserving AD.
In this talk, we present several results on preservation and non-preservation of AD via forcings. This is joint work with Nam Trang.

16:30–17:30 Talk Invited by Section on Foundation and History of Mathematics

Tatsuji Kawai (JAIST) Real numbers from a point-free perspective

Summary: We take another look at real numbers from the viewpoint of point-free topology. The intuitionistic presentation of real numbers by a spread leads to a unique representation of a real number called regular ideal. Regular ideals form the models of a certain geometric theory; thus the point-free space associated with this theory provides us with a novel notion of real numbers. As applications of this point-free real numbers, we give point-free proofs of the intermediate value theorem and Brouwer's fixed-point theorem. These point-free proofs make the finitary aspect of these theorems more explicit than their point-set counterparts.

September 16th (Fri) Conference Room IX

10:30–12:00

11 Takahiro Seki (Niigata Univ.) Commutativity of non-associative substructural logics with restricted weakening and contraction 15

Summary: It is well-known that the associative substructural logic $\mathbf{FL_{cw}}$, obtained from **FL** by adding both contraction and weakening rules, derives exchange rule. In this talk, we consider the commutativity result in non-associative substructural logics with weakening, contraction, restricted weakening and restricted contraction axioms.

12 Yutaka Katō (Tokyo Tech) Semantics and cut-elimination for the provability modal logic GLS ... 15
Ryo Kashima (Tokyo Tech)

Summary: Solovay (1976) introduced a modal logic GLS and proved the arithmetic completeness of GLS with respect to the standard model of PA. Kushida (2020) introduced a sequent calculus of GLS and proved the cut-elimination theorem. Our study attempt to construct a Kripke semantics of GLS and prove soundness of GLS and completeness of cut-free GLS, which gives an alternative proof of the cut-elimination theorem.

13 Yuya Okawa (Chiba Univ.) Simplified Veltman frames for sublogics of the interpretability logic **IL** 15

Summary: Visser proved that the interpretability logic **IL** is sound and complete with respect to a corresponding class of simplified Veltman frames and is not complete with respect to a corresponding class of finite simplified Veltman frames. Ignatiev introduced the conservativity logic **CL** which is a sublogic of **IL**, and he proved that **CL** is sound and complete with respect to a corresponding class of simplified Veltman frames. On the other hand, Ignatiev proposed the problem whether **CL** is complete with respect to a corresponding class of finite simplified Veltman frames or not.
We investigate the completeness with respect to (finite) simplified Veltman frames for several sublogics of **IL**. Then, we solve Ignatiev's problem affirmatively.

14 Nobu-Yuki Suzuki (Shizuoka Univ.) Remarks on intermediate predicate logics enjoying prenex normal form theorem 15

Summary: The prenex normal form theorem (PNFT) is a well-known metatheorem on classical predicate logic. It is said to characteristically express the behavior of quantifiers in classical predicate logic. We consider PNFT in the framework of intermediate predicate logics, and make some remarks.

15 Hiromasa Hori (Nagoya Univ.) Equivalence of infinite and cyclic proof systems for propositional logics
Koji Nakazawa (Nagoya Univ.) 15
Makoto Tatsuta
(Nat. Inst. of Informatics)

Summary: It is proved that the provabilities of infinite proof system and cyclic proof system are equivalent for some propositional logics: the propositional LK with inductively defined propositions, the propositional LK with fixed point operators, and the proof system for the linear temporal logic with fixed point operators.

14:15–15:55

16 Noriko Tanaka (Aichi Prefectural Asahigaoka High School) — The Experimental Class for Science Education in Kyoto in the near end of the World War II ····· 15

Summary: Following a decision of the Ministry of Education, "the Experimental Classes for Science Education" were formed in four cities of Japan in the near end of the World War II. The one of the Experimental classes were established in the Kyoto-Prefectural Kyoto First Secondary School, one each in the 3rd, 2nd and 1st year. In addition to the actual management of the class, the content of the lessons and the pupils'careers after the class are described. I will once again shed light on the Experimental Class for Science Education, and make use of a part of science and technology education in Japan in the future.

17 Katsushi Waki (Yamagata Univ.) — Extraction of graphic regions within WASAN books ····· 10

Summary: Two pre-processes that have been carried out to extract the graphic regions in the WASAN books are described. First, an evaluation of the recognition accuracy of the first pre-process, the extraction of important characters by character recognition, is presented. Next, the results of the shape area using the Hough transform are presented. Finally, the expected improvement in accuracy by combining the two pre-processing methods and future issues are explained.

18 Hideyuki Majima (Ochanomizu Univ.*) — Theoretical meaning of the calculation of Pi used by Seki Takakazu and Takebe Katahiro ····· 15

Summary: We will give some theoretical meaning on culculation of the number Pi by Seki Takakazu. Seki found the so-called Aitken's delta-sequenced process in his theory, but there were some errors in his calculation and he only claimed that his approximate number of Pi was a bit less than 3.14159265359. Katahiro Takebe followed Seki's method and discovered another method of calculation of Pi.

19 Mitsuo Morimoto (Yokkaichi Univ./Sophia Univ.*) — On the *Sekisan Shidensho* (2) ····· 15

Summary: In the *Sekisan Shidensho*, there is the list of private library of the Yamaji, masters of Seki's wasan school. There are 175 items in this list, most of which are related with wasan but a few are important Chinese books on mathematics imported by the 8th shogun Yoshimune. We shall present a preliminary talk on this Yamaji List ad discuss how the books or materials in the list are treated in the *Sekisan Shidensho* itself.

20 Tsukane Ogawa (Yokkaichi Univ.) — Inductive methodology in the 'Myouku Shu' written by Oka Yukitada ····· 15

Summary: The 'Myouku shu' written by Oka Yukitada (1791–?) is a kind of formula collection in Edo period. The word 'Yuzuri Koshi' appears in the proofs of formulae 20, 21, and 23 in the book, but its meaning is not obvious so far. It could be seen as a term related to inductive reasoning, it is more appropriate to think it as an analogy. Oka was interested in whether similar results could be obtained by analogy in generalising a problem. I will illustrate this with some examples.

21 Makoto Tamura (Osaka Sangyo Univ.) — On the solution of cubic equations in China ····· 15

Summary: "Jigu Suanjing (Continuation of Ancient Mathematics)" written shortly after 626 deals with cubic equations, but does not explain how to solve them. However, the book shows correct solutions to many cubic equations, it is natural to consider that the method had been established before the book appeared. In this talk, we consider the difference between calculating cube roots and solving cubic equations, and a numeric solution according to the text proposed by Qian Baocong.

16:00–16:15 Mathematics History Team Meeting

16:25–17:25 Talk Invited by Section on Foundation and History of Mathematics

Harald Kuemmerle
(German Inst. for Japanese Stud.)

A re-evaluation of "civil mathematicians" in Ogura Kinnosuke's historiography

Summary: In his historical research on mathematics since the Meiji period, Ogura Kinnosuke assigns "civil mathematicians" (minkan sugakusha) a role that was important but limited in scope. For example, in his Meiji sugakushi no kiso koji, he judges that although they did important translation work until the 1880s, their role was limited to publishing popularizing literature and test-taking journals after this. A systematic study of his statements on civil mathematicians and their context helps to highlight their relevance. As Ogura also referred to himself as a civil mathematician, studying his biography also gives important insights. Doing so, the study of mathematics in the Meiji period from the perspective of knowledge circulation through journals becomes possible and allows for international contextualization.

Algebra

September 13th (Tue) Conference Room IV

9:30–12:00

Summary: An efficient method for computing Jordan chains of a matrix of integers or rational numbers by exact computation is proposed. A Jordan–Krylov basis, special generators in the sense of Krylov subspace, of a certain subspace over rational numbers is introduced. It is shown that computation of Jordan chains is reduced to a Jordan–Krylov basis. In this theory, the Krylov subspace is effectively used.

Summary: An efficient method for computing Jordan chains of a matrix of integers or rational numbers by exact computation is proposed. A Jordan–Krylov basis, special generators in the sense of Krylov subspace, of a certain subspace over rational numbers is introduced. Efficient computation of both a Jordan–Krylov basis and Jordan chains is given.

Summary: In this talk, we give some sufficient conditions for $\mathrm{Cl}(\Bbbk[P])$ to be torsionfree, where $\mathrm{Cl}(\Bbbk[P])$ denotes the divisor class group of the toric ring $\Bbbk[P]$ of an integral polytope P. We prove that $\mathrm{Cl}(\Bbbk[P])$ is torsionfree if P is compressed, and $\mathrm{Cl}(\Bbbk[P])$ is torsionfree if P is a $(0,1)$-polytope which has at most $\dim P + 2$ facets. Moreover, we characterize the toric rings of $(0,1)$-polytopes in the case $\mathrm{Cl}(\Bbbk[P]) \cong \mathbb{Z}$.

Summary: Levelness and nearly Gorensteinness are well-studied properties on graded rings as a generalized notion of Gorensteinness. In this presentation, we talk about the strength of these properties. Under some additional conditions, we proved that every nearly Gorenstein domain is level. We also talk about nearly Gorenstein Stanley–Reisner rings of low-dimensional simplicial complexes.

Summary: Let $G = (V, E)$ be a cycle graph. We show that the Ehrhart ring of the stable set polytope of G is almost Gorenstein. Further, we show that the conjecture of Hibi–Tsuchiya is true.

Summary: For a partition λ of a positive integer n, let I_λ^{Sp} be the ideal of $R = K[x_1, \ldots, x_n]$ generated by all Specht polynomials of shape λ. It is known that if $R/I_\lambda^{\mathrm{Sp}}$ is Cohen–Macaulay then λ is of the form either $(n-d, 1, \ldots, 1), (n-d, d)$, or $(d, d, 1)$, and it is also known that the converse is true if $\mathrm{char}(K) = 0$.
In this talk, we construct minimal free resolutions of $R/I_{(n-d,d)}^{\mathrm{Sp}}$, when $\mathrm{char}(K) = 0$ by using Specht modules and operations on Young diagrams.

7 Ken-ichi Yoshida (Nihon Univ.)
Tomohiro Okuma (Yamagata Univ.)
Kei-ichi Watanabe (Nihon Univ.)
Gorensteinness for normal tangent cones of elliptic ideals ····· 13

Summary: Throughout this talk, let (A,m) be a 2-dimensional excellent normal local domain containing an algebraically closed field, and let I be an m-primary integrally closed ideal. An ideal I is called an elliptic ideal if the normal reduction number 2. In this talk, we discuss the Gorensteinness for normal tangent cones. In particular, we give a criterion for Gorensteinness in the case of elliptic ideals.

8 Naoki Endo (Meiji Univ.)
Shiro Goto (Meiji Univ.)
Reflexive modules over the endomorphism algebras of reflexive trace ideals ····· 13

Summary: In this talk, we investigate the behavior of reflexive modules over the endomorphism algebras of reflexive trace ideals in one-dimensional Cohen–Macaulay local rings. The main result generalizes both of the results of S. Goto, N. Matsuoka, and T. T. Phuong and T. Kobayashi regarding the Gorensteinness of the endomorphism algebra of the maximal ideal. We also explore the question of when the base ring has only finitely many isomorphism classes of indecomposable reflexive modules. We will show that the finiteness of the isomorphism classes implies the ring is analytically unramified and has only finitely many Ulrich ideals.

9 Shinya Kumashiro (Oyama Nat. Coll. of Tech.)
Upper bound on the colength of the trace of the canonical module ····· 13

Summary: We study upper bounds of the colength of the trace of the canonical module in one-dimensional Cohen–Macaulay rings. We answer two questions posed by Herzog–Hibi–Stamate and Kobayashi.

14:15–16:45

10 Toshiya Yurikusa (Tohoku Univ.)
Acyclic cluster algebras with dense g-vector fans ····· 10

Summary: The g-vector fans play an important role in studying cluster algebras and silting theory. We show that a connected acyclic cluster algebra has a dense g-vector fan if and only if it is either finite type or affine type. As an application, we also show that a finite dimensional, connected, hereditary algebra over an algebraically closed field has a dense g-vector fan if and only if it is Morita equivalent to the path algebra of a quiver of Dynkin or extended Dynkin type.

11 Yuichiro Goto (Osaka Univ.)
Connectedness of quasi-hereditary structures ····· 13

Summary: Dlab and Ringel showed that algebras being quasi-hereditary in all orders for indices of primitive idempotents becomes hereditary. So, we are interested in for which orders a given quasi-hereditary algebra is again quasi-hereditary. As a matter of fact, we consider permutations of indices, and if the algebra with permuted indices is quasi-hereditary, then we say that this permutation gives a quasi-hereditary structure. In this talk, we consider those which we call connectedness of quasi-hereditary structures. For two permutations s, s' giving quasi-hereditary structures, the definition of connectedness for s, s' is provided that there exists a decomposition $s's^{-1} = s_l \cdots s_2 s_1$ into adjacent transpositions such that each product $s_k \cdots s_2 s_1 s$ for $0 < k < l$ also gives a quasi-hereditary structure. We then show that any two quasi-hereditary structures are connected.

12 Satoshi Usui (Tokyo Univ. of Sci.)
Characterization of eventually periodic modules in the singularity categories, and its application ····· 13

Summary: The singularity category of a ring makes only the modules of finite projective dimension vanish among all modules. Hence, the singularity category is expected to capture some homological properties of modules of infinite projective dimension. In this talk, we focus on eventually periodic modules among those of infinite projective dimension and characterize them by using morphisms in the singularity categories. As an application, we show that, for the class of finite dimensional algebras over a field, being eventually periodic is invariant under singular equivalence of Morita type with level.

Summary: In the field of topological data analysis, two-parameter persistence can be studied using the representation theory of the 2d commutative grid, the tensor product of two A_n-type quivers. In a previous work, we studied interval approximations using restrictions to subquivers of intervals and Möbius inversion, related to the idea of the generalized rank invariant. In this work, we consider the homological approximations using the interval representations, and show that the interval global dimension is finite for the 2d commutative grid, and that it is equal to the maximum of the interval dimensions of the Auslander–Reiten translates of the interval representations. Furthermore, by a suitable modification of our interval approximation, we provide a formula linking the two conceptions of approximation.

Summary: In this talk we explore the almost Cohen–Macaulayness of the associated graded ring of stretched $\mathfrak{m}$-primary ideals with small first Hilbert coefficient in a Cohen–Macaulay local ring $(A, \mathfrak{m})$. In particular, we explore the structure of stretched $\mathfrak{m}$-primary ideals satisfying the equality $\mathrm{e}_1(I) = \mathrm{e}_0(I) - \ell_A(A/I) + 4$ where $\mathrm{e}_0(I)$ and $\mathrm{e}_1(I)$ denotes the multiplicity and the first Hilbert coefficient respectively.

Summary: Beilinson, Bernstein and Deligne introduced the notion of t-structures on triangulated categories. As a remarkable property of t-structures, various abelian categories inside triangulated categories can be realized as hearts of t-structures. Happel, Reiten and Smalø provided a construction of new t-structures through torsion pairs in the heart of a given t-structure. This construction is called the HRS-tilt. In this talk, we introduce t-structures on an extriangulated category, which is a common generalization of triangulated categories and exact categories, and give a generalization of the HRS-tilt.

Summary: A twisting system is one of the major tools to study graded algebras, however, it is often difficult to construct a (non-algebraic) twisting system if a graded algebra is given by generators and relations. In this talk, we show that a twisted algebra of a geometric algebra is determined by a certain automorphism of its point scheme. As an application, we explain the classification of twisted algebras of 3-dimensional Sklyanin algebras up to graded algebra isomorphism.

Summary: The purpose of this research is to define and classify noncommutative analogues of quadratic complete intersections. We say that $S/(f_1, ..., f_r)$ is a quantum (resp. Clifford) quadratic complete intersection if S is an n-dimensional Calabi–Yau (resp. Clifford) quantum polynomial algebra, and $f_1, ..., f_r \in S_2$ a regular sequence of central elements. The main result in this talk is that there is a natural one-to-one correspondence between the set of isomorphism classes of (commutative) quadratic complete intersections and the set of isomorphism classes of Clifford quadratic complete intersections. We also give a complete classification of quantum quadratic complete intersections for $n = 3$ and $r = 1, 2, 3$.

18 Mayu Tsukamoto (Yamaguchi Univ.) Takahide Adachi (Yamaguchi Univ.) Cotorsion pairs and silting subcategories in extriangulated categories 13

Summary: The notion of co-t-structures on a triangulated category was introduced as an analog of t-structures. While the heart of a t-structure becomes an abelian category, the coheart of a co-t-structure becomes a so-called presiltiing subcategory. Bondarko and Mendoza–Santiago–Saenz–Souto gave a bijection between bounded co-t-structures and silting subcategories in a triangulated category. In this talk, we generalize their result. Namely, we provide a bijection between bounded hereditary cotorsion pairs and silting subcategories in an extriangulated category. Moreover, we show that our result recovers a bijection between contravariantly finite resolving subcategories and basic tilting modules for a finite dimensional algebra with finite global dimension.

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

Aaron Chan (Nagoya Univ.) Algebras associated to surface dissections and their tilting theory

Summary: We are interested in two particular classes of finite-dimensional algebras. One is called Brauer graph algebra and the other is called gentle algebra. The former class has its origin traced back to the dawn of modular representation theory of finite groups, whereas the latter grew out of the studies of quiver representations for quivers of Dynkin type A and of affine Dynkin type A. Recent advances in homological mirror symmetry and cluster algebras arising from Teichmuller theory reveals a new approach to studying the homological algebra of gentle algebras. Namely, each gentle algebra can be associated to a dissection of some topological surface with vertices (marked points) on the boundary, and by doing so, one can interpret the representation theory and homological behaviour of a gentle algebra in terms of the topology or geometry of the associated dissected surface. In this talk, we will survey this connection as well as how such a connection can be exploited in the same way for Brauer graph algebras. We will also survey results on how this algebra-vs-topology connection gives us classification of objects (such as silting/tilting complexes and t-structures) that are used to study equivalences between the derived categories for these algebras.

September 14th (Wed) Conference Room IV

9:30–12:00

19 Cid Reyes-Bustos (NTT Inst. for Funda. Math.) Spectra and Ihara zeta function of group-subgroup pair graphs 10

Summary: Group-subgroup pair graphs (or pair-graphs) are a non-regular generalization of Cayley graphs for group-subgroup pairs that maintain the properties of Cayley graphs to a certain extent. In particular, when the subgroup is abelian, the eigenvalues are expressed in terms of sums of irreducible characters of the subgroup. We present a new proof for the formulas of the spectrum and new formulas for the Laplacian and signless Laplacian spectra of pair-graphs, along with formulas for the Ihara zeta function in terms of the subgroup characters. In addition, we consider examples and applications for several families of non-regular graphs described by pair-graphs and compare with their regular analogs.

20 Kiyoto Yoshino (Tohoku Univ.) Equiangular lines with common angle arccos(1/3) 13

Summary: I discuss sets of equiangular lines with common angle arccos(1/3), or equivalently, Seidel matrices with largest eigenvalue at most 3 by using switching roots. The switching roots were introduced to give integral lattices corresponding to sets of equiangular lines. When the common angle of a set of equiangular lines is arccos(1/3), the corresponding lattice is a root lattice. From this correspondence, the maximal sets of equiangular lines with common angle arccos(1/3) were classified. As an application, I explain why the numbers of sets of n equiangular lines with common angle arccos(1/3) in dimension 7 are almost symmetrical around $n = 14$.

Summary: For any algebra A over an algebraically closed field $\mathbb{F}$, we say that an A-module M is Schurian if $\mathrm{End}_A(M) \cong \mathbb{F}$. We say that A is Schurian-finite if there are only finitely many isomorphism classes of Schurian A-modules, and Schurian-infinite otherwise. I will present recent joint work with Susumu Ariki in which we determined that many blocks of type A Hecke algebras are Schurian-infinite. A wide variety of techniques were employed in this project—I will give more details on those required for our results concerning the principal blocks.

Summary: Let p be a prime number, k an algebraically closed field of characteristic p, G a finite group, and N a normal subgroup of G having a p-power index in G. Moreover let b be a block of kN with a cyclic defect group and B be the unique block of kG covering b. We show that the block B is a tilting-discrete algebra. Moreover we show that the set of all tilting complexes over B is isomorphic to that over b as partially ordered sets.

Summary: An essential basis is a basis of a finite-dimensional irreducible representation of a semisimple Lie algebra, which was introduced by Fang–Fourier–Littelmann as a generalization of an FFLV basis. In this talk, we slightly generalize the notion of an essential basis, and discuss an explicit description of its parametrizing set. To give such description, the notion of a Newton–Okounkov body is useful. In this talk, we focus on a specific (generalized) essential basis, and see that the corresponding Newton–Okounkov body is a marked chain-order polytope. This result connects previous realizations of Gelfand–Tsetlin polytopes and FFLV polytopes as Newton–Okounkov bodies in a uniform way.

Summary: In this talk, we will discuss structure on Hopf superalgebras of low dimension. Using known results on classification of Hopf algebras and the "bosonization technique", we obtain the following two results. Let p be an odd prime. (1) There are no non-trivial Hopf superalgebras of dimension p. (2) There exists only one isomorphism class of pointed Hopf superalgebras of dimension p^2.

Summary: Quandle is an algebraic system with one binary operation, but it is quite different from a group. In our talk, we investigate a special kind of quandles, called generalized Alexander quandles, which are defined by groups together with their group automorphisms. We give new quandle invariants for generalized Alexander quandles. Moreover, we give an equivalent condition of the quandle isomorphic property among special generalized Alexander quandles.

Summary: The Nakayama functor for a finite abelian category plays an important role in recent study of finite tensor categories and their modules. Given a finite tensor category $\mathcal{C}$ and a finite left $\mathcal{C}$-module category, the dual of $\mathcal{C}$ with respect to $\mathcal{M}$, denote by $\mathcal{C}^*_{\mathcal{M}}$, is defined as the category of linear right exact left $\mathcal{C}$-module endofunctors on $\mathcal{M}$. In this talk, an explicit formula of the Nakayama functor of $\mathcal{C}^*_{\mathcal{M}}$ will be given.

27 Katsusuke Nabeshima (Tokyo Univ. of Sci.) Shinichi Tajima (Niigata Univ.⋆) On Noetherian operators of zero-dimensional ideals · · · · · · · · · · · · · · · · · 13

Summary: We consider the relations between a zero-dimensional ideal and its Noetherian operators. Upon utilizing the theory of holonomic D-modules, we present a new method for computing Noetherian operators associated to a zero-dimensional ideal. An effective algorithm that consists mainly of linear algebra techniques is proposed for computing them. Moreover, as applications, new computation methods of polynomial ideals are discussed by utilizing the Noetherian operators.

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

Naoki Genra (Univ. of Tokyo) Feigin–Semikhatov duality

Summary: W-algebras are a family of vertex (super)algebras defined by the quantized Drinfeld–Sokolov reductions of affine Lie (super)algebras. They include the Virasoro algebra, Super Virasoro algebra, N=2 super conformal algebras and so on, important algebras related to (super)symmetries in (super) conformal field theory. We talk about Feigin–Semikhatov duality, which is dualities between subregular W-algebras and principal W-superalgebras, super analogs of Feigin–Frenkel duality and generalizations of Kazama–Suzuki cosets correspondences. The Feigin–Semikhatov duality gives rise to correspondences of fusion rules of dual W-(super)algebras in rational cases, and the induced coset functors imply equivalences between blocks of the module categories in general levels. This is joint work with Thomas Creutzig, Shigenori Nakatsuka and Ryo Sato.

September 15th (Thu) Conference Room IV

9:30–11:30

28 Tomohiro Iwami (Kyushu Inst. of Tech.) ♭ Strong approximation property related to three-dimensional Miyaoka–Yau type inequality with the associated third Chern classes · · · · · · · · · 13

Summary: For an three-dimesnional extremal neighborhood $(X, C) \subset \mathbb{C}^4$ of type A, S. Mori proved the existence of three-dimesional flip via "2-game" for 0-dimensional supports of general members of $|-K_X|$([M88]). Based on [M88], for an extended (X, C_s) with C_s not necessary irreducible nor reduced ([I2019Mar]), the author had found three-dimesional Miyaoka–Yau type inequality $(MY)_{3,c_3}$ with the associated c_3 ([I2018Mar, I2019Sep]), $(MY)_{3,c_3}$ with the differential operators ([I2020Sep]) and so on, moreover introduce an interemdiate Jacobians ([I2022Mar et al]). Continueing to [I2022Mar], as its Part II, the author will report: 1) to introduce valuations of "continuous" diffrential operators related to $(MY)_{3,c_3}$, 2) to construct "quaterion algebra" data along the above 1) as adele, and 3) to discuss strong apporoximation for 2) in order to determine (exponential) periods of $(MY)_{3,c_3}$.

29 Ryo Ohashi (Yokohama Nat. Univ.) Fast enumeration of superspecial hyperelliptic curves of genus 4 with automorphism group V_4 · 13

Summary: In arithmetic and algebraic geometry, superspecial curves have been studied as one of the most important objects, with practical applications to cryptography and coding theory. The enumeration of those curves is a central problem, but if $g \geq 4$ it is not even known whether a superspecial curve of genus g exists in general characteristic $p > 0$. In this paper, we propose an algorithm with complexity $\tilde{O}(p^3)$ to enumerate superspecial hyperelliptic curves of genus 4 with automorphism group V_4. By executing the algorithm over Magma, we enumerate those curves over $\overline{\mathbb{F}_p}$ for p up to 200. We also succeeded in finding a superspecial hyperelliptic curve of genus 4 in every characteristic p with $19 \leq p < 7000$.

30 Hirokazu Nasu (Tokai Univ.) On the primary obstructions to deforming curves on a threefold ····· 13

Summary: In Theorem 3.3 of Internat. J. Math. 28(13) (2017) 1750099, I gave a sufficient condition for a first order deformation of a curve on a projective threefold to be primarily obstructed. However the statement of the theorem is false as it stands. In this talk, I will make a correction to the theorem and will give its reformulation.

31 Hirokazu Nasu (Tokai Univ.) Obstructions to deforming space curves lying on a smooth cubic surface ····· 13

Summary: In 1980s, J. O. Kleppe gave a conjecture concerning maximal families of space curves lying on a smooth cubic surface. Later, the conjecture was modified by Ph. Ellia by a counterexample. I will talk about a recent progress on the conjecture. I will also give a sufficient condition for curves lying on a smooth cubic surface to be obstructed in $\mathbb{P}^3$ in terms of lines on the surface.

32 Akihiro Higashitani (Osaka Univ.) Combinatorial mutation equivalence of two toric degenerations of Grassmannians arising from matching fields ····· 13

Summary: Matching fields are used for the construction of toric degenerations of Grassmannians. Whenever a matching field gives rise to a toric degeneration, the associated polytope of the toric variety coincides with the matching field polytope. In this talk, we study combinatorial mutation equivalences of two certain matching field polytopes, which correspond to order polytopes and chain polytopes of Grassmannian posets.

33 Ryo Kawaguchi (Nara Medical Univ.) A lower bound for the ith sectional geometric genus of polarized toric varieties ····· 13

Summary: The sectional genus is one of the fundamental invariants in the study of polarized varieties, and is extended to the notion of ith sectional geometric genus. The ith sectional geometric genus has an upper bound proved by Y. Fukuma, and a conjectured lower bound which has not yet been completely proven. This lower bound, however, is trivial in the case of polarized toric varieties. In this talk, we provide a new lower bound for the ith sectional geometric genus of polarized toric varieties resulting from the theory of Ehrhart h-vector of polytopes.

34 Shou Yoshikawa (RIKEN) Quasi-F-splitting ····· 13

Summary: Yobuko recently introduced the notion of quasi-F-splitting and F-split heights, which generalize and quantify the notion of Frobenius-splitting, and proved that F-split heights coincide with Artin–Mazur heights for Calabi–Yau varieties. In this talk, I will introduce a generalization of Fedder's criterion for F-splitting and the theory of F-splittings in the context of birational geometry. The talk is based on joint work with Tatsuro Kawakami, Teppei Takamatsu, Hiromu Tanaka, Jakub Witaszek and Fuetaro Yobuto.

11:30–12:00 Research Section Assembly

14:15–17:15

35 Atsuhira Nagano (Kanazawa Univ.) A family of lattice polarized K3 surfaces which contains the family of Kummer surfaces ····· 13

Summary: The speaker will introduce a family of lattice polarized K3 surfaces which contains the family of Kummer surfaces derived from principally polarized Abelian surfaces. Also, he will introduce a relation between the period mapping of this family, theta functions and invariants of a complex reflection group.

Summary: Let $K_n/\mathbf{Q}$ be a Galois CM-filed with $G_n = Gal(K_n/\mathbf{Q}) \cong D_n\langle\rho\rangle$,where D_n denotes the dihedral group of degree $2n$ and ρ the complex conjugation. Let $S \subset G_n$ be an arbitrary CM-type,and let A_S be the abelian variety of CM-type such that $End_{\mathbf{Q}}(A_S) \cong K_n$ and its CM-type is given by S. Let $Hg(A_s)$ denote the Hodge group of A_S. It is known that $Hg(A_S)$ is an algebraic torus and $dimHg(A_S) \leq dimA_S = 2n$. When $dimHg(A_S) = 2n$, A_S is said to be non-degenerate, and the Hodge ring of A_S is known to be generated by its divisor classes. In this talk we classify the CM-type S for which the abelian variety A_S is degenerate.

Summary: Geometric transition is a process of connecting two smooth Calabi–Yau 3-folds by a birational contraction followed by a complex smoothing. It has attracted the interest of both mathematicians and physicists, since it may give the right notion to connect moduli spaces of Calabi–Yau 3-folds. For Calabi–Yau hypersurfaces in toric varieties, a well-known idea of constructing geometric transitions is the use of nested reflexive polytopes. In this talk, I will report the current situation of this approach.

Summary: We discuss the non-existence of Bridgeland stability conditions on an R-linear triangulated category.

Summary: Recently, I have introduced the notion of prime thick subcategories of a given triangulated category $\mathcal{T}$ and of the spectrum $\mathrm{Spec}(\mathcal{T})$ as the set of prime thick subcategories of $\mathcal{T}$ together with a certain topology. In this talk, using the spectrum, we will give an alternative proof of the Bondal–Orlov–Ballard reconstruction theorem. Also, I will give the similar reconstruction result for quasi-affine varieties.

Summary: We develop an elementary theory of partially additive rings as a foundation of $\mathbb{F}_1$-geometry. Our approach is so concrete that an analog of classical algebraic geometry is established straightforwardly. As applications, (1) we construct a kind of group scheme $\mathbb{GL}_n$ whose value at a commutative ring R is the group of $n \times n$ invertible matrices over R and at $\mathbb{F}_1$ is the n-th symmetric group, and (2) we construct a projective space $\mathbb{P}^n$ as a kind of scheme and count the number of points of $\mathbb{P}^n(\mathbb{F}_q)$ for $q = 1$ or $q = p^n$ a power of a rational prime, then we explain a reason of number 1 in the subscript of $\mathbb{F}_1$ even though it has two elements.

Summary: In this talk, we prove that the cone of the extended Catalan arrangement of type A is always hereditarily free, while we determine the dimension that the cone of the extended Shi arrangement of type A is hereditarily free. For this purpose, we define a class of arrangements which contains the extended Shi and Catalan arrangement of type A and which closed under restriction, using digraphs with vertex weights.

42 Norihiko Minami (Nagoya Inst. of Tech.) A type 1 local uniformization theorem for arbitrary geometric valuations 13

Summary: A geometric valuation is a special kind of Abhyankar valuation. A rank 1 geometric valuation is also called a divisorial valuation, which admits for any base field with arbitrary characteristic the so-called type 1 local uniformization, realizing its valuation ring as the local ring at its center, thanks to a 1939 classical theorem of Zariski. Motivated by my own effort to construct a birational subsheaf for any unramified sheaf in the sense of Morel, I shall report a generalization of such a type 1 local uniformization theorem for arbitrary geometric valuation.

43 Norihiko Minami (Nagoya Inst. of Tech.) Two applications of the birational motive to the retract $(-i)$-rationality 13

Summary: The birational motives of Kahn–Sujatha and Rost is applied to study the following two types of implications of the retract $(-i)$-rationality of a smooth projective variety: (1) in terms of an arbitrary $\mathbb{P}^1$-invariant Nisnevich sheaf with transfer. (2) in terms of the Bloch–Srinivas type decomposition of the diagonal.

44 Ryosuke Shimada (Univ. of Tokyo) On some simple geometric structure of affine Deligne–Lusztig varieties for GL_n 13

Summary: We study the geometric structure of affine Deligne–Lusztig varieties $X_\lambda(b)$ for GL_n and b basic. Motivated by the work of Görtz–He–Nie and Chan–Ivanov, we consider a new condition on a cocharacter λ. If this is satisfied, then $X_\lambda(b)$ is the disjoint union of classical Deligne–Lusztig varieties times finite-dimensional affine spaces.

17:30–18:30 Talk Invited by Algebra Section

Takashi Kishimoto (Saitama Univ.) ♭ Equivariant completions of vector groups into Fano varieties

Summary: It is well known that the structure as toric variety on a given projective variety is uniquely determined (if there exists at all), and it can be interpreted by means of complete fans. In contrast with toric varieties, namely, equivariant completions of algebraic tori, we are instead interested in equivariant completions of vector groups into projective varieties, especially into Fano varieties. Different from torus embeddings, the equivariant completions of vector groups do not have an explicit interpretation except for projective spaces, meanwhile certain varieties admit several non-isomorphic structures as equivariant vector group completions. In the talk, we will devote ourselves mainly to equivariant vector group completions into (forms of) quintic del Pezzo varieties and an observation of their automorphism groups. This is based on the joint work with Adrien Dubouloz and Pedro Montero.

September 16th (Fri) Conference Room IV

9:30–12:00

45 Shin Nakano (Gakushuin Univ.) On ideal class groups of quintic cyclic fields 10
Kotaro Kato

Summary: We give an infinite family of quintic cyclic fields with class number divisible by any prime less than 10000.

46 Aiki Kimura (Tohoku Univ.) The duality relations derived from the derivation relations for multiple zeta values 13

Summary: The duality relations are a basic family of relations for multiple zeta values. The extended double shuffle relations (EDSR) are one of the families expected to generate all linear relations among multiple zeta values, but it remains unclear whether all the duality relations can be derived from EDSR. In this talk, we consider two families of relations generated by the duality and the derivation relations, and characterize explicitly the intersection of them. Here the derivation relations are specializations of EDSR.

47 Wataru Takeda (Tokyo Univ. of Sci.)
Yasuo Ohno (Tohoku Univ.)
Maki Nakasuji (Sophia Univ.)
An interpolation of the generalized duality formula for the Schur multiple zeta values to complex functions 13

Summary: One of the important research subjects in the study of multiple zeta functions is to clarify the linear relations and functional equations among them. Among many relations, the duality formula and its generalization are important families for both Euler–Zagier type and Schur type multiple zeta values. In this talk, following the method of previous works for multiple zeta values of Euler–Zagier type, we give an interpolation of the sums in the generalized duality formula, called Ohno relation, for Schur multiple zeta values. Moreover, we prove that the Ohno relation for Schur multiple zeta values is valid for complex numbers.

48 Naho Kawasaki (Tohoku Univ.)
An explicit formula of the relation between multiple zeta functions of Arakawa–Kaneko and Euler–Zagier types 10

Summary: Multiple zeta functions of Arakawa–Kaneko and Euler–Zagier types are known as generalizations of the Riemann zeta function. In 2018, Kaneko and Tsumura proved the existence of functional equations between these multiple zeta functions. In this talk, we give the functional equations explicitly.

49 Masataka Ono (Waseda Univ.)
Shuji Yamamoto (Univ. of Tokyo)
Kaneko–Zagier conjecture for general integer indices 13

Summary: Finite multiple zeta values and symmetric multiple zeta values are defined for positive integer indices. Kaneko and Zagier conjectured that they satisfy the same algebraic relations. In this talk, we generalize Kaneko–Zagier conjecture for general integer indices and prove that the generalized conjecture is deduced from the original one.

50 Hirotaka Kobayashi (Nagoya Univ.)
On an entire function derived from higher derivatives of Hardy's Z-function 13

Summary: In 2012, Matsuoka showed that the zeros of $Z^{(k+1)}(t)$ are interlaced with the zeros of $Z^{(k)}(t)$ for $t > T$ with sufficiently large T under the Riemann Hypothesis, where $Z^{(k)}(t)$ is the kth derivative of Hardy's Z-function associated with the Riemann ζ-function. We introduce a generalisation of Riemann's ξ-function derived from higher derivatives of Hardy's Z-function to try to make the proof of his result simpler. Our proof is based on the proof of special case $k = 1$ by H. M. Edwards and J. Mozer.

51 Shota Inoue (Tokyo Tech)
Junxian Li (Univ. Bonn)
Joint value distribution of L-functions on the critical line 13

Summary: The independence of L-functions is firstly mentioned by Selberg. Later Bombieri and Hejhal established the independence by showing the joint central limit theorem of L-functions on the critical line. In this talk, we discuss the large deviations in the central limit theorem of Bombieri and Hejhal. Our results have some consequences for moments of L-functions. For example, our results lead to a relation between the moment of the Riemann zeta-function and of the minimum of the Riemann zeta-function and Dirichlet L-functions. This is a joint work with Junxian Li (Universität Bonn).

52 Masahiro Mine (Sophia Univ.)
Discrepancy estimates for the Hurwitz zeta-functions and Mahler's classification 13

Summary: In this talk, we consider the speed of the convergence of the limit theorem for the value-distribution of the Hurwitz zeta-functions. The estimates of the speed are sometimes called the discrepancy estimates. We prove several discrepancy estimates for the Hurwitz zeta-functions under a certain condition on the parameters, which is based on Mahler's classification of transcendental numbers.

53 Kenta Endo (Nagoya Univ.) Universality theorem for the iterated integrals of the logarithm of the Riemann zeta-function 13

Summary: In 1975, Voronin proved the universality theorem for the Riemann zeta-function. In this talk, we generalized this theorem to the iterated integrals of the logarithm of the Riemann zeta-function on some line parallel to the real axis.

14:15–17:00

54 Yasuaki Gyoda (Univ. of Tokyo) Positive integer solutions to $(x+y)^2+(y+z)^2+(z+x)^2=12xyz$ and generalized markov cluster algebra 13

Summary: We give a specific way of describing positive integer solutions of a Diophantine equation $(x+y)^2+(y+z)^2+(z+x)^2=12xyz$ and introduce a generalized cluster pattern behind it.

55 Shigeru Iitaka (Gakushuin Univ.*)
Yukimasa Saito
(Azabu Junior High School) Generalization of perfect numbers 13

Summary: By P we denote an odd prime, which plays Base of perfect numbers. For $a=P^e$, $\overline{P}=P-1$ satisfies $\overline{P}\sigma(a)=P^{e+1}-1=aP-1$. Let m denote translation parameter, and let $h(\neq P)$ (another odd prime) denote multiplier.
$\overline{P}^3\sigma(\alpha)+(\overline{P}-h)P^2\varphi(\alpha)=\overline{P}P\alpha(2\overline{P}-h)-m\overline{P}^2-h(P-2)\overline{P}$ is established.
The number α which satisfies the above equality is said to be $\sigma\phi$ perfect number, which is a kind of Generalization of perfect numbers.

56 Tadaaki Igawa
Debika Banerjee
(Indraprastha Inst. of Information Tech. Delhi)
Makoto Minamide (Yamaguchi Univ.)
Yoshio Tanigawa On averages of indexes of congruence subgroups in the modular group 10

Summary: We shall consider averages of indexes of congruence subgroups in the modular group, and deduce some results on error terms of them.

57 Ryota Tajima (Kyushu Univ.) A p-adic property of mock modular forms whose shadows have complex multiplication 10

Summary: Let f be a mock modular form and g denote the shadow of f. Then there exists a unique p-adic number $\alpha(f)$ and we can obtain a p-adic modular form from f and $\alpha(f)$. When g has complex multipulication by K and p is split in K, it is known that $\alpha(f)$ is not zero. On the other hand, we don't know much about $\alpha(f)$ for an inert prime p. The speaker proved that $\alpha(f)$ is not zero when p is inert in K under certain conditions. In this talk, I will explain the result.

58 Yuichi Sakai (Kurume Inst. of Tech.)
Kiyokazu Nagatomo
Don Zagier (Max Plank Inst. for Math.) Modular linear differential equations and generalized Rankin–Cohen brackets 13

Summary: We show that all modular linear differential operators can be described in terms of Rankin–Cohen brackets and a modified Rankin–Cohen bracket found by Kaneko and Koike. We give more uniform descriptions of MLDEs in terms of an extension of Rankin–Cohen brackets.

59 Daniel Duverney (Baggio Eng. School)
Takeshi Kurosawa (Tokyo Univ. of Sci.)
Iekata Shiokawa (Keio Univ.*) Irrationality exponents of certain series generated by continued fraction with folding lemma 13

Summary: Let x_n be a certain fast converging sequence of rational numbers greater than one. We give the irrationality exponents of reciprocal sums of x_n using a continued-fraction expansion with the folding lemma.

Summary: Let $(i,j) \in \mathbb{N} \times \mathbb{N}_{\geq 2}$ and $S_{i,j}$ be an infinite subset of positive integers including all prime numbers in some arithmetic progression. In this talk, we show the linear independence over $\mathbb{Q}$ of the numbers

$$1, \quad \sum_{n \in S_{i,j}} \frac{a_{i,j}(n)}{b^{in^j}}, \quad (i,j) \in \mathbb{N} \times \mathbb{N}_{\geq 2},$$

where $b \geq 2$ is an integer and $a_{i,j}(n)$ are bounded nonzero integer-valued functions on $S_{i,j}$. Our theorem generalizes a result of V. Kumar.

Summary: Let $(c_k)_{k=1}^{\infty}$ be a sequence of positive integers. We investigate the set of $A > 1$ such that the integer part of $A^{c_1 \cdots c_k}$ is always a prime number for every positive integer k. Let $\mathcal{W}(c_k)$ be this set. The first goal of this talk is to determine the topological structure of $\mathcal{W}(c_k)$. Under some conditions on $(c_k)_{k=1}^{\infty}$, we reveal that $\mathcal{W}(c_k) \cap [0,a]$ is homeomorphic to the Cantor middle third set for some a. The second goal is to propose an algebraically independent subset of $\mathcal{W}(c_k)$ if c_k is rapidly increasing. As a corollary, we disclose that the minimum of $\mathcal{W}(k)$ is transcendental.

Summary: Some entire functions of one variable are known to have the property that the values of their derivatives of any order at any nonzero distinct algebraic numbers are algebraically independent. On the other hand, there are very few results on the algebraic independence of the values of the partial derivatives of a given entire function of several variables at distinct algebraic points. In this talk we construct an entire function with arbitrary number of variables having the following property: The infinite set consisting of all the values of all its partial derivatives of any orders at all algebraic points is algebraically independent.

Summary: For certain families of entire functions of one variable defined by power series and infinite products, we show the algebraic independence of the values of their derivatives at distinct algebraic numbers. This is obtained as a corollary to the algebraic independence result on the values of the partial derivatives of a certain family of entire functions of two variables.

Summary: In this talk, we give a congruence relation, called supercongruence, for a hypergeometric function of two variables. There are some congruence relations between a truncation of a hypergeometric series and a p-adic unit modulo a power of a prime number p. If we give an additional assumption, some of them hold modulo higher power of p. Then such congruences are called supercongruence. The purpose of this talk is to give a supercongruence relation for Appell's function F_4.

17:15–18:15 Talk Invited by Algebra Section

Makoto Kawashima (Nihon Univ.) On arithmetic properties of the Siegel G-functions

Summary: The Grothendieck period conjecture predicts that all the algebraic relations among the periods of a smooth algebraic variety over a number field are only due to its geometric structure. Following the definition by C. L. Siegel, the G-function is a certain class of power series with algebraic coefficients, satisfying a linear differential equation, whose typical example is the polylogarithmic function. It is conjectured by Bombieri and Dwork that the ring of the values of G-functions at algebraic points exactly coincides with the ring of periods of the varieties above. Their observation thus suggests us to study the values of the G-functions at algebraic points together with the transcendence or the irrationality, to approach the period conjecture.

Relying on this background, we are motivated to construct Pade approximation of the values of G-functions, which is one of efficient tools to investigate such an arithmetic property. It is worth mentioning that R. Apery succeeded in proving the irrationality of $\zeta(3)$ by Pade approximation, however, for a given number, it is in general crucial and very difficult whether we can construct Pade approximation of the number in an explicit way.

In this talk, we focus on the generalized hypergeometric G-functions and our explicit construction of Pade approximation. We give a survey of our recent progress on arithmetic properties of the values of the functions, including the linear independence criteria, which have been unknown.

Geometry

September 13th (Tue) Conference Room VI

9:30–11:45

Summary: In this talk, we show that the statistical manifold of multivariate normal distribution admits solvable Lie group structure. In addition, we give a characterization of Amari–Chenstov α-connections of it.

Summary: A symmetric Clifford system is a finite set of real symmetric matrices satisfying some relations. In this talk, we define subspace arrangements associated with symmetric Clifford systems which are named Clifford arrangements. Moreover, we show several properties of Clifford arrangements.

Summary: It is known that an isometric action of a Lie group on a compact symmetric space gives rise to a proper Fredholm action of a path group on a path space via the gauge transformations. In this talk, I will introduce my recent results concerning the principal curvatures and the austere property of orbits of path group actions induced by Hermann actions. Here a submanifold is called austere if the set of principal curvatures in the direction of each normal vector is invariant under the multiplication by minus one. The results greatly extend the author's previous result in the case of the standard sphere and show that there exist a larger number of infinite dimensional austere submanifolds in Hilbert spaces.

Summary: We show that there exists a representative with good properties in the isomorphism class of a compact symmetric triad. We call such a representative a canonical form of the compact symmetric triads. In order to study the geometry of Hermann actions, it is sufficient to consider ones obtained from canonical forms. We also show that canonical forms give sections of Hermann actions.

Summary: We show that each of the pseudo-Riemannian symmetric R-space associated with a non-degenerate Jordan triple system and a real form of an effective simple irreducible pseudo-Hermitian symmetric space can be realized as a para-real form of an effective semisimple para-Hermitian symmetric space of hyperbolic orbit type.

Summary: Manifolds admitting Killing spinors are Einstein manifolds. Thus, a deformation of a Killing spinor entails a deformation of Einstein metrics. In this time, we study infinitesimal deformations of Killing spinors on nearly parallel G_2 manifolds. Furthermore, since there is a one-to-one correspondence between nearly parallel G_2 structures and Killing spinors on 7-dimensional spin manifolds, our results imply that we investigate an infinitesimal deformation of nearly parallel G_2 structures. Applying the same technique, we identify that the space of the Rarita–Schwinger fields coincides with a subspace of the eigenspace of the Laplacian.

Summary: We discuss non-naturally reductive Einstein metrics on special unitary group $SU(k_1+(p-1)k)$ via the generalized flag manifold $SU(k_1+(p-1)k)/S(U(k_1)\times\underbrace{U(k)\times\cdots\times U(k)}_{p-1})$. We show that, if $k_1>k$ and $p\geq 3$, there exist at least two such Einstein metrics.

14:15–16:15

Summary: A hanging chain (catenary) is a naturally generated curve by its weight, and a reversed hanging chain resists gravity with pure compression stress states. In the architectural field, an analogy for the surface case is known as hanging membranes, however, no effective formulation applicable to the membrane structure is known. In this presentation, we introduce a mathematical formulation of the hanging membranes compatible with the mechanics of the membrane structure, variational characterization, shape generation by appropriate discretization, and structural analysis of hanging membranes in the architectural surface design. This study is based on the joint work with Prof. Yohei Yokosuka (Kagoshima University).

Summary: We construct new nonorientable maximal surfaces and study their singular points.

Summary: By using an idea of integral geometry, we define integral invariants of the second fundamental form of a map between Riemannian manifolds and construct an S^1-family of energy functionals including the bienergy functional. In this talk, we introduce the Chern–Federer energy functional, whose Euler–Lagrange equation is a second-order partial differential equation. For an isometric immersion into a Riemannian space form, we give a necessary and sufficient condition to be a Chern–Federer map. Considering this condition, there is an obstruction for the domain manifold. In addition, we show some examples of Chern–Federer submanifolds in Riemannian space forms, where a Chern–Federer submanifold is the image of an isometric immersion which is a Chern–Federer map.

Summary: It is known that the minimality of non-vertical surfaces in the three-dimensional Heisenberg group with the left-invariant Riemannian metric is characterized by the non-conformal harmonic maps into the hyperbolic plane, and then the minimality can be denoted by the integrable systems. We show that non-vertical timelike minimal surfaces in the three-dimensional Heisenberg group with the left-invariant Lorentzian metric are characterized by the non-conformal Lorentz harmonic maps into the de Sitter two-sphere.

Summary: In the minimal surface theory, the Krust theorem asserts that if a minimal surface in the Euclidean 3-space is the graph of a function over a convex domain, then each surface of its associated family is also a graph. The same is true for maximal surfaces in the Minkowski 3-space. In this talk, we prove a Krust-type theorem for a deformation family including various important deformation of minimal and maximal surfaces such as the associated family and the Lopez–Ros deformation and the Calabi-type correspondence. We also prove another Krust-type theorem which does not assume the convexity assumption. The results are proved based on the recent progress of planar harmonic mapping theory.

13 Pham Hoang Ha (Hanoi National Univ.)
Yu Kawakami (Kanazawa Univ.)
Mototsugu Watanabe (Takaoka special support school)
On the total weight of a number of totally ramified values of the Gauss map of a complete minimal surface with finite total curvature ····· 15

Summary: We give a new example of algebraic minimal surface whose Gauss map has two omitted values and one totally ramified value of order 2. Thus, the total weight of a number of totally ramified value of its Gauss map equals 2.5. Moreover, we study a more precise estimate for the total weight of a number of totally ramified value of the Gauss map of an algebraic minimal surface which has genus 0 in Euclidean 4-space.

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

Masatoshi Kokubu (Tokyo Denki Univ.) Flat fronts in hyperbolic three-space and related topics

Summary: Recent works about flat fronts and related topics will be introduced after a brief overview. It is known that a complete flat surface immersed in hyperbolic 3-space H^3 is either a horosphere or a hyperbolic circular cylinder. However, if the condition is weakened so that surfaces are not necessarily immersed, then there are many 'complete flat surfaces', properly speaking, weakly complete flat fronts. The word 'front' comes from a wavefront which means a mapping which have a Legendrian lift to the projective cotangent bundle of the target space. In early 2000s, M. Umehara, K. Yamada and I started to study flat fronts. After that, W. Rossman and K. Saji joined and our research was advanced. There are still some interesting problems that I am working on.

September 14th (Wed) Conference Room VI

10:10–10:25 Presentation Ceremony for the 2022 MSJ Geometry Prize

10:30–11:30 Award Lecture for the 2022 MSJ Geometry Prize

Hiroshi Iriyeh (Ibaraki Univ.)
Masataka Shibata (Meijo Univ.)
A solution of Mahler's conjecture of three dimensional symmetric convex bodies

Summary: We have proved Mahler's conjecture concerning the volume product of three dimensional centrally symmetric convex bodies in $\mathbb{R}^3$. In this talk, we give an outline of its proof and also provide its applications and recent developments.

13:15–14:15 Award Lecture for the 2022 MSJ Geometry Prize

Tatsuki Kuwagaki (Kyoto Univ.)♭ Geometry and algebraic analysis of sheaf quantization

Summary: Sheaf quantization is a way of quantizing Lagrangian submanifolds. The concept is quite rich and useful to study symplectic geometry, algebraic analysis, and etc. In this talk, I will give an introduction to the concept.

September 15th (Thu) Conference Room VI

9:30–11:45

14 Takumi Gomyou (Nagoya Univ.)
Shin Nayatani (Nagoya Univ.)
Maximization of the first eigenvalue of a finite graph and Nadirashvili-type theorem ····· 15

Summary: Given an edge-length parameter on a finite graph, we construct a vertex-weight and an edge-weight from it and define the corresponding graph Laplacian. We consider a maximization of the first nonzero eigenvalue of the graph Laplacian over all edge-length parameters subject to a normalization. We obtain a Nadirashvili-type theorem which describes the maximizing edge-length parameter in terms of the first eigenfunctions of the corresponding Laplacian.

Summary: The purpose of this article is to quantify the estrangement of non-reversible geodesics in Finsler space.In the paper [2], it is shown that the images of non-reversible geodesics which go to opposite direction are different from each other.Then the estrangement degree for the purpose of quantifying of the extent of branching for non-reversible geodesics are defined in this time.Finally, a proposition that if some conditions are satisfied, then the indicatrix on the tangent space of the point is closed is shown for the estrangement degree as the application.

Summary: We will discuss the Blaschke–Santaló inequality and inverse Santaló inequality which are well known in convex geometry. A key ingredient in our talk is the smoothing property of Ornstein–Uhlenbeck semigroup, namely Gaussian hypercontractivity. Our first result is to make a new connection between the Blaschke–Santaló inequality and the reverse hypercontractivity. In particular, we give a new proof of the Blaschke–Santaló inequality via an improvement of the reverse hypercontractivity. Our second result is to give the forward hypercontractivity with a special exponent, which is naturally motivated from our first result. As a corollary, it enables us to obtain some stability type estimate of the inverse Santaló inequality. This talk is based on a joint work with Neal Bez (Saitama University) and Shohei Nakamura (Osaka University).

Summary: Eathquake maps give important flows on the Teichmuller spaces. We calculate earthquake maps in terms of shear coordinates, which are examples of cluster X-variables in the cluster algebra. In this talk, We define an analogue of earthquake maps for any cluster algebras of finite type and prove a similar result to the Thurston's earthquake theorem.

Summary: We defined an "earthquake map" for a cluster manifold of finite type as an analogue of the Thurston's earthquake map for a closed surface. Moreover, we proved an analogue of the Thurston's earthquake theorem for a cluster manifold of finite type, namely, we gave a homeomorphism between the tropicalized cluster manifold and the cluster manifold via the earthquake map. In this talk, we observe how the Fock–Goncharov fan, which lies in the tropicalized cluster manifold, behaves under the earthquake map. In particular, we discuss its asymptotic behavior in a certain sense.

Summary: The main topic of this talk will be the relation between chaotic dynamics in foliated spaces and the geometry of the leaves. A compact foliated space is chaotic if it has a dense leaf and the set of compact leaves is dense. We will study the metric, differentiable and topological realization of manifolds as dense leaves without holonomy in compact, chaotic foliated spaces.

20 Yuya Kodama (Tokyo Metro. Univ.) A generalization of the Lodha–Moore group · · · · · 15

Summary: In this talk, I state the new group obtained by generalizing the Lodha–Moore group. The Lodha–Moore group is known as a nonamenable finitely presented group similar to the Thompson group F. Since the Lodha–Moore group is defined by using infinite binary words, it can be generalized into "n-ary". After I give a short definition of the Lodha–Moore group, I will state the definition of the generalized one and the results for "expected" properties.

14:15–16:15

21 Yoshito Ishiki (RIKEN) On dense subsets in spaces of metrics · · · · · 15

Summary: In spaces of metrics, we investigate topological distributions of the doubling property, the uniform disconnectedness, and the uniform perfectness, which are the quasi-symmetrically invariant properties appearing in the David–Semmes theorem. We show that the set of all doubling metrics and the set of all uniformly disconnected metrics are dense in spaces of metrics on finite-dimensional and zero-dimensional compact metrizable spaces, respectively. Conversely, this denseness of the sets implies the finite-dimensionality, zero-dimensionality, and the compactness of metrizable spaces. We also determine the topological distribution of the set of all uniformly perfect metrics in the space of metrics on the Cantor set.

22 Yoshito Ishiki (RIKEN) Branching geodesics of the Gromov–Hausdorff distance · · · · · 15

Summary: We first evaluate topological distributions of the sets of all doubling spaces, all uniformly disconnected spaces, and all uniformly perfect spaces in the space of all isometry classes of compact metric spaces equipped with the Gromov–Hausdorff distance. We then construct branching geodesics of the Gromov–Hausdorff distance continuously parameterized by the Hilbert cube, passing through or avoiding sets of all spaces satisfying some of the three properties shown above, and passing through the sets of all infinite-dimensional spaces and the set of all Cantor metric spaces. From our results, we observe that the sets explained above are geodesic spaces and infinite-dimensional.

23 Yoshito Ishiki (RIKEN) Fractal dimensions and topological embeddings of the Hilbert cube into the Gromov–Hausdorff space · · · · · 15

Summary: We show that for all four non-negative real numbers, there exists a Cantor ultrametric space whose Hausdorff dimension, packing dimension, upper box dimension, and Assouad dimension are equal to given four numbers, respectively. By constructing topological embeddings of the Hilbert cube into the Gromov–Hausdorff space, we prove that the set of all compact metric spaces possessing prescribed topological dimension, Hausdorff dimension, packing dimension, upper box dimension, and Assouad dimension, and the set of all compact ultrametric spaces are path-connected and have infinite topological dimension. This observation on ultrametrics provides another proof of Qiu's theorem stating that the ratio of the Archimedean and non-Archimedean Gromov–Hausdorff distances is unbounded.

24 Homare Tadano (Yamaguchi Univ.) Boju–Funar type theorems via m-Bakry–Émery Ricci curvature with $m \leqslant 1$ · · · · · 15

Summary: We establish some Boju–Funar type compactness criteria for complete Riemannian manifolds by assuming that the m-Bakry–Émery Ricci curvature with $m \leqslant 1$ tends slowly to zero as the distance from a fixed point goes to infinity. Our results largely improve previous Boju–Funar type compactness criteria for complete Riemannian manifolds via m-Bakry–Émery Ricci curvature established by the author. The key ingredient is a modification of the second variation formula in terms of the m-Bakry–Émery Ricci curvature with $m \leqslant 1$.

25 Homare Tadano (Yamaguchi Univ.) Bonnet–Myers type theorems via m-Bakry–Émery Ricci curvature with ε-range ····· 15

Summary: Inspired by recent works by Y. Lu, E. Minguzzi, and S. Ohta and by K. Kuwae and Y. Sakurai, we give various compactness criteria for complete Riemannian manifolds via m-Bakry–Émery Ricci curvature with ε-range. Our results generalize a Bonnet–Myers type theorem by Y. Lu, E. Minguzzi, and S. Ohta as well as an Ambrose type theorem by K. Kuwae and Y. Sakurai via m-Bakry–Émery Ricci curvature with ε-range. The key ingredients in proving our results are Riccati inequalities obtained from Bochner–Weitzenböck formulas via m-Bakry–Émery Ricci curvature with ε-range.

26 Tomohiro Fukaya (Tokyo Metro. Univ.) A topological product decomposition of Busemann space ····· 15

Summary: We show that a Busemann space X which is covered by parallel bi-infinite geodesics is homeomorphic to a product of another Busemann space Y and the real line. We also show that a semi-simple isometry on X preserving the foliation by parallel geodesics canonically induces a semi-simple isometry on Y.

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

Takefumi Kondo (Kagoshima Univ.) Nonlinear spectral gaps of Coxeter groups with respect to CAT(0) spaces

Summary: Nonlinear spectral gap is an invariant defined for a pair of a finite graph and a metric space and plays important roles in geometric group theory and metric geometry. Pansu calculated the exact values of nonlinear spectral gaps of cycles and generalized triangles with respect to CAT(0) spaces by applying the Wirtinger inequalities for finite cyclic groups proved by Gromov. However, no example of exact calculation was known other than Pansu's results.
In this talk, we discuss variants of the Wirtinger inequalities for finite irreducible Coxeter groups and its application to calculations of nonlinear spectral gaps of Coxeter groups. This contains a nonlinear analogue of computations of spectral gaps of Coxeter groups by Kassabov and Ivrissimtzis–Peyerimhoff.
This is a joint work with Tetsu Toyoda and Takato Uehara.

September 16th (Fri) Conference Room VI

9:30–12:00

27 Norihiko Minami (Nagoya Inst. of Tech.) Cohomological characterization of the hierarchical structures interpolating the uniruledness and the rationally connectedness ····· 15

Summary: For a complex projective manifold, Bouchsom–Demailly–Paun–Peternell (J. Algebraic Geom. 2013) characterized its uniruledness by the non peudoeffectiveness of its canonical divisor. Furthermore, Campana–Demailly–Peternell (London Math. Soc. Lecture Note ser., 417, 2015) gave a cohomological characterization of rationally-connectedness. In this talk, I shall report these characterizations can be interpolated to give some cohomological characterization of the hierarchical structures interpolating the uniruledness and the rationally connectedness.

28 Mamoru Doi ♭ Naoto Yotsutani (Kagawa Univ.) On applications of differential geometric global smoothings of simple normal crossing complex surfaces with trivial canonical bundle ····· 15

Summary: Let X be a simple normal crossing compact complex surface with trivial canonical bundle which includes at most triple intersections. In our recent article [DY22], we have proved that if X is d-semistable, then there exists a family of smoothings in a differential geometric sense. As an important application, we shall provide several examples of d-semistable simple normal crossing complex surfaces with trivial canonical bundle including triple points, which are smoothable to $K3$ surfaces.

29 Naoto Yotsutani (Kagawa Univ.) Diffeomorphism classes of the doubling Calabi–Yau threefolds ····· 15

Summary: In our previous work (New York J. Math. **20** (2014) 1–33), we have constructed Calabi–Yau 3-folds by a differential-geometric gluing method using Fano 3-folds with their smooth anticanonical $K3$ divisors, which are called the *doubling Calabi–Yau 3-folds*. In this talk, we show that any two of the doubling Calabi–Yau 3-folds with Picard number 2 are not diffeomorphic to each other when the underling Fano 3-folds are distinct.

30 Koki Matsuzaka (Hokkaido Univ.)
Masao Jinzenji (Okayama Univ.)
Period integrals and intersection numbers of moduli space of quasimaps in the case of Calabi–Yau hypersurface in CP^{N-1} ····· 15

Summary: In mirror symmetry, period integrals are used in the computation of genus 0 Gromov–Witten invariants. Jinzenji introduced moduli space of quasimaps instead of moduli space of stable maps, and intersection numbers of it. In the case of Calabi–Yau Hypersurface in CP^{N-1}, Jinzenji also showed that there are some relations between intersection numbers $w(\mathcal{O}_{h^a}\mathcal{O}_{h^b})_{0,d}$ of moduli space of quasimaps $\widetilde{Mp}_{0,2}(N,d)$ and corresponding Gromov–Witten invariants $\langle\mathcal{O}_{h^a}\mathcal{O}_{h^b}\rangle_{0,d}$. In this talk, we derived the expressions of period integrals and Givental's I function as generating function of intersection numbers of $\widetilde{Mp}_{0,2}(N,d)$.

31 Yuta Watanabe (Univ. of Tokyo) Bogomolov–Sommese type vanishing theorem for holomorphic vector bundles equipped with positive singular Hermitian metrics ····· 15

Summary: We introduce the Bogomolov–Sommese type vanishing theorem involving multiplier ideal sheaves for big line bundles. We define a dual Nakano semi-positivity of singular Hermitian metrics with L^2-estimates and obtain the vanishing theorem which is a generalization of the Bogomolov–Sommese type vanishing theorem to holomorphic vector bundles.

32 Masaya Kawamura (Kagawa Nat. Coll. of Tech.) Compact almost Hermitian manifolds with quasi-negative curvature and the almost Hermitian curvature flow ····· 15

Summary: In this talk, we introduce a result that the non-positivity of the first Chern–Ricci curvature can be preserved along the almost Hermitian curvature flow, if the initial almost Hermitian metric has the Griffiths non-positive Chern curvature. We have shown that as an application, if additionally the first Chern–Ricci curvature of the initial metric is negative at some point, then the almost complex structure of a compact non-quasi-Kähler almost Hermitian manifold equipped with such a metric cannot be integrable.

33 Taito Tauchi (Kyushu Univ.)
Tsuyoshi Yoneda (Hitotsubashi Univ.)
Leandro A. Lichtenfelz (Wake Forest Univ.)
Existence of a conjugate point in the incompressible Euler flow on a three-dimensional ellipsoid ····· 15

Summary: The existence of a conjugate point on the volume-preserving diffeomorphism group of a compact Riemannian manifold M is related to the Lagrangian stability of a solution of the incompressible Euler equation on M. The Misiołek curvature is a reasonable criterion for the existence of a conjugate point on the volume-preserving diffeomorphism group corresponding to a stationary solution of the incompressible Euler equation. In this talk, we introduce a class of stationary solutions on an arbitrary Riemannian manifold whose behavior is nice with respect to the Misiołek curvature and give a positivity result of the Misiołek curvature for solutions belonging to this class. Moreover, we also show the existence of a conjugate point in the three-dimensional ellipsoid case as its corollary.

34 Tomohiro Asano (Kanazawa Univ.)
Yuichi Ike (Univ. of Tokyo)
Completeness of derived interleaving distances for sheaves and C^0 symplectic geometry ····· 15

Summary: We show the completeness of a derived category of sheaves with respect to the interleaving distance and construct a sheaf quantization of a Hamiltonian homeomorphism. We also develop Lusternik–Schnirelmann theory in the microlocal theory of sheaves. With these new tools, we prove an Arnold-type theorem for the image of the zero-section under a Hamiltonian homeomorphism.

14:15–16:30

35 Akifumi Sako (Tokyo Univ. of Sci.) Category of quantizations and its application to inverse problem ····· 15

Summary: We introduce a category composed of all quantizations of all Poisson algebras. By the category, we can treat in a unified way the various quantizations for all Poisson algebras and develop a new classical limit formulation. This formulation proposes a new method for the inverse problem, that is, the problem of finding the classical limit from a quantized space. Equivalence of quantizations is defined by using this category, and the conditions under which the two quantizations are equivalent are investigated. Two types of classical limits are defined as the limits in the context of category theory, and they are determined by giving a sequence of objects. Using these classical limits, we discuss the inverse problem of determining the classical limit from some noncommutative Lie algebra. We present a method to obtain this classical limit from the principle of least action by using matrix regularization.

36 Naoyuki Kanomata (Tokyo Univ. of Sci.)
Akifumi Sako (Tokyo Univ. of Sci.)
Exact solution of the multipoint correlation function in the Φ_2^3 finite matrix model ····· 15

Summary: We find the exact solutions of the Φ_2^3 finite matrix model (Grosse–Wulkenhaar model). In the Φ_2^3 finite matrix model, multipoint correlation functions are expressed as $G_{|a_1^1 \ldots a_{N_1}^1|\ldots|a_1^B \ldots a_{N_B}^B|}$. It is known that any $G_{|a_1^1 \ldots a_{N_1}^1|\ldots|a_1^B \ldots a_{N_B}^B|}$ can be expressed using $G_{|a^1|\ldots|a^n|}$ type n-point functions. Thus we focus on rigorous calculations of $G_{|a^1|\ldots|a^n|}$. The formula for $G_{|a^1|\ldots|a^n|}$ is obtained, and it is achieved by using the partition function $\mathcal{Z}[J]$ calculated by the Harish-Chandra–Itzykson–Zuber integral.

37 Noriaki Ikeda (Ritsumeikan Univ.)
Yuji Hirota (Azabu Univ.)
Homotopy momentum sections on pre-multisymplectic manifold ····· 15

Summary: We introduce a notion of a homotopy momentum section on a Lie algebroid over a pre-multisymplectic manifold. A homotopy momentum section is a generalization of the momentum map with a Lie group action and the momentum section on a pre-symplectic manifold, and is also a generalization of the homotopy momentum map on a multisymplectic manifold.

38 Shota Hamanaka (Mitsubishi Electric Corp. Adv. Tech. R&D Center)
C^0, C^1 limit theorems for total scalar curvatures ····· 15

Summary: We give some C^0 or C^1 limit theorems for total scalar curvatures. More precisely, we show that the lower bound of the total scalar curvatures on a closed manifold is preserved under the C^0 or C^1 convergence of the Riemannain metrics under some assumptions. Moreover, we give some counterexamples to the above theorems on an open manifold.

39 Tomoki Fujii (Tokyo Univ. of Sci.) Graphical translating solitons for the inverse mean curvature flow and isoparametric functions ····· 15

Summary: In this talk, we consider a translating soliton for the inverse mean curvature flow given as the graph of a function over some domain of a Riemannian manifold whose level sets give isoparametric foliation. The translating soliton is the graph of a function which is a composition of an isoparametric function and a solution of a certain ordinary differential equation. In particular, in case where the Riemannian manifold is the sphere, we classify the shape of such translating solitons.

40 Keita Kunikawa (Utsunomiya Univ.)
Yohei Sakurai (Saitama Univ.)
Gaussian heat kernel estimates of Bamler–Zhang type along super Ricci flow ····· 15

Summary: Bamler–Zhang have developed geometric analysis on Ricci flow with scalar curvature bound. A part of their work can be extended to more general geometric flows. In this talk, we show Gaussian heat kernel estimates of Bamler–Zhang type along super Ricci flow with non-negative differential quantity.

Summary: We show the Reeb sphere theorem for Lipschitz functions, i.e., if a closed Riemannian manifold admits a Lipschitz function with exactly two singular points in the sense of Clarke, then the manifold is homeomorphic to the sphere.

Complex Analysis

September 13th (Tue) Conference Room VIII

9:30–12:00

1 Sei-Ichiro Ueki (Yokohama Nat. Univ.) Isometries of analytic Besov-type Bergman–Orlicz spaces · · · · · 15

Summary: We consider isometries of the analytic Besov-type Bergman–Orlicz space on the open unit disk. We describe the form of linear isometries of this space. Furthermore, we give the characterization for a subjective multiplicative isometry.

2 Rikio Yoneda (Kanazawa Univ.) Invertibility of Toeplitz operators on the Bergman spaces with harmonic symbols · · · · · 15

Summary: We give the sufficient conditions ensuring the invertibility of Toeplitz operators on the Bergman spaces with harmonic symbols.

3 Ryoya Fukasaku (Kyushu Univ.) Shinichi Tajima (Niigata Univ.*) Efficient algorithms for computing univariate residues · · · · · 15

Summary: We introduce a new algorithm for computing univariate residues, which is based on the theories of local cohomology classes and differential operators. In addition, we compare the algorithm with existing algorithms.

4 Takanori Ayano (Osaka Metro. Univ.) Hurwitz integrality of the power series expansion of the sigma function for the telescopic curves · · · · · 15

Summary: The elliptic sigma function, which is defined and studied by Weierstrass, is generalized to the multivariable sigma functions associated with the higher genus curves. The coefficients of the power series expansion of the sigma function around the origin are included in the ring generated by the coefficients of the defining equations of an algebraic curve over the rationals. From this algebraic property, when a curve degenerates to a singular curve, the sigma function has a limit. Y. Onishi proved more precise property, i.e., the Hurwitz integrality of the power series expansion of the sigma function for the (n, s) curves. In this talk, we will generalize this result to the telescopic curves, which contain the (n, s) curves as special cases.

5 Md Shafiul Alam (Univ. of Barishal) Toshiyuki Sugawa (Tohoku Univ.) On geometric deduction of the solutions to generalized modular equations · · · · · 15

Summary: Ramanujan presented without proof many remarkable formulae for the solutions to generalized modular equations. Much later, proofs of the formulae were provided by making use of highly nontrivial identities for theta series and hypergeometric functions. We offer a geometric approach to the proof of those formulae. We emphasize that our proofs are geometric and independent of such identities.

6 Yohei Komori (Waseda Univ.) Angle parameters for hyperelliptic Riemann surfaces · · · · · 10

Summary: We show that any hyperelliptic Riemann surface can be parametrized by means of 4g-2 angles between simple closed geodesics.

7 Ryo Matsuda (Kyoto Univ.) Geodesics on the Teichmüller space of a Riemann surface with $\mathbb{Z}$ action · · · · · 15

Summary: Let R be a Riemann surface of infinite analytic type. We give sufficient conditions for extremality of Beltrami coefficients on R. Next, we apply these results to a discussion of geodesics in Teichmüller spaces. In particular, we explain a construction of a Beltrami coefficient μ_0 in Teich$(\mathbb{C} \setminus \mathbb{Z})$ satisfying the following conditions: $|\mu_0|(z) = \|\mu_0\|$ (a.e.z) and there exists a family of geodesics $\{\gamma_\lambda\}_{\lambda \in D}$ from $[0]$ to $[\mu_0]$ with complex analytic parameter, where D is an open set in l^∞. This means that we cannot exclude condition $|\mu_0|(z) = \|\mu_0\|$, which is one of the necessary and sufficient conditions for the unique existence of a geodesic given by Earle–Kra–Krushkaĺ.

8 Hidetoshi Masai (Tokyo Tech)
Greg McShane (Inst. Fourier)
Deformation of complex structures on 4 punctured sphere along a Teichmüller geodesic ····· 15

Summary: Some pictures and movies of complex structures on the 4 punctured sphere, and the mathematics behind them will be presented.

9 Katsuhiko Matsuzaki (Waseda Univ.)
Huaying Wei (Jiangsu Normal Univ.)
Chordal Loewner chains and Teichmüller spaces on the half-plane ···· 15

Summary: We consider a univalent analytic function f on the half-plane satisfying the condition that the supremum norm of its (pre-)Schwarzian derivative vanishes on the boundary. Under certain extra assumptions on f, we show that there exists a chordal Loewner chain initiated from f until some finite time, and this Loewner chain defines a quasiconformal extension of f over the boundary such that its complex dilatation is given explicitly in terms of the (pre-)Schwarzian derivative in some neighborhood of the boundary. As an application of this quasiconformal extension, we complete the characterization of an element of the VMO-Teichmüller space on the half-plane using the vanishing Carleson measure condition induced by the (pre-)Schwarzian derivative.

14:15–15:15

10 Shunji Horiguchi
Extended Mandelbrot sets of $f(z) = (z^m + c)^n$ ····· 15

Summary: In section 1, we extend the Mandelbrot set M(2,c,1) of f(z)=z*z+c to M(m,c,n) of g(z)=(z**m+c)**n, and show that the extend Mandelbrot is connected,closed set. Nest we show that the outlines of M(m,c,n) related to M(1,c,mn) are same. In section 2, we give definitions of fractals. In section 3, we give 6 examples of extended Mandelbrot sets which are fractals.

11 Takayuki Watanabe (Kyoto Univ.)
On the stochastic bifurcations regarding random iterations of polynomials of the form $z^2 + c_n$ ····· 15

Summary: In this talk, we consider random iterations of polynomial maps $z^2 + c_n$ where c_n are complex-valued independent random variables following the uniform distribution on the closed disk with center c and radius r. The aim of this paper is twofold. First, we investigate the bifurcation of our proposed random iterations and give quantitative estimates of bifurcation parameters. Second, we apply the estimates to the (dis)connectedness of random Julia sets. In particular, we prove that for the central parameter $c = -1$, almost every random Julia set is totally disconnected with much smaller radial parameters r than expected.

12 Yûsuke Okuyama (Kyoto Inst. Tech.)
Uniform perfectness in non-archimedean dynamics ····· 15

Summary: The notion of uniform perfectness of subsets in $\mathbb{C}$ (or $\mathbb{P}^1$) plays an important role in complex analysis, complex dynamics, and (complex) potential theory. In this talk, we will introduce a non-archimedean counterpart to this important notion, and give a few applications of it in non-archimedan dynamics and potential theory on the Berkovich projective line.

13 Yûsuke Okuyama (Kyoto Inst. Tech.)
Reduction, quantization, and degeneration in non-archimedean and complex dynamics ····· 15

Summary: For a family of (complex) rational functions on $\mathbb{P}^1$ of degree $d > 1$ holomorphically parametrized by $\mathbb{D}^*$ and meromorphically parametrized by $\mathbb{D}$, when this family degenerates at the puncture $t = 0$ for $\mathbb{D}^*$, the family of the equilibrium measures of each rational functions converges weakly as $t \to 0$. In this talk, we will complement a key computation in the proof of the above DeMarco–Faber's degenerating limit theorem, which is in terms of reduction and quantization of non-archimedean dynamics on the Berkovich projective line.

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

Kazuya Tohge (Kanazawa Univ.) Revisiting the Stothers–Mason theorem with Nevanlinna

Summary: By the Stothers–Mason theorem we mean the *abc* inequality for complex polynomials stating: *three relatively prime and non-constant polynomials a, b and c satisfy the relation $a+b=c$ only if each of their degree is at most the number of distinct roots of the product abc minus one.* It is well known that this estimate is sharp with many examples and applies to polynomial or rational solutions of Fermat-type equations as for Davemport's theorem, naturally. One can bring Picard's Little Theorem over to the observation of $a+b=c$ so that some of the known generalizations of the Stothers–Mason theorem are stated in Nevanlinna's value distribution theory of meromorphic functions on the complex plane. Then it is obvious that Wronskian plays an essential role in order to count the number of distinct roots of the *abc*. In this talk, we change this way of counting and see that another type of *abc* inequalities is available with another operation than differentiation. In other words, we introduce a new radical based on a judgment of multiple roots in a different angle. When one observes the multiplicity as the repletion number of roots with a fixed stride, the operation is, of course, the shift or difference operator. We give the *abc* inequality in this setting and apply it for the corresponding Fermat or Davemport type estimates as well as for some known generalizations of the Stothers–Mason theorem. All those discussions proceed in parallel to the usual differential setting where Casoratian replaces Wronskian as a matter of course. Some of their extremal solutions can be exchanged in some translation rule. But we have found no indication of a possible geometric approach in the difference setting, yet. Hence this talk is all about complex functions of one variable and not about integers but a very naïve experiment. This is based on a joint work with K. Ishizaki, R. Korhonen, and N. Li.

September 14th (Wed) Conference Room VIII

9:30–12:00

Summary: We consider a family of dissipative quadratic complex Hénon maps $H_{a,t}$ with $a \in \mathbb{D}_\delta$ and $t \in [0,1]$, where $\delta > 0$. Suppose that $H_{a,t}$ has a fixed point $\mathbf{q}_{a,t} \in \mathbb{C}^2$, depending continuously on a and t, with one eigenvalue λ_t such that $\lambda_t \to \lambda = \exp(2\pi ip/q), (p,q) \in \mathbb{Z} \times \mathbb{N}$ as $t \to 0$. Let λ_t/λ be expressed by $\exp(L_t + i\theta_t)$ and $\theta_t \to 0$ as $t \to 0$. We prove that the Julia sets J and J^+ depend continuously on t if $\theta_t^2/L_t \log(|\theta_t/L_t|) \to 0$ as $t \to 0$. We see that $H_{a,t}$ is hyperbolic if $\theta_t = O(L_t)$ and $L_t \neq 0$. Moreover, $\{H_{a,t}\}$ is J-stable if $\theta_t = O(L_t)$ and $L_t \geq 0$.

Summary: We pose a normal form of transition functions along some Levi-flat hypersurfaces obtained by suspension. By focusing on methods in circle dynamics and linearization theorems, we give a sufficient condition to obtain a normal form as a geometrical analogue of Arnol'd's linearization theorem.

Summary: In this talk, we first give a necessary and sufficient condition for the composition operator C_φ from the α-Bloch space into the β-Bloch space to be bounded. Next, we discuss a necessary condition for C_φ to be compact.

Summary: We give another proof of analytic Ax–Schanuel theorem for semi-abelian varieties by means of Nevanlinna theory. It was motivated by Schanuel's Conjecture, which implies the algebraic independence of e and π as a special case. The Ax–Schanuel Theorem is a formal functional version of Schanuel's Conjecture and was proved by Ax 1971 by making use of Kolchin's differential algebra. Here we give another proof of the analytic Ax–Schanuel Theorem by means of the Log Bloch–Ochiai Theorem and some estimate of integrals of log-differentials.

Summary: The purpose is to explore Nevanlinna theory of the entire curve $\widehat{\exp} f := (\exp f, f) : \mathbf{C} \to A \times \mathrm{Lie}(A)$ associated with an entire curve $f : \mathbf{C} \to \mathrm{Lie}(A)$, where A is a semi-abelian variety. In particular, we prove a *2nd Main Theorem* for $\widehat{\exp} f$ and its k-jet lifts with truncated counting functions at level one. We give some applications to a problem of a type raised by S. Lang and the unicity. The results clarify a relationship between the problems of Ax–Schanuel type and Nevanlinna theory.

Summary: What we call the CR Killing operator D on a contact manifold (M, H) equipped with a compatible almost CR structure J (also known as a strictly pseudoconvex partially integrable almost CR manifold) is the linear differential operator describing trivial deformations of J. We report our recent finding that D can also be found as the first operator in the so-called Bernstein–Gelfand–Gelfand sequence. More precisely, D is the first BGG operator induced by a modified tractor connection introduced by Čap, not by the normal tractor connection, of the adjoint tractor bundle.

Summary: In this talk, we show that a C^2-mapping from an open subset in $\mathbb{C}^q$ to $\mathbb{C}^k$ is holomorphic if its graph is pseudoconcave of order q. This is an extension of Hartogs' analyticity theorem. The proof is given using the characterization of pseudoconcave sets of order q by local maximum principle for q-convex functions.

Summary: We review the Sasakian structure of the Heisenberg group and the Kähler structure of its Kähler cone. The latter provides the horospherical model of the complex hyperbolic plane, which is known as Siegel domain. We study the geometric properties of the Kähler manifolds, such as its curvature, geodesics. The Kähler manifolds and the complex hyperbolic plane are neither biholomorphic nor isometric; however, we prove that there exist subbundles of their respective (1,0) tangent spaces such that the horospherical tangent map is a holomorphic isometry when restricted to those subbundles. This is a joint work with Ioannis D. Platis.

Summary: A complex manifold is said to be complete Kähler at infinity if it admits a complete metric whose fundamental form is closed outside a compact subset. A large amount of locally pseudoconvex domains have this property. It is expected that basic existence theorems on strongly pseudoconvex manifolds for coherent analytic sheaves have natural generalizations for locally free sheaves with approriate curvature conditions on such manifolds. Affirmative results in this direction will be shown.

13:30–14:30 Talk Invited by Complex Analysis Section

Shinichi Tajima (Niigata Univ.*) Complex and algebraic analysis of singularities, and algorithms

Summary: We consider complex analytic properties of singularities. In this talk, we show that the use of local cohomology and Grothendieck local duality allow us to construct a new approach for studying singularities. As applications, we present several algorithms for computing complex analytic invariants of singularities. We study in particular non-isolated hypersurface singularities. By using Gröbner basis on Poincaré–Birkhoff–Witt algebra, we give a method for computing b-functions and holonomic D-modules associated to non-isolated hypersurface singularities. We study the structure of holonomic D-modules and give some applications to singularity theory.

Functional Equations

September 13th (Tue) Conference Room II

9:45–12:00

1 Ichiro Tsukamoto (Toyo Univ.) ♭ On asymptotically linear solutions of $x'' = \pm e^{\alpha\lambda t}x^{1+\alpha}$ 10

Summary: As already known, the differential equations denoted in the title have solutions asymptotic to linear functions as t tends to $-\infty$. In this talk, we get the asymptotic expansions of these in terms of Hukuhara's theory of a Briot–Bouquet differential equation.

2 Shunya Adachi (Kumamoto Univ.) Monodromy invariant Hermitian forms for second order Fuchsian differential equations 10

Summary: In our previous work, we characterized the conditions for the monodromy of second order Fuchsian differential equations with four singularities to have an invariant Hermitian form. In this talk, we relax the assumption regarding the number of singularities. Namely, we consider the existence of monodromy invariant Hermitian form when the number of singularities is arbitrary. As a result, we give a criterion for the existence of monodromy invariant Hermitian forms in terms of monodromy variety.

3 Shuhei Mano (Inst. of Stat. Math.)
Nobuki Takayama (Kobe Univ.) A sum formula of GKZ-hypergeometric polynomials with matrices associated with chordal graphs at specific values 10

Summary: The graphical toric model is an important and interesting model in statistics. The normalizing constant of the probability function is a multi-variable polynomial and satisfies a GKZ hypergeometric holonomic system. Sundberg (1975) obtained a closed form expression of the special value of the polynomial when the graph is chordal. He derived it by using a factorization of the probability measure. From the GKZ point of view, the polynomial has an Euler type integral representation. We will give a proof for the formula by the integral representation.

4 Shinji Sasaki (Shibaura Inst. of Tech.) Borel summability of WKB-theoretic transformation near a double turning point 10

Summary: We consider the one-dimensional stationary Schödinger equation with a double turning point. Near the double turning point, the equation is WKB-theoretically transformed to the canonical equation (the degenerate Weber equation). Following the result of Kamimoto–Koike (2011) near a simple turning point, we give Borel summability of the transformation near a double turning point, so that we obtain the connection formula from the canonical equation via the transformation.

5 Takashi Aoki (Kinki Univ.*)
Takao Suzuki (Kinki Univ.)
Shofu Uchida (Kinki Univ.) Exact WKB analysis for the Pearcey system with a large parameter 10

Summary: The Pearcey system is an extension of the Airy equation for multi variables. In this talk, we show that the Borel transform of WKB solutions for the Pearcey system can be written as linear combinations of algebraic functions.

6 Masafumi Yoshino (Hiroshima Univ.) Movable singular point of solution of some Hamiltonian system 10

Summary: In this talk we study the solution of the Hamiltonian system with two movable singular points. We solve the Hamiltonian system by transforming it to a certain simpler Hamiltonian system by virtue of the homology equation and the global Borel summability method for PDEs.

7 Kazuki Ishibashi (Hiroshima Nat. Coll. of Maritime Tech.) — A nonoscillation theorem for damped linear differential equations with a proportional derivative controller · · · · · 10

Summary: The proportional derivative controller of a differential operator is commonly referred to as the conformable derivative. In this talk, we present a nonoscillation theorem for damped linear differential equations with a differential operator using the conformable derivative of control theory. The proof of the nonoscillation theorem utilizes the Riccati inequality corresponding to the equation considered.

8 Hiroshi Ogawara (Kumamoto Univ.) — Differential transcendence of solutions for second order linear q difference equations · · · · · 10

Summary: We investigate differential transcendence of solutions for second order linear q difference equations based on a criterion of Nishioka.

9 Masato Hashizume (Hiroshima Univ.), Norisuke Ioku (Tohoku Univ.) — A power type approximation of the Moser–Trudinger inequality · · · · · 10

Summary: The Moser–Trudinger inequality is considered to be a limiting case of the Sobolev inequality in the framework of Orlicz spaces. However, the Moser–Trudinger inequality is not obtained via a direct limiting procedure. In this talk, we consider a Sobolev type inequality and some properties of the inequality. In particular, we show that the Carleson–Chang limit on the Moser–Trudinger inequality is derived by the limiting procedure for the concentration level of the Sobolev type inequality.

10 Hiroyuki Usami (Gifu Univ.), Manabu Naito (Ehime Univ.⋆) — On the existence and asymptotic behavior of solutions of perturbed half-linear ordinary differential equations · · · · · 10

Summary: Perturbed half-linear ordinary differential equations are considered near the infinity. When the perturbed term is identically zero, every nontrivial solutions of the equation behaves like exponential functions near the infinity. We show that, if the perturbed term is small enough, every nontrivial solution of the equation still behaves like exponential functions.

14:15–16:45

11 Tetsutaro Shibata (Hiroshima Univ.) — Oscillatory bifurcation problems for ODEs with logarithmic nonlinearity · · · · · 10

Summary: We consider the asymptotic behavior of the bifurcation curve of nonlinear ODEs with logarithmic and oscillatory terms. It is well known that the bifurcation curve λ is a continuous function of the maximum norm $\alpha = \|u_\lambda\|_\infty$ of the solution u_λ corresponding to λ. Moreover, it is parameterized by α such as $\lambda = \lambda(\alpha)$. Our goal is to obtain the asymptotic formula for $\sqrt{\lambda(\alpha)}$ as $\alpha \to \infty$.

12 Tatsuki Mori (Musashino Univ.), Sohei Tasaki (Hokkaido Univ.), Tohru Tsujikawa (Univ. of Miyazaki⋆), Shoji Yotsutani (Ryukoku Univ.⋆) — Secondary bifurcation and the direction of bifurcation of stationary solutions to a phase field model · · · · · 10

Summary: We are concerned with bifurcation diagrams of stationary solutions to a phase field model proposed by Fix and followed by Caginalp. We obtained all global bifurcation diagrams of stationary solutions, which include the secondary bifurcation from odd symmetric solutions. In this talk, we clarify the direction of bifurcation after the secondary bifurcation. The direction of bifurcation is crucial for investigating the stability/instability of solutions.

13 Ryuji Kajikiya (Osaka Electro-Comm. Univ.) — Bifurcation of solutions for the sublinear Moore–Nehari differential equation · · · · · 10

Summary: We study the bifurcation of symmetric nodal solutions for the sublinear Moore–Nehari equation. Here we call a solution symmetric if it is even or odd. For a nonnegative integer n, we call a solution n-nodal if it has exactly n zeros in $(-1, 1)$. We denote the unique n-nodal symmetric solution by $u_n(x, \lambda)$. We prove that if n is even, $u_n(x, \lambda)$ does not bifurcate, however if n is odd, it bifurcates at a certain point and a bifurcation branch consists of asymmetric solutions.

14 Yuki Osada (Tokyo Metro. Univ.) A singular perturbation problem for a nonlinear Schrödinger system with three wave interaction ····· 10

Summary: In this talk, we consider the locations of spikes of ground states for the following nonlinear Schrödinger system with three wave interaction

$$\begin{cases} -\varepsilon^2\Delta u_1 + V_1(x)u_1 = |u_1|^{p-1}u_1 + \gamma u_2 u_3 & \text{in } \mathbb{R}^N, \\ -\varepsilon^2\Delta u_2 + V_2(x)u_2 = |u_2|^{p-1}u_2 + \gamma u_1 u_3 & \text{in } \mathbb{R}^N, \\ -\varepsilon^2\Delta u_3 + V_3(x)u_3 = |u_3|^{p-1}u_3 + \gamma u_1 u_2 & \text{in } \mathbb{R}^N \end{cases}$$

as $\varepsilon \to +0$, where $N \le 5$, $2 \le p < 2^* - 1$, $2^* = \infty$ $(N \le 2)$, $2^* = 2N/(N-2)$ $(N \ge 3)$, $\varepsilon, \gamma > 0$. More precisely, we define a function ρ, where the spikes are trapped at the minimum points of $\rho(V_1(x), V_2(x), V_3(x))$ under certain conditions.

15 Satoshi Tanaka (Tohoku Univ.)
Kotaro Watanabe (Nat. Defense Acad. of Japan)
Naoki Shioji (Yokohama Nat. Univ.)
Existence and multiplicity of positive solutions to the scalar-field equation on large annuli in the 3-sphere ····· 10

Summary: A Dirichlet problem for the scalar-field equation on an annular domain in the unit 3-sphere is considered. The existence and multiplicity of positive solutions are shown.

16 Yuki Naito (Hiroshima Univ.)
Yasuhito Miyamoto (Univ. of Tokyo)
Singular solutions for semilinear elliptic equations with general supercritical growth ····· 10

Summary: A positive radial singular solution for $\Delta u + f(u) = 0$ with a general supercritical growth is constructed. An exact asymptotic expansion as well as its uniqueness in the space of radial functions are also established. These results can be applied to the bifurcation problem $\Delta u + \lambda f(u) = 0$ on a ball. Our method can treat a wide class of nonlinearities in a unified way, e.g., $u^p \log u$, $\exp(u^p)$ and $\exp(\cdots \exp(u) \cdots)$ as well as u^p and e^u. Main technical tools are intrinsic transformations for semilinear elliptic equations and ODE techniques.

17 Jumpei Inoue (Waseda Univ.) On the optimal habitat profile for the Dirichlet problem of a logistic equation ····· 10

Summary: This talk is concerned with the stationary problem for a diffusive logistic equation with the homogeneous Dirichlet boundary condition. Relating to the corresponding Neumann problem, Wei-Ming Ni proposed a question as follows: Maximizing the ratio of the total masses of species to resources. For this question, Bai, He and Li showed that the supremum of the ratio is 3 in the one dimensional case, and the speaker and Kuto showed that the supremum is infinity in the multi-dimensional ball. In this talk, we show the same results still hold true for the Dirichlet problem.

18 Shuhei Kitano (Waseda Univ.) $W^{\sigma,p}$ a priori estimates for fully nonlinear integral equations ····· 10

Summary: In this talk, we discuss $W^{\sigma,p}$ estimates for a class of fully nonlinear integral equations of order σ, which are analogues of $W^{2,p}$ estimates by Caffarelli. We also obtain ABP maximum principles, which are improvements of estimates proved by Guillen and Schwab, depending only on L^p norms of inhomogeneous terms.

19 Shuhei Kitano (Waseda Univ.) ABP maximum principles for fully nonlinear integral equations with unbounded inhomogeneous terms ····· 10

Summary: ABP maximum principles for integral equations have been investigated by Caffarelli–Silvestre and Guillen–Schwab, but strictly depends on the boundness of inhomogeneous terms. We present an improved ABP maximum principle when the order of equation is close to 2, by using a new iteration method.

20 Yasuhiro Fujita (Univ. of Toyama) Norikazu Yamaguchi (Univ. of Toyama) Antonio Siconolfi (Sapienza Univ. di Roma) — Hamilton–Jacobi flows and nowhere differentiablity of initial data · · · · 10

Summary: In this talk, we report that nowhere differentaiblity of initial data can be derived from specific assumptions on the Hamilton–Jacobi flow issued from these data. This is a sort of inverse problem. The results of this talk can be seen in an electronic version of Mathematische Annalen, https://doi.org/10.1007/s00208-021-02353-w, Open Access.

21 Takashi Suzuki (Osaka Univ.) — Differentiability of eigenvalues concerning domain perturbations · · · · · 5

Summary: We show the first and the second differentiability of the eigenvalues of Laplacian concerning general perturbation of Lipschitz domains provided with mixed boundary conditions, particularly, for multiple eigenvalues. This property is valid if the order of eigenvalues is changed and the derivatives are characterized by the other eigenvalues on finite dimensional spaces. Joint work with Takuya Tsuchiya.

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

Daisuke Yamakawa (Tokyo Univ. of Sci.) — Geometry and symmetry of isomonodromic deformations

Summary: Isomonodromic deformations are some nice deformations of linear ordinary differential equations with meromorphic coefficients and are governed by nonlinear differential equations, called the isomonodromy equations. The most famous examples of isomonodromy equations are the Painlevé equations. I will give an overview of some topics on isomonodromic deformations relating to the algebraic and symplectic geometry.

September 14th (Wed) Conference Room II

9:45–12:00

22 Kazuya Hirose (Hokkaido Univ.) Nao Hamamuki (Hokkaido Univ.) — A dynamical approach to lower gradient estimates for viscosity solutions of Hamilton–Jacobi equations · 10

Summary: In this talk, we present a new approach to deriving lower bounds for gradients of a viscosity solution to a Hamilton–Jacobi equation when the Hamiltonian is convex. For the proof, we study solutions to the approximate Hamiltonian systems. Moreover, we compare our results with the previous work by O. Ley (2001). We show that our results give better and optimal estimates in several senses.

23 Kuniyasu Misu (Hokkaido Univ.) — A game-theoretic approach to the asymptotic behavior of solutions to an obstacle problem for the mean curvature flow equation · · · · · · · · · · · 10

Summary: We consider the asymptotic behavior of solutions to an obstacle problem for the mean curvature flow equation by using a game-theoretic approximation, which we extend from that of Kohn and Serfaty (2006). We prove that moving curves governed by the mean curvature flow converge in time to the boundary of the convex hull of obstacles under some assumptions on the initial curves and obstacles. In these proofs, we utilize the properties of the game trajectories given by very elementary game strategies.

24 Ryunosuke Mori (Meiji Univ.)
Eita Tomimatsu (Tokyo Tech)
Yoshihiro Tonegawa (Tokyo Tech)
On a strong solution to a generalized mean curvature flow with a transport term in the sense of Brakke's formulation ····· 10

Summary: Suppose that a family of k-dimensional surfaces in $\mathbb{R}^n$ evolves by the generalized mean curvature flow with a given transport vector u in the sense of Brakke's formulation of velocity. When the flow is locally close to a time-dependent k-dimensional plane in a weak sense of measure in space-time, it is represented as a graph of a $C^{1,\alpha}$ function over the plane. On the other hand, it is not known if the graph satisfies the corresponding PDE pointwise in general. For this problem, when $k = n - 1$ and the distributional time derivative of the graph is a signed Radon measure, it is proved that the graph satisfies the PDE pointwise. An application to a short-time existence theorem for a surface evolution problem is given.

25 Keisuke Takasao (Kyoto Univ./Kyoto Univ.)
Existence of weak solution to volume preserving mean curvature flow in all dimensions ····· 10

Summary: We consider the weak solution to the volume preserving mean curvature flow. In 2016, Mugnai, Seis, and Spadaro proved the existence of the weak solution (flat flow) by the minimizing movement scheme. In addition, they also showed that the flat flow is the distributional solution under the reasonable assumption for the convergence of the approximate solution. In this talk, we prove the existence of the weak solution called L^2-flow via the phase field method without the assumption. We also show that the weak solution is the distributional solution for a short time, under an assumption for initial data.

26 Ryo Ito (Kanagawa Univ.)
Hirokazu Ninomiya (Meiji Univ.)
Unbounded traveling wave solutions for reaction-diffusion equations ·· 10

Summary: We discuss the existence of unbounded traveling wave solutions for one dimensional reaction-diffusion equations with several type of nonlinearities. It is well known that in the monostable nonlinearity case there exist traveling wave solutions connecting two zero points. The idea of this study is varying the one zero point. We consider the question: what happens when one of the zero point goes to infinity? The purpose of this study is to construct a theory of unbounded traveling wave solutions and to reconsider the classical theory of traveling wave solutions from new viewpoint introduced in this study.

27 Yu Ichida (Meiji Univ.)
Radially symmetric stationary solutions for certain chemotaxis systems based on compactification in phase space ····· 10

Summary: This talk reports results on the existence, shapes, and asymptotic behavior of positive radially symmetric stationary solutions for several models (the simplest parabolic-elliptic Keller–Segel model and the simplest attraction-repulsion chemotaxis system) of chemotaxis in higher dimensions, using a method that combines classical results from the continuous dynamical systems theory and Poincaré–Lyapunov compactification. The key to the discussion is to derive a scalar equation by using a transformation on the averaged mass for the equation satisfied by the radially symmetric stationary solution and to investigate the infinity dynamics as geometric information for the two-dimensional ordinary differential equations derived from it.

28 Jumpei Inoue (Waseda Univ.)
Kousuke Kuto (Waseda Univ.)
Homare Sato (Waseda Univ.)
Full cross-diffusion limit in the stationary SKT model with Dirichlet boundary conditions ····· 10

Summary: This talk is concerned with positive steady-states of the Shigesada–Kawasaki–Teramoto model with homogeneous Dirichlet boundary conditions. A main result reveals that the asymptotic behavior of positive steady-states as both cross-diffusion terms tend to infinity can be classified into two types. Furthermore, each type is characterized by the limiting system. Concerning one of two limiting systems, we obtain the global bifurcation structure.

29 Yuki Tsukamoto (Meiji Univ.) A convergence of reaction-diffusion approximation · · · · · · · · · · · · · · · · · · 10

Summary: We consider a singular limit problem called the fast reaction limit. This problem has been studied extensively when the reaction terms of each component are the same function in a two-component system. However, it is not fully understood how solutions behave in problems with different reaction terms. In this talk, we will consider the problem where the reaction term is represented by a power term. We proved that the initial interface instantly vanishes and the function converges to a function satisfying the heat equation.

30 Yuta Ishii (Ibaraki Nat. Coll. of Tech.) The existence and stability of multi-peak solutions to the Gierer–Meinhardt model on Y-shaped metric graph · 10

Summary: In this talk, we consider the existence and the stability of two-peak solutions to the Gierer–Meinhardt model with heterogeneity in front of nonlinear terms on Y-shaped metric graphs. In particular, we explain that the location, amplitude, and stability of spikes are decided by the interaction of the heterogeneity function with the geometry of the graph, represented by the associated Green's function. Also, to investigate the effect of the geometry of the graph in details, we consider the non-heterogeneity function case, comparing the corresponding previous works of the one-dimensional interval case.

31 Yuta Ishii (Ibaraki Nat. Coll. of Tech.) The existence and stability of multi-peak solutions to the Schnakenberg model on star shaped metric graph · 10

Summary: In this talk, we explain the results on the existence and the stability of N-peak solutions to the Schnakenberg model with heterogeneity in front of nonlinear terms on star shaped metric graphs. The location, amplitude, and stability of spikes are decided by the effects of the heterogeneity function and the geometry of the graph represented by the associated Green's function. Also, by considering non-heterogeneity function case, we describe the effects of the geometry of a star graph on N-peak solution in details. Moreover, we give the classification of the lengths of segments in the case that spikes are arranged on segments one by one.

13:30–14:30 Talk Invited by Functional Equations Section

Masataka Shibata (Meijo Univ.) Asymptotic behavior of positive solutions for a class of quasilinear elliptic equations with H^1-critical growth

Summary: We consider a quasilinear elliptic equation $-\Delta u - \kappa u \Delta(u^2) = u^p - u$ in $\mathbb{R}^N$, where $N \geq 3$, $p > 1$, $\kappa > 0$. The equation appears in the study of standing waves of a modified Schrödinger equation. In this talk, we focus on the case of $p + 1 = 2^*$ (H^1-critical case) and discuss the asymptotic behavior of positive solutions.

September 15th (Thu) Conference Room II

9:45–12:00

32 Kota Ikeda (Meiji Univ.) Stability analysis of a uniform flow in a mathematical model of camphor boats · 10

Summary: Various collective motions of camphor boats, called jamming, clustering, and swarming state observed in a one-dimensional circuit, have been studied. It is expected that the center manifold theories proposed in previous works are useful for the analysis of the collective motion of camphor boats. In my previous work, we have developed a new theory for a system with Dirac's delta functions in L^2-framework. In this talk, we will examine the stability analysis in the reduced system and numerically show that the uniform flow can be destabilized even if the length of the circuit is large.

Summary: We consider a free boundary problem for a reaction-diffusion equation with positive bistable nonlinearity under a radially symmetric environment. 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, and give some sufficient conditions for each dynamical behavior. We will also discuss the spreading speed of the free boundary.

Summary: This talk deals with occurrence of blow-up phenomena in a diffusive Lotka–Volterra competition model with chemotaxis. In 2012 Tello–Winkler (Nonlinearity; 2012: 25; 1413–1425) proposed a diffusive Lotka–Volterra competition model having chemotaxis terms. As to this model, boundedness of solutions was obtained under conditions that chemotactic effect is small by e.g. Tello–Winkler (2012) and Mizukami (Math. Methods Appl. Sci.; 2018; 41; 234–249). However, blow-up of solutions has not been derived yet. The purpose of this talk is to discuss whether solutions blow up.

Summary: This talk is concerned with existence and uniqueness of energy solutions to the Cauchy–Dirichlet problem posed on bounded domains for nonlinear diffusion equations involving the so-called restricted fractional Laplacians.

Summary: We construct a linear approximation of the solution to the Surface Quasi-Geostrophic Equation in two-dimensional Euclidean space, and obtain a convergence rate, in the Lebesgue norm, between the solution and this approximation with respect to time. We also demonstrate that the nonlinear term of the solution is bounded sharply by the same function of time.

Summary: We show several estimates of the semigroup generated by the fractional Dirichlet Laplacian on an arbitrary domain of $\mathbb{R}^d$. We also describe a procedure to introduce Sobolev spaces associated with the Dirichlet Laplacian.

Summary: An inverse scattering method is established for finding soliton solutions of a hierarchy generalising the KdV hierarchy. The soliton solutions become generically exploding solitons.

Summary: We study the dynamics of solutions of nonlinear Schrödinger equation near unstable ground states. The existence of the local center stable manifold around ground states and the asymptotic stability for the solutions on the manifold is proved. The novelty of our result is that we allow the existence of internal modes.

40 Tomoharu Kinoshita (Waseda Univ.) Infinitely many solutions for nonlinear Schrödinger equations under Berestycki–Lions condition 10

Summary: In this talk, we study the existence and multiplicity of solutions of the nonlinear Schrodinger equatios under Berestycki–Lions condition. For this purpose, we apply a new deformation lemma argument under a new version of the Palais–Smale condition.

41 Masayuki Hayashi (Kyoto Univ.)
Noriyoshi Fukaya (Tokyo Univ. of Sci.)
Takahisa Inui
(Osaka Univ./Univ. of British Columbia)
Traveling waves for a nonlinear Schrödinger system with quadratic interaction 10

Summary: We study traveling wave solutions for a system of nonlinear Schrödinger equations with quadratic interaction. For the non mass-resonance case, the system has no specific symmetry such as Galilean or pseudo-conformal symmetry, which is of particular interest. We construct traveling wave solutions by variational methods, and also show global existence for oscillating large data as an application.

14:15–16:45

42 Isao Kato (Kyoto Univ.) Ill-posedness for the half wave Schrödinger equation 10

Summary: We study the Cauchy problem for the half wave Schrödinger equation introduced by Xu (2017). There are some well-posedness results for the equation, however there is no ill-posedness result. We focus on the scale critical space and obtain the ill-posedness in the super-critical or the critical space under certain condition. The proof in the super-critical space is based on the argument established by Christ, Colliander and Tao (2003). For the critical space, we use the standing wave solution, which was proved the existence by Bahri, Ibrahim and Kikuchi (2021).

43 Wataru Nakahashi (Tokyo Univ. of Sci.)
Keiichi Kato (Tokyo Univ. of Sci.)
Non-smoothness of the fundamental solutions of Schrödinger equations in three dimensions with super-quadratic potential 10

Summary: We consider non-smoothness of the fundamental solution for the initial value problem of the Schrödinger equations with super-quadratic scalar potential. One dimensional case was studied by K. Yajima (1996). The purpose of this talk is to show the case which spatial dimension is three and scalar potential is radical.

44 Naoki Matsui (Tokyo Univ. of Sci.) Minimal-mass blow-up solutions for inhomogeneous nonlinear Schrödinger equations with potentials 10

Summary: It is known that all the subcritical mass solutions of the nonlinear Schrödinger equation with L^2-critical power-type nonlinear terms and small perturbation terms are bounded time global solutions. On the other hand, in the critical mass case, blow-up solutions may exist. In this talk, I treat an equation with the power-type nonlinear terms with inhomogenity and a potential including a growing one as a smaller perturbation term, and state that there exists a critical mass blow-up solution for this equation.

45 Yuji Sagawa (Chiba Inst. of Tech.)
Chunhua Li (Yanbian Univ.)
Yoshinori Nishii (Tokyo Univ. of Sci.)
Hideaki Sunagawa
(Osaka Metro. Univ.)
Upper and lower L^2-decay bounds for a class of derivative nonlinear Schrödinger equations 10

Summary: We consider the initial value problem for cubic derivative nonlinear Schroedinger equations possessing weakly dissipative structure in one space dimension. We show that the small data solution decays like O(-1/4 power of (log t)) in L2 as t tends to infinity. Furthermore, we find that this L2-decay rate is optimal by giving a lower estimate of the same order.

46 Takuya Sato (Tohoku Univ.)♭
Naoyasu Kita (Kumamoto Univ.)
Optimal L^2-decay of solutions to dissipative nonlinear Schrödinger equations with a critical cubic nonlinearity 10

Summary: We consider the optimality of L^2-decay of solutions to the Cauchy problem of dissipative nonlinear Schrödinger equations with a long-range nonlinearity. We show that the L^2-norms of any global solutions do not decay more rapidly than $(\log t)^{-1/2}$, and we also prove that there exists a solution decaying just at the rate of $(\log t)^{-1/2}$ in L^2. This talk is based on the joint work with Professor Naoyasu Kita (Kumamoto University).

47 Kouichi Taira (Ritsumeikan Univ.)
Strichartz estimates for Schrödinger equations with slowly decreasing potentials in dimension two 10

Summary: In this talk, we introduce a result on the Strichartz estimates for Schrödinger equations with slowly decreasing potentials in dimension two. It is a generalization of a recent result by Mizutani. Ingredients of the proof are Kato's perturbation method, resolvent estimates near zero energy and Hardy's inequality.

48 Toshiyuki Suzuki (Kanagawa Univ.)
Nonlinear Schrödinger equations with some singular electromagnetic potentials of the critical scailing 10

Summary: We consider the Cauchy problems for nonlinear Schrödinger equations with the singular electromagnetic field. Here the electric potential V and the magnetic potential A satisfy $V(\mu x) = \mu^{-2}V(x)$, $A(\mu x) = \mu^{-1}A(x)$, and $x \cdot A(x) = 0$. The main result is the unique existence of the solution to the semilinear problems under the condition that $P := (-i\nabla + A)^2 + A$ is nonnegative and selfadjoint in the sense of Friedrichs extension.

49 Hayato Miyazaki (Kagawa Univ.)
Masaki Kawamoto (Ehime Univ.)
Long-range scattering for a critical homogeneous type nonlinear Schrödinger equation with time-decaying harmonic potentials 10

Summary: We consider the final state problem for a homogeneous type nonlinear Schrödinger equation with time-decaying harmonic potential. The nonlinearity has the critical order and is not necessarily the form of a polynomial. In the case of the gauge-invariant nonlinearity, Kawamoto proves that the equation admits a nontrivial solution that behaves like a free solution with a logarithmic phase correction. In this talk, we extend his result into the case with the general homogeneous nonlinearity by the technique due to the Fourier series expansion introduced by Masaki and Miyazaki. To prove the main result, we develop a factorization identity for the propagator and require a little stronger decay condition for the Fourier coefficients arising from the harmonic potential.

50 Alex Hernandez Ardila (Univ. Federal de Minas Gerais)
Masaru Hamano (Waseda Univ.)
Masahiro Ikeda (RIKEN/Keio Univ.)
Global dynamics of mass-energy threshold for NLS with an inverse-power potential 10

Summary: In this talk, we treat a nonlinear Schrödinger equation with an inverse-power potential. In particular, we consider global dynamics of mass-energy threshold for the equation. Here, mass-energy threshold implies solutions, whom the product of its mass and energy is equal to that of the ground state to a nonlinear Schrödiger equation without the potential. We prove that if a virial functional of initial data is positive, then the solution scatters and if a virial functional of initial data is negative and "the initial data is radial or has finite variance", then the solution blow-up in finite time.

51 Haruya Mizutani (Osaka Univ.)
Zijun Wan
(Central China Normal Univ.)
Xiaohua Yao
(Central China Normal Univ.)
The L^p-boundedness of wave operators for fourth-order Schrödinger operators in one space dimension 10

Summary: Some recent progress on the L^p-boundedness properties of the wave operators for fourth-order Schrödinger operators in one space dimension will be discussed. For instance, we will provide some conditions on the potential and spectrum of the Hamiltonian such that the wave operators are bounded on the weighted L^p spaces for any non-endpoint p and of weighted weak-type (1,1) with general even Muckenhoupt weights.

52 Ryosuke Nakasato (Waseda Univ.) Global well-posedness and time-decay of solutions for the compressible quantum MHD model with Hall effect 10

Summary: We consider the initial value problem for the compressible quantum MHD system with Hall effect in the whole space $\mathbb{R}^3$. Because the quantum MHD system is equipped with the correction term similar to the Korteweg stress tensor, the solution of its problem is expected to satisfy some good properties, for instance, the L^1-maximal regularity of the density. In this talk, we shall state the existence of global-in-time solutions in a critical L^p framework and L^p-$L^{p/2}$ type decay estimates for global solutions.

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

Hiroaki Kikuchi (Tsuda Coll.) Ground state of double power nonlinear Schrödinger equations in three space dimensions

Summary: In this talk, we consider minimization problem related to the double power nonlinear Schrödinger equations involving the Sobolev critical exponent in three space dimensions. In four and higher space dimensions, it is known that for any frequency and any power of the subcritical nonlinearity, there exists a ground state. In contrast to those cases, when the space dimension is three and the subcritical power is three or less, we can show that there exists a threshold frequency, above which no ground state exists, and below which the ground state exists. If time permits, I will also explain about several properties of the ground state and global dynamics of solutions to the nonlinear Schrödinger equations. Main part of this talk is based on a joint work with Takafumi Akahori (Shizuoka Univ.), Slim Ibrahim (Univ. of Victoria) and Hayato Nawa (Meiji Univ.).

September 16th (Fri) Conference Room II

9:45–12:00

53 Naofumi Mori
(Tokyo Univ. of Marine Sci. and Tech.)
Mari Okada (Yamaguchi Univ.)
Shuichi Kawashima (Waseda Univ.)
Decay property for symmetric hyperbolic system with memory-type diffusion 10

Summary: We consider the decay property for symmetric hyperbolic systems with memory-type diffusion. Under the structural condition (called Craftsmanship condition) we prove that the system is uniformly dissipative and the solutions satisfy the corresponding decay property. Our proof is based on a technical energy method in the Fourier space which makes use of the properties of strongly positive definite kernels.

Summary: We consider the decay property for a symmetric hyperbolic system with memory-type relaxation. We assume that the memory kernel is a strongly positive definite kernel and prove that the system has the decay property of regularity-loss type. Our proof is based on a technical energy method in the Fourier space which makes use of the structural condition (called Craftsmanship condition or Condition (K)) and the modified properties of strongly positive definite kernels.

Summary: In this talk, we discuss about the initial value problems for semilinear wave equations of derivative type with characteristic weights in one space dimension. The lifespan estimates of classical solutions are quite different from those for nonlinearity of unknown functions itself in the almost global existence case by interaction of characteristic weights.

Summary: In this talk, we consider a blow-up curve for systems of semilinear wave equations with different propagation speeds in one space dimension. The blow-up curve has been studied from the view point of its differentiability and singularity. In 2012, Merle and Zaag considered a single wave equation and showed that there are cases that its blow-up curve is not differentiable if the sign of the solution changes. They also showed that the blow-up curve near the singular point is characterized by the propagation speed. However, it is not known that the blow-up curve for systems of semilinear wave equations with different propagation speeds has a singular point or not. In this talk, we show that the blow-up curve has a singular point under suitable initial conditions.

Summary: We study the large time behavior of solutions to the wave equation with space-dependent damping in an exterior domain. We show that if the damping is effective, then the solution is asymptotically expanded in terms of solutions of corresponding parabolic equations. The main idea to obtain the asymptotic expansion is the decomposition of the solution of the damped wave equation into the solution of the corresponding parabolic problem and the time derivative of the solution of the damped wave equation with certain inhomogeneous term and initial data.

Summary: This talk is concerned with the nonlinear damped wave equation on a measure space with a self-adjoint operator, instead of the standard Laplace operator. Under a certain decay estimate on the corresponding heat semigroup, we establish the linear estimates which generalize the so-called Matsumura estimates, and prove the small data global existence and asymptotic behavior of solutions to the damped wave equation based on the linear estimates. Our approach is based on a direct spectral analysis analogous to the Fourier analysis.

59 Yusuke Ishigaki (Tokyo Tech)
Yoshihiro Ueda (Kobe Univ.)
Asymptotic stability of stationary solutions to outflow problem for compressible viscoelastic system 10

Summary: This talk is concerned with the stability of stationary solutions to the outflow problem for compressible viscoelastic system in the one-dimensional half space. We classify the existence of stationary solutions by determining suitable conditions for several parameters, such as the Mach number and propagation speed of elastic wave. We next establish the stability result and convergence rate toward the stationary solutions under the small initial perturbation.

60 Yoshihiro Ueda (Kobe Univ.)
Marcio Antonio Jorge Silva (State Univ. of Londrina)
Memory effects on the stability of viscoelastic Timoshenko systems ... 10

Summary: In this talk, we investigate new classes of viscoelastic Timoshenko–Ehrenfest systems under the presence of full or partial memory effects in one-dimensional whole space. Our achievements rely on recent approaches to the theory of dissipative structure for systems of partial differential equations by featuring optimal pointwise estimates in the Fourier space and explicit energy decay rates depending on the viscoelastic damping coupling.

61 Ikki Fukuda (Shinshu Univ.)
Masahiro Ikeda (RIKEN/Keio Univ.)
Asymptotic behavior of solutions to the Cauchy problem for the BBM–Burgers equation 10

Summary: In this talk, we consider the asymptotic behavior of the solutions to the Cauchy problem for the BBM–Burgers equation. We prove that the solution to this problem converges to the self-similar solution to the Burgers equation. Moreover, we construct the appropriate second asymptotic profiles of the solutions depending on the initial data. Based on that discussion, we investigate the effect of the initial data on the asymptotic behavior of the solutions, and derive the optimal asymptotic rate to the self-similar solution. Especially, the main novelty of this study is that the second asymptotic profiles of the solutions with slowly decaying data, whose case has not been studied, are obtained.

62 Masashi Ohnawa (Tokyo Univ. of Marine Sci. and Tech.)
Masahiro Suzuki (Nagoya Inst. of Tech.)
Asymptotic stability of river flows subject to friction 10

Summary: We consider stationary flows around weirs in rivers modeled by one-dimensional shallow water equation with friction. Waters enter weirs at subcritical states, and are accelerated beyond critical states flowing down weirs, and return to subcritical states discontinuously due to the gentle slope downstream of weirs. We focus on the discontinuous transition from supercritical states to subcritical states, and claim the asymptotic stability of the stationary shock wave whatever large the strength of the shock or the gradient of the bed elevation may be.

14:15–16:45

63 Tetu Makino (Yamaguchi Univ.*)
On the equation of motion of the rotating atmosphere of the Earth 10

Summary: Even the simplest model of motions of the atmosphere of the Earth has not yet been analyzed in mathematically rigorous manner. We present few fundamental properties of the solutions governed by the compressible Euler equations.

64 Naoki Hamamoto (Osaka Metro. Univ.)
Higher-dimensional extension of uncertainty principle inequality with a degenerate structure for solenoidal fields 10

Summary: We show the functional inequality $\int_{\mathbb{R}^N} |\nabla \boldsymbol{u}|^2 dx \int_{\mathbb{R}^N} |\boldsymbol{x} \times \boldsymbol{u}|^2 dx \geq C_N \left(\int_{\mathbb{R}^N} |\boldsymbol{u}|^2 dx \right)^2$ for vector fields $\boldsymbol{u}$ under the condition $\mathrm{div} \boldsymbol{u} = 0$. This is a degenarated version of Heisenberg's uncertainty principle inequality for vector fields, here the sharp constant number C_N can be positive and computable by considering $\boldsymbol{u}$ in the class of solenoidal fields.

65 Hiroyuki Tsurumi (Kyoto Univ.)
Yasunori Maekawa (Kyoto Univ.)
Existence of the 2D stationary Navier–Stokes flow on the whole plane around a radial flow ····· 10

Summary: We consider the stationary Navier–Stokes equations on the whole plane $\mathbb{R}^2$. We show that for a given small and smooth external force around a radial flow, there exists a classical solution decaying like $|x|^{-1}$. In our result, it is not necessary to impose any symmetric conditions on external forces.

66 Masahiro Suzuki (Nagoya Inst. of Tech.)
Masahiro Takayama (Keio Univ.)
Stationary solutions of the Vlasov–Poisson system ····· 10

Summary: The purpose of this talk is to mathematically investigate the formation of a plasma sheath, and to analyze the Bohm criterions which are required for the formation. Bohm derived originally the (hydrodynamic) Bohm criterion from the Euler–Poisson system. Boyd and Thompson proposed the (kinetic) Bohm criterion from kinetic point of view, and then Riemann derived it from the Vlasov–Poisson system. We study the solvability of boundary value problems of the Vlasov–Poisson system. On the process, we see that the kinetic Bohm criterion is a necessary condition for the solvability. Furthermore, the hydrodynamic criterion can be derived from the kinetic criterion. It is of great interest to find the relation between the solutions of the Vlasov–Poisson and Euler–Poisson systems. To clarify the relation, we also investigate the delta mass limit of solutions of the Vlasov–Poisson system.

67 Keiji Yoneda (Kyushu Univ.)
Ryo Takada (Univ. of Tokyo)
Global solutions for the rotating magnetohydrodynamics system in the scaling critical Sobolev space ····· 10

Summary: We consider the initial value problem for the incompressible magnetohydrodynamics system with the Coriolis force in the 3D whole space. We prove the global in time existence and the uniqueness of solutions for large initial data in the scaling critical Sobolev space when the speed of rotation is sufficiently high. In order to control the large magnetic fields, we introduce a modified linear solution for the velocity, and show its smallness in a suitable space-time norm by means of the dispersive effect of the Coriolis force.

68 Motofumi Aoki (Tohoku Univ.)
Iwabuchi Tsukasa (Tohoku Univ.)
A sufficient condition for the energy conservation law of compressible Navier–Stokes equations ····· 10

Summary: We consider the energy conservation law for two and three-dimensional compressible Navier–Stokes equations. We study a sufficient condition for the density, velocity and pressure such that a weak solution of the full system of compressible Navier–Stokes equations conserves the total energy which is constructed by the kinetic energy, the elastic potential and the heat contribution. Moreover, we generalize the result of the energy conservation law for the motion of the ideal gas.

69 Taiki Takeuchi (Waseda Univ.)
On the local well-posedness and inviscid limits for the Keller–Segel–Navier–Stokes system ····· 10

Summary: We consider the Cauchy problem for the Keller–Segel–Navier–Stokes system of parabolic-elliptic type in $\mathbb{R}^N$, $N \geq 3$. We show the local well-posedness for the system with initial data in Sobolev spaces, where the solutions are uniformly bounded with respect to the viscosity. In addition, we also obtain inviscid limits of the above system. The proof is mainly based on the a priori estimates independent of the viscosity combined with the method of Kato–Lai (1984) and the commutator estimate of Kato–Ponce (1988).

70 Kenta Oishi (Waseda Univ.)
Yoshihiro Shibata (Waseda Univ.)
On the global well-posedness and decay for a free boundary problem of the Navier–Stokes equation in unbounded domains ····· 10

Summary: A free boundary problem for the incompressible Navier–Stokes equations in unbounded domains is considered. We obtain a sufficient condition for the L_p-L_q decay estimate of the Stokes semigroup to prove the global well-posedness of the problem. This result improves the result in exterior domains by Shibata when $N \geq 4$, where N stands for the dimension of the space. The novelty is that the compactness of the boundary is not needed. We also develop the global well-posedness in the half space with $N \geq 3$. This is a joint work with Professor Yoshihiro Shibata (Waseda University).

Summary: We consider the stability of the equilibrium figure of uniformly rotating viscous incompressible fluid in $\mathbb{R}^3$ with surface tension, where the equilibrium figure is rotationally symmetric about a certain axis. It is proved that this stability result can be characterized by the positivity of the second variation of the energy functional associated with the equation that determines an equilibrium figure, provided that initial data are close to an equilibrium state. The solution converges exponentially to an equilibrium. The proof is inspired by a series of papers due to Shibata, but a new orthogonal condition is introduced in order to show the exponential stability of an associated analytic C_0-semigroup. If a value of initial angular momentum is small, the steady-state is determined uniquely.

Summary: We consider the three dimensional compressible Navier–Stokes equations with the Coriolis force and prove the long-time existence of a unique strong solution. More precisely, we show that for any $0 < T < \infty$ and arbitrary large initial data in the scaling critical Besov spaces, the solution uniquely exists on $[0, T]$ provided that the Rosbby and Mach numbers are sufficiently small. To the best of our knowledge, our result is the first contribution to the well-posedness of the compressible Navier–Stokes–Coriolis system in the whole space $\mathbb{R}^3$. The key ingredient of our analysis is to establish the dispersive estimates despite a complicated structure of the linearized system due to the anisotropy of the Coriolis force.

Summary: It is known that resolvent esimates and maximal regularity are important topics for linear parabolic evolution equations. We prove these estimates for the Stokes equations with various boundary conditions in a unite way. The method is applied for Dirichlet, Neumann and Robin boundary although the talk is presented only main ideas. The basis is to obtain a suitable form of the solution. Then we use a useful sufficient condition to use Fourier multiplier theorem and L_q-L_q-boundedness in the half space. Since the symbols are R-bounded for λ, we can get maximal regularity at the same time.

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

Yutaka Terasawa (Nagoya Univ.) ♭ Weak solutions of nonlocal diffuse interface model for two-phase flows and those local asymptotics

Summary: We talk on existence of weak solutions for local and nonlocal diffuse interface models for two-phase flows and nonlocal-to-local asymptotics of them, some of which are the speaker's recent results. The talk is based on joint works with Helmut Abels (Regensburg Univ., Germany). Diffuse interface models for two-phase flows describe the behavior of a mixture of two kinds of fluids such as water and oil. The fluids are macroscopically immiscible, but the model takes a partial mixing on a small length scale measured by a small parameter into account. A classical diffuse interface model treating fluids with the same densities and different viscosities is due to Hohenberg and Halperin (1977). More recently, a model treating fluids with different densities were introduced by Abels, Garcke and Gruen (2012). This is a coupled system of the Navier–Stokes equations and the Cahn–Hilliard equations. If the chemical potential contains a elliptic operator acting on a order parameter, which is a concentration difference of two fluids, it is called a local model and if the chemical potential contains a nonlocal operator, it is called a nonlocal model. Frigeri (2015) proved the existence of weak solutions for some nonlocal diffuse interface model with different densities. We review his result and method of proof. We next explain the speaker's result with Abels (2020) on existence of weak solution for another nonlocal diffuse interface model containing some kind of fractional Laplacian. We moreover explain the speaker's recent result with Abels (2022) on convergence of weak solutions for the nonlocal model with a small parameter to weak solutions for the local model when the small parameter tends to zero. The proof is based on a corresponding result in the case of a single Cahn–Hilliard equation by Davoli, Scarpa and Trussardi (2021).

Real Analysis

September 15th (Thu) Conference Room VIII

9:30–11:30

Summary: To describe the geometry of normed space, many geometric constants have been investigated. Among them, there are two geometric constants related to Minkowski ellipses. Here we study the lower bound of one of them. We also consider Birkhoff orthogonality. This generalized orthogonality is not symmetric in general. A two-dimensional normed plane in which Birkhoff orthogonality is symmetric is called Radon plane. An inequality had shown in Radon planes will be proved in general spaces.

Summary: We show that, under appropriate conditions, there exists a quasinonexpansive extension of a mapping with an attractive point in the sense of Takahashi and Takeuchi (2011) such that the fixed point set of the extension equals the attractive point set of the given mapping. Then using the quasinonexpansive extension, we establish some convergence theorems for approximating attractive points of a generalized hybrid mapping in the sense of Kocourek, Takahashi, and Yao (2010).

Summary: In this talk, we compare several types of approximation methods of a fixed point of a mapping defined on a complete geodesic space. In particular, one can see that some projection methods are related to those generated by convex combinations. We also show a new approximation method convergent to a fixed point of a mapping defined on a complete geodesic space.

Summary: In this talk, the Choquet–Lorentz spaces are defined for a nonadditive measure μ and the completeness of the spaces is investigated. A new characteristic of nonadditive measures, called property (C), is introduced to establish the Cauchy criterion for convergence in μ-measure of measurable functions. This criterion and a suitable convergence theorem of the Choquet integral provide instruments for showing the completeness of the Choquet–Lorentz spaces.

Summary: In this talk, we show that the sparse operators are not weak $(1,1)$ on the Choquet space with the Hausdorff content. In view of this result, we define a variant of the Orlicz–Morrey–Choquet space, and prove that the sparse operator maps Choquet space to the Orlicz–Morrey–Choquet space.

Summary: In this talk, we establish two embedding inequalities for the weighted Sobolev space and the weighted homogeneous endpoint Besov space by using the weighted Hausdorff capacity. To do this, we shall determine the dual spaces of weighted Choquet and weighted homogeneous Besov spaces.

14:15–16:20

Summary: We consider the singular limit problem of a single-well Modica–Mortola energy and the Kobayashi–Warren–Carter energy. In this study, we introduce a finer topology of sliced graph convergence of functions into the function space and derive the singular limit of a single-well Modica–Mortola energy and the Kobayashi–Warren–Carter energy energies in the sense of Gamma-convergence. The energy functional obtained as this singular limit is also shown to have the remarkable property of a minimizing function that is concave concerning the strength of jumps of a function.

Summary: We give an exact expression of the set of all medians with non-increasing rearrangements. After that, we consider fractional maximal functions with rearrangements and medians instead of integral averages, and discuss their boundedness on Lorentz spaces.

Summary: In this talk we give the characterization of pointwise multipliers on Orlicz–Morrey spaces of the second kind. Orlicz–Morrey spaces of the second kind was first studied by Sawano, Sugano and Tanaka in 2012 and are difference from Orlicz–Morrey spaces of the first kind which was first studied by Nakai in 2004. To do this we first prove a generalized Hölder's inequality for the Orlicz–Morrey spaces of the second kind. Next, to characterize the pointwise multipliers, we use the fact that all pointwise multipliers from a Orlicz–Morrey space of the second kind to another Orlicz–Morrey space of the second kind are bounded operators.

Summary: In this talk we show that the inequalities

$$\|f\|_{L_\infty} \le C\left\{1 + \|f\|_{BMO}\log^+(\|f\|_{L_p} + \|(-\Delta)^{s/2}f\|_{L_q})\right\},$$
$$\|f\|_{L_\infty} \le C\left\{1 + \|f\|_{L_p} + \|f\|_{BMO}\log^+\|(-\Delta)^{s/2}f\|_{L_q}\right\}$$

hold if $f \in L_p(\mathbb{R}^n)$ and $(-\Delta)^{s/2}f \in L_q(\mathbb{R}^n)$ for $1 \le p < \infty$, $1 < q < \infty$ and $n/q < s < \infty$. These inequalities improve the results obtained by Kozono–Taniuchi (2000) and Kozono–Wadade (2008). The proof is based on Muramatu's integral formula.

Summary: We consider bilinear pseudo-differential operators with symbols in the bilinear Hömander classes $S_{0,0}$. In particular, we discuss the boundedness of these operators on Sobolev spaces by using symbolic calculus and some boundedness results for bilinear pseudo-differential operators with symbols in more general classes than the bilinear Hömander classes on Lebesgue spaces. In contrast to the linear case, we need some restrictions on the exponents of Sobolev spaces to assure the boundedness, and we also discuss the necessity of these restrictions.

Summary: We discuss model semilinear elliptic equations of the type $-\mathrm{div}(A(x)\nabla u) = fu^{-\lambda}$ in Ω, where Ω is a bounded domain in $\mathbf{R}^N$, $A \in L^\infty(\Omega)^{N\times N}$ is a coercive matrix, $0 < \lambda \le 1$ and f is a nonnegative Radon measure on Ω. We consider various properties of positive $H^1_0(\Omega)$-solutions in relation to the corresponding Sobolev type embedding.

16:40–17:40 Talk Invited by Real Analysis Section

Takeshi Iida (Fukushima Nat. Coll. of Tech.) Orlicz maximal operators on L^p and Morrey spaces

Summary: In this talk, we deal with boundedness for Orlicz maximal operators and Orlicz-fractional maximal operators on L^p spaces and Morrey spaces. Next, we define and classify Orlicz–Morrey spaces into three kinds. Then, we study the boundedness of the Orlicz maximal operator and the Orlicz-fractional maximal operator on the second kind of the Orlicz–Morrey space, which we plan to focus our study on the second kind of the Orlicz–Morrey space.

September 16th (Fri) Conference Room VIII

9:30–11:50

13 Yoshiho Akagawa (Gifu Nat. Coll. of Tech.), Risei Kano (Kochi Univ.), Fukao Takeshi (Kyoto Univ. of Edu.) Time-dependence of the thereshold function in a perfect plasticity model 15

Summary: This paper discusses the time-dependence of the threshold function in the perfect plasticity model. In physical terms, it is natural that the threshold function depends on some unknown variable. Therefore, it is meaningful to discuss the well-posedness under the weaker assumption of time-dependence.

14 Yutaro Chiyo (Tokyo Univ. of Sci.), Tomomi Yokota (Tokyo Univ. of Sci.) Stabilization in a quasilinear attraction-repulsion chemotaxis system: balanced case 15

Summary: This talk deals with global existence, boundedness and stabilization in a quasilinear parabolic-elliptic-elliptic attraction-repulsion chemotaxis system. Boundedness and blow-up in this system have been classified by the sizes of the effects of the attraction and repulsion (Z. Angew. Math. Phys.; 2022; 73; Paper No. 61). More precisely, in the case that the effect of the attraction is stronger than the one of the repulsion, boundedness has been shown. Also, in the opposite case, blow-up has been obtained. However, the case that the effects of the attraction and repulsion are balanced has been excluded. The purpose of this talk is to prove boundedness and stabilization in the balanced case.

15 Chiharu Kosugi (Japan Women's Univ.), Toyohiko Aiki (Japan Women's Univ.) A large time behavior of solutions to initial and boundary value problems for compressible elastic curves 15

Summary: We talk about a large time behavior of the solutions to the initial and boundary value problem for the beam equation with the viscosity term and the nonlinear stress function having a singularity. We have already shown the existence and uniqueness of weak solutions. Moreover, thanks to the estimate of lower bounds for the strain, we also proved the existence of strong solutions. In this talk, for a solution u, we prove that the ω - limit of the orbit $\{u(t)|t \geq 0\}$ is not empty and included in the set of steady solutions. Also, we give an example in which the solutions of the steady problem are not uniquely determined.

16 Shodai Kubota (Kanagawa Univ.), Ken Shirakawa (Chiba Univ.) Periodic solutions for KWC type systems of grain boundary motions 15

Summary: In this talk, we consider the periodic solutions for the parabolic PDE systems, denoted by (S). Each system (S) is associated with the phase-field model of grain boundary motion, proposed by [Kobayashi et al.; Phys. D, 140 (2000), 141–150]. Under suitable assumptions, the existence of the periodic solution to the system (S) will be reported as the main theorem of this talk.

17 Keiichiro Kagawa (Waseda Univ.)
Ôtani Mitsuharu (Waseda Univ.*)
Existence of solutions for initial value problem of viscous Cahn–Hilliard equation with dynamic boundary condition ····· 15

Summary: In 2011, Goldstein, Miranville, and Schimperna proposed the Cahn–Hilliard model with dynamic boundary condition (GMS model). In 2015, Colli and Fukao showed the existence of the solutions to the initial value problem of the GMS model. They considered the nonlinear terms appearing in the interior and surface equations as the sum of the monotone term and the global Lipschitz term and assume that the condition (A) where the interior monotone term is controlled by the surface monotone term holds. In this talk, we focus on the existence of solutions to the initial value problem with viscous terms. We extend the global Lipschitz term to apply to a wider class of nonlinear functions and assume that the restriction (A) or the growth rate on the inner monotone term holds.

18 Kosuke Kita (Waseda Univ.)
Mitsuharu Ôtani (Waseda Univ.)
Existence and nonexistence of global solutions to nonlinear diffusion equations on a bounded domain ····· 15

Summary: This talk is devoted to studying the existence and nonexistence of global solutions to nonlinear diffusion equations with nonlinear boundary conditions. In the whole space, it is well known that the critical Fujita exponent exists, which gives the threshold that divides the existence of global solutions. On the other hand, there is no such a critical exponent in the case of a bounded domain. However, we show that the threshold phenomenon, controlled according to boundary conditions, can occur in a bounded domain.

19 Takanori Kuroda (Waseda Univ.)
Mitsuharu Ôtani (Waseda Univ.)
Thierry Cazenave (Sorbonne Univ.)
Existence and non-existence of stationary solutions of the complex Ginzburg–Landau equations ····· 15

Summary: In this talk, we study the stationary problem for the complex Ginzburg–Landau equations (CGL) on bounded domain Ω:

$$-(\lambda + i\alpha)\Delta u - (\kappa + i\beta)|u|^{q-2}u = 0, \quad u|_{\partial\Omega} = 0,$$

where $q > 2$, $\lambda, \kappa > 0$ and $\alpha, \beta \in \mathbb{R}$. Since multiplying (CGL) by u, we may prove the non-existence of weak nontrivial solutions when $\alpha/\lambda \neq \beta/\kappa$, we consider the case where $\alpha/\lambda = \beta/\kappa$. Our results can be formulated as follows: when $N = 1$, then there exists no non-constant phase classical solution; when $N \geq 2$ and let q be Sobolev sub-critical, then there exists a non-constant phase solution for some domains; when $N \geq 2$ and let q be Sobolev critical or super-critical, then there exists no nontrivial classical solution including constant phase solutions on star-shaped domains.

20 Shunsuke Kurima (Tokyo Univ. of Sci.)
Convergence of a singular nonlocal phase field system of conserved type ····· 15

Summary: This talk deals with convergence of a singular nonlocal phase field system of conserved type. Colli–K. (2020) have proved existence of solutions to a singular phase field system of conserved type. On the other hand, Davoli–Scarpa–Trussardi (2021) have studied nonlocal-to-local convergence of Cahn–Hilliard equations. In this talk we focus on nonlocal-to-local convergence of singular nonlocal phase field systems of conserved type.

14:15–16:20

Summary: Hypergraph G is the triplet consisting of a finite set V, a family $E \subset 2^V$, and $w : E \to (0, \infty)$. We are concerned with an ODE governed by some nonlinear set-valued operator defined on $\mathbb{R}^V$, which is called "hypergraph Laplacian". This ODE can be interpreted as a model of "heat" diffusion in the network represented by hypergraph. In this talk, we consider the case where the heat at some vertices of the hypergraph is given, and discuss the existence of solution and the continuous dependence of solution on given data.

Summary: In this talk, we consider a one-dimensional free boundary problem describing the penetration of diffusant into rubber. In this problem, the free boundary represents the front of the diffusant region and its growth rate is given by an ordinary differential equation including the effect of breaking the growth of the diffusant region. In the previous result, we showed the existence and uniqueness of a local solution to our problem. In this talk, we discuss the existence and uniqueness of a global solution to the problem and the large-time behavior of a solution as time goes to infinity.

Summary: We consider one-dimensional Cauchy problems (CP) for scalar parabolic-hyperbolic conservation laws. The equation has both properties of hyperbolic equations and those of parabolic equations. Accordingly, it is difficult to investigate the regularity and the behavior of solutions to (CP). In this talk, we prove decay estimates for entropy solutions to (CP). To see this, we modify Oleinik type entropy estimates for them.

Summary: In this talk we consider the fourth-order total variation flow equation in $\mathbb{R}^n$. We characterize the solution in terms of what is called the Cahn–Hoffman vector field, based on a duality argument, and introduce a notion of calibrability of a set in our fourth-order setting. This notion is related to whether a characteristic function preserves its form throughout the evolution. It turns out that all balls are calibrable. However, unlike in the second-order total variation flow, the outside of a ball is calibrable if and only if $n \neq 2$. If $n \neq 2$, all annuli are calibrable, while in the case $n = 2$, if an annulus is too thick, it is not calibrable.

25 Takeshi Fukao (Kyoto Univ. of Edu.)
Pierluigi Colli (Univ. degli Studi di Pavia)
Luca Scarpa (Politecnico di Milano)
The Cahn–Hilliard equation with forward-backward dynamic boundary condition via vanishing viscosity 15

Summary: An asymptotic analysis for a system with equation and dynamic boundary condition of Cahn–Hilliard type is carried out as the coefficient of the surface diffusion acting on the phase variable tends to 0, thus obtaining a forward-backward dynamic boundary condition at the limit. This is done in a very general setting, with nonlinear terms admitting maximal monotone graphs both in the bulk and on the boundary. The two graphs are related by a growth condition, with the boundary graph that dominates the other one. It turns out that in the limiting procedure the solution of the problem looses some regularity and the limit equation has to be properly interpreted in the sense of a subdifferential inclusion. However, the limit problem is still well-posed since a continuous dependence estimate can be proved.

26 Ken Shirakawa (Chiba Univ.)
Shodai Kubota (Kanagawa Univ.)
Optimal inner-heat controls of Warren–Kobayashi–Lobkovsky–Carter type systems under higher dimensional settings 15

Summary: In this talk, we deal with the optimal control problem motivated by grain boundary motion in 2 or 3 dimensional space. In this light, the regularized version of the phase-field model, proposed by [Warren et al.; Acta Materialia, 51 (2003), 6035–6058], is adopted as the corresponding state system. Under suitable assumptions, the well-posedness of state system, and the existence and necessary condition for the optimal control will be presented as the main results of this talk.

27 Noriaki Yamazaki (Kanagawa Univ.)
Nobuyuki Kenmochi (Chiba Univ.*)
Ken shirakawa (Chiba Univ.)
Singular optimal control problems for doubly nonlinear evolution inclusions with quasi-variational structure 15

Summary: In this talk we consider singular optimal control problems for abstract doubly quasi-variational evolution inclusions governed by time-dependent subdifferentials with the unknown-dependent constraints. Then, we show the existence of optimal control for our problems. Also, we apply our abstract results to quasi-variational inequalities with time-dependent gradient constraints.

16:40–17:40 Talk Invited by Real Analysis Section

Masaaki Mizukami (Kyoto Univ. of Edu.)
Global existence and asymptotic behavior in some chemotaxis-consumption system

Summary: In the study of the chemotaxis systems asymptotic behavior of solutions is one of the important themes; mainly it is shown that solutions converge to constant steady states in the previous works. For example, Tao–Winkler (2012) considered a chemotaxis-consumption system, and derived that solutions of the problem converge to constant steady states. However, this result does not describe some pattern formation of species suggested by Tuval et.al. (2005). Here one of the reasons is the boundary condition for the oxygen in the problem; in the previous works the boundary conditions is the Neumann boundary condition, even though that suggested in Tuval et, al. is a Robin-type boundary conditions. Thus, this talk considers a chemotaxis-consumption system under realistic boundary conditions for the oxygen. The purpose of this talk is to show that solutions of the problem converge to non-constant steady states.

Functional Analysis

September 13th (Tue) Conference Room I

10:00–11:45

1 Yoritaka Iwata (Kansai Univ.) Generation of nolinear semigroup associated with second or third order nonlinearity ····· 15

Summary: Nonlinear abstract evolution equations in a Banach space X:

$$\frac{du(t)}{dt} = A_2(t)(u(t)+\bar{u})(u(t)-\bar{u}),$$

$$\frac{du(t)}{dt} = A_3(t)u(t)(u(t)+\bar{u})(u(t)-\bar{u})$$

are systematically studied by the logarithmic representation of operators. In conclusion representations for the nonlinear semigroup are obtained.

2 Itaru Sasaki (Shinshu Univ.)♭ A general theory of diagonalization by Bogoliubov transformations ··· 15

Summary: It is believed that quantum field models whose interactions are quadratic can be diagonalized by Bogoliubov transformations. However, in many cases, the construction of the Bogoliubov transformation was complicated. Here we construct Bogoliubov transformations that explicitly diagonalize a wide class of quadratic Hamiltonians. For relativistic particles, the resulting one-particle Hamitltonians turn out to be the square root of non-relativistic Schrodinger operators with trace class perturbation.

3 Masaki Kawamoto (Ehime Univ.)
Atsuhide Ishida (Tokyo Univ. of Sci.) Existence and nonexistence of wave operators for critical time-decaying harmonic oscillator ····· 15

Summary: The critical time-decaying harmonic oscillator decelerate a quantum particle but whose probability of the position growth like $t^{1/2}\log t$. Because of its log growth term, the threshold of the decay order of the potential, in order to exist the wave operators, can not be characterized only by the polynomial decay rate. Hence we give the log-weight in x to the potential and the characterize the threshold using growth order of log-weight.

4 Fumio Hiroshima (Kyushu Univ.)
Noriaki Teranishi (Hokkaido Univ.) Matrix representation of time operators of 1D harmonic oscillator ···· 15

Summary: A time operator of the one-dimensional harmonic oscillator is rigorously constructed in the sense of sesqui-linear form, and the continuous limit of the time operator is shown. Finally a matrix representation of the time operator and its analytic continuation are given.

5 Noriaki Teranishi (Hokkaido Univ.)
Fumio Hiroshima (Kyushu Univ.) A genralization of the phase operator ····· 15

Summary: We study about time operators of the quantum harmonic oscillator H. It is known that H is unitary equivarent to the number operator $N+1/2$ on $\ell^2(\mathbb{N})$. We construct time operators of N and show that a relation between the phase operator and Galapon's time operator.

6 Pavel Exner
(Czech Tech. Univ./Czech Acad. of Sci.)
Shu Nakamura (Gakushuin Univ.)
Yukihide Tadano (Tokyo Univ. of Sci.) Continuum limit of the lattice quantum graph Hamiltonian ····· 15

Summary: We consider a continuum limit problem of quantum graph Hamiltonians, that is, Schödinger operators defined on metric graphs. We show that the quantum graph Hamiltonian on the ν-dimensional square lattice $\ell\mathbb{Z}^\nu$ with its mesh size ℓ converges as the continuum limit ($\ell \to 0$) to the corresponding Schrödinger operator on $\mathbb{R}^\nu$ in the sense of norm resolvent convergence.

14:15–15:15 Talk Invited by Functional Analysis Section

Youko Umeta (Josai Univ.) A unified family of P_{J}-hierarchies (J=I,II,IV,34) with a large parameter

Summary: The exact WKB analysis is a very effective method in studying both linear and non-linear differential equations which contain a large parameter in an appropriate way. We study the common structures between P_{J}-hierarchies(J=I,II,IV,34) with a large parameter from a view point of the exact WKB analysis. The first part is the result concerning the Stokes geometry for a unified family of P_{J}-hierarchies(J=I,II,IV,34) with a large parameter. We study the relation between the Stokes geometry of the system of non-linear ordinary differential equations and that of its underlying Lax pair. In the second part, we construct instanton-type solutions with sufficiently many free parameters which can describe the Stokes phenomenon of the Borel sum of a 0-parameter solution.

September 14th (Wed) Conference Room I

9:30–12:00

7 Hideyuki Ishi (Osaka Metro. Univ.) Construction of homogeneous cones from colored homogeneous graphs 15

Summary: We show that the cone of positive definite symmetric matrices of a specific form defined from an undirected simple graph satisfying certain conditions and a subgroup of the automorphism group of the graph is a homogeneous cone. In this way, we can construct many examples of homogeneous cones. We mention some applications of integral formulas over the homogeneous cone to mathematical statistics. This is joint work with Piotr Graczyk (University of Angers) and Bartosz Kolodziejek (Warsaw University of Technology).

8 Hideto Nakashima (Inst. of Stat. Math.) On b-functions and invariant differential operators of prehomogeneous vector spaces associated with sub-Hankel determinants 15

Summary: In this talk, we give an explicit formula of Capelli-type identity of invariant differential operators on a prehomogeneous vector space associated with sub-Hankel determinants. Moreover, an explicit formula of multivariate b-functions with respect to relatively invariant functions is also given.

9 Kyo Nishiyama (Aoyama Gakuin Univ.), Lucas Fresse (IECL, Univ. Lorraine) Steinberg theory for double flag varieties and RSK correspondence ... 15

Summary: Let G be a connected reductive algebraic group, and K its symmetric subgroup. By the double flag variety of G/K, we mean a product of flag varieties of G and K. For a double flag variety associated with the symmetric space of type AIII, we establish two kinds of generalized Steinberg maps, which sends conormal bundles of K-orbits to nilpotent K-orbits in the Lie algebra of K and in the tangent space of the symmetric space respectively. We described the Steinberg maps combinatorially, which generalize the classical RSK correspondence for permutations.

10 Kyo Nishiyama (Aoyama Gakuin Univ.), Lucas Fresse (IECL, Univ. Lorraine) Action of a Hecke algebra on the space of orbits on a double flag variety 15

Summary: Consider a connected reductive algebraic group G and its symmetric subgroup K. Let $\mathfrak{X} = K/B_K \times G/P$ be a double flag variety of finite type, where B_K is a Borel subgroup of K, and P a parabolic subgroup of G. A general argument shows that the orbit space $\mathbb{C}\mathfrak{X}/K$ inherits a natural action of the Hecke algebra $\mathscr{H} = \mathscr{H}(K, B_K)$ of double cosets via convolutions. However, to find out the explicit structure of the Hecke module is a quite different problem. We will clarify the explicit action of $\mathscr{H}$ on $\mathbb{C}\mathfrak{X}/K$ in combinatorial way using graphs for the double flag variety of type AIII.

Summary: We give a description of invariant measures on non-symmetric reductive spherical homogeneous spaces of rank-one type. For this, we revisit a Cartan decomposition for a spherical homogeneous space and consider the set of restricted roots associated to this decomposition. The idea of our description of invariant measures is similar to that for semisimple symmetric spaces.

Summary: A Lorentzian manifold has an intrinsic second-order differential operator called the Laplacian as in a Riemannian manifold. However, the Laplacian is no longer an elliptic but a hyperbolic differential operator, and there are non-smooth eigenfunctions in general.
A Lorentzian manifold with negative constant sectional curvature is called an anti-de Sitter manifold, and especially in the 3-dimensional case, its rich deformation theory is known to exist. In this talk, I will discuss quantitative results on the behavior of multiplicities of eigenvalues of the Laplacian in the 3-dimensional case when deforming anti-de Sitter structures.

Summary: Let D be a quaternion algebra over $\mathbb{R}$, $G = GL_n(D)$ and $H = GL_n(\mathbb{C})$ regarded as a subgroup of G. For a character χ on $\mathbb{C}^\times$, we say that an irreducible representation π of G is χ_H-distinguished if $\mathrm{Hom}_H(\pi, \chi \circ \det_H) \neq 0$. We compute the root number of a χ_H-distinguished representation π twisted by the representation induced from χ, and prove an Archimedean analogue of the conjecture by Prasad and Takloo-Bighash. The proof is based on the analysis of the contribution of H-orbits in a flag manifold of G on the Schwartz homology of principal series representations. Moreover, we prove that the Schwartz homology $H_*(H, \pi)$ is finite-dimensional for a general reductive symmetric pair (G, H) and a Casselman-Wallach representation of G. This is a joint work with Miyu Suzuki (Kanazawa Univ.).

Summary: The non-commutative harmonic oscillator (NCHO) is a generalization of the quantum harmonic oscillator that is related with the physical model called the quantum Rabi model via a confluence process on their respective ODE pictures. A generalization of the QRM, called the asymmetric QRM, has a rich structure in its hidden symmetry including a far-reaching conjecture relating its spectrum with algebraic geometry. In this talk we define a generalization of the the NCHO, called the η-shifted NCHO, related to the AQRM via a confluence process and give its basic properties. In addition we show how the finite eigenvalues of the η-NCHO converge to the degenerate eigenvalues of the AQRM via the confluence process.

13:15–14:15 Talk Invited by Functional Analysis Section

Summary: In this talk, we introduce a family of compact open subgroups of unramified odd unitary groups over a p-adic field, and explain that for any irreducible generic representation, the subspaces fixed by these compact subgroups give a specific vector called a *local newform*, which is uniquely determined up to a scalar multiple. This is an analogue of a well-known result of Jacquet–Piatetskii–Shapiro–Shalika for the case of general linear groups. For the proof, we establish the fundamental lemma for our compact groups. This is a joint work with Masao Oi in Kyoto University and Seidai Yasuda in Hokkaido University.

September 15th (Thu) Conference Room I

9:30–12:00

15 Shigeru Furuichi (Nihon Univ.) On inequalities related to logarithmic mean ····· 15

Summary: After reviewing the ordering among some weighted means including the weighted logarithmic mean, we state some operator inequalities related to logarithmic mean. We also give some inequalities for the nested means. In addition, we show the natural generalization of Zou–Jiang with weighted mean. Finally, considering the geometric bridge between the arithmetic mean and the geometric mean, we study some unitarily invariant norm inequalities.

16 Yuki Seo (Osaka Kyoiku Univ.) Karcher mean and normalized determinant ····· 15
Sora Hiramatsu
(Osaka Prefectural Izumiohtsu High School)

Summary: As a natural generalization of the Fuglede–Kadison determinant, there is an attempt to extend the concept of the determinant to vector states. In this talk, we present the normalized determinant for a state on a von Neumann algebra, and by virtue of the Specht ratio, we show a variant of determinant identity of Karcher mean for the normalized determinant of positive invertible operators on a separable Hilbert space.

17 Mitsuru Uchiyama Symmetric matrix means ····· 15
(Shimane Univ.*/Ritsumeikan Univ.)

Summary: Let A and B be linearly independent positive definite matrices and σ a symmetric operator mean but the arithmetic mean. We show that $A\sigma B$ is a linear combination of A and B if and only if $A^{-1}B$ has just two different eigenvalues. Moreover, we get similar results for three-variable symmetric means.

18 Yoichi Udagawa (Ritsumeikan Univ.) Stability of $\mathcal{AN}$-property for the induced Aluthge transformations ··· 15
Hiroyuki Osaka (Ritsumeikan Univ.)
Takeaki Yamazaki (Toyo Univ.)
Gola Ramesh (Indian Inst. Tech.)

Summary: Let H be a Hilbert space. An operator $T \in \mathcal{B}(H)$ is $\mathcal{AN}(H)$-operator if and only if there exists a unit vector $x \in \mathcal{B}(H)$ such that $\|T|_M x\| = \|T|_M\|$ for any closed subspace $M \subseteq H$. In this talk, we shall discuss stability of An-property. Especially, we shall introduce that if $T \in \mathcal{AN}(H)$, then the induced Aluthge transformation of $T \in \overline{\mathcal{AN}(H)}$. Moreover, we shall consider the iteration of mean transformation.

19 Hiroyuki Osaka (Ritsumeikan Univ.) On a subclass of norm attaining operators ····· 15
Golla Ramesh
(Indian Inst. of Tech. Hyderabad)

Summary: A bounded linear operator $T : H_1 \to H_2$, where H_1, H_2 are Hilbert spaces, is said to be norm attaining if there exists a unit vector $x \in H$ such that $\|Tx\| = \|T\|$ and absolutely norm attaining (or $\mathcal{AN}$-operator) if $T|M : M \to H_2$ is norm attaining for every closed subspace M of H. Let $\mathcal{R}_T$ denote the set of all reducing subspaces of T. Define $\beta(H) := \{T \in \mathcal{B}(H) : T|_M : M \to M \textit{ is norm attaining } \forall\, M \in \mathcal{R}_T\}$. In this talk we present a structure theorem for operators in $\beta(H)$.

20 Osamu Hatori (Niigata Univ.*) The complex Mazur–Ulam property for extremely C-regular spaces ··· 15

Summary: We exhibit a sufficient condition for the complex Mazur–Ulam property. In particular, we show that a uniformly closed extremely C-regular space has the complex Mazur–Ulam property.

21 Shiho Oi (Niigata Univ.) Jordan $*$-homomorphisms on Banach algebras of vector-valued Lipschitz maps ····· 15

Summary: In this talk, we consider Jordan $*$-homomorphisms on Banach $*$-algebras of all Lipschitz maps from a compact metric space into a unital C^*-algebra. We show that every Jordan $*$-homomorphism on the space is represented as a weighted composition operator by using the irreducible representations of a unital C^*-algebra. Our results generalize previous works on algebra $*$-homomorphisms on the space of all Lipschitz maps from a compact metric space into a unital C^*-algebra.

22 Michiya Mori (RIKEN) Lattice isomorphisms between projection lattices of von Neumann algebras ····· 15

Summary: Let M, N be von Neumann algebras, and $\mathcal{P}(M)$, $\mathcal{P}(N)$ their projection lattices. I will explain that every lattice isomorphism from $\mathcal{P}(M)$ onto $\mathcal{P}(N)$ can be described by means of a ring isomorphism between the algebras of locally measurable operators if M has no direct summands of type I_1 and I_2. If M has no finite type I direct summands, then every ring isomorphism between the algebras of locally measurable operators of M and N is similar to a real *-isomorphism.

14:15–16:00

23 Hiroshi Inoue (Kyushu Sangyo Univ.) An unbounded generalization of Tomita's observable algebras ····· 15

Summary: In this talk I shall introduce the basic theory of Tomita's observable algebras and build the basic theory of unbounded Tomita's observable algebras which are related to unbounded operator algebras, especially unbounded Tomita-Takesaki theory, operator algebras on Krein spaces, studies of positive linear functionals on $*$-algebras and so on.

24 Yusuke Isono (Kyoto Univ.) Pointwise inner automorphisms of almost periodic factors ····· 15

Summary: We prove that a large class of nonamenable almost periodic type III_1 factors M, including all McDuff factors that tensorially absorb the Araki–Woods factor R_∞ of type III_1 and all free Araki–Woods factors, satisfy Haagerup–Størmer's conjecture (1988): any pointwise inner automorphism of M is the composition of an inner and a modular automorphism. This is joint work with C. Houdayer.

25 Takuya Takeishi (Kyoto Inst. Tech.), Christopher Bruce (Univ. Glasgow) Constructing number field isomorphisms from *-isomorphisms of certain crossed product C*-algebras ····· 15

Summary: We prove that the class of crossed product C*-algebras associated with the action of the multiplicative group of a number field on its ring of finite adeles is rigid in the following explicit sense: Given any *-isomorphism between two such C*-algebras, we construct an isomorphism between the underlying number fields. As an application, we prove an analogue of the Neukirch–Uchida theorem using topological full groups, which gives a new class of discrete groups associated with number fields whose abstract isomorphism class completely characterises the number field.

26 Keisuke Yoshida (Hokkaido Univ.) Non-commutative topological entropy for some Exel–Laca algebras ··· 15

Summary: In this talk, I will discuss non-commutative entropy for the canonical ucp (unital completely positive) maps on Exel–Laca algebras associated to some infinite 0-1 matrices. In the first half of the talk, I show that one can define the canonical ucp maps on Exel–Laca algebras associated to some infinite 0-1 matrices. In particular, we see that we have the canonical ucp map on the Exel–Laca algebras associated with the renewal shift. In the last half of the talk, I show an evaluation of the non-commutative entropy for the canonical ucp map on the Exel–Laca algebras associated with the renewal shift.

27 Tsuyoshi Kajiwara (Okayama Univ.), Yasuo Watatani (Kyushu Univ.*) Cores of the C*-algebras associated with self-similar maps ····· 15

Summary: In this talk, we report that the products of self-similar sets which satisfies simple condition are contained in the class where we can do matrix representation, analysis of the restriction of model traces to the finite core, and the structure of primitive ideals of the cores.

28 Yasuo Watatani (Kyushu Univ.*)
Masaru Nagisa
(Chiba Univ./Ritsumeikan Univ.)
Non-linear positive maps on C*-algebras, non-linear traces on matrix algebras and majorization theory 15

Summary: We study non-linear monotone positive maps on C*-algebras. In this talk we consider non-linear and non-commutative integration theory. Choquet integrals and Sugeno integrals are studied as non-linear integrals in non-additive measure theory. We introduce non-linear traces of Choquet type and Sugeno type on matrix algebras and characterize these non-linear traces of Choquet type and Sugeno type by partial additivity called comonotonic additivity and comonotonic F-additivity respectively. We study a close relation among non-linear traces of Choquet type, majorization and unitarily invariant norms and 2-positivity.

16:15–17:15 Talk Invited by Functional Analysis Section

Yuhei Suzuki (Hokkaido Univ.)♭ Non-commutative amenable actions

Summary: Recently amenability of C*-dynamical systems attracted much attention. This is a consequence of my discovery of amenable actions on simple C*-algebras. The characterizations/formulations of amenability of C*-dynamical systems had been unclear for a long time ($>$ 30 years?), but Ozawa and I recently settled it. This allows us to give a functorial construction of amenable actions on Kirchberg algebras. A recent highlight on this subject may be my observation that amenability of actions is the genuine ingredient for the classification of C*-dynamical systems. In particular, interestingly, the well-known dichotomy in von Neumann algebra theory (Ocneanu, Jones, Popa, Brothier–Vaes etc) fails in the C*-algebra realm. Notably an ultimate classification theorem was recently established by Gabe–Szabo in the purely infinite case.
Partly joint work with Ozawa. If time permits, I also explain my latest work, which gives amenable actions on tracial simple C*-algebras. This example clarifies/motivates an ultimate goal in classification theory of C*-algebras.

Statistics and Probability

September 13th (Tue) Conference Room Ⅲ

9:30–11:50

1 Noe Kawamoto (Hokkaido Univ.) Spread-out limit of the critical points for lattice trees and lattice animals in dimensions $d > 8$ ····· 15

Summary: A spread-out lattice animal(LA) is a finite connected set of edges in $\{\{x, y\} \subset \mathbb{Z}^d : 0 < ||x - y|| \leq L\}$. A lattice tree(LT) is a LA with no loops. Both models are the statistical-mechanical models for branched polymers. Let χ_p be the susceptibility which is a sum of the generating function of LT or LA containing the origin and x, with fugacity $p/|\Lambda|$, where $|\Lambda|$ is the degree of a vertex. There exists the critical point p_c of χ_p in the sense that χ_p diverges if p is bigger than p_c and χ_p is finite otherwise. As the previous research, Penrose (JSP, 77 (1994): 3-15) proved that $p_c = 1/e + O(L^{-2d/7} \log L)$ for both models for all $d \geq 1$. We show that $p_c = 1/e + CL^{-d} + O(L^{-d-1})$ for all $d > 8$, where the non-universal constant C has the random-walk representation. This talk is based on the joint research with Prof. Sakai at Hokkaido univ.

2 Yuta Nakagawa (Kyoto Univ.) Density of states for random Schrödinger operators associated with Gibbs point processes ····· 15

Summary: We consider the Schrödinger operator for the field generated by a non-negative single-site potential and a realization of a point process. If the point process is a Poisson point process, it is known that the integrated density of states (IDS) for the Schrödinger operator decays exponentially near its spectral lower edge. In this talk, we consider a pairwise interaction Gibbs point process and compare the asymptotic behavior of the IDS with that of the case of a Poisson point process.

3 Hiroshi Kawabi (Keio Univ.)
Masato Hoshino (Osaka Univ.)
Seiichiro Kusuoka (Kyoto Univ.) Stochastic quantization associated with the $\exp(\Phi)_2$-quantum field model driven by the space-time white noise ····· 15

Summary: We consider a quantum field model with exponential interactions on the two-dimensional torus, which is called the $\exp(\Phi)_2$-quantum field model or Hoegh–Krohn's model. In this talk, we discuss the stochastic quantization of this model. Combining key properties of Gaussian multiplicative chaos with a method for singular SPDEs, we construct a unique time-global solution to the corresponding parabolic stochastic quantization equation in the full L^1-regime $|\alpha| < \sqrt{8\pi}$ of the charge parameter α. We also identify the solution with an infinite dimensional diffusion process constructed by the Dirichlet form approach.

4 Yuji Hamana (Univ. of Tsukuba) Square-root boundaries for Bessel processes ····· 10

Summary: We consider the hitting times of a Bessel process to a square-root boundary and obtain the explicit form of the distribution function of the hitting time by means of zeros of the confluent hypergeometric function with respect to the first parameter.

5 Shun Yanashima (Tokyo Metro. Univ.)
Kensuke Ishitani (Tokyo Metro. Univ.) On the weak convergence of conditioned Bessel bridges ····· 15

Summary: The purpose of this presentation is to introduce the construction of a stochastic process called "δ-dimensional Bessel house-moving" and its properties. δ-dimensional Bessel house-moving is a δ-dimensional Bessel process hitting a fixed point at $t = 1$ for the first time. We show that this process can be obtained as the weak limit of δ-dimensional Bessel bridges conditioned from above. Applying this weak convergence, we give the decomposition formula for its distribution and the Radon–Nikodym density for the distribution of the Bessel house-moving with respect to the one of the Bessel process. We also study sample path properties of the Bessel house-moving.

Summary: We show explicit expression for the Laplace–Beltrami operator on the symmetric space of positive definite matrices by using the Iwasawa coordinate, and study the corresponding diffusion process and its largest and smallest eigenvalues.

Summary: The spectral dimension d_S of a metric space is an exponent associated with the asymptotic behavior of the heat kernel of the standard Dirichlet form and Brownian motion on the space. The Ahlfors regular conformal dimension $\dim_{\mathrm{AR}}$ of the metric space is a quasisymmetric invariant, where quasisymmetry is a well-studied property of homeomorphisms between metric spaces. For (generalized) Sierpiński carpets or Sierpiński gaskets, Kigami showed that $\dim_{\mathrm{AR}} \leq d_S < 2$ or $\dim_{\mathrm{AR}} \geq d_S \geq 2$ holds, in 2020. In this lecture, we give an appropriate extension of this results to the framework of resistance forms. We also show that another simple extension, which is to be expected, does not hold in the framework in general.

Summary: We present a concrete family of fractals, which we call the *(two-dimensional) thin scale irregular Sierpiński gaskets* and each of which is equipped with a canonical strongly local regular symmetric Dirichlet form. We prove that any fractal K in this family satisfies the full off-diagonal heat kernel estimates with some space-time scale function Ψ_K and the singularity of the associated energy measures with respect to the canonical volume measure (uniform distribution) on K, and also that the decay rate of $r^{-2}\Psi_K(r)$ to 0 as $r \downarrow 0$ can be made arbitrarily slow by suitable choices of K. These results together support [*Ann. Probab.* **48** (2020), no. 6, 2920–2951, Conjecture 2.15] stating that the full off-diagonal heat kernel estimates with space-time scale function Ψ satisfying $\lim_{r\downarrow 0} r^{-2}\Psi(r) = 0$ imply the singularity of the energy measures.

14:15–15:15 Award Lecture for the 2021 MSJ Analysis Prize

Makoto Katori (Chuo Univ.) Multiple Schramm–Loewner evolution and Dyson's Brownian motion model

Summary: Schramm–Loewner evolution (SLE) is a stochastic extension of the classical Loewner theory in complex analysis on a simply connected proper domain of $\mathbb{C}$ such that the driving function of the Loewner chain of conformal maps is given by a one-dimensional stochastic process. Here we assume that the domain is the upper-half complex-plane $\mathbb{H}$ and the driving process runs on $\mathbb{R}$. It was proved that the SLE driven by a time changed Brownian motion on $\mathbb{R}$, $(B_{\kappa t})_{t\geq 0}$, $\kappa > 0$, determines a one-parameter family of probability laws of a random continuous curve in $\overline{\mathbb{H}}$ connecting 0 and ∞, and that this family, denoted by SLE_κ, $\kappa > 0$, covers all probability laws of such curves having the conformal invariance and the domain Markov property. In probability theory and statistical physics, the SLE_κ has been playing a central role in studying critical phenomena associated with continuous phase transitions and fractal geometries in two dimensions. Therefore, it is natural to generalize the SLE theory to describe random multiple curves in $\mathbb{H}$ driven by an interacting particle system on $\mathbb{R}$. The problem is that the requirement of the conformal invariance and the domain Markov property is not sufficient to determine a 'canonical' family of multiple SLEs. Motivated by the recent work by Sheffield on the quantum gravity zipper and a series of papers by Miller and Sheffield on the imaginary geometry, we employ the coupling of Gaussian free fields (GFFs) and multiple SLEs. We show that a multiple SLE is correctly coupled with a certain GFF if and only if the driving particle system is given by Dyson's Brownian motion model studied in random matrix theory. Dyson's Brownian motion model is also a one-parameter ($\beta > 0$) family of one-dimensional log-gases. The coupling is achieved if and only if $\beta = 8/\kappa$. The present study on the GFF/multiple SLE coupling enables us to clarify the basic properties of the constructed multiple SLE (e.g., continuity of multiple SLE curves, 'phase transitions' at $\kappa = 4$ and 8). Moreover, we expect that a notion of conformal invariance of SLE will enrich the study of random matrix theory via the present results on the trinity of the GFF, the multiple SLE, and Dyson's Brownian motion model. The present talk is based on a joint work with Shinji Koshida (Aalto University).

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

Takahiro Hasebe (Hokkaido Univ.) Loewner chains, Markov processes and non-commutative stochastic processes

Summary: The notion of Loewner chain is a one-parameter family of univalent holomorphic self-maps of a domain with certain properties. It played a key role in some problems on univalent functions, especially in the de Branges' proof of Bieberbach's conjecture in 1985. Loewner chains have found another application to the theory of SLE around 2000. Later, reverse evolution families (more general than Loewner chains) began to be used in free probability and then in monotone probability. More recently, (temporally inhomogeneous) branching processes are analyzed with the help of reverse evolution families. This talk summarizes recent work of the speaker concerning some of the above mentioned topics, in which additive processes, a certain class of Markov processes, branching processes and non-commutative stochastic processes are involved. One of the general purposes of this work is to make a dictionary between different fields or objects. For example, the Laplace exponents of a branching process form a reverse evolution family. Then some basic properties (e.g. having finite first moment) of the branching process can be translated into some basic properties of reverse evolution families that were formerly developed independently in complex analysis. The presentation will be based on joint work with Uwe Franz, Sebastian Schleissinger, Ikkei Hotta, Pavel Gumenyuk and Jose-Luis Perez.

September 14th (Wed) Conference Room III

9:30–11:30

9 Yuki Hirai (Kyoto Univ.) Linear integral equations with additive noise in the pathwise Itô calculus 15

Summary: The Itô–Föllmer calculus, pioneered by Föllmer (1981), is a deterministic counterpart of classical Itô's stochastic calculus. In this talk, we treat linear integral equations with additive noise in the framework of the Itô–Föllmer calculus in Banach spaces. We interpret the term 'noise' as a càdlàg path that has quadratic variation along a sequence of partitions. We give a solution to such an equation by the variation of constants formula and study the regularity of the solution path using that representation. As an application, we consider a purely pathwise approach to the HJM term structure model of bond markets.

10 Yushi Hamaguchi (Osaka Univ.) Chaos expansions for linear stochastic Volterra integral equations 15

Summary: We consider a general class of linear stochastic Volterra integral equations with singular kernels. By means of the Wiener–Itô chaos expansion approach, we define suitable classes of stochastic Volterra kernels and introduce a new notion of the product for adapted L^2-processes. Observing the algebraic properties of stochastic Volterra kernels, we obtain a variation of constants formula which gives an explicit expression for the Wiener–Itô chaos expansion of the solution to a general class of linear SVIEs.

11 Toshio Nakata (Fukuoka Univ. of Edu.) Large deviations for super-heavy tailed distributions 10

Summary: In this talk, we study large deviations for sums of independent and identically distributed random variables (random walks) with nonnegative *super-heavy tailed* distributions. While Hu and Nyrhinen (2004) gave results for heavy tailed distributions, our result is an improvement of one of theirs for super-heavy tailed ones. Moreover, we apply it to the *log-Pareto distribution* and the distribution for the *super-Petersburg game*.

12 Shigeyoshi Ogawa (Ritsumeikan Univ.) Mean value theorems for the noncausal stochastic integral 10

Summary: In the classical calulus the statement called mean value theorem for the integral is well known. We are now concerned with the validity of a similar statement for the stochastic integrals. The aim of the talk is to show that we can establish mean value theorems as exact formulae when limited to the *noncausal stochastic integral* (also called *ogawa integral*) of the form $\int_a^b f(X_t)d_*W_t$, where W_t is Brownain motion and X_t an Itô process, causal or not. We also discsuss the case of Itô integral $\int_a^b f(X_t)d_0W_t$, moreover such a genuin noncausal case where the process X_t is noncausal. Whole discussions are developed in the framework of the noncausal stochastic calculus. hence for the related materials and basic facts we would refer to the monograph "Noncausal Stochastic Calculus" by Ogawa, S., (2017, Springer).

13 Yuki Ueda (Hokkaido Univ. of Edu.)
Takahiro Hasebe (Hokkaido Univ.)
Kei Noba (Inst. of Stat. Math.)
Noriyoshi Sakuma (Nagoya City Univ.)
Regularity results on the class of Boolean selfdecomposable distributions 15

Summary: Khintchine introcuded the class L of limit distributions of certain independent triangular arrays. This class contains the class of stable distributions as a subset. In 1937, Lévy characterized the class L as follows: A probability measure μ on $\mathbb{R}$ is in the class L if and only if μ is selfdecomposable. In non-commutative probability theory, notions of independence of random variables are classified into five ones: tensor, free, Boolean, monotone and anti-monotone independence. The concept of selfdecomposability is also formulated for each notion of independence. In this talk, we focus on Boolean version of the class of selfdecomposable distributions and investigate general regularity results on the class of Boolean selfdecomposable distributions.

14 Shunsuke Usuki (Kyoto Univ.) $\times a$ and $\times b$ empirical measures, the irregular set and entropy ····· 15

Summary: For integers a and $b \geq 2$ which are multiplicatively independent, let T_a and T_b be multiplication by a and b on $\mathbb{R}/\mathbb{Z}$. It is known that the only T_a, T_b-invariant and ergodic measure with positive entropy of T_a or T_b is the Lebesgue measure. In this talk, we consider the empirical measures with respect to T_a, T_b-action and show that the set of x such that the empirical measures of x do not converge to any measure has Hausdorff dimension 1 and the set of x such that the empirical measures accumulate to some invariant measure with small entropy has small Hausdorff dimension. Furthermore, we obtain some equidistribution result about the T_a, T_b-orbit of x in the complement of a set of Hausdorff dimension 0.

15 Yuto Nakajima (Kyoto Univ.)
Hiroki Takahashi (Keio Univ.)
Hausdorff dimension of sets with restricted, slowly growing partial quotients in the semi-regular continued fraction ····· 15

Summary: We describe the Hausdorff dimension of sets of irrational numbers whose partial quotients in the semi-regular continued fraction expansion obey certain restrictions and growth conditions. To prove our results, we construct non-autonomous iterated function systems well-adapted to the given restrictions and growth conditions, and then apply the dimension theory developed by Rempe-Gillen and Urbański.

11:30–12:00 Research Section Assembly

September 15th (Thu) Conference Room Ⅲ

9:30–12:00

16 Toshiharu Fujita (Kyushu Inst. of Tech.)
On recursive methods for converging decision process in stochastic environment ····· 15

Summary: The goal of this study is to solve the stochastic decision process models with a converging transition system. In this presentation, a simple example will be discussed and some recursive equations will be derived by using dynamic programming technique.

17 Teruo Tanaka (Hiroshima City Univ.)
Prophet inequalities for finite stage multiparameter optimal stopping problems ····· 10

Summary: We consider the optimal stopping problem for discrete time multiparameter stochastic processes. In the classical optimal stopping problems, the comparisons between the expected reward of a player with complete foresight and the expected reward of a player using nonanticipating stop rules, known as prophet inequalities, have been studied by many authors. We shall study the prophet inequalities for optimal stopping problems for finite stage multiparameter stochastic processes.

18 Shoko Chisaki (Osaka Inst. of Tech.)
Shinji Kuriki (Osaka Pref. Univ.*)
Ryoh Fuji-Hara (Univ. of Tsukuba*)
Nobuko Miyamoto (Tokyo Univ. of Sci.)
Optimality of spanning bipartite block designs ····· 10

Summary: It is usually to design an experiment using treatments and its blocks in the design of experiments. Consider a set of edges of a complete bipartite graph as a treatments set and suppose the treatments have a structure. Then, we proposed a spanning bipartite block design (SBBD) to achieve better estimation accuracy. In this talk, using an SBBD as a statistical model, we discuss the optimality of how small the variance of the estimator was. And we prove that the variances of all estimators are equal (variance balanced). We also show the goodness of SBBD by the simulation.

19 Ryuya Yahagi (Tokyo Univ. of Sci.)
Ayumu Uehara (Tokyo Univ. of Sci.)
Satoru Shinoda (Yokohama City Univ.)
Takuya Yoshimoto (Chugai Pharmaceutical Co.)
Kouji Tahata (Tokyo Univ. of Sci.)
The generalization of marginal cumulative inhomogeneity model for multi-way contingency tables 15

Summary: For multi-way contingency tables, Bhapkar and Darroch (1990) considered the marginal symmetry model for order h. Yoshimoto *et al.* (2020) proposed the marginal cumulative logistic model for order h as a model of an inhomogeneity for marginal cumulative probability for order h. This presentation proposes a generalized marginal cumulative inhomogeneity model for order h. It also gives the decomposition of the marginal symmetry model for order h into the generalized marginal cumulative inhomogeneity model for order h, the marginal moment equality model for order h and the marginal symmetry model for order $h-1$.

20 Koji Tsukuda (Kyushu Univ.)
On the asymptotic behavior of the length of a Pitman partition 15

Summary: The Pitman sampling formula is a multivariate discrete distribution with three parameters, and a Pitman partition is a random partition whose law is given by the Pitman sampling formula. This presentation discusses the asymptotic behavior of the length of a Pitman partition under a two-parameter asymptotic regime. In particular, convergence in probability is shown and evaluated.

21 Yoichi Miyata (Takasaki City Univ. of Econ.)
Takayuki Shiohama (Nanzan Univ.)
Toshihiro Abe (Hosei Univ.)
On an extension of the family of sine-skew circular distributions 15

Summary: The sine skewed circular distribution is a circular probability model that can be asymmetric in shape and that has the advantage that the sine and cosine moments can be written in explicit forms, and generation of random numbers can be easily implemented. In contrast, this distribution is difficult to be largely asymmetric near the modes of the distributions. In this talk, we use the framework of Ley and Verdebout to propose a new family of probability distributions, that can give stronger asymmetry around the mode than the sine skewed circular distribution. We also show that a subfamily of extended sine-skewed wrapped Cauchy distributions, and a subfamily of von Mise distributions are identifiable with respect to parameters.

22 Yohji Akama (Tohoku Univ.)
Atina Husnaqilati (Tohoku Univ.)
A dichotomous behavior of Guttman–Kaiser criterion from equi-correlated normal population 15

Summary: In high-dimensional statistics, a famous *eigenvalue-greater-than-one rule (GK rule)* assesses the number of significant components/factors of inferences principal component analysis and exploratory factor analysis. Psychologists and simulation study report: if the dimension p is small, when a common correlation coefficient among the p variables is r, GK rule assessment is very small ($r > 0$), and $p/2$ ($r = 0$). For the sample size n, we establish this dichotomy for large p but small p/n and equi-correlated normal population, by proving: as $n, p \to \infty$, $p/n \to c > 0$, the spectral distribution of the sample correlation matrix goes to *Marčenko-Pastur distribution* scaled by $1 - r$

23 Yohji Akama (Tohoku Univ.) Shrinkage of eigenvalue distributions of sample correlation matrix formed from equi-correlated normal population 15

Summary: From a p-dimensional normal population with all the correlation coefficient between variables being a fixed, nonnegative constant $r < 1$, we draw a sample of size n and form a sample correlation matrix R. Suppose $p, n \to \infty, p/n \to c > 0$. The eigenvalue distribution of R almost surely converges weakly to Marčenko-Pastur distribution $F_c(x/(1-r))$ of scale parameter $1-r$ and index c (A. and A. Husnaqilati, *A dichotomous behavior of Guttman–Kaiser criterion from equi-correlated normal population*, preprint, 2022). For the largest eigenvalue λ of R, we aim to prove λ/p converges to r almost surely, to explain a shrinkage phenomenon (Laloux et al. Random matrix theory and financial correlations, *Int. J. Theor. Appl. Finance*, 2000): the histogram of eigenvalues of a sample correlation matrix R of stock market fits the density of $F_{p/n}(x/(1-\lambda/p))$.

12:10–12:45 Presentation Ceremony for the 2021 & 2022 MSJ Analysis Prize

14:25–15:25 Talk Invited by Statistics and Probability Section

Shinpei Imori (Hiroshima Univ.) Variable selection in high-dimensional multivariate linear regression models

Summary: Recently, there are advances in variable selection for high-dimensional multivariate linear regression models, where the dimension of response variables and the sample size are large. In this talk, we consider the asymptotic properties of variable selection procedures including model selection consistency (i.e., the selection probability of the true model goes to one with the sample size tending to infinity) and efficiency (i.e., a loss or risk function of the selected model is similar to that of the best model). The properties of variable selection procedures in high-dimensional situations are not always the same as those derived in low-dimension. We consider a situation that each response variable does not need to use the same explanatory variables. This condition yields more flexible variable selection frameworks.

15:45–16:45 Talk Invited by Statistics and Probability Section

Yuichi Goto (Kyushu Univ.) Integrated copula spectrum with applications to tests for time-reversibility and tail symmetry

Summary: The spectral density plays a pivotal role in time series analysis. Since the classical spectral density is defined as the Fourier transform of autocovariance functions, it fails to capture the distributional features. To overcome this drawback, we consider the spectral density based on copula and show the weak convergence of integrated copula spectra. This result combined with the subsampling procedure enables us to construct uniform confidence bands, a test for time-reversibility, and a test for tail symmetry. This talk is based on joint work with T. Kley (Georg-August-Univ. Gottingen), R. Van Hecke (Ruhr-Univ. Bochum), S. Volgushev (Univ. of Toronto), H. Dette (Ruhr-Univ. Bochum), and M. Hallin (Univ. libre de Bruxelles).

September 16th (Fri) Conference Room III

9:30–12:00

24 Nobuhiro Taneichi (Hokkaido Univ. of Edu.)
Yuri Sekiya (Hokkaido Univ. of Edu.)
Jun Toyama (Inst. for Pract. Appl. of Math.)
Improvement of the test statistics for conditional independence in 3-way contingency table based on asymptotic expansion ····· 15

Summary: We derived an expression of asymptotic expansion for the distribution of test statistics based on fai-divergence which include power divergence family of statistics for conditional independence in 3-way J x K x L contingency table. The expansion consists of continuous and discrete terms. Continuous terms mean terms of multivariate Edgeworth expansion. Using the continuous terms of the expansion, we constructed transformations that improve the speed of convergence to the chi-square asymptotic distribution of the test statistics. When the statistics are power divergence family of statistics as a special case, performance of the transformed statistics was investigated by Monte Carlo simulation.

25 Koshiro Yonenaga (Hokkaido Univ.)
Akio Suzukawa (Hokkaido Univ.)
Higher order moments of the product of a Wishart matrix and a normal vector ····· 15

Summary: In this report, we consider the distribution of the product of a Wishart matrix and a normal vector with uncommon covariance matrices. We provide the stochastic representation which reduces the computational burden for the generation of realizations of the product. Based on the stochastic representation of the product, the density function and higher order moments of the product are derived. In a numerical illustration, we investigate some properties of the distribution of the product; in particular, skewness and kurtosis are computed for various values of the parameters of the product. We further suggest the Edgeworth type expansions of the product, and we observe that the suggested approximations provide a good performance for moderately large degrees of freedom of a Wishart matrix.

26 Ayaka Yagi (Tokyo Univ. of Sci.)
Takashi Seo (Tokyo Univ. of Sci.)
Multivariate pairwise comparisons among mean vectors with monotone missing data ····· 15

Summary: We consider the approximate simultaneous confidence intervals for pairwise comparisons among mean vectors with monotone missing data. On the test for mean vectors, for example, Yagi and Seo (2017) and Yagi et al. (2018) discussed the simplified T^2-type test statistic $\widetilde{T}^2$ to test the equality of two mean vectors. Further, they proposed the approximate simultaneous confidence intervals for pairwise comparisons among mean vectors using the approximate upper percentile of the $T^2_{\max}$-type test statistic based on $\widetilde{T}^2$. In this talk, we give the $T^2_{\max}$-type statistic based on a partially modified $\widetilde{T}^2$ and derive an approximate upper percentile for it. By using this approximate upper percentile, an approximate simultaneous confidence interval is given.

27 Yugo Nakayama (Kyoto Univ.)
Kazuyoshi Yata (Univ. of Tsukuba)
Makoto Aoshima (Univ. of Tsukuba)
Robustness in high-dimensional principal component analysis ····· 15

Summary: In this talk, we discuss the robustness of principal component analysis (PCA) for high-dimensional, low-sample-size (HDLSS) data. PCA has been studied extensively in the framework of HDLSS. It should be noted that conventional PCA is strongly influenced by outliers. On the other hand, Locantore et al. (1999, Test) and Visuri et al. (2000, JSPI) proposed robust PCA based on a spatial sign covariance matrix. The work of Zhou and Marron (2015, EJS) showed asymptotic properties of robust PCA in the HDLSS setting under Gaussian. In this talk, we evaluate both conventional PCA and robust PCA under non-Gaussian with some outliers and compare their performance using numerical simulations and microarray datasets.

Summary: The Minkowski functionals, including the Euler characteristic statistics, are standard tools for morphological analysis in cosmology. Motivated by cosmological research, we examine the Minkowski functional of the excursion set for an isotropic central limit random field, the k-point correlation functions (kth order cumulants) of which have the same structure as that assumed in cosmic research. We derive the asymptotic expansions of the expected Euler characteristic density incorporating skewness and kurtosis, which is a building block of the Minkowski functional. The resulting formula reveals the types of non-Gaussianity that cannot be captured by the Minkowski functionals. As an example, we consider an isotropic chi-square random field, and confirm that the asymptotic expansion precisely approximates the true Euler characteristic density.

Summary: Testing the null hypothesis that all elements of observation vector are independent has been studied. Schott (2005) proposed the testing statistic and gave the limiting null distribution under high-dimensional asymptotic framework that the sample size n and the dimensionality p go to infinity together while p/n converges to a positive constant. We give a one-term asymptotic expansion of the null distribution as $\min\{n, p\}$ tends toward infinity. In addition, we derive a correction of the critical point for Schott (2005)'s test based on this expansion. The finite sample size and dimensionality performance for attained significance level is evaluated in a simulation study and the results are compared to those of Schott (2005)'s test.

Summary: Three asymptotic behaviors of hierarchical clustering are investigated under several settings from moderate dimension to high-dimension, low-sample size (HDLSS). However, it is considered that conditions required are strict for HDLSS data. Given this background, this presentation focuses on HDLSS settings and we give the asymptotic properties of hierarchical clustering under practical settings. Lastly, numerical simulations are given and we discuss the performance of the hierarchical clustering for HDLSS data.

Summary: We consider a class of non-ergodic dynamic regression models partially driven by a locally stable Levy process, specified by the characteristics: constant activity index, parametric trend coefficient, and parametric scale coefficient. Assuming that the process is observed at high frequency and the activity index is unknown, we derive the stochastic expansion of the marginal quasi-likelihood to formulate a Schwarz-type model selection of the trend and scale coefficients. The modeling is essentially based on the conditional stable quasi-likelihood function.

14:25–16:50

32 Yujie Xue (Waseda Univ.)
Masanobu Taniguchi (Waseda Univ.)
A new generalized estimator for autoregressive coefficient which improves MLE uniformly ····· 10

Summary: For the first order autoregressive model, in Ochi (1983), a generalized estimator of the coefficient with two constants was introduced, which includes Daniels's estimator, least-squares estimator and Durbin's estimator. From Fujikoshi and Ochi (1984), compared with a third-order approximated estimator of maximum likelihood estimator, it was shown that approximated estimator of maximum likelihood estimator is better than Ochi's estimator in the third-order sense if we modify the both estimators to be third-order asymptotically median unbiased. In this paper, we propose a new estimator based on Ochi (1983) which improves the MLE uniformly in the sense of the third-order mean square error without bias-adjustments.

33 Kou Fujimori (Shinshu Univ.)
Yuichi Goto (Kyushu Univ.)
Yan Liu (Waseda Univ.)
Masanobu Taniguchi (Waseda Univ.)
The Lasso-based principal component analysis for high-dimensional stationary time series ····· 15

Summary: In this talk, we discuss the Lasso-based principal component analysis for high-dimensional stationary processes. This problem is motivated by the observation that the standard principal component analysis performs poorly when the dimension of the data is large with sparse eigenvector. We deal with stationary time series under suitable mixing conditions and establish the rate of convergence of the Lasso-type estimators of the first eigenvector. We also elucidate the theoretical rate for choosing the tuning parameter in the Lasso-type estimators. The performance of the sparse principal component analysis is demonstrated by numerical simulations.

34 Tong Liu (Waseda Univ.)
Yujie Xue (Waseda Univ.)
Masanobu Taniguchi (Waseda Univ.)
Characterization of time series models by various divergences ····· 10

Summary: In this talk, we characterize representative time series models which best fit under the given constraints in the sense of maximizing three divergences. First, we show an another understanding of the characterization of the maximum entropy spectral distribution via Durbin–Levinson algorithm. Next, we characterize the spectral distribution which maximizes the minimum linear interpolation error, when autocovariances with finite number of lags of a stationary process are known. Lastly, when a finite number of generalized autocovariance values (Proietti & Lauti (2015)) are given, we show that the exponential model introduced by Bloomfield (1973) minimizes the divergence of the integral of power spectral measure.

35 Fumiya Akashi (Univ. of Tokyo)
Robust statistical inference for vector autoregressive models by smoothed generalized empirical likelihood method ····· 15

Summary: In this talk, we develop the generalized empirical likelihood (GEL) method for vector autoregressive models. The models in this talk involve infinite variance processes, and the distribution of the error term is nonparametric. Motivated by a concept of the spatial median vector, we consider the spatial median regression-based moment function and its smoothed version. We also consider the weighted version of the moment function, and the proposed GEL estimator has asymptotic normality regardless of whether the model has finite or infinite variance. A feasible testing procedure for a possively nonlinear restriction of the coefficients is proposed, and some simulation experiments illustrate the finite sample performance of the proposed methods.

Summary: In this talk, we introduce a new class of minimum contrast estimators for spectral densities of multivariate time series. Previous studies have shown the efficiency of the Whittle estimator, which was originally designed for parameter estimation of Gaussian processes. It is thought of as a special form of the minimum contrast estimator in time series analysis. For univariate time series, the estimator has been generalized to several classes of minimum contrast estimators. However, the generalization was limited in the sense of univariate time series. We focused on the multivariate time series and introduce a new class of the minimum contrast estimators. We study asymptotic distributions of minimum contrast estimators. The asymptotic properties will be illustrated by our simulation studies.

Summary: We consider a linear regression model with overparameterization, in which the number of features exceeds the sample size. When the model is with overparameterization and without regularization, there exist interpolators which fit all the training data and achieve zero training error. It is known that the excess risk of an interpolator can be convergent to zero if the eigenvalues of the covariance of the features decay moderately and the i.i.d. assumption for training data holds. We show that a similar result can hold even if the features and noises are dependent processes by showing upper bounds for the excess risk. We also examine how the dependence structures appear in those upper bounds.

Summary: In this talk we study asymptotic properties of quantile estimators which are based on the empirical distrubution function and kernel type estimator. We show that the kernel quantile estimator has small mean squared error in many case.

Summary: The usual approximation (near the origin $x = 0$) of a certain smooth function u as the convolution integral does not hold when $u(0) \neq 0$, and, even for the case $u(0) = 0$, the order of the approximation (near the origin $x = 0$) is slower when $u'(0) \neq 0$. For the data supported on $[0, \infty)$ or $[0, 1]$, this boundary bias problem is one of the interests. Instead of the location-scale kernel $k((x - \cdot)/h)/h$ (e.g. Rosenblatt), we focus on an application of an asymmetric kernel to solve the boundary bias problem. In this talk, we consider estimating the density derivative for the nonnegative data, using the asymmetric kernel method.

Summary: Here we propose a new nonparametric framework for two-sample testing, named as the OVL-q ($q = 1, 2, \ldots$). This can be regarded as a natural extension of the Smirnov test, which is eqivalent to the OVL-1. We specifically focus on the OVL-2, implement its fast algorithm, and show its superiority over other statistical tests in some experiments. The system to perform the OVL-1 and OVL-2 developed here can be used on-line at https://fiveseven-lambda.github.io/ovl-test.

Applied Mathematics

September 13th (Tue) Conference Room V

10:00–11:45

1 Naoki Matsumoto (Keio Univ.)
Masaki Yamamoto (Seikei Univ.)
Masahito Yamazaki (Seikei Univ.)
The minimum number of vertices of graphs containing two monochromatic triangles for any edge 2-coloring ····· 15

Summary: The simplest problem in graph theoretic Ramsey theory is to ask for the minimum number of vertices of complete graphs K_n such that there is one monochromatic triangle for any edge 2-coloring. It is well-known that the answer is six and so every graph with K_6 satisfies the same property. From this fact, it is natural to ask for a structure of graphs with such a property that does not contain K_6, which was posed by Erdős and Hajnal. Graham answered this question by constructing a minimal graph with the condition, which is on eight vertices and called the Graham graph. In this talk, we introduce a generalization of this study focusing on the number of monochromatic triangles and our result about the minimum number of vertices of graphs containing two monochromatic triangles for any edge 2-coloring.

2 Yumiko Ohno (Yokohama Nat. Univ.)
Naoki Matsumoto (Keio Univ.)
The difference between the achromatic number and the pseudoachroamtic number of caterpillars ····· 15

Summary: A *complete k-coloring* (resp., a *pseudocomplete k-coloring*) is a proper coloring (resp., a not necessarily proper coloring) such that each pair of colors appears on at least one edge. The *achromatic number* (resp., the *pseudoachromatic number*) of a graph G is the largest number k such that G has a complete k-coloring (resp., a pseudocomplete k-coloring).
Hedetniemi conjectured that the difference between the achromatic number and the pseudoachromatic number is at most 1 for every tree. A *caterpillar* is a tree such that the set of vertices of degree at least two induces a path. In this talk, we shall show that Hedetniemi's conjecture holds for a caterpillar satisfying certain conditions.

3 Kengo Enami (Seikei Univ.)
Atsuhiro Nakamoto (Yokohama Nat. Univ.)
Kenta Ozeki (Yokohama Nat. Univ.)
Surface immersions and projective planar graphs ····· 15

Summary: Let G and H be 4-regular graphs embedded on a surface F^2. A pair of edges in G is *consecutive* if these edges induced a cousecutive part of a facial walk. We say that G contains H as a *surface immersion* if H can be obtained from G by repeatedly splitting off pairs of consecutive edges. We prove that for any 4-regular graph H embedded on the projective plane, there exists an integer $N = N(H)$ such that every 4-regular graph of dual width at least N contains H as a surface immersion.

4 Hideaki Morita (Muroran Inst. of Tech.)
Ayaka Ishikawa (Yokohama Nat. Univ.)
On the Ihara expression for graps zeta functions ····· 15

Summary: We consider a determinant expression of graph zeta functions, which is called the Ihara expression, for finite digraphs. Digraphs allow multi-arcs and multi-loops. We will see that graph zeta functions have the Ihara expression in the case where the inverse arc is given uniquely for each arc if it exists in this general setting.

5 Ayaka Ishikawa (Yokohama Nat. Univ.)
Hideaki Morita (Muroran Inst. of Tech.)
A remark on inverse arcs in finite digraphs ····· 15

Summary: We consider the Ihara expression of graph zeta functions for finite digraphs, which allow multi-arcs and multi-loops. The existence of Ihara expression depends on a way we assign the set of inverse arcs for each arc. In this talk, we will see an example of the way which does not appear in the classical cases.

6 Iwao Sato (Oyama Nat. Coll. of Tech.)
Norio Konno (Yokohama Nat. Univ.)
Takashi Komatsu
(Math. Res. Inst. Calc for Industry)
Shunya Tamura (Yokohama Nat. Univ.)
A generalized Grover/Zeta correspondence 15

Summary: We introduce a generalized Grover matrix of a graph and present an explicit formula for its characteristic polynomial. Next, we define a zeta function and a generalized zeta function of a graph G with respect to its generalized Grover matrix and present explicit formulas for their zeta functions for a vertex-transitive graph. As applications, we express the limit on the generalized zeta functions of a family of finite vertex-transitive regular graphs by an integral. Furthermore, we give the limit on the generalized zeta functions of a family of finite tori as an integral expression.

14:15–15:25

7 Shinsuke Odagiri (Shumei Univ.)
Faces of maximal chain polytopes and guided crown structure 15

Summary: For a finite ordered set P, we define the maximal chain polyhedron $\mathscr{M}(P)$ as the convex hull of all the points in $\mathbb{R}^P$ corresponding to maximal chains. Let $\mathcal{C}$ be a set of maximal chains, and consider the convex hull of corresponding points in $\mathbb{R}^P$. We will show that the obtained polytope is a face of $\mathscr{M}(P)$ if and only if $\mathcal{C}$ does not have an incomplete guided crown structure. Using this result, we calculate the dimension of the maximal chain polytope when $P = \boldsymbol{m} \times \boldsymbol{n}$.

8 Chie Nara (Meiji Univ.)
Jin-ichi Itoh (Sugiyama Jogakuen Univ.)
Erik Demaine (MIT)
Continuous flattening of all polyhedral manifolds using countably infinite creases 15

Summary: We report results by joint-work with Z. Abel, M. Demaine, J. Ku, and J. Lynch: any finite polyhedral manifold in 3D can be continuously flattened into 2D while preserving intrinsic distances and avoiding self-crossing, answering an open problem proposed in 2001, if we extend standard folding models to allow for countable infinite creases, and the area of the manifold that needs to support moving creases can be made arbitrary small.

9 Tomohiro Kamiyoshi
(Matsue Coll. of Tech.)
Makoto Nagura
(Osaka Electro-Comm. Univ.)
Otani Shin-ich (Kanto Gakuin Univ.)
On exponential extended Riordan arrays and unified Stirling numbers 10

Summary: We propose the notion of extended Riordan array, permitted negative indices, of exponential type by using the Roman factorial. In this context, we will establish a fundamental theory of the unified Stirling numbers that were introduced by Hsu and Shiue. As a consequence, we give a luminous explanation for the reciprocity law among those numbers that was discovered by Choi, et al. and Maltenfort. Moreover, our methods reveal that some interesting numbers appear in a certain part of the exponential extended array, although the numbers in the area had been regarded as zero until now.

10 Daiki Kawabata (Osaka Pref. Univ.)
Tatsuya Maruta (Osaka Metro. Univ.)
On the achievement of the Griesmer bound 15

Summary: An $[n, k, d]_q$ code is a linear code of length n, dimension k and minimum weight d over the field of order q. The Griesmer bound gives a lower bound on the length n of an $[n, k, d]_q$ code. It is known that the Griesmer bound is attained for all sufficiently large d for fixed q and k. We pose a conjecture on the problem to find $D_{q,k}$, the largest value of d such that the Griesmer bound is not attained for fixed q and k. And we give some new results on the conjecture.

15:45–16:45 Talk Invited by Applied Mathematics Section

Momoko Hayamizu (Waseda Univ.) Combinatorics of phylogenetic trees and networks

Summary: Since the time of Charles Darwin, phylogenetic trees have been widely used as a model of evolution to describe the branching history of how the various organisms on Earth arrived at the present day from their common ancestor. On the other hand, reconstructing phylogeny from biological data often requires the use of more general graphs called phylogenetic networks to represent both branching and merging. However, existing theorems and algorithms concerning phylogenetic trees do not work as they are for phylogenetic networks in general. Indeed, as the mathematical biologist Joel E. Cohen stressed in a 2004 essay, the paradigm shift from evolutionary trees to networks is regarded as one of the biological challenges that could stimulate, and benefit from, major innovations in mathematics. Particularly active in this direction are studies of combinatorics aimed at elucidating the mathematical and computational properties of phylogenetic networks. In this talk, in an attempt to introduce the field of combinatorial phylogenetics, I will present an overview of my research results on the structure of phylogenetic networks, together with related studies and some open problems.

September 14th (Wed) Conference Room V

10:00–11:45

11 Akihiro Higashitani (Osaka Univ.)
Kenta Ueyama (Hirosaki Univ.)
Classification of (±1)-skew polynomial rings by switching of graphs and its associated simplicial complexes ····· 15

Summary: Classifying skew polynomial rings is important in noncommutative algebraic geometry because a skew polynomial ring can be regarded as a noncommutative version of the homogeneous coordinate ring of the projective space. In this talk, we focus on (±1)-skew polynomial rings. For this case, we prove that the classification of (±1)-skew polynomial rings up to equivalence of their graded module categories can be completely done by using the switching of graphs and the simplicial complexes associated to switching equivalence classes.

12 Shuhei Tsujie (Hokkaido Univ. of Edu.)
Tan Nhat Tran (Ruhr Univ. Bochum)
A characterization of strongly chordal graphs by edge-labeling ····· 15

Summary: Stanley showed that a graphic arrangement is free if and only if the corresponding graph is chordal. The class of MAT-free arrangements is an important subclass of free arrangements. We proved that a graphic arrangement is MAT-free if and only if the corresponding graph is strongly chordal. To prove this we gave a characterization of strongly chordal graphs by edge-labeling.

13 Norifumi Ojiro (Toyota Tech. Inst.)
Hajime Matsui (Toyota Tech. Inst.)
Minimum Euclidean weights for codes over rational integer quotient rings via tensor products ····· 15

Summary: In this research, we explain that any $\mathbb{Z}_m$-code can be uniquely represented by a certain integer coefficient square matrix called a reduced generator matrix. Then we show that the Kronecker product of the reduced generator matrices G_i for $\mathbb{Z}_{m_i}$-code $\mathcal{C}_i$ of length l_i with $i = 1, 2$ is the reduced generator matrix for a $\mathbb{Z}_{m_1 m_2}$-code $\mathcal{C}_3$ of length $l_1 l_2$. As the main result, we give a theorem to calculate the minimum Euclidean weight of $\mathcal{C}_3$ from those of $\mathcal{C}_1$ and $\mathcal{C}_2$.

14 Ken'ichi Yoshida (Ochanomizu Univ.)
Hiroki Kodama (Tohoku Univ./RIKEN)
A mathematical model of network elastoplasticity ················· 15

Summary: A thermoplastic elastomer (TPE) is a polymeric material with rubber elasticity and is removable at high temperatures. In this talk, we present results of modeling the elastoplastic deformation of a TPE by using a network represented as a periodic graph. A TPE consists of a soft domain, which exhibits rubber elasticity, and hard domains, which act as cross-links. This structure can be represented as a graph. We introduce the tension tensor for a periodically realized graph, which induces the stress and the elasticity. The hard domains of a TPE are less robust than the cross-links of vulcanized rubber. We express this as local moves of a graph, which induce the plasticity in elongation.

15 Kei Saito (Kanagawa Univ.)
Etsuo Segawa (Yokohama Nat. Univ.)
Spectral analysis for continuous-time Szegedy walks ················ 15

Summary: The time evolution of continuous-time quantum walks are defined by the Scrödinger equations while that of discrete-time walks are defined by the product of coin and shift operators. Strauch (2006) gives a connection between continuous-time and discrete-time walks by taking a continuous limit for one-dimensional model. The methods in the paper are difficult to apply to graphs more complex than one-dimensional lattice. By defining split-step quantum walks on the graph, we have led to similar results for Szegedy walks on more general graphs, which we call continuous version of Szegedy walk. In this talk, we will report on the method to deriving such a continuous walk and the spectral analysis of its Hamiltonian.

16 Tomoyuki Terada (Yokohama Nat. Univ./Kanazawa Inst. of Tech.)
Yusuke Ide (Nihon Univ.)
Norio Konno (Yokohama Nat. Univ.)
Probability measure for the Szegedy walk on the path graph ········· 15

Summary: In this talk, we consider a spectral analysis of the Szegedy walk on the path graph. Here, we have derived an explicit formula for the probability measure of the walker by using eigenvalues and eigenvectors of the Jacobi matrix related to the birth and death chain.

13:00–14:15

17 Shinya Fujita (Yokohama City Univ.)
Classification of graphs in terms of the domination number of central graphs ·· 10

Summary: For a graph G, the central graph $C(G)$ is the graph constructed from G by subdividing each edge of G with one vertex and also by adding an edge to every pair of non-adjacent vertices in G. In this talk, we give a new classification of graphs in terms of the domination number of central graphs.

18 Kiyoshi Ando (Nat. Inst. of Informatics)
Properly contractible edges and properly liftable vertices in a 4-connected graph ·· 15

Summary: We focus on the distribution of properly contractible edges and properly liftable vertices in a minimally 4-connected graph G. Let $E_c^*(G)$ and $\mathcal{L}^*(G)$ denote the set of properly 4-contractible edges of G and the set of properly $2k$-liftable vertices of G, respectively.

Theorem 2 *Let G be a minimally 4-connected graph. Then,*

$$2|E_c^*(G)| + |\mathcal{L}^*(G)| \geq 3|U_{4K_1}(G)| + 2|U_{2K_1 \cup K_2}(G)| + \sum_{H \in \mathcal{A}'} |U_H(G)|.$$

where $\mathcal{A}'$ is the set of graphs on four vertices with at least two edges whose maximum degree is less than 3, and $U_H(G) = \{x \in V_4(G) \mid G[N_G(x)] \cong H\}$.

19 Akira Saito (Nihon Univ.) Secure domination in C_5-free graphs 15
Shingo Degawa (Nihon Univ.)

Summary: A dominating set X in a graph G is said to be secure if for each $v \in V(G) - X$, there exists a vertex x in $N_G(v) \cap X$ such that $\big(X - \{x\}\big) \cup \{v\}$ is a dominating set. The order of a smallest secure dominating set is called a secure domination number and denoted by $\gamma_s(G)$. For a connected graph H, G is said to be H-free if G does not contain an induced subgraph isomorphic to H. In this talk, we report that every C_5-free graph satisfies $\gamma_s(G) \leq \alpha(G)$, where $\alpha(G)$ is the independence number of G. This result unites and extends several known bounds of $\gamma_s(G)$ in terms of $\alpha(G)$.

20 Akira Saito (Nihon Univ.) Relative length of triangle-free graphs 15
Hiroya Fijinami
(Grad. Univ. for Adv. Stud.)

Summary: For a 2-connected graph G, the difference of the orders of a longest path and a longest cycle is called the relative length of G and denoted by $\mathrm{diff}(G)$. In 2008, Paulusma and Yoshimoto proved that every 2-connected triangle-free graph G of order n with $\sigma_4(G) \geq n + 2$ satisfies $\mathrm{diff}(G) \leq 1$, where $\sigma_4(G)$ is the minimum value of the sums of degrees of four independent vertices in G. We conjecture that every 2-connected triangle-free graph G of order n with $\sigma_4(G) \geq s$ satisfies $\mathrm{diff}(G) \leq n + 3 - s$. The result by Paulusma and Yoshimoto corresponds to the case $s = n + 2$. We verify the conjecture for $s = n + 1$.

September 15th (Thu) Conference Room V

9:30–12:00

21 Tokuhiro Eto (Univ. of Tokyo) On a discrete scheme for the Mullins–Sekerka flow and its fine properties 15

Summary: The Mullins–Sekerka problem is numerically solved by the charge simulation method at the first time. In this scheme, an evolving curve in the plane $\mathbb{R}^2$ is imitated by a regular polygon. An evolving law is discretized by the forward Euler method. An optimal rate between the time step and the number of vertices of the polygon is revealed by means of a careful calculation. A particular contribution of the study is to clarify the possibility to handle the case where an evolving interface touches the boundary of a container. To our best knowledge, there have been no researches to treat numerically the Mullins–Sekerka problem with boundary contact angle condition.

22 Kazunori Matsui (Seikei Univ.) The rotation form and the Lagrange–Galerkin method for the Navier–Stokes equations 15

Summary: The advection term in the Navier–Stokes equations can be written in several ways. One of them is the rotation form. The rotation form is easy to conserve the total kinetic energy when discretized. On the other hand, the Lagrange–Galerkin (LG) method is a powerful numerical method for flow problems because of its robustness for convection-dominated problems and symmetry of the resulting matrix. The LG method uses that the sum of the time derivative and advection terms is the material derivative. In this talk, we propose a LG scheme for the rotation form Navier–Stokes equations, where the nonlinear term is different from the advection term.

23 Tomoya Kemmochi (Nagoya Univ.) L^p-resolvent estimates for finite element approximation of the Stokes operator 15

Summary: In this study, we consider finite element approximation of the Stokes resolvent problem. For parabolic problems, finite element approximation of a priori estimates, such as resolvent estimates, analyticity of semigroups, and maximal regularity, are well-studied. Moreover, these estimates are applied to error estimates for finite element methods to nonlinear problems. However, studies in this direction has not been developed for the Stokes case. As a starting point of the study, we present the L^p-resolvent estimate for the finite element approximation of the Stokes resolvent problem.

Summary: An interior penalty (IP) method for the biharmonic problem is studied. An a priori difference estimate between the IP method and the HJ method is derived. From the difference estimate and the a priori error estimate of the Herrmann–Johnson (HJ) method, an a priori error estimate of the IP method is obtained. It is shown that the error estimate of the IP method is the same as that of the HJ method by taking a penalty parameter of $O(1/h)$, where h is the mesh size parameter. Further it is shown that the number of iterations of a naive linear solver for the IP method is independent of the penalty parameter.

Summary: This talk presents a computer-assisted proof of the existence of steady-state solutions for the Proudman–Johnson equation which is a representative of the two-dimensional fluid flow. The proposed approach is based on an infinite-dimensional fixed-point theorem with interval arithmetic, and it is another proof by Miyaji–Okamoto (2019). Verification results show their validity.

Summary: Stommel (1950) considered a model of thermal convection in horizontally long liquid layer with non-uniform heat supply under gravity. He obtained approximate solutions by asymptotic expansion of the equations with respect to a dimension-less parameter and showed its picture of contour line of the stream function and isothermal line. It may be considered as a simplest model to indicate thermal effect on the ocean current. Here we have an existence theorem of stationary solutions for the model under some assumptions and obtain several figures of contour line of the stream function and isothermal line by numerical computations, which show the above meaning of the model. Some of the computations are out of the existence theorem.

Summary: An analytic formula of solutions to a modified Liouville equation on a curved torus is presented. It yields point vortex equilibria with strengths quantized by 2π in a background smooth Liouville-type vorticity field, which is a model of quantized vortex crystals appearing superfluids and Bose–Einstein–Condensates (BEC). We show that appropriate choices of the loxodromic function in the solution lead to stationary vortex patterns with point vortices of identical strengths. We also find solutions continuously dependent on a parameter, such that the point vortices remain fixed whereas the smooth background vorticity changes with the parameter. We investigate how non-constant curvature and a handle structure of the torus affect the topological flow structures. This talk is based on joint work with Dr. V. S. Krishnamurthy at Indian Institute of Technology Hyderabad.

Summary: We discuss what kind of large-scale stationary flow stretch small-scale vortex blob in alignment with straining direction in 3D incompressible Euler flow.

29 Makoto Okumura (Hokkaido Univ.)
Yasuaki Kobayashi (Hokkaido Univ.)
Masaharu Nagayama (Hokkaido Univ.)
Hironobu Fujiwara (RIKEN)
Yasugahira Yusuke (Hokkaido Univ.)
Kota Ohno (Chuo Univ.)
Reproduction of the cylinder structure of hair follicles using a plastic deformable basement membrane model 15

Summary: As an appendage of the skin, a hair follicle is the source of the hair. The hair follicle is crucial for maintaining the epidermis and hair tissue homeostasis and for repairing damaged tissue. We have been attempting to design a mathematical model that reproduces the cylinder structure of the hair follicle. Although we have reproduced the cylinder shape of the hair follicle to some extent in the mathematical model, there are still significant differences from the actual experimental results. Thus, we aim to reproduce the cylinder structure closer to the experimental results by improving the mathematical model. In this presentation, we present the results.

14:15–16:45

30 Junichi Takahashi (Kochi Univ.)
Shosuke Ohmori (Waseda Univ.)
Construction of Rigged Hilbert space for non-Hermitian quantum system with η symmetry 10

Summary: Non-Hermitian quantum systems with η symmetry have been widely studied because of their interesting features. On the other hand, the rigged Hilbert space is a set of linear phase spaces introduced to justify the description of brackets in quantum mechanics and can be obtained by expanding the Hilbert space to incorporate superfunctions such as delta functions. It is known that ordinary Hermite quantum mechanics is formulated in this space, but it is unclear whether it can be a mathematical foundation space for systems that go beyond conventional quantum theory, such as non-Hermite quantum systems. In this talk, we show that RHS formulation is possible for η symmetric non-Hermitian quantum systems.

31 Hirotaka Kai (Osaka City Univ.)
Path-properties of jump-diffusion processes on Riemannian manifolds 15

Summary: It is natural to construct Lévy processes on Riemannian manifolds and study their properties. We focus on the jump-diffusion process which is given by projecting the solution of the Marcus-type stochastic differential equation on the orthonormal frame bundle. The generator of the jump-diffusion process is similar to the one of the Lévy process on Euclidian space. In this talk, we will discuss irreducibility, transience and conservativeness. In order to grasp the behavior of the paths of the jump-diffusion process, we will introduce some nice upper and lower estimates.

Summary: Disastrous heavy rain events are expected to occur more frequently as climate change progresses, and it is important to update information on water areas such as rivers, reservoirs and coastal waters. This study focuses on construction of underwater topographic surfaces from positioning data and echo sounder data. Longitude and latitude components of ellipsoidal coordinates recorded by a GPS receiver are transformed to rectangular coordinates, and combined with vertical components including depth data recorded by an echo sounder unit. So generated underwater topographic data are introduced into construction of an underwater topographic surface which is defined as a piecewise linear function over a triangular mesh.

Summary: High dimension low sample size (HDLSS) data brings difficulties in statistical analysis. In this talk, we will first show the asymptotic behavior of persistence diagrams of high dimensional random data. As a result of the asymptotic behavior, we show the unreliability of using observed persistence diagrams in reality due to the presence of high dimensional noise, indicating the existence of curse of dimensionality (CoD) in persistence diagrams. Finally, we claim that simple application of principal component analysis (PCA) is not sufficient to completely eliminate the curse of dimensionality in persistence diagrams

Summary: Equilibria of continuous differential equation models of network dynamics is investigated. The motivation comes from gene regulatory networks where each directed edge represents either down- or up-regulation, and is modeled by a sigmoidal nonlinear function. We show that the existenceand stability of equilibria of a sigmoidal system are determined by a combinatorial analysis of the limiting switching system with piecewise constant nonlinearities.

Summary: In this talk, we briefly review some recent results on nonintegrability of dynamical systems: Nearly integrable systems, time-periodic perturbations of single-degree-of-freedom Hamiltonian systems and the SEIR epidemic model. A generalized version due to Ayoul and Zung of the Morales–Ramis and Morales–Ramis–Simó theories were used to obtain these results. A perturbation approach was also used for the first two results.

36 Kazuyuki Yagasaki (Kyoto Univ.) Nonintegrability of three- and four-dimensional dynamical systems near degenerate equilibria 15

Summary: In this talk, we review a recent result on nonintegrability of three- and four-dimensional dynamical systems near degenerate equilibria. We assume that the origin $x = 0$ is an equilibrium and the Jacobian matrix of the vector field at $x = 0$ has (I) a zero and pair of purely imaginary eigenvalues, $\lambda = 0, \pm i\omega$ $(\omega > 0)$, in the three-dimensional case or (II) two pairs of purely imaginary eigenvalues, $\pm i\omega_j$ $(\omega_j > 0)$, $j = 1, 2$, with $\omega_1/\omega_2 \notin \mathbb{Q}$ in the four-dimensional case. Our results also imply that three- and four-dimensional systems exhibiting fold-Hopf and double-Hopf bifurcations, respectively, are real-analytically nonintegrable in general.

37 Yuika Kajihara (Kyoto Univ.)
Eiko Kin (Osaka Univ.)
Mitsuru Shibayama (Kyoto Univ.) Braid types of periodic solutions in the planar $2n$-body problem 15

Summary: Periodic solutions of the planar n-body problem determine braids through the trajectory of n bodies. According to the Nielsen–Thurston classification of surface automorphisms, braids fall into three types: periodic, reducible and pseudo-Anosov. In this talk, we give a way to classify periodic orbits in the planar $2n$-body problem through braid types.

38 Tomoharu Suda (Keio Univ.) Partial maps generated by flows 15

Summary: The concept of the first-return map is fundamental in studying continuous-time dynamical systems. Such maps are usually not global and are defined only partially, reflecting the dynamics of the flow. A question here is whether we can use that partiality to our advantage. In this talk, we consider a generalization of the first-return map and discuss its applications to the description of dynamics and a reduction of hybrid systems to flows. This talk is based on arXiv:2205.03794 [math.DS].

17:00–18:00 Talk Invited by Applied Mathematics Section

Junya Nishiguchi (Tohoku Univ.) Infinite-dimensionality and transcendency brought by time-delay

Summary: Time evolutionary systems and their mathematical models with a "time-lag" in causality are collectively called *time-delay systems*. A "time-lag" in such a time-delay system arises, for example, from the finiteness of the rate of transmission of information. One can observe various dynamic phenomena as time-delay systems. A *delay differential equation* (DDE), which is a differential equation whose derivative $\dot{x}(t)$ of an unknown function $x = x(t)$ also depends on the past value of x, is a typical example of a time-delay system as a mathematical model. DDEs are similar in form to ordinary differential equations, however, these equations have infinite-dimensionality and transcendency as their characteristics. In the talk, we share previous studies of time-delay systems and discuss possible future directions from the viewpoint of theory and applications. For this purpose, the talk will be divided into two parts: 1. Overview of previous studies of time-delay systems, especially of mathematical studies of DDEs, 2. A recent study by the speaker including variation of constants formula for DDEs.

September 16th (Fri) Conference Room V

9:30–12:00

39 Itsuki Watanabe (Waseda Univ.) Application of Markov chain approximation method to nonlinear reaction-diffusion equation 15

Summary: We consider the hight density scaling limit of the stochastic model for nonlinear diffusion. The stochastic model can be constructed as a random walk on the discrete torus with a nonlinear diffusion rates. In this talk, we show that the deterministic limit of the stochastic model is governed by the nonlinear reaction-diffusion equation by showing the relative compactness and using the continuous mapping theorem.

Summary: In this talk, we consider the dynamics of a prey-predator model describing hunting cooperation. By focusing on coefficients for hunting cooperation and carrying capacity, we investigate the stability of a predator-free equilibrium and coexistence equilibria. In particular, for the case where the carrying capacity is small, we investigate the condition under which saddle-node bifurcation occurs when the model has two coexistence equilibria. Some of results are based on a joint work with Malay Banerjee (IIT Kanpur).

Summary: In a competitive system, two species are competing with each other, and the question is whether an invasive alien species can invade. In this case, the problem of what kind of potentials the eigenvalues exist in the Strum–Liouville type eigenvalue problem determines the above problem. In this talk, I will present results obtained for the Strum–Liouville type eigenvalue problem by using a topological index called the Malov index to determine the shape of the potential and the existence of eigenvalues.

Summary: We are concerned with stationary solutions of the Allen–Cahn equations in compact metric graphs. More precisely, we attempt to reveal a parameter dependence of sets of stationary solutions through an edge labelling problem. In this presentation, we present some numerical simulations for the Allen–Cahn equations in metric graphs and show that solutions of the edge labeling problem actually reveal the structures of stationary solutions of the Allen–Cahn equations.

Summary: In this study, we consider the spectral problem for a reaction-diffusion equation of a traveling wave solution traveling in the cylindrical domain and construct the Evans function. For the boundary conditions, we consider the periodic and the Robin boundary conditions, respectively, and introduce the results obtained.

Summary: We consider asymptotic behavior of blow-up solutions to a quasi-linear parabolic equation $u_t = u^\delta(u_{\theta\theta} + u)$ which appears in the classical curve-shortening flow of a closed cardioid-like immersed curve with a self-crossing point. It is known that this problem has type II blow-up solutions. In this talk, we provide upper esitimates for blow-up rates of solutions for the case of $2 < \delta < 3$ and $\delta = 3$.

Summary: We consider the pattern formation in 2-component reaction-diffusion systems. Introducing a specific parameter into the 2-component reaction-diffusion systems, the constant steady state is destabilized due to Hopf bifurcation, and spatially homogeneous periodic solutions appear. In this talk, we numerically treat a bifurcation problem from the spatially homogeneous periodic solutions.

46 Masaharu Nagayama (Hokkaido Univ.)
Harunori Monobe (Osaka Metro. Univ.)
Koya Sakakibara (Okayama Univ. of Sci.)
Ken-Ici Nakamura (Kanazawa Univ.)
Yasuaki Kobayashi (Hokkaido Univ.)
Hiroyuki Kitahata (Chiba Univ.)
Reaction-diffusion model for the self-propelled body 15

Summary: A self-propelled system is a system that moves by having an action that deforms itself or by having an action that changes its own motion field. The motion of bacteria and cells, which are living systems, and the motion of camphor and pentanol droplets, which are non-living systems, are considered to belong to self-driven systems because they have internal mechanisms that generate motion. We developed a self-propelled system model based on the Allen–Cahn equation. We combined it with the equation for molecular surfactant concentration used in previous studies to construct a mathematical model that can handle self-propelled system motion with shape change. One feature of our mathematical model is that it can represent deforming self-propelled bodies such as droplets and solid self-propelled bodies such as camphor with a single parameter.

47 Masataka Kuwamura (Kobe Univ.)
Oscillations and wave-pinning in cell polarity formation 15

Summary: We consider reaction-diffusion systems with bistable nonlinearity and mass conservation, which are useful for understanding cell polarization. We show that a specific model proposed by [Otsuji et al, PLoS Comp. Biol. 3 (2007), e108] exhibits four different spatiotemporal patterns including two types of oscillatory patterns which can be regarded as cell polarity oscillations with the reversal and non-reversal of polarity, respectively. Moreover, we show the existence and stability of single transition layer in such reaction-diffusion systems under general assumptions by the singular perturbation theory. This result provides a condition for wave-pinning in cell polarity formation.

14:15–16:10

48 Tadashi Takahashi (Konan Univ.)
Tomohiro Washino (Konan Univ.)
Analysis of phenomenon using a learning model 10

Summary: We consider an initial value of the statistic model and the dynamics of learning changing under the influence of a critical line in case the true distribution near the singular regions is realizable by the statistical model. Then over-fitting phenomena that a training loss decreases but a validation loss increases have been observed in case the true distribution on the singularity is realizable by the statistical model. We consider the phenomenon of dynamics on the learning loss surface using the theory of the learning model.

49 Yuhan Chen (Kobe Univ.)
Takashi Matsubara (Osaka Univ.)
Takaharu Yaguchi (Kobe Univ.)
Compatibility of the neural symplectic forms and the variational principle 15

Summary: In recent years, research on deep learning techniques to formulate models from observed data of physical phenomena has been attracting attention. Neural symplectic forms learn the symplectic form from data using neural networks, thereby providing a method for learning Hamiltonian equations from data represented in general coordinate systems. However, there has been little research on discretization methods for simulation using those models. In this presentation, I will talk about a variational principle that leads to neural symplectic forms. Using this, a numerical method called variational integrator can be designed.

Summary: In recent years, methods for learning governing equations of physical phenomena using deep learning have been studied extensively. Therein Dissipative SymODEN is known as a deep learning model that learns the port-Hamiltonian dynamics with energy dissipation. On the other hand, the GENERIC formulation is a framework for describing non-equilibrium thermodynamic systems, including terms of two dynamics, reversible and irreversible. In this work, by rewriting the dissipative SymODEN models to GNERIC systems, we propose a deep neural GENERIC model for the port-Hamiltonian dynamics, thereby revealing the hidden GENERIC structure behind the data.

Summary: Recently, methods for constructing differential equation models using neural networks have been attracting much attention. If such methods can be used to learn equations from images, it would be possible to construct models at a very low cost. Although research on such an approach has been performed, only simple problems have been considered. In this study, we apply such a technique to construct a model from a real data, i.e., images of a neural activity.

Summary: Deep learning has attracted much attention recently because of its interpretation as a variational problem with differential equations as constraints, or ODE-Net. On the other hand, the existence of a solution to the problem has been guaranteed only in impractical conditions. Therefore, we use the Benamou–Brenier formula to prove the existence of ODE-Nets under some reasonable assumptions.

Summary: Deep learning is one of the leading machine learning methods in recent years. One of the major research issues in deep learning is the problem of model design, and since many models have been proposed experimentally, a systematic understanding of models is still insufficient. In this study, we focus on the activation function among the components of designing a model to interpret a certain model in a unified manner. Specifically, we show that there is no difference between the widely used ReLU activation function and similar piecewise linear functions in terms of expressive ability.

54 Takuya Jinno (Univ. of Tokyo)
Hiroaki Miura (Univ. of Tokyo)
Kengo Nakai
(Tokyo Univ. of Marine Sci. and Tech.)
Yoshitaka Saiki (Hitotsubashi Univ.)
Tamaki Suematsu (RIKEN)
Daisuke Takasuka
(Japan Agency for Marine-Earth Sci. and Tech.)
Tsuyoshi Yoneda (Hitotsubashi Univ.)

Constructing a data-driven model of intraseasonal weather time-series using machine learning 15

Summary: By employing a reservoir computing, a machine learning technique, we construct a data-driven model for predicting time-series of an index of Madden–Jullian oscillation (MJO). MJO has far reaching influence on the global weather and is recognized to be one of the most important sources of predictability in an extended-range weather forecast. Our model has the potential of predicting the MJO for one month. This successful modelling relies on the the creation of an appropriate training time-series which has relatively low dimensional deterministic structures by employing a newly created band-pass filter. The usage of the delay coordinate also contributes to the effective modeling.

16:25–17:25 Talk Invited by Applied Mathematics Section

Akane Kawaharada
(Kyoto Univ. of Edu.)

Characterization of fractals generated by cellular automata

Summary: In this talk, we mainly study linear one-dimensional and two-dimensional elementary cellular automata that generate symmetrical spatio-temporal patterns. By observing self-similar structures, we count the number of nonzero states in the spatio-temporal patterns of cellular automata for each time step $n \in \mathbb{Z}_{\geq 0}$. This allows us to compute future activities more efficiently than simulating the entire spatio-temporal patterns. We also normalize the number of nonzero states of the patterns, take the limits, and give one-variable functions for the limit sets. We can obtain a one-variable function for each limit set and show that the resulting functions are singular functions, which are non-constant, are continuous everywhere, and have a zero derivative almost everywhere. For Rule 90, a one-dimensional elementary cellular automaton, and a two-dimensional elementary CA, we show that the resulting functions are Salem's singular function.

Topology

September 13th (Tue) Conference Room VII

9:30–12:00

Summary: We study perfectness of Higson type compactifications and give a necessary and sufficient condition that the subpower and the sublinear Higson compactification of locally connected proper metric space are perfect. Consequently, we show that the sublinear Higson corona of the half open interval with the usual metric is an indecomposable continuum.

Summary: Given a metrizable space X, let $PM(X)$, $M(X)$, $AM(X)$, and $EM(X)$ be the spaces consisting of continuous bounded pseudometrics, continuous bounded metrics, bounded admissible metrics, and admissible metrics that can be extended on the one-point compactification of X, which are regarded as subspaces in the space of real-valued continuous bounded functions on X^2. In this talk, we shall investigate the topological types of $PM(X)$, $M(X)$ and $AM(X)$ endowed with the uniform convergence topology, and $EM(X)$ endowed with the compact-open topology.

Summary: The Hopf algebra $K(n)_*(K(n))$, the stable cooperations of n-th Morava K-theory at an odd prime, is well-known. Whereas the main part of $K(n)_*(K(n))$ corepresents the group-valued functor consisting of the automorphisms of a formal group law of height n, relations between the whole structure of $K(n)_*(K(n))$ and formal group laws have not been investigated well. Firstly, we constitute the fiber product of two natural transformations between the automorphism groups of formal group laws, and the corepresenting Hopf algebra C_*. Next, we construct a Hopf algebra homomorphism from C_* to $K(n)_*(K(n))$ via Boardman's stable comodule algebras. By Yagita's results and the algebra structure of $K(n)_*(K(n))$, we see that the homomorphism is an isomorphism.

Summary: We show that every irreducible D^{**}-continuum is an arc. This gives the negative answer to [1, Question 2]. Also, we prove that being Wilder, being D, being D^*, and being D^{**} are Whitney properties.

Summary: A typical example of a Cartan calculus is the Lie algebra representation of vector fields of a manifold on the derivation ring of the de Rham complex. In this talk, we investigate Cartan calculus on the Hochschild chain complex of DGAs. It is a Lie algebra representation of the André–Quillen cohomology of a CDGA on the endomorphism ring of the Hochschild homology in terms of the homotopy Cartan calculi in the sense of Fiorenza and Kowalzig. Moreover, the representation in the Cartan calculus is interpreted geometrically as a map from the real homotopy group of the monoid of self-homotopy equivalences to the derivation ring on the loop cohomology.

6 Katsuhiko Kuribayashi (Shinshu Univ.)
Takahito Naito (Nippon Inst. of Tech.)
Shun Wakatsuki (Shinshu Univ.)
Toshihiro Yamaguchi (Kochi Univ.)
BV exactness and string brackets 15

Summary: The string bracket is a Lie bracket on the S^1-equivariant homology of the free loop space of an oriented closed manifold, which is introduced by Chas and Sullivan. In this talk, we explain methods to compute them when the manifold is BV exact. This method can be applied to many examples, since any rationally formal space (or more generally a space admitting positive weights) is BV exact. We also give non-examples of BV exact spaces, which are found by a computer-assisted method.

7 Yasuhiko Asao (Fukuoka Univ.)
Kenshi Ishiguro (Fukuoka Univ.)
Makoto Yamagata (Fukuoka Univ.)
Admissible maps and the cohomology of classifying spaces 10

Summary: The admissible map that determines a map between classifying spaces of connected compact Lie groups can be regarded as a matrix. We discuss the diagonalizability of such matrices as well as the triangularizability, particularly in the case of generalized cyclic matrices. Sometimes a high-dimensional behavior characterizes the induced homomorphism of the cohomology. We will generalize some previous results.

8 Masato Tanabe (Hokkaido Univ.)
Canonical stratification of definable groupoids 10

Summary: We consider semialgebraic or subanalytic category, or more generally, o-minimal category over $\mathbb{R}$ or $\mathfrak{X}$-category. These are examples of 'tame topology.' In this talk, we present a structure of a definable Lie groupoid and its orbit space in these categories. Our work is based on M. Shiota's theory of $\mathfrak{X}$-category, and refine and generalize J. N. Mather and V. A. Vassiliev's results on real algebraic group actions.

9 Takahiro Yamamoto (Tokyo Gakugei Univ.)
Topology of stable maps of surfaces with boundary into the plane 15

Summary: A smooth map of a compact surface with boundary into the plane is called weakly admissible if it behaves locally like a stable map on a neighbourhood of the boundary. The notions of the half boundary winding number of a weakly admissible smooth map $M \to \mathbb{R}^2$ and weakly-admissibly homotopic among weakly admissible smooth maps $M \to \mathbb{R}^2$ are introduced. Then, we show that weakly admissible smooth maps f_0 and $f_1 \colon M \to \mathbb{R}^2$ are weakly-admissibly homotopic if and only if the half boundary winding number of f_0 coincides with that of f_1.

14:20–18:00

10 Chihaya Jibiki (Tokyo Tech)
Constructions of left-orderings and investigating their properties 15

Summary: I show new left orderings of an HNN extension and an countably-generated group. More precisely, these are left-orderings of Baumslag–Solitar groups and inductive limits of groups and investigate properties of them. Our construction is based on the fact that an HNN extension is a semidirect product of an inductive limit of amalgamated free products with $\mathbb{Z}$. The left ordering on the $\mathrm{BS}(m, n)$ is nether Conradian nor isolated.

11 Takamichi Sato (Waseda Univ.)
On subgroups of Richard Thompson's group F 15

Summary: The R. Thompson group F has a description as the group of piecewise linear homeomorphisms from the closed unit interval onto itself that are differentiable everywhere except at finitely many dyadic rational numbers and such that on the intervals of differentiability the derivatives are integer powers of 2. We give an algebraic characterization, as subgroups of F, of the stabilizers of finite sets of numbers in the interval $(0, 1)$ under the natural action of F on $(0, 1)$.

12 Yu Tajima (Hokkaido Univ.)♭ Magnitude homology of cycle graphs and the homotopy type of the Asao–Izumihara complexes · · · 15

Summary: The magnitude homology is defined by Hepworth and Willerton as a categorification of the magnitude (an invariant for metric spaces). Recently, Asao and Izumihara introduced CW complexes whose homology groups are isomorphic to direct summands of graph magnitude homology groups. We prove that the Asao–Izumihara complex is homotopy equivalent to a wedge of spheres (of various dimensions) for cycle graphs with $2m-1$ $(m=3,4,\cdots)$ vertices.

13 Yuuki Tadokoro (Kisarazu Nat. Coll. of Tech.) Takuya Sakasai (Univ. of Tokyo) Kokoro Tanaka (Tokyo Gakugei Univ.) Minimal generating sets of groups of Kim–Manturov · · · 10

Summary: Kim and Manturov introduced a certain group derived from triangulations of a surface. Using a combinatorial group method, we give a minimal generating set of the group.

14 Sakumi Sugawara (Hokkaido Univ.) $\mathbb{Z}$-local system cohomology of hyperplane arrangements and a CDO-type theorem · · · 15

Summary: For the complement of a complex hyperplane arrangement, a vanishing theorem of $\mathbb{C}$-local system cohomology is known, which is first proved by Cohen, Dimca, and Orlik. In this talk, we consider the $\mathbb{Z}$-local system cohomology for complexified real arrangements and prove a CDO-type theorem for $\mathbb{Z}$-local system cohomology. The method to calculate the cohomology is based on the minimality of arrangements and combinatorial descriptions of basis in terms of chambers.

15 Masahiko Yoshinaga (Osaka Univ.) Suguru Ishibashi (ARISE analytics) Sakumi Sugawara (Hokkaido Univ.) The icosidodecahedral arrangement and related double coverings · · · 15

Summary: The icosidodecahedral arrangement is a plane arrangement in three dimensional space which is closely related to the icosidodecahedron. The icosidodecahedral arrangement has two peculiar properties. First, it provides the first example of arrangement such that the first homology of the Milnor fiber has torsion. Second, it breaks a conjecture by Papadima and Suciu concerning the first Betti number of the Milnor fiber. In this talk we will discuss the relationship between these two peculiar properties.

16 Shuichi Harako (Univ. of Tokyo) Computational results for the symplectic derivation Lie algebras · · · 15

Summary: The Lie algebras consisting of symplectic derivations on certain algebras are called the symplectic derivation Lie algebras. We determine the second homology group of the certain Lie ideal of "the commutative world" of the symplectic Lie algebras in terms of symplectic modules.

17 Yakov Eliashberg (Stanford Univ.) Noboru Ogawa (Tokai Univ.) Toru Yoshiyasu (Kyoto Univ. of Edu.) Stabilized convex symplectic manifolds are Weinstein · · · 15

Summary: We show that a stabilized convex symplectic (also called Liouville) manifold with the homotopy type of a half dimensional CW-complex is symplectomorphic to a flexible Weinstein manifold.

18 Shin Hayashi (JST PRESTO / Tohoku Univ.) An index theorem for quarter-plane Toeplitz operators via extended symbols · · · 15

Summary: We discuss index theory for some Toeplitz operators on a discrete quarter-plane (called quarter-plane Toeplitz operators). Duducava employed Gohberg–Krein theory for matrix factorizations and obtained an index formula in an analytic way. In this talk, we investigate his idea from a geometric point of view. We discuss Fredholm quarter-plane Toeplitz operators of two-variable rational matrix function symbols and show that their symbols defined originally on a two-dimensional torus can canonically be extended to some three-dimensional sphere. Their Fredholm indices are expressed as three-dimensional winding numbers of extended symbols.

19 Alastair Darby (Xi'an Jiaotong-Liverpool Univ.)
Shintaro Kuroki (Okayama Univ. of Sci.)
Jongbaek Song (KIAS)
Equivariant cohomology of torus orbifolds 15

Summary: In this talk, we introduce the calculation of the integral equivariant cohomology, in terms of generators and relations, of locally standard torus orbifolds whose odd degree ordinary cohomology vanishes. This is joint work with Alastair Darby and Jongbaek Song.

20 Shunsuke Tamura (Tsuyama Nat. Coll. of Tech.)
On odd-Euler-characteristic actions of finite groups on low-dimensional spheres 15

Summary: Let G be a finite group, M a smooth manifold with a smooth G-action and M^G the G-fixed-point set of the G-action on M. We call the G-action on M an odd-Euler-characteristic action (resp. a one-fixed-point action) if $\chi(M^G) \equiv 1 \bmod 2$ (resp. $|M^G| = 1$). The existence of one-fixed-point actions of finite groups on low-dimensional spheres has been studied by various topologists. In this talk, we will discuss a necessary condition for the existence of odd-Euler-characteristic actions of finite groups on the sphere S^n of dimension $n \leq 6$.

September 14th (Wed) Conference Room VI

10:10–10:25 Presentation Ceremony for the 2022 MSJ Geometry Prize

10:30–11:30 Award Lecture for the 2022 MSJ Geometry Prize

Hiroshi Iriyeh (Ibaraki Univ.)
Masataka Shibata (Meijo Univ.)
A solution of Mahler's conjecture of three dimensional symmetric convex bodies

Summary: We have proved Mahler's conjecture concerning the volume product of three dimensional centrally symmetric convex bodies in $\mathbb{R}^3$. In this talk, we give an outline of its proof and also provide its applications and recent developments.

13:15–14:15 Award Lecture for the 2022 MSJ Geometry Prize

Tatsuki Kuwagaki (Kyoto Univ.)♭
Geometry and algebraic analysis of sheaf quantization

Summary: Sheaf quantization is a way of quantizing Lagrangian submanifolds. The concept is quite rich and useful to study symplectic geometry, algebraic analysis, and etc. In this talk, I will give an introduction to the concept.

September 15th (Thu) Conference Room VII

9:30–12:00

21 Genki Omori (Tokyo Univ. of Sci.)
Susumu Hirose (Tokyo Univ. of Sci.)
Finite presentations for the balanced superelliptic mapping class groups 15

Summary: The balanced superelliptic mapping class group is the normalizer of the transformation group of the balanced superelliptic covering space in the mapping class group of the total surface. We give finite presentations for the balanced superelliptic mapping class groups of closed surfaces, surfaces with one marked point, and surfaces with one boundary component. To give these presentations, we construct finite presentations for corresponding liftable mapping class groups in a different generating set from Ghaswala–Winarski's presentation.

Summary: The balanced superelliptic mapping class group is the normalizer of the transformation group of the balanced superelliptic covering in the mapping class group of the total surface. We prove that the balanced superelliptic mapping class groups with either one marked point, one boundary component, or no marked points and boundary are generated by three elements. To prove this, we also show that its liftable mapping class groups are also generated by three elements. These generating sets are minimal except for several no marked points and boundary cases.

Summary: Omori and the speaker have given an infinite presentation for the mapping class group of a compact non-orientable surface. In this work, we give more simple four infinite presentations for this group.

Summary: For any finite type connected surface S, we give an infinite presentation of the fundamental group $\pi_1(S, *)$ of S based at an interior point $* \in S$ whose generators are represented by simple loops. When S is non-orientable, we also give an infinite presentation of the subgroup of $\pi_1(S, *)$ generated by elements which are represented by loops whose regular neighborhoods are annuli.

Summary: We give a necessary and sufficient condition for embedding a finite index subgroup of Artin's braid group into the mapping class group of a connected orientable surface.

Summary: The fatgraph complex of an oriented surface is a combinatorial model for the Teichmuller space of the surface, and it can be used for studying the cohomology of the mapping class group. We consider a certain 1-cocycle on the fatgraph complex introduced by Penner, and we give an explicit cobounding 0-cochain for it.

Summary: We compute the Reidemeister-Turaev torsion of homology cylinders which takes values in the K_1-group of the I-adic completion of the group ring $\mathbb{Q}\pi_1\Sigma_{g,1}$, and prove that its reduction to $\widehat{\mathbb{Q}\pi_1\Sigma_{g,1}}/\hat{I}^{d+1}$ is a finite-type invariant of degree d. We also show that the 1-loop part of the LMO functor and the Enomoto-Satoh trace are written by the leading term of our torsion.

Summary: We give explicit formulas for the actions of the Dehn twists along simple closed curves in a compact connected oriented surface on the completions of some types of skein modules. Using them, we can define some "quantum" Johnson homomorphisms and some invariants for integral homology 3-spheres and homology cylinders.

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

Christine Vespa (Univ. of Strasbourg / JSPS) — Eilenberg Mac Lane polynomial functors and their applications

Summary: In 1954, Eilenberg and Mac Lane introduced the notion of a polynomial functor as a generalization of additive functors. Fundamental results in representation theory and algebraic topology have been obtained using the polynomial functors. Polynomial functors are used both as a tool to measure the complexity of a functor and to study such functors. In this talk, I will give results on polynomial functors on finitely generated free groups and present some recent applications.

15:40–18:00

29 Jun Murakami (Waseda Univ.) — On quantization of knot groups ····· 10

Summary: By using the plat presentation of a knot, a quantization of the knot group is constructed. The main tool is the bottom tangle. The relations of the knot group is reformulated as relations of the algebra of bottom tangles, and the quantization of the knot group is defined as the quotient of the algebra with these relations.

30 Yasutaka Nakanishi (Kobe Univ.), Shunki Takagi — Differences of Conway polynomials for knots caused by a single pass move ····· 15

Summary: In this talk, we will characterize Conway polynomials of knots which are transformed into the trivial knot by a single pass move.

31 Toshiyuki Akita (Hokkaido Univ.), Aoi Hasegawa (Hokkaido Univ.) — On the associated group of a quandle ····· 10

Summary: The associated groups of quandles play an important role in understanding quandles themselves. In this talk, we give several explicit descriptions of structure of associated groups by introducing certain quotient groups of them.

32 Atsuhiko Mizusawa (Waseda Univ.), Yuka Kotorii (Hiroshima Univ. / RIKEN) — A classification of 5-component link-homotopy classes through the clasper theory ····· 15

Summary: The link-homotopy classes of links are obtained from the link-homotopy classes of string links modulo the partial conjugations. Yasuhara and Meilhan gave a standard form of the link-homotopy classes of string links by using the claspers. In this talk, we calculate the actions of the partial conjugations for the 5-component link-homotopy classes of string links by using the clasper theory and give a new presentation of the link-homotopy classes of 5-component links.

33 Shun Sawabe (Waseda Univ.) — On the potential function of the colored Jones polynomial with arbitrary colors ····· 10

Summary: In this study, we consider the potential function of the colored Jones polynomial for a link with arbitrary colors. This potential function has new parameters derived from the colors of the link. When we fix the new parameters, we can obtain a cone-manifold structure of the complement of a hyperbolic link from a saddle point of the potential function. Furthermore, when we regard the new parameters as variables, the derivatives with respect to the new parameters correspond to the completeness conditions. This correspondence implies that the saddle point of the potential function gives the complete hyperbolic structure to the link complement.

34 Masaaki Suzuki (Meiji Univ.), Anh T. Tran (Univ. of Texas at Dallas) — Genera and crossing numbers of 2-bridge knots ····· 10

Summary: We determine the average genus of all the 2-bridge knots with a given crossing number. As a consequence, we obtain the oblique asymptote of this value as the crossing number grows.

35 Teruaki Kitano (Soka Univ.) Algebraic integrality of Reidemeister torsion ····· 10
Yuta Nozaki (Hiroshima Univ.)

Summary: For a 3-manifold M and an acyclic $SL(2,\mathbb{C})$-representation ρ of its fundamental group, the Reidemeister torsion $\tau_\rho(M) \in \mathbb{C}$ is defined. If there are finitely many conjugacy classes of irreducible representations, then the Reidemeister torsions are known to be algebraic numbers. In this talk we report that any value of them is an algebraic integer for a Seifert fibered space under mild conditions, even though there are inifinite conjugacy classes.

36 Teruaki Kitano (Soka Univ.) Epimorphisms between knot groups and the $SL(2;\mathbb{C})$-character variety ····· 10

Summary: In this talk we will study to how determine the knot by the $SL(2;\mathbb{C})$-character variety. This includes some joint work with Michel Boileau, Steven Sivek, and Raphael Zentner.

37 Akihiro Takano (Univ. of Tokyo) The Long–Moody construction and twisted Alexander invariants ····· 15

Summary: The Long–Moody construction is a method of constructing a new representation of the braid group from a representation of the semidirect product of the braid group and the free group. In this talk, we show that its matrix presentation is described by the Fox derivation, and also a relation with twisted Alexander invariants.

September 16th (Fri) Conference Room VII

9:30–12:00

38 Seiichi Kamada (Osaka Univ.) Twisted intersection colorings and invariants of twisted links ····· 10
Hiroki Ito (KISTEM)

Summary: Twisted links are a generalization of classical links and virtual links. Here we introduce twisted intersection colorings of a diagram and construct invariants of a twisted link using such colorings. As an application, we show that there exist infinitely many pairs of twisted links such that for each pair the two twisted links are not equivalent but their double coverings are equivalent.

39 Naoko Kamada (Nagoya City Univ.) Virtual link diagrams and their sublink diagrams ····· 10

Summary: Jin and Lee proved the following: Suppose that $D_1, \ldots, D_n$ are link diagrams. Given a link L which is partitioned into sublinks $L_1, \ldots, L_n$ admitting diagrams $D_1, \ldots, D_n$ respectively, there is a diagram D of L whose restrictions to $L_1, \ldots, L_n$ are isotopic to $D_1, \ldots, D_n$, respectively. In this talk we show that a similar result does hold for welded links and does not for virtual links.

40 Kodai Wada (Kobe Univ.) Writhes and $2k$-moves for virtual knots ····· 10

Summary: In this talk, we show that if two virtual knots are related by a finite sequence of $2k$-moves, then their n-writhes are congruent modulo k for any nonzero integer n. Moreover, we give a necessary and sufficient condition for two virtual knots to be equivalent up to $2k$-moves and Ξ-moves in terms of their odd writhes.

41 Keiichi Sakai (Shinshu Univ.) The Fox–Hatcher cycle and the Vassiliev invariants ····· 15
Saki Kanou

Summary: Configuration space integral produces cohomology classes of the space of long knots from graph cocycles, and it is known that, if the graphs are trivalent, then the corresponding cohomology classes are closely related to the Vassiliev invariants. We give a combinatorial formula for the evaluation of the cocycles coming from certain non-trivalent graphs over the Fox–Hatcher cycles of the space of framed long knots. As a corollary we see that some non-trivalent graphs also produce (possibly trivial) Vassiliev invariants.

Summary: Agol proved that ribbon concordance forms a partial ordering on the set of knots in the 3-sphere. In this talk, we prove that a tight fibered knot, such as a torus knot, is minimal in the partially ordered set. This result gives a supporting evidence of the generalization of the slice-ribbon conjecture proposed by Daemi and Scaduto.

Summary: J. S. Carter, M. Saito and S. Satoh defined an invariant of oriented surface knots using a quandle 2-cocycle θ. In this talk, we relate the surface knot invariant using a quandle 2-cocycle θ to an f-twisted Alexander matrix, which was introduced by A. Ishii and K. Oshiro, using the Alexander pair associated with the quandle 2-cocycle θ. As an application, we determine the second quandle homology group of the knot quandle of 2-knots.

Summary: A plat form for links is a presentation of a classical link using a braid. We can apply this presentation to surface-links, using a braided surface instead of a braid, and prove that every surface-link has a plat form presentation. Using plat form presentation for surface-links, the plat index is defined as a surface-link invariant, which is an analogy of the bridge index for links. In this talk, we consider a lower bounds of the plat index for a surface-link by using a symmetric quandle coloring. As an application, we give infinitely many surface-knots with the plat index m for any positive integer m.

Summary: A (relative) trisection of a 4-manifold (with boundary) is a decomposition of the 4-manifold into three 4-dimensional 1-handlebodies. The complement of a surface-knot S has the standard decomposition according to a trisection T of a closed 4-manifold X, but it is never a relative trisection. Kim and Miller developed a new technique called a boundary-stabilization, so that the decomposition is a relative trisection. We study the difference between T and a new trisection of X obtained by boundary-stabilizing the complement of S when S is a P^2-knot which is of Kinoshita type.

Summary: A relative trisection is a decomposition of a smooth 4-manifold with boundary into three 4-dimensional 1-handlebodies. In this talk, we show how to construct minimal genus relative trisections for infinitely many corks. As an application, we determine the minimal number of binding components of planar open book decompositions on the boundaries of these corks.

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

Shin Satoh (Kobe Univ.) Toward tabulation of 2-knots

Summary: The crossing number $c(k)$ of a knot k in S^3 is the minimal number of crossings for all diagrams of k. It has been used to tabulate knots; in fact, $c(k) = 0$ holds if and only if k is the trivial knot, there is no knot of $c(k) = 1, 2$, $c(k) = 3$ holds if and only if k is the trefoil knot, and so on.
A 2-knot is a 2-dimensional sphere embedded in S^4 smoothly. It is presented by a diagram through a projection onto 3-space with a finite number of branch points and triple points. The minimal number of branch points for all diagrams of a 2-knot K is known to be equal to zero. The triple point number $t(K)$ of K is the minimal number of triple points for all diagrams of K. We would like to tabulate 2-knots by using the triple point number $t(K)$.
We have a great difference between the crossing number and the triple point number: There are infinitely many 2-knots of $t(K) = 0$ which are called ribbon. By introducing the notion of ribbon concordance, we can say that $t(K) = 0$ if and only if K is ribbon concordant to the trivial 2-knot. It is also known that there is no 2-knot of $t(K) = 1, 2, 3$. Our main theorem is that $t(K) = 4$ if and only if K is ribbon concordant to the 2-twist-spun trefoil knot. The aim of this talk is to review diagrammatic 2-knot theory and give a sketch of our theorem.

15:40–17:00

47 Motoo Tange (Univ. of Tsukuba)
Tatsumasa Suzuki (Tokyo Tech)
Pochette surgery of S^4 15

Summary: Iwase and Matsumoto defined a pochette P, which is $S^1 \times D^3 \natural S^2 \times D^2$ and defined a surgery (it is called a pochette surgery) around an image $P \hookrightarrow M$ in a 4-manifold M. They gave a complete data to determine the diffeomorphism type of the surgery. We clarify the diffeomorphism type of pochette surgery for any embedding with trivial cord. As a result we prove that any pochette surgery for embedding with trivial core sphere gives M or a Gluck surgery. We also show that there exist embeddings $P \hookrightarrow S^4$ with non-trivial core sphere and non-trivial cord such that the pochette surgery gives S^4.

48 Hiroki Kodama (Tohoku Univ./RIKEN)
Naohiko Kasuya (Hokkaido Univ.)
Yoshihiko Mitsumatsu (Chuo Univ.)
Atsuhide Mori (Osaka Dent. Univ.)
♭ Torus fibrations from S^5 to S^3 found from Milnor fibrations of certain complex surface singularities 15

Summary: We explain T_{pqr} cusp singularities and Milnor fibers F_θ of them. We construct a complex map g on a Milnor fiber F_θ so that it has $p + q + r$ critical points and the inverse images of regular values are tori T^2. We also construct a deformation of the Milnor fiber so that all critical points become Lefschetz type.

49 Yoshihiko Mitsumatsu (Chuo Univ.)
Naohiko Kasuya (Hokkaido Univ.)
Hiroki Kodama (Tohoku Univ./RIKEN)
Atsuhide Mori (Osaka Dent. Univ.)
Lefschetz fibration of Milnor fibers of cusp singularities and topological decompositions of the K3 surface 15

Summary: We explain that the K3 surface admits a smooth topological decomposition into the two Milnor fibers of T_{pqr} cusp singularities which are dual in the sense of the extended strange duality. Among such 10 decompositions, the pair T_{237}-T_{237} gives a particularly good decomposition.

Summary: We show the fact that the space of homogeneous quadratic maps from $\mathbb{R}^4$ to $\mathbb{R}^2$ for which the origin is the unique critical point has two path connected components, which has the following application. If the Hessian of a smooth map from a 4-manifold to a 2-manifold at a critical point P is of above type and belongs to the positive component, then the map is deformed in an arbitrary small neighborhood of P without creating new critical points so that P is a Lefschetz type critical point.

Infinite Analysis

September 13th (Tue) Conference Room IX

9:30–12:00

1 Yohei Tutiya (Kanagawa Inst. of Tech.) Theta function solutions for periodic ILW equation with discrete Laplacian · · · · · 10

Summary: It will be reported that periodic ILW equation with discrete Laplacian admits theta function solutions whose genera are greater than two. It will be achieved by conducting a special reduction for theta solutions for n-component KP equation that requires certain incommensurate relation among three points on compact Riemann surface.

2 Hidehito Nagao (Akashi Coll. of Tech.) A certain factorized matrix Lax form · · · · · 15

Summary: It is well known that the q-Painlevé system and its multivariable extension (called q-Garnier system) are given as a condition for the compatibility of the Lax pair (i.e. a set of a linear equation and its deformation equation). Recently, a factorized matrix Lax form for the q-Garnier system was obtained through a similarity reduction of the q-KP hierarchy. In this talk, we discuss an extension of the factorized matrix Lax form and its relation to other systems.

3 Kazuyuki Yagasaki (Kyoto Univ.) Integrability of the two-dimensional Zakharov–Shabat systems by quadrature · · · · · 15

Summary: In this talk we consider the two-dimensional Zakharov–Shabat (ZS) systems, which are linear systems of ordinary differential equations appearing in application of the inverse scattering transform (IST) to integrable partial differential equations (PDEs) such as the KdV equation, the nonlinear Schrödinger equation and so on. To obtain solutions to the initial value problems of these PDEs using the IST, we first have to solve the ZS systems. In particular, we show under some wide condition that if for any wave number they can be solved by quadrature, i.e., they are integrable in the meaning of differential Galois theory, then the potentials are reflectionless.

4 Genki Shibukawa (Kobe Univ.)
Tsuchimi Satoshi (Kobe Univ.) A generalization of Zwegers' μ-function according to the q-Hermite–Weber difference equation · · · · · 15

Summary: We introduce a one parameter deformation of the Zwegers' μ-function as the image of q-Borel and q-Laplace transforms of a fundamental solution for the q-Hermite–Weber equation. We further give some formulas of our generalized μ-function, for example, forward and backward shift, translation, symmetry, a difference equation for the new parameter, and q-bilateral hypergeometric expressions. From one point of view, the continuous q-Hermite polynomials are some special cases of our μ-function, and the Zwegers' μ-function is regarded as a continuous q-Hermite polynomial of "minus degree".

5 Tetsu Masuda (Aoyama Gakuin Univ.) Additional symmetry of Kajiwara–Noumi–Yamada systems · · · · · 15

Summary: We present a description of the additional symmetry of the discrete dynamical systems proposed by Kajiwara, Noumi and Yamada, which originally possess the extended affine Weyl group symmetry $\widetilde{W}(A^{(1)}_{m-1}) \times \widetilde{W}(A^{(1)}_{n-1})$.

6 Yumi Arai (Ochanomizu Univ.)
Kouichi Takemura (Ochanomizu Univ.) On q-middle convolution and q-hypergeometric equations · · · · · 15

Summary: We reformulate q-integral transformations associated with the q-middle convolution. We obtain q-integral representations of the variants of the q-hypergeometric equation by applying the q-middle convolution.

7 Shota Shigetomi (Kyushu Univ.) Kenji Kajiwara (Kyushu Univ.) An explicit formula of Kaleidocycle · · · · · 15

Summary: We construct an explicit formula of Kaleidocycle in terms of elliptic theta function.

8 Yuta Nishiyama (Kumamoto Univ.) On a conjecture on 2-reduced Schur functions and Schur's Q-functions · · · · · 15

Summary: Sato and Mori introduced some families of functions to state about behavior of the solutions of the KdV equation. Mizukawa, Nakajima and Yamada interpreted them as symmetric functions using 2-reduced Schur functions and Littlewood–Richardson coefficients. They also made a conjecture that these symmetric functions are equal to Schur's Q-functions up to a scalar. In this talk we prove the conjecture in a special case and give some consideration on the general case.

9 Yousuke Ohyama (Tokushima Univ.) A q-analogue of the Euler–Poisson–Darboux equation · · · · · 15

Summary: We study a q-analogue of the Euler–Poisson–Darboux equation, different from the q-EPD equation proposed by Koga and Nagatomo in 1995. We show our q-EPD equation has special solutions written by basic hypergeometric series.

14:15–15:15 Talk Invited by Infinite Analysis Special Session

Ayumu Hoshino (Hiroshima Inst. of Tech.) Macdonald polynomials of type C with hook-shape diagrams and Pieri type formula

Summary: We obtained explicit forms of the Koornwinder polynomials with one-row and one-column diagrams by a series of our studies. In this lecture, we give explicit forms of the Macdonald polynomials of type C with hook-shape diagrams. Moreover, we present an explicit Pieri type formula for the Macdonald polynomials of type C with one-row, one-column and hook-shape diagrams.

September 14th (Wed) Conference Room IX

9:30–10:50

10 Ryo Takenaka (Osaka Metro. Univ.) Affine Lie algebras of type $A_{2l}^{(2)}$ and fermionic formulas · · · · · 15

Summary: Vertex algebraic construction of modules for the twisted affine Lie algebra $A_2^{(2)}$ was studied by Calinescu, Lepowsky and Milas. In this talk, we see that such construction will be true for higher rank cases, that is for twisted affine Lie algebras of type $A_{2l}^{(2)}$. As a consequence, we obtain some fermionic character formulas.

11 Hideya Watanabe (Osaka Metro. Univ.) On $\imath$canonical bases of finite type of real rank one · · · · · 15

Summary: In 2010's, Huanchen Bao and Weiqiang Wang generalized the theory of canonical basis for quantum groups to that for $\imath$quantum groups (also known as quantum symmetric pair coideal subalgebras). In this talk, we focus on the $\imath$quantum groups of real rank one, and show that their canonical bases have a stability property. Then, we introduce possible applications to integrable system and combinatorial representation theory.

12 Yuma Mizuno (Chiba Univ.) Mutations of blowups of toric surfaces and q-Painlevé systems · · · · · 15

Summary: We provide a relation between the geometric framework for q-Painlevé equations and cluster Poisson varieties by using toric models of rational surfaces associated with q-Painlevé equations. We introduce the notion of seeds of q-Painlevé type by the negative semi-definiteness of symmetric bilinear forms associated with seeds, and classify the mutation equivalence classes of these seeds. This classification coincides with the classification of q-Painlevé equations given by Sakai.

13 Yuuki Shiraishi (Osaka Univ.)
Atsushi Takahashi (Osaka Univ.)
Akishi Ikeda (Josai Univ.)
Takumi Otani (Osaka Univ.)
A Frobenius manifold for ℓ-Kronecker quiver ····· 15

Summary: A Frobenius manifold is a complex manifold whose tangent bundle is a flat family of commutative Frobenius algebras satisfying certain conditions. In this talk, I will explain that a unique Frobenius manifold, whose intersection form coincides with the Cartan matrix of ℓ-Kronecker quiver $K(\ell)$, can be constructed from the invariant theory of the Weyl group associated to $K(\ell)$.

14 Wataru Takeda (Tokyo Univ. of Sci.)
Maki Nakasuji (Sophia Univ.)
Pfaffian expression of the Schur Q type multiple zeta functions ····· 15

Summary: We introduce Schur P and Q type multiple zeta functions. These functions are defined as sums over combinatorial objects called shifted Young tableaux. We will show that the Schur Q type multiple zeta function has a pfaffian expression under an assumption on variables.

11:00–12:00 Talk Invited by Infinite Analysis Special Session

Taichiro Takagi (Nat. Defense Acad. of Japan) ♭
A geometric lifting of integrable cellular automata and its continuum limits

Summary: I first explain a method to construct a family of discrete integrable systems with periodic boundary conditions, which can be regarded as a geometric lifting of a family of integrable cellular automata associated with affine type A crystals. By combining an unconventional usage of the matrices for defining the discrete periodic Toda chain with the Perron-Frobenius theorem, we give a definition of our systems. It is carried out on the space of real positive dependent variables, without regarding them to be written by subtraction-free rational functions of independent variables.
Next I present two types of systems of differential equations that can be derived from those discrete integrable systems. One is a kind of extended Lotka–Volterra systems, and the other seems to be generally new. Both equations have Lax representations associated with what are known as the loop elementary symmetric functions. I would like to talk about an example of the derivations of the continuous time Lax equations from a discrete time one, where a novel method of taking a continuum limit by assuming asymptotic behaviors of the eigenvalues of the Lax matrix in Puiseux series expansions is used.