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The Mathematical Society of Japan

2019 Autumn Meeting

Titles and Short Summaries of the Talks

September, 2019

at Kanazawa University

2019 The Mathematical Society of Japan

AUTUMN MEETING

Dates: September 17th (Tue)–20th (Fri), 2019

Venue: Kakuma Campus, Kanazawa University
Kakuma-machi, Kanazawa
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	I Nat. Sci. and Tech Library Large Conf. Rm.	II Nat. Sci. and Tech Main Hall 101 Lect. Rm.	III Nat. Sci. and Tech Main Hall 103 Lect. Rm.	IV Nat. Sci. and Tech Main Hall AV Lect. Rm.	V Nat. Sci. and Tech Main Hall Lect. Hall	VI Nat. Sci. and Tech Main Hall Large Lect. Rm. A	VII Nat. Sci. and Tech Main Hall Large Lect. Rm. B	VIII Nat. Sci. and Tech Main Hall 105 Lect. Rm.	IX Nat. Sci. and Tech Main Hall 107 Lect. Rm.
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	MSJ Prizes Presentation (Nat. Sci. and Tech Main Hall) ····· (15:10–15:40)								
	Plenary Talks (Nat. Sci. and Tech Main Hall) Autumn Prize Winner ····· (15:50–16:50)								
	Masaki Kashiwara (Kyoto Univ.) ····· (17:00–18:00)								
	Official Party (Royal Blue Hall, Tokyo Tech Front) ····· (19:00–20:30)								
19th (Thu)	Statistics and Probability 9:00–12:00 14:15–14:55	Found. of Math. & Hist. of Math. 9:15–11:35 14:15–16:35	Topology 9:30–12:00 15:30–17:10	Functional Equations 9:00–12:00 14:15–16:15	Algebra 9:15–11:30 15:30–17:40	Geometry 9:10–11:45 14:15–16:15	Applied Mathematics 9:15–11:55 Special Session 14:15–17:45	Real Analysis 10:00–11:55 14:15–16:05	Functional Analysis 9:00–11:45 14:15–16:00
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20th (Fri)		Found. of Math. & Hist. of Math. 9:00–10:15 14:15–15:30		Functional Equations 9:00–12:00 14:15–16:15	Algebra 9:45–12:00 15:30–16:15		Applied Mathematics 9:15–11:55 14:15–16:25	Real Analysis 9:00–11:55 14:15–16:05	
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Plenary Talks

September 18th (Wed) Large Lecture Rm. A & B (Conf. Rm. VI–VII), 1F, Natural Science and Technology Main Hall

The 2019 MSJ Autumn Prize

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

Invited Lecture on the Occasion of the Third Chern Medal

Masaki Kashiwara (Kyoto Univ.) Categorifications and quiver Hecke algebras ..... (17:00–18:00)

Summary: Fomin–Zelevinsky introduced the notion of cluster algebras and they proved (in a prticular case) that the quantum coordinate ring has a cluster algebra structure. In this talk, we discuss such a cluster algebra structures using its categorification by quiver Hecke algebras introduced by Rouquier and Khovanov–Lauda. This is a joint work with Seok-Jin Kang, Myungho Kim, Se-jin Oh and Euiyong Park.

Featured Invited Talks

September 17th (Tue)

Conference Room I

Tetsuya Hattori (Keio Univ.) Amazon ranking and hydrodynamic limit of stochastic ranking process ····· (13:00–14:00)

Summary: We review our mathematical and applied studies on large particle numbers (hydrodynamic) limits of stochastic ranking processes (SRP), systems of particles aligned in a line with move-to-front rules driven by point processes. On the application side, we observe that a simple version of the model, driven by the Poisson processes, explains behaviors of book ranking numbers at Amazon.co.jp. The results further imply that the main sales of the company is from top sales books, in opposition to expectations of possibilities of long-tail business model. On the mathematical study, we prove a hydrodynamic limit of SRP with position dependent intensities, allowing dependence of intensity functions of the driving processes on positon variables, which mathematically implies non-trivial stochastic dependence among the particles, complicating the studies. To overcome the difficulties, we introduce an intermediate model, SRP with flow driven intensities, which is driven by what we name 'the point processes with last-arrival-time dependent intensities' (PPLATDI), which, unlike Poission processes, lack independence of disjoint increments. The solutions in the hydrodynamic limit correspond to those of the systems of partial differential equations of one-dimensional fluid solved by characteristic curves, generalized to allow for non-local interaction terms, and whose solutions are found to be written by the expectations of PPLATDI.

Conference Room IV

Kengo Hirachi (Univ. of Tokyo)♭ Ramadanov conjecture for the Bergman kernel ····· (13:00–14:00)

Summary: In 1974, Charles Fefferman proved that the Bergman kernel for strictly pseudoconvex domains has pole type and logarithmic type singularities. Since then many people thought that the logarithmic singularity vanishes if and only if the domain is biholomorphic to the ball —it is so called the Ramadanov conjecture. It is affirmatively solved in dimensions 2 more than 30 yeas ago, but is still open in higher dimensions. In this talk, I will explain the current status of the conjecture starting from the basic facts on CR geometry and complex Monge–Ampère equation.

Conference Room VI

Takuro Mochizuki (Kyoto Univ.) Harmonic bundles, monopoles and instantons —an intersection of differential geometry and algebraic geometry— ···· (13:00–14:00)

Summary: One of the interesting themes in complex differential geometry is to pursue a natural correspondence between objects in differential geometry and algebraic geometry. In particular, the variants of "Kobayashi–Hitchin correspondence" have been studied for a long time. The original theorem says that an algebraic vector bundle on a complex projective manifold has a Hermitian–Einstein metric if and only if it is stable. Among many variants, the most interesting is the "trinity" of Higgs bundles, flat bundles and harmonic bundles, which is a starting point of the so called non-abelian Hodge theory. After the study of the singularity, we obtained a correspondence between semisimple algebraic holonomic D-modules and polarizable pure twistor D-modules, which was applied to the study of the functoriality of the semisimplicity of algebraic holonomic D-modules.

The abstract existence theorem and the functorial property of mixed twistor D-modules imply that harmonic bundles exist ubiquitously. It is expected that they are related to concrete examples of "1-parameter family of flat bundles degenerating to a Higgs bundle" which naturally appear in various fields of mathematics, called quantum curves, quantum D-modules, etc. For that purpose, it would be useful to obtain more explicit information for some classes of twistor D-modules. For instance, we made some explicit computations for GKZ-systems and Toda equations.

More recently, by pursing an analogue of the non-abelian Hodge theory, we are interested in Kobayashi–Hitchin correspondences for monopoles with periodicity, and it turned out that they are equivalent to difference modules of various types which have not yet been intensively studied in differential geometry. It is expected that the equivalences would be a starting point of new rich studies.

September 19th (Thu)

Conference Room IV

Takaaki Nomura (Kyushu Univ.*/Osaka City Univ.) Homogeneous open convex cones ····· (13:00–14:00)

Summary: In this talk, I would like to present, mainly to non-specialists, some of the results concerning homogeneous open convex cones obtained during these 20 years or so by collaborating with Hideyuki Ishi, Chifune Kai, Hideto Nakashima and Takashi Yamasaki. Topics include the minimum size matrix realization with the help of weighted oriented graphs, basic relative invariants, various characterizations of symmetric cones among homogeneous open convex cones, interesting examples of homogeneous open convex cones etc.

Conference Room VI

Guest Talk from Korean Mathematical Society

Yongnam Lee (KAIST) Deformation of a generically finite map to a hypersurface embedding and the moduli space of smooth hypersurfaces in abelian varieties ····· (13:00–14:00)

Summary: In this talk, we give a structure theorem for projective manifolds W_0 with the property of admitting a 1-parameter deformation where W_t is a hypersurface in a projective smooth manifold Z_t. Their structure is the one of special iterated univariate coverings which we call of normal type. We give an application to the case where Z_t is a projective space, respectively an abelian variety. We also give a characterizaton of smooth ample hypersurfaces in abelian varieties and describe an irreducible connected component of their moduli space. This is a joint work with Fabrizio Catanese.

September 20th (Fri)

Conference Room IV

Shuichi Jimbo (Hokkaido Univ.) Time entire solutions of Allen–Cahn equation in the star graph ····· (13:00–14:00)

Summary: I consider the Allen–Cahn equation (or Nagumo equation) in a set Ω of some special type. For semilinear parabolic equations, there are a lot of studies on the initial value problem in the case that Ω is a bounded or unbounded domain. The existence and uniqueness of solutions and analysis of behavior of solution u for t grows up to infinity are important problems. In this talk I deal with the case that Ω is a star graph which is a union of several half lines connected at the common end point (or a network of some special type) and consider the existence of time entire solutions and their structure. The "time entire" implies that a solution $u = u(t, x)$ exists for all $t \in (-\infty, \infty)$. I explain some results obtained through the joint work with Y. Takazawa (Hokkaido Univ.) and Y. Morita (Ryukoku Univ.).

Conference Room VI

Shane Kelly (Tokyo Tech) Applications of algebraic geometry (especially mixed motives) to representation theory ····· (13:00–14:00)

Summary: This is joint work Jens Niklas Eberhardt. Categories of mixed l-adic sheaves and mixed Hodge modules are indispensable tools in geometric representation theory. They are used in the proof of the Kazhdan–Lusztig conjecture, uncover hidden gradings in categories of representations or categorify objects such as Hecke algebras, representations of quantum groups and link invariants, to name a few. But they are—by their nature—limited to characteristic zero coefficients.

In this talk, I will discuss a formalism of mixed sheaves with coefficients in characteristic p following ideas of Soergel, Wendt, and Virk to make use of the recent developments in the world of motivic sheaves. As an application, our work produces a geometric and graded version of Soergel's modular category $\mathcal{O}(G)$, consisting of rational representations of a split semisimple group G over a positive characteristic field, thereby equipping it with a full six functor formalism. In particular, one can express characters of irreducible modules of SL_n in terms of mixed motives.

Foundation of Mathematics and History of Mathematics

September 19th (Thu) Conference Room II

9:15–11:35

1 Shigeru Masuda (Res. Workshop of Classical Fluid Dynamics) Application to the mechanics with the elliptic functions by Legendre ····· 15

Summary: Legendre applies his theory of elliptic functions not only to the geometry but also to the mechanics in Study of Elliptic functions in 1825. Poisson issues the Study of Mechanics in 1833. Legendre's mechanics is discussed based on his Theory of Number, however, Poisson's one is based on the mathematical physics with experiments and the observations. We discuss mechanics to which Legendre applies the elliptic functions.

2 Shigeru Masuda (Res. Workshop of Classical Fluid Dynamics) "Construction of integral table with the elliptic functions" by Legendre ····· 15

Summary: In 1826, Legendre issues his integral table based on his theory of elliptic functions in Study of Elliptic functions in 1825, who is then 73 years old. Poisson applies thankfully to his calculation of the capillarity or of Earth temperature. In Construction of Integral Table, Legendre verifies the principle functions and constructs the Table with logarithms.

3 Ken Saito (Osaka Pref. Univ.*/Yokkaichi Univ.) Diagrams in Greek manuscripts of Apollonius' *Conics* ····· 15

Summary: In the diagrams of manuscripts of Apollonius' *Conics*, all the conic sections are substituted by circle arcs. Modern printed editions do not reproduce them, but provide mathematically correct diagrams. We will examine some of the manuscript diagrams, especially multiple diagrams corresponding to different arrangement of points and lines (partly omitted in modern editions), and try to find the best way to present the complicated diagrams of ancient theory of conic sections to modern readers.

4 Tsukane Ogawa (Yokkaichi Univ.) Theory of equations developed by Seki Takakazu ····· 15

Summary: Seki Takakazu is the first mathematician who studied equations themselves in Pre-modern Japan. His first work, *Hatsubi sanpou*, solved 15 problems set by Sawaguchi Kazuyuki's *Kokon sanpou ki*. His main methods to solve simultaneous equations are "squaring", "cubing", and "Hungou". These reveal that he aimed to solve various equations by some unified methods. He also tried to generalize a specific method to get an abstract one. For example, his "Shouchou" method was led to one using an expansion of a determinant later.
In the process, he studied equations themselves. I will consider his originality and significance of his theory on equations in the history of Pre-modern Japanese mathematics.

5 Toshio Harikae (Osaka Sangyo Univ.) The approximate calculation by the false position method to extract square root ····· 15

Summary: In ancient China before the invention of extraction of square root, the false position method is used as the approximate calculation. In this talk, we present several problems of the books in ancient China.

6 Hirotaka Kikyo (Kobe Univ.) On Hrushovski's pseudoplanes in rational cases ····· 15

Summary: Hrushovski constructed pseudoplanes corresponding to irrational numbers which refute a conjecture by Lachlan. Hrushovski's construction is valid for any real numbers α with $0 < \alpha < 1$. The automorphism groups of the pseudoplanes corresponding to rational numbers α with $0 < \alpha < 1$ are simple groups. Also, the theories of these pseudoplanes are model complete.

7 Koichiro Ikeda (Hosei Univ.) On superstability of generic structures · · · · · · · · · · 15

Summary: In this talk, we show that if α is irrational then any normal generic structure is not superstable.

8 Kota Takeuchi (Univ. of Tsukuba) Kanoko Ueda (TIS) On isomorphic submodels of nonstandard models of arithmetic · · · · · · 15

Summary: By the Friedman's theorem, we know that every nonstandard model of PA has a proper initial segment which is isomorphic to itself. One of the author investigated when the intersection of such submodels coincides the standard model in her Master thesis. We report her result and related topics, especially the relation of fixed points of self-embeddings and special kinds of initial segments.

9 Akito Tsuboi (Univ. of Tsukuba) A remark on Ehrenfeucht theories · · · · · · · · · · 10

Summary: We present a result that improves the main theorem of:
Akito Tsuboi, On Theories Having a Finite Number of Nonisomorphic Countable Models, J. Symbolic Logic Volume 50, Issue 3 (1985), 806–808.

11:35–11:55 Mathematics History Team Meeting

14:15–16:35

10 Masahiro Kumabe (Open Univ. of Japan) Kenshi Miyabe (Meiji Univ.) Yuki Mizusawa (Tokyo Metro. Univ.) Toshio Suzuki (Tokyo Metro. Univ.) Solovay reduction and continuity · · · · · · · · · · 15

Summary: In the theory of computability, the concept of reduction is a certain type of pseudo order that compares complexity of two sets of natural numbers, or two real numbers. The aim of our talk is a better understanding of the relationships between reduction and continuity. We observe that Solovay reduction is characterized by the existence of a certain Lipschitz continuous real function. Then we ask whether there is a concept of reducibility that exactly corresponds to Hoelder continuous function (with order less than or equal to 1). We show this is the case. We introduce the concept of quasi Solovay reduction. We separate it from Solovay reduction and from Turing reduction. We investigate the relationships between quasi Solovay complete sets and randomness.

11 Kohtaro Tadaki (Chubu Univ.) A refinement of quantum information theory by algorithmic randomness II · · · · · · · · · · 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 alternative rule to the Born rule, called the principle of typicality, for specifying the property of results of measurements in an operational way. In this talk, we reformulate the quantum operations formalism in terms of the principle of typicality, in order to demonstrate how properly our framework works in practical problems in quantum mechanics.

12 Masanao Ozawa (Nagoya Univ.) Improving Takeuti's quantum set theory to satisfy De Morgan's law for bounded quantifications 15

Summary: In classical set theory, De Morgan's laws (i) $\neg(\forall x \in a)\ A(x) \Leftrightarrow (\exists x \in a)\ \neg A(x)$ and (ii) $\neg(\exists x \in a)\ A(x) \Leftrightarrow (\forall x \in a)\ \neg A(x)$ hold for bounded quantifications. However, these laws do not hold in Takeuti's quantum set theory. Here, we show that Takeuti's quantum set theory can be improved so that these De Morgan's laws hold, while maintaining the results obtained so far, such as the transfer principle for theorems of ZFC set theory. As a result, duality is established between conjunction and disjunction, universal quantification and existential quantification in quantum set theory just as in classical set theory, and more powerful developments will be expected in quantum set theory and its applications.

13 Yukinobu Yajima (Kanagawa Univ.) Yasushi Hirata (Kanagawa Univ.) A characterization of certain products of ordinals and weakly inaccessible cardinals 15

Summary: For a space X, $e(X)$ denotes the extent of X. We give a characterization of rectangular (equivalently, countably paracompact) products of two subspaces of an ordinal in terms of the equality of extents, under the non-existence of weakly inaccessible cardinal. We also give a simple example that the characterization does not hold under the existence of a weakly inaccessible cardinal.

14 Katsuya Eda (Waseda Univ.) Archipelago groups 15

Summary: Archipelago groups $\mathcal{A}(G)$ are defined for groups G, i.e. the quotient group of the free σ-product of countable copies of G by the narmal closure of the free product of countable copies of G. Though theses groups appear as the fundamental groups of natural spaces, the fundamental questions are open.

15 Teruyuki Yorioka (Shizuoka Univ.) Uniformization of ladder system colorings and Todorcevic's fragments of Martin's Axiom 15

Summary: Uniformization of ladder system colorings has been introduced by analysis of a proof of the Shelah's solution of Whitehead problem. Here, for a subset $\mathcal{S}$ of $\omega_1 \cap \mathsf{Lim}$, $\mathsf{U}(\mathcal{S})$ is the assertion that, for any ladder system coloring $\langle d_\alpha : \alpha \in \omega_1 \cap \mathsf{Lim}\rangle$, there exists $S \in \mathcal{S}$ such that the restricted coloring $\langle d_\alpha : \alpha \in S\rangle$ can be uniformized. Shelah's proof can be separated into the following two theorems: $\mathsf{MA}_{\aleph_1}$ implies $\mathsf{U}(\{\omega_1 \cap \mathsf{Lim}\})$, and $\mathsf{U}(\{\omega_1 \cap \mathsf{Lim}\})$ implies the existence of a non-free Whitehead group. It is proved that the assertion $\mathcal{K}_3$, which is one of Todorcevic's fragments of Martin's Axiom, implies that $\mathsf{U}(\mathsf{stat})$ holds, where stat stands for the set of stationary subsets of $\omega_1 \cap \mathsf{Lim}$.

16 Yoshihiro Abe (Kanagawa Univ.) A condition for an ideal to be a P-point 15

Summary: P-points over $\mathcal{P}_\kappa\lambda$ are defined using functions. We present an equivalent condition for an ideal I to be a P-point using a family of sets belonging to I.

17 Souji Shizuma (Osaka Pref. Univ.) Infinite Hat Guessing Games and the axiom of choice 15

Summary: We investigate variants of so-called Hat Guessing Games; played by infinitely many agents, finitely or infinitely many colors, restricted visibility, non-simultaneous guesses, and so on. We show, assuming the axiom of choice, that in several typical cases the agents have optimal strategies.

18 Daisuke Ikegami (Shibaura Inst. of Tech.) On supercompactness of ω_1 15

Summary: It is known that many concrete forcings such as Cohen forcing destroy AD. In this talk, we show that one cannot preserve AD via forcings as long as the forcing increases Θ and V satisfies AD^+ and $\mathrm{V} = \mathrm{L}(\mathcal{P}(\mathbb{R}))$. We also provide an example of forcings which preserve AD while increasing Θ when V is not of the form $\mathrm{L}(\mathcal{P}(\mathbb{R}))$. This is joint work with Nam Trang.

16:45–17:45 Talk Invited by Section on Foundation and History of Mathematics

Diego A. Mejía (Shizuoka Univ.) Cichon's maximum over ZFC alone

Summary: A very classical subject of study in combinatorics of the real line is Cichon's diagram, which lists cardinal characteristics (and the provable relations between them) that encompasses combinatorial concepts related to measure and category of the real line, and to compactness of subsets of irrational numbers.
It is known that Cichon's diagram is complete, in the sense that no other inequality between them can be proved. However, just in the present decade it has been explored consistency results regarding three or more different values considered simultaneously in the diagram.
Is it consistent with ZFC that all the cardinals in Cichon's diagram are pairwise different? This is the main question of the research mentioned above.
A couple of years ago, Goldstern, Kellner and Shelah used large cardinals to answer this question affirmatively. Just very recently, the speaker joined their work, and they managed to show how to prove this consistency result without using large cardinals.

September 20th (Fri) Conference Room II

9:00–10:15

19 Saburou Saitoh (Gunma Univ.*/Inst. of Reproducing Kernels) Meanings of zero and infinity; Relations of zero and infinity ····· 15

Summary: Zero and infinity are, of course, have long histories over mathematics. From the division by zero, we found some basic meanings of zero and infinity, as mathematics. We would like to talk some global viewpoints on zero and infinity. We will give their definitions first clearly as mathematics. We will introduce a surprising relationship of zero and infinity, clearly in this talk based on the cited references.

20 Nobu-Yuki Suzuki (Shizuoka Univ.) Logics constructed in my previous talk are incomplete with respect to Kripke and algebraic frames ····· 15

Summary: In the previous talk (MSJ Spring Meeting 2018), we reported that there exists a continuum of intermediate predicate logics that have the disjunction property but lack the existence property. In this talk, we report that the logics constructed in this way are all incomplete with respect to Kripke-frame semantics and algebraic frame semantics. Note that these logics have the same propositional part as intuitionistic logic.

21 Daishi Yazaki (Shizuoka Univ.) Another restriction of cut in sequent calculi for the modal logics S5 and K4B. ····· 15

Summary: Standard sequent calculi for modal logics S5 and K4B do not enjoy the cut-elimination property. Takano showed that the application of (cut) in these calculi can be restricted to analytic cut. For some modal logics, he investigated the relationships between the inference rules and semantical properties by introducing analytically saturated sequents. By extending his method, we found that we can improve the restriction of (cut) in S5 and K4B. We can prove finite model property of these logics simultaneously.

22 Tatsuya Shimura (Nihon Univ.) Modal logics around $\mathbf{KD4Z_{14}}$. ····· 15

Summary: The modal propositonal logic $\mathbf{KD4Z_{14}}$ is an irreflexive counter part of $\mathbf{S4.1.4}$. We treat$\mathbf{KD4Z_{14}}$ and a little weaker logic $\mathbf{K4Z^{+}_{14}}$.
1. Both logics have cut-free systems.
2. Both logics have f.m.p. and Craig interpolation property, and these properties can be proved simultaneously.

23 Takahiro Seki (Niigata Univ.) On some restricted weakening rules · 15

Summary: In non-associative substructural logics, we can consider not only the weakening rules in the usual sense but also restricted weakening rules associated with associativity. In this talk, we introduce a cut-free Gentzen-style formulation for some non-associative substructural logics with restricted weakening rules, and consider some related topics.

10:30–11:30 Talk Invited by Section on Foundation and History of Mathematics

Hidenori Kurokawa (Kanazawa Univ.) The completeness theorem revisited

Summary: In this talk, we reconsider the significance of the completeness theorem, primarily, for classical first-order logic. We argue that the significance of the theorem is more complicated than often discussed, since it ultimately rests on the issue of how we should consider the relationship between pertinent informal (or preformal) logical concepts and formal counterparts thereof. More specifically, we first give a concise historical overview of the theorem. Secondly, we discuss a few conceptual problems concerning the theorem. Thirdly, we pay attention to what is often called 'Kreisel's squeezing argument,' which has been given in order to solve one of the conceptual problems that arise in relation to the significance of the completeness theorem. Finally, we discuss both limitations and repercussions of Kreisel's argument, focusing on Kreisel's methodological concept called 'informal rigour,' which has been introduced to handle the foregoing issue.

11:35–11:55 Research Section Assembly

14:15–15:30

24 Ken-etsu Fujita (Gunma Univ.) Equational theory and reduction rules of reduction paths · · · · · · · · · · · 15

Summary: We introduce a formal system of reduction paths as an extension of a monoid-like structure. Our motivation comes from a quantitative analysis of reduction systems based on the perspective of computational cost and orbit. From the perspective, we define a formal system of reduction paths for parallel reduction, wherein paths are generated from a quiver by means of three path-operators. Next, we introduce an equational theory and reduction rules for paths, and show that the rules on paths are terminating and confluent so that normal paths are obtained. Following normal paths, a graphical representation of reduction paths is provided. Then we show that the reduction graph is a plane graph, and unique path and universal common-reduct properties are established.

25 Ryo Kashima (Tokyo Tech) On the completeness of simple type assignment system for lambda calculus · 15

Summary: We consider how to define adequate semantics for the simple type assignment system for lambda calculus such that $M : \tau$ is provable if and only if $M : \tau$ is valid in the semantics.

26 Yuya Okawa (Chiba Univ.) Around Guaspari's problem on partially conservative sentences · · · · · · 15
Taishi Kurahashi
(Nat. Inst. of Tech., Kisarazu Coll.)

Summary: A sentence φ is said to be Γ-conservative over T if for every Γ sentence θ, if $T + \varphi \vdash \theta$, then $T \vdash \theta$. For $\Gamma = \Sigma_n$ (resp. Π_n), let $\Gamma^d = \Pi_n$ (resp. Σ_n). In 1979, Guaspari proved that for any reasonable theory T, there is an independent Γ^d sentence φ which is Γ-conservative over T. Also Guaspari asked the following question: For any reasonable theories T_0 and T_1, is there a Γ^d sentence which is simultaneously independet and Γ-conservative over both T_0 and T_1? For $\Gamma = \Sigma_n$, this problem was solved negatively by Bennet, however, for $\Gamma = \Pi_n$, it has not been settled yet.

First, we introduce a new sufficient condition about the existence of simultaneously independent Π_n-conservative Σ_n sentences. Secondly, we investigate the situation of the existence of such sentences in the case of finite sequences of theories.

27 Sohei Iwata (Kobe Univ.) Fixed-point properties in predicate modal logics 15
Taishi Kurahashi
(Nat. Inst. of Tech., Kisarazu Coll.)

Summary: It is known that the propositional provability logic **GL** satisfies the fixed-point property. However, Montagna showed that the predicate modal logic **QGL** loses the fixed-point property. In this talk, we prove that several extensions of **QGL** including Tanaka's system **NQGL** do not have the fixed-point property. Secondly, we prove that the fixed-point theorem for $\mathbf{QK} + \Box^{n+1}\bot$. As a consequence, we obtain that the class $\mathcal{BL}$ of Kripke frames which are transitive and of bounded length satisfies the fixed-point property locally. We also obtain that **NQGL** does not satisfy the Craig interpolation property. Finally, we investigate a sufficient condition for formulas to have a fixed-point in **QGL**.

28 Taishi Kurahashi On the second incompleteness theorem 15
(Nat. Inst. of Tech., Kisarazu Coll.)

Summary: We investigate relationships between Gödel's second incompleteness theorem and derivability conditions for provability predicates. First, we exhibit some new sets of derivability conditions which are sufficient for unprovability of the consistency statement $\forall x(\mathrm{Pr}_T(x) \to \neg\mathrm{Pr}_T(\dot{\neg}x))$. Secondly, we show that Hilbert–Bernays' conditions and Löb's conditions are mutually incomparable. Thirdly, we show that both of Hilbert–Bernays' conditions and Löb's conditions do not accomplish Gödel's original statement of the second incompleteness theorem. At last, we improve Buchholz's proof of uniform version of provable Σ_1-completeness.

Algebra

September 17th (Tue) Conference Room V

9:15–11:50

1 Keiji Ito (Tohoku Univ.) Nearly multiplicity-free for imprimitive permutation groups ····· 15
Akihiro Munemasa (Tohoku Univ.)

Summary: For a transitive permutation group, if its permutation character is decomposed into the sum of irreducible characters with all their multiplicity 1, then the transitive permutation group is called multiplicity-free. An association scheme constructed by a transitive permutation group is commutative if and only if the transitive permutation group is multiplicity-free. As a generalization of the multiplicity-free condition, we introduce the concept of nearly multiplicity-free for imprimitive permutation groups and some relations to association schemes. In particular, we construct bases of matrix units for such association schemes.

2 Yugen Takegahara (Muroran Inst. of Tech.) p-adic properties of the number of permutation representations of a finite abelian p-group ····· 15

Summary: Let p be a prime. Suppose that P is a finite abelian p-group of type $m = (m_1, m_2, \cdots)$ with $m_1 \geq m_2 \geq \cdots$ and $\sum m_i = s$. Define nonnegative integers u and v by $u = \max\{m_1, [(s+1)/2]\}$ and $v = \min\{s - m_1, [s/2]\}$. For each nonnegative integer n, let $h_n(P)$ denote the number of homomorphisms from P to the symmetric group S_n on n letters. Except for the case where $p = 2$ and $u + \delta_{v0} \leq v + 1$ or $p = 3$ and $u = v \geq 1$, there exist p-adic analytic functions $f_r(X)$ for $r = 0, 1, \cdots, p^{u+1} - 1$ and a polynomial $g(X) \in \mathbb{Z}[X]$ such that for any nonnegative integer y, $h_{p^{u+1}y+r}(P) = p^{\{\sum_{j=1}^{u} p^j - (u-v)\}y} f_r(y) \prod_{j=1}^{y} g(j)$ and $\mathrm{ord}_p(h_{p^{u+1}y+r}(P)) = \{\sum_{j=1}^{u} p^j - (u-v)\}y + \mathrm{ord}_p(f_r(y))$. If $p = 2$, $\lambda_3 = 0$, and $u = v \geq 1$ or if $p = 3$ and $u = v \geq 1$, then $h_n(P)$ has analogous properties.

3 Taro Sakurai (Chiba Univ.) A criterion for the modular isomorphism problem ····· 10

Summary: The modular isomorphism problem—which is open for more than 60 years—asks whether $\mathbb{F}_p G \cong \mathbb{F}_p H$ implies $G \cong H$ for finite p-groups G and H. In this talk, we introduce a new class of finite groups and provide a criterion (sufficient condition) for the problem from adjoint and counting homomorphisms. New proofs for the theorems by Deskins and Passi–Sehgal are provided.

4 Shigeto Kawata (Nagoya City Univ.) On almost split sequences and tensor products for group rings ····· 10

Summary: Let $\mathcal{O}$ be a complete discrete valuation ring of characteristic zero with residue class field of characteristic $p > 0$. Let $\mathcal{O}G$ be the group ring of a finite group G over $\mathcal{O}$. Suppose that L is a virtually irreducible $\mathcal{O}G$-lattice with vertex Q and p'-rank Q-source. Then the tensor product of an almost split sequence terminating in a Scott $\mathcal{O}G$-lattice with vertex Q and L is the direct sum of an almost split sequence terminating in L and a split sequence.

5 Satoshi Usui (Tokyo Univ. of Sci.) A Batalin–Vilkovisky structure on the complete cohomology ring of a
Tomohiro Itagaki (Tokyo Univ. of Sci.) Frobenius algebra ····· 15
Katsunori Sanada (Tokyo Univ. of Sci.)

Summary: The complete cohomology of a Frobenius algebra is introduced by Nakayama, which is an analogy to Tate cohomology of a finite group. Recently, Wang discovered a Batalin–Vilkovisky (BV) structure on the complete cohomology for a symmetric algebra. In this talk, we show that there exists a BV structure on the complete cohomology for a Frobenius algebra whose Nakayama automorphism is diagonalizable.

6 Mayu Tsukamoto (Yamaguchi Univ.)
Takahide Adachi (Osaka Pref. Univ.)
Tilting modules and dominant dimension with respect to injective modules ····· 15

Summary: In this talk, we study a relationship between tilting modules with finite projective dimension and dominant dimension with respect to injective modules as a generalization of results of Crawley-Boevey–Sauter, Nguyen–Reiten–Todorov–Zhu and Pressland–Sauter. As an application, we give a characterization of relative Auslander algebras in terms of such tilting modules.

7 Takahide Adachi (Osaka Pref. Univ.)
τ-rigid modules over an algebra with radical square zero ····· 15

Summary: It is known that an algebra with radical square zero is stable equivalent to a certain hereditary algebra. By comparing indecomposable τ-rigid modules between both algebras, we give a characterization of τ-tilting finite algebras with radical square zero in terms of the separated quivers. This is an analog of a famous characterization of representation-finite algebras with radical square zero due to Gabriel.

8 Toshiya Yurikusa (Nagoya Univ.)
Density of g-vector cones from triangulated surfaces ····· 15

Summary: For a tagged triangulation T of a marked surface (S, M) of rank n, we study g-vector cones associated with support τ-tilting modules of the Jacobian algebra defined from T. We show that the closure of the union of g-vector cones associated with all support τ-tilting modules is equal to $\mathbb{R}^n$. As an application, if (S, M) is a closed surface with exactly one puncture, the exchange graph of support τ-tilting modules has precisely two connected components. Otherwise, it is connected.

9 Takahiro Honma (Tokyo Univ. of Sci.)
TakumaAihara (Tokyo Gakugei Univ.)
Aaron Chan (Nagoya Univ.)
Representation-finite gendo-symmetric algebras ····· 15

Summary: In representation theory of algebras, endomorphism algebras play an important role. In particular, the endomorphism algebra of a generator has good homological properties. In this talk, I give representation finiteness of a gendo-symmetric algebra, which is the endomorphism algebra of a generator over a symmetric algebra.

10 Takuma Aihara (Tokyo Gakugei Univ.) ♭
Aaron Chan (Nagoya Univ.)
Takahiro Honma (Tokyo Univ. of Sci.)
On the weakly Iwanaga–Gorenstein property of gendo algebras ····· 15

Summary: We explore the subject on the weakly Iwanaga–Gorenstien property of gendo algebras. Here, a gendo algebra means the ENDOmorphism algebra of a Generator over an algebra. We state that if a given algebra is representation-finite, then its gendo algebra is weakly Iwanaga–Gorenstein with finite CM type.

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

Kazuya Kawasetsu (Kyoto Univ.)
Vertex operator algebras and modular differential equations

Summary: Vertex operator algebras are, shortly speaking, algebras of quantum fields and admit a lot of important infinite-dimensional graded representations. They appear as (chiral) symmetry algebras of 2d conformal field theory and these days also appear as a kind of invariants of 4d $\mathcal{N} = 2$ superconformal field theory. It is known that the characters of modules over vertex operator algebras with some finiteness conditions satisfy *modular differential equations*, which are linear ordinary differential equations invariant under the action of $SL_2(\mathbb{Z})$. This allows us to study characters of modules using theory of differential equations and modular forms. In this talk, we recall modular differential equations and explain their application to study representations of vertex operator algebras. This talk is based on joint works with Tomoyuki Arakawa and Yuichi Sakai.

15:30–17:40

11 Taiki Shibata (Okayama Univ. of Sci.) Typical representations for Chevalley supergroups of type I · · · · · · · · · · 10

Summary: For finite-dimensional simple Lie superalgebras (or supergroups), all irreducible representations can be constructed in an analogous way as the ordinary (non-super) case. However, in general, it is hard to describe its characters. Over an algebraically closed field of characteristic zero, V. Kac determined characters of irreducible representations for "typical" weights. In this talk, we will extend Kac's result to Chevalley supergroups of type I defined over an arbitrary field.

12 Ryotaro Kawago (Okayama Univ. of Sci.)
Takeshi Ikeda (Okayama Univ. of Sci.) Multiplicities of points on Schubert varieties in the symplectic flag variety · · · · · · · · · · 15

Summary: Let Sp_{2n} be a symplectic group and $B \subset Sp_{2n}$ be a Borel subgroup. It is known that Schubert subvarieties of flag variety Sp_{2n}/B have singular points. The combinational formula of multiplicities of points on Schubert varieties in symplectic Grassmannian is already known (Ghorpade and Raghavan 2006, Ikeda and Naruse 2009). We were able to obtain a combinatorial formula of multiplicities of points on Schubert varieties of symplectic flag variety. That is an extension of the case of symplectic Grassmannian. This research is a joint work with David Anderson and Minyoung Jeon.

13 Naoki Fujita (Univ. of Tokyo) Recursive constructions of Nakashima–Zelevinsky polytopes · · · · · · · · · 15

Summary: A Nakashima–Zelevinsky polytope is a rational convex polytope whose lattice points give a polyhedral realization of a highest weight crystal basis. This polytope can be realized as a Newton–Okounkov body of a flag variety, and it induces a toric degeneration. In this talk, we give a recursive construction of a specific class of Nakashima–Zelevinsky polytopes by using Kiritchenko's Demazure operators on polytopes. From this construction, it follows that polytopes in this class are all lattice polytopes. We also give a geometric application to the normal toric variety associated with a Nakashima–Zelevinsky polytope.

14 Haruhisa Enomoto (Nagoya Univ.) The Jordan–Hölder property and Grothendieck monoids of exact categories · · · · · · · · · · 10

Summary: We investigate the Jordan–Hölder property (JHP) in exact categories. First, we introduce a new invariant of exact categories, the Grothendieck monoids, show that (JHP) holds if and only if the Grothendieck monoid is free, and give some numerical criterion. Next, we apply these results to the representation theory of algebras. In most situation, (JHP) holds precisely when the number of projectives is equal to that of simples. We study examples in type A quiver in detail by using combinatorics on symmetric groups.

15 Takahiko Furuya (Meikai Univ.)
Masashi Yamauchi (Meikai Univ.) Auslander–Reiten translations and monomorphism categories · · · · · · · · 10

Summary: Let A be a finite-dimensional algebra. We introduce a category $\mathcal{S}_{m,n}(A)$ consisting of diagrams of monomorphisms between finitely generated A-modules. We then show that $\mathcal{S}_{m,n}(A)$ has Auslander–Reiten sequences, and constuct the Auslander–Reiten translation in $\mathcal{S}_{m,n}(A)$.

16 Izuru Mori (Shizuoka Univ.)
Kenta Ueyama (Hirosaki Univ.) Noncommutative graded Knörrer's periodicity theorem · · · · · · · · · · · · 15

Summary: In commutative ring theory, Knörrer's periodicity theorem plays a crucial role to study maximal Cohen–Macaulay modules over hypersurfaces, and matrix factorizations are essential ingredients to prove the theorem. In order to study noncommutative hypersurfaces, which are important objects in noncommutative algebraic geometry, we introduce a notion of noncommutative matrix factorization and show noncommutative graded versions of Eisenbud's theorem and Knörrer's periodicity theorem.

17 Ryo Kanda (Osaka Univ.) Normal extensions of Artin–Schelter regular algebras and flat families of Calabi–Yau central extensions ····· 15

Summary: This talk is based on joint work with Alex Chirvasitu and S. Paul Smith. We introduce a new method to construct 4-dimensional Artin–Schelter regular algebras as normal extensions of 3-dimensional ones. When this is applied to a 3-Calabi–Yau algebra, it produces a flat family of 4-dimensional Calabi–Yau central extensions parametrized by a projective space. The construction is explicit and gives a rich source of new 4-dimensional regular algebras.

18 Ayako Itaba (Tokyo Univ. of Sci.)
Kenta Ueyama (Hirosaki Univ.) Hochschild cohomology of Beilinson algebras of down-up algebras ···· 15

Summary: Let $A = A(\alpha, \beta)$ be a graded down-up algebra with $\deg x = 1$, $\deg y = n \geq 1$ and $\beta \neq 0$. The aim of our talk is to give the dimension formula of the Hochschild cohomology groups $\mathrm{HH}^i(\nabla A)$ of the Beilinson algebra ∇A of A. Our result implies that the structure of the bounded derived category $\mathsf{D}^{\mathsf{b}}(\mathsf{tails}\, A)$ of the noncommutative projective scheme $\mathsf{tails}\, A$ of A is different depending on whether $\begin{pmatrix}1 & 0\end{pmatrix}\begin{pmatrix}\alpha & 1\\ \beta & 0\end{pmatrix}^n\begin{pmatrix}1\\ 0\end{pmatrix}$ is zero or not.

19 Fumitsuna Maruyama
Yozo Deguchi
Masao Toyoizumi (Toyo Univ.) Euler–Fermat type theorem for matrices ····· 10

Summary: We study an Euler–Fermat type theorem for matrices.

September 18th (Wed) Conference Room V

9:15–12:00

20 Yoshiharu Shibata (Yamaguchi Univ.)
Isao Kikumasa (Yamaguchi Univ.)
Yosuke Kuratomi (Yamaguchi Univ.) On d-square free modules over a right perfect ring ····· 10

Summary: A module M is square free if whenever its submodule is isomorphic to $N^2 = N \oplus N$ for some module N, then $N = 0$. We introduce the dual concept "d-square free"; a module M is d-square free if whenever its factor module is isomorphic to $N^2 = N \oplus N$ for some module N, then $N = 0$. This property is not closed under submodules and essential extensions in general. The main purpose is to study rings whose d-square free modules are all closed under submodules and essential extensions.

21 Tsunekazu Nishinaka (Univ. of Hyogo) On Thompson group F and its group ring ····· 10

Summary: We have studied about group algebras of non-noetherian groups and showed that they are often primitive if base groups have non-abelian free subgroups. Our main method was two edge-colored graph theory. In general our method using these graphs seems to be effective for a group algebra of a group with a non-abelian free subgroup. But there exist some non-Noetherian groups with no non-abelian free subgroups such as a Thompson group F. In this talk, we introduce an improvement of our graph theory and its application to a problem on a group algebra of a Thompson group F.

22 Norihiro Nakashima (Nagoya Inst. of Tech.) High order freeness for 3-arrangements and Holm's problems ····· 10

Summary: The m-free arrangement is a generalization of the free arrangement where m is a nonnegative integer. Holm asked whether all arrangements are m-free for m large enough. In a recent work by Abe and the speaker, counter examples are given for the question when the dimension of vector space is grater than three. However the question is still open when m is three. In this talk I show that 3-arrangements are m-free for m large enough and determine m-exponents in that cases.

23 Kaori Shimada (Meiji Univ.) On the radius of the category of totally reflexive modules ····· 10

Summary: The radius of subcategories of abelian categories was introduced by Dao and Takahashi in 2014 as an analogue of the dimension of triangulated categories. We focus on the category consisting of totally reflexive R-modules G(R) and we find an upper bound of the radius of G(R) when R is a residue class ring of a Noetherian local ring.

24 Shinya Kumashiro (Chiba Univ.) The Auslander–Reiten conjecture for non-Gorenstein rings ····· 15

Summary: Let R be a Cohen–Macaulay local ring and Q be an ideal of R generated by a regular sequence on R. Due to M. Auslander, S. Ding, and Ø. Solberg, the Auslander–Reiten conjecture holds for R if and only if it holds for R/Q. In the former part of this talk, we study the Auslander–Reiten conjecture for the ring R/Q^{ℓ} in connection with that for R. As a corollary, the Auslander–Reiten conjecture holds for determinantal rings with some conditions. In the latter part, we study the existence of Ulrich ideals and generalize the result of J. Sally. We finally show that the Auslander–Reiten conjecture holds if there is an Ulrich ideal whose residue ring is a complete intersection.

25 Ryotaro Isobe (Chiba Univ.) Ulrich ideals in hypersurfaces ····· 10

Summary: The purpose of this talk is to investigate the structure and ubiquity of Ulrich ideals in a hypersurface ring. In a Cohen–Macaulay local ring (R, m), an m-primary ideal I is called an Ulrich ideal in R if there exists a parameter ideal Q of R such that $I \supsetneq Q$, $I^2 = QI$, and I/I^2 is R/I-free. Even for the case of hypersurface rings, there seems known only scattered results which give a complete list of Ulrich ideals, except the case of finite CM-representation type and the case of several numerical semigroup rings. Therefore, in this talk, we focus our attention on a hypersurface ring which is not necessarily finite CM-representation type.

26 Hiroki Matsui (Univ. of Tokyo) On the second rigidity theorem and Tor-rigidity of modules ····· 10

Summary: Torsion in tensor products of modules has been well studied by several authors with relation to Auslander–Reiten conjecture. Such a study is started by Auslander and he proved that over a regular local ring, if the tensor product of finitely generated modules is torsion-free, then these modules are Tor-independent. Three decades later, Huneke–Wiegand generalized this result for hypersurface local rings. The aim of this talk is to prove a generalization of these result using n-Tor-rigid modules.

27 Mitsuhiro Miyazaki (Kyoto Univ. of Edu.) On the symbolic powers of the canonical ideal of the Ehrhart ring of a chain polytope ····· 10

Summary: Let P be a finite poset, $C(P)$ the chain polytope of P, $E_K[C(P)]$ the Ehrhart ring of $C(P)$ over a field K and ω the canonical ideal of $E_K[C(P)]$. In this talk, we show that the positive and negative symbolic powers of ω are identical with the ordinary powers of ω.

28 Mitsuhiro Miyazaki (Kyoto Univ. of Edu.) On the generators of the canonical ideal of the Ehrhart ring of a chain polytope ····· 15

Summary: Let P be a finite poset, $O(P)$ (resp. $C(P)$) the order polytope (resp. chain polytope) of P, $E_K[O(P)]$ (resp. $E_K[C(P)]$) the Ehrhart ring of $O(P)$ (resp. $C(P)$) over a field K and $\omega_{E_K[O(P)]}$ (resp. $\omega_{E_K[C(P)]}$) the canonical ideal of $E_K[O(P)]$ (resp. $E_K[C(P)]$). In our previous work, we characterized the generators of $\omega_{E_K[O(P)]}$.
In this talk, we characterize the generators of $\omega_{E_K[C(P)]}$. As a corollary, we show that if $E_K[C(P)]$ is level, the so is $E_K[O(P)]$. We exhibit an example that shows the converse does not hold true. We also show that, as in the case of $\omega_{E_K[O(P)]}$, the degrees of the generators of $\omega_{E_K[C(P)]}$ are consecutive integers.

29 Hidefumi Ohsugi (Kwansei Gakuin Univ.)
Akiyoshi Tsuchiya (Univ. of Tokyo)
Enriched Hibi ring ····· 15

Summary: In 1987, Hibi introduced a class of commutative rings associated to finite partially ordered sets, which are called Hibi rings. Hibi rings are normal Cohen–Macaulay domains and Koszul. Moreover, Stanley showed that the Hilbert functions of Hibi rings coincide with some counting functions of P-partitions. In this talk, from the theory of (left) enriched P-partitions, which are introduced and studied by Stembridge and Petersen, we introduce enriched Hibi rings. In particular, we show that enriched Hibi rings are normal Gorenstein domains and Koszul, and their Hilbert functions coincide with some counting functions of left enriched P-partitions.

30 Takayuki Hibi (Osaka Univ.)
Kyouko Kimura (Shizuoka Univ.)
Kazunori Matsuda (Kitami Inst. of Tech.)
Akiyoshi Tsuchiya (Univ. of Tokyo)
Regularity and a-invariant of Cameron–Walker graphs ····· 15

Summary: Let S be the polynomial ring over a field K and $I \subset S$ a homogeneous ideal. Let $h(S/I, \lambda)$ be the h-polynomial of S/I and $s = \deg h(S/I, \lambda)$ the degree of $h(S/I, \lambda)$. We are interested in finding a natural class of finite simple graphs G for which $S/I(G)$, where $I(G)$ is the edge ideal of G, satisfies $s - r = d - e$, where $r = \mathrm{reg}(S/I)$, $d = \dim S/I$ and $e = \mathrm{depth} S/I$. Let $a(S/I(G)) = s - d$ be the a-invariant of S/I. One has $a(S/I(G)) \leq 0$. In this talk, by showing the fundamental fact that every Cameron–Walker graph G satisfies $a(S/I(G)) = 0$, a classification of Cameron–Walker graphs G for which $S/I(G)$ satisfies $s-r = d-e$ will be exhibited.

31 Hiroju Kanno (Osaka Univ.)♭
Takayuki Hibi (Osaka Univ.)
Kazunori Matsuda (Kitami Inst. of Tech.)
Induced matching numbers of finite graphs and edge ideals ····· 15

Summary: Let G be a finite simple graph on the vertex set $V(G) = \{x_1, ..., x_n\}$ and $I(G) \subset K[V(G)]$ its edge ideal, where $K[V(G)]$ is the polynomial ring in $x_1, ..., x_n$ over a field K with each $\deg x_i = 1$ and where $I(G)$ is generated by those squarefree quadratic monomials $x_i x_j$ for which $\{x_i, x_j\}$ is an edge of G. In the present paper, given integers $1 \leq a \leq r$ and $s \geq 1$, the existence of a finite connected simple graph $G = G(a, r, s)$ with $\mathrm{im}(G) = a$, $\mathrm{reg}(R/I(G)) = r$ and $\deg h_{K[V(G)]/I(G)}(\lambda) = s$, where $\mathrm{im}(G)$ is the induced matching number of G and where $h_{K[V(G)]/I(G)}(\lambda)$ is the h-polynomial of $K[V(G)]/I(G)$.

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

Futoshi Hayasaka (Okayama Univ.)
Integral closure of modules over a regular local ring

Summary: The theory of integrally closed ideals in a two-dimensional regular local ring was developed by Zariski. One of the main results is the product theorem, which asserts that the product of any two integrally closed ideals in a two-dimensional regular local ring is again integrally closed. Since then, the theory has been attracting interest and has been generalized to more general situations. In this talk, I will talk about such a generalization in two different directions. First, I will discuss a possibility in higher dimensional regular local ring. Then, after a brief survey on a notion of integral closure of a module and a theory of integrally closed modules over a two-dimensional regular local ring developed by Kodiyalam, I will talk about a recent result on the ubiquity of indecomposable integrally closed modules of rank two with a monomial Fitting ideal.

September 19th (Thu) Conference Room V

9:15–11:30

32 Yasutoshi Nomura ♭ A search for quasi-linear congruence via Chinese remainders ····· 10

Summary: Given an Apery-like numbers $X(n)$ the author had once a cojecture that there hold that $X(p-r)$ with $r = 2, 3, \ldots$ and p primes are congruent to $(xp - em)/q$ mod p, where $e = -1$ or 1 and both m and q are indepenet of p. If this is true then one can deduce that em are congruent to $-qX(p-r)$ mod p, which provides us with a situation of the Chinese remainder theorem. And we get a weapon for finding m, q.

33 Wataru Takeda (Nagoya Univ.) Brocard–Ramanujan problem for irreducible polynomials ····· 10

Summary: We study the number of integer solutions (x, y, l) of an equation $F(x, y) = \Pi_K(l)$, where $F(x, y)$ is a homogeneous polynomial with integer coefficients and $\Pi_K(l)$ is a generalized factorial function over number fields. We show a sufficient condition for the finiteness of solutions for $F(x, y) = \Pi_K(l)$. As a corollary, we obtain the finiteness of solutions for $P(x) = l!$, where P is an irreducible polynomial with $\deg P \geq 2$ or satisfies some condition. This corollary solves the generalized Brocard–Ramanujan problem partially.

34 Yusuke Tanuma (Keio Univ.) Algebraic independence of certain series generated by Beatty sequence ····· 10

Summary: The generating function of Beatty sequence $\{[k\omega]\}_{k\geq 1}$ for real irrational ω is called Hecke–Mahler series. We also consider exponential-type Hecke–Mahler series $\sum_{k=1}^{\infty} z^{[k\omega]}$ for positive irrational ω. In this talk, we study the algebraic independence of not only the values of the Hecke–Mahler series or the exponential-type Hecke–Mahler series but also its derivatives at any nonzero distinct algebraic numbers inside the unit circle.

35 Kurt Fischer (Tokuyama Coll. of Tech.) Explicit formulas for Dirichlet series of the Liouville and Möbius functions ····· 15

Summary: We derive new explicit formulas for the Dirichlet series of the Liouville and Moebius functions.

36 Makoto Minamide (Yamaguchi Univ.) On the mean square of the derivatives of Hardy's Z-function ····· 10
Yoshio Tanigawa

Summary: R. R. Hall studied the mean square of the kth derivative of Hardy's Z-function and obtained an asymptotic formula with the error $O\left(T^{3/4}(\log T)^{2k+1/2}\right)$, as $T \to \infty$. We show that this error term is estimated by $O\left(T^{1/2}(\log T)^{2k+1}\right)$.

37 Shota Inoue (Nagoya Univ.) On the prime numbers and the distribution of zeros of the Riemann zeta-function ····· 10

Summary: In this talk, we discuss a relation between the prime numbers and the distribution of zeros of the Riemann zeta-function under the Riemann Hypothesis. The speaker recently showed a formula for the logarithm of the Riemann zeta-function and its iterated integrals. By using the formula, he obtained some results which are related with the present theme and a value distribution of the Riemann zeta-function. The speaker is going to introduce the formula and these results in this talk.

38 Kenta Endo (Nagoya Univ.)
Shōta Inoue (Nagoya Univ.) Value-distribution of the integral of the logarithm of the Riemann zeta-function ····· 10

Summary: It is the famous open problem whether or not the values of the Riemann zeta-function on the critical line is dense in the complex plane. We considered an analogue problem for the function $\int_0^t \log \zeta(1/2 + i\beta) d\beta$ and obtained a result that the values of this function is dense in the complex plane under the Riemann hypothesis. In this talk, we will discuss the problem for the function of iterated integral of $\log \zeta(\sigma + it)$ over the vertical line and explain the above result.

39 Masahiro Mine (Tokyo Tech) On the value-distribution of Artin L-functions and counting functions for cubic fields · · · · · 10

Summary: In this talk, we study the discrete value-distribution of Artin L-functions associated with cubic fields. We prove that discrete mean values of the Artin L-functions are represented by integrals involving a density function which can be explicitly described. As an application, we obtain an asymptotic formula of the counting function for a certain family of cubic fields.

40 Ryota Umezawa (Nagoya Univ.) Evaluation of iterated log-sine integrals by multiple polylogarithms · · · 10

Summary: Iterated log-sine integrals which are defined as iterated integrals of (generalized) log-sine integrals was introduced to study on multiple zeta values. In this talk, we give an evaluation of iterated log-sine integrals by multiple polylogarithms and multiple zeta values.

41 Yoshitaka Sasaki (Osaka Univ. of Health and Sport Sci.) On the coefficients of the asymptotic expansion of the multiple zeta-function at non-positive integers · · · · · 10

Summary: Recently, Onozuka gave the asymptotic expansion of the multiple zeta-function at non-positive integers. In this talk, we show that coefficients of the asymptotic expansion are evaluated inductively.

42 Masaki Kato (Kobe Univ.) On (p, q)-deformations of multiple zeta values · · · · · 15

Summary: In this talk,we introduce certain integrals, regarded as two parameter deformations of multiple zeta values, and investigate their properties. In particular, we consider two parameter generalizations of the harmonic and shuffle product formulas, which are fundamental relations for multiple zeta values.

11:30–12:00 Research Section Assembly

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

Hiraku Atobe (Hokkaido Univ.) Jacquet modules and local Langlands correspondence

Summary: The Jacquet functor is one of the most basic and important functors in representation theory of p-adic groups. It is a local analogue of Siegel's Φ operator on Siegel modular forms, which is used to define Siegel cusp forms. In this talk, I will compute the Jacquet functors for irreducible tempered representations of symplectic groups $\mathrm{Sp}(2n, F)$, where F is a p-adic group. To do this, one needs some sort of classification of irreducible representations of these groups. As such a classification, I use the local Langlands correspondence developed by Arthur.

15:30–17:40

43 Masataka Ono (Kyushu Univ.) Shuji Yamamoto (Keio Univ.) Series expression of symmetric multiple zeta values · · · · · 15

Summary: It is known that there exists a series expression of symmetric multiple zeta value of harmonic type. In this talk, we give a series expression of symmetric multiple zeta value of shuffle type. By using this series expression, we give another proof of the shuffle relation for symmetric multiple zeta values.

44 Henrik Bachmann (Nagoya Univ.) Yoshihiro Takeyama (Univ. of Tsukuba) Koji Tasaka (Aichi Pref. Univ.) Finite multiple harmonic q-series at roots of unity and finite & symmetric multiple zeta values · · · · · 15

Summary: In this talk, we will discuss multiple harmonic q-series evaluated at roots of unity. The motivation to study these series comes from recent results on the connection of finite multiple zeta values (FMZV) and symmetrized multiple zeta values (SMZV). We start by giving a small introduction into the theory of multiple zeta values and then discuss their finite analogues, which were introduced by Kaneko and Zagier. After this, we introduce the notion of finite multiple harmonic q-series at roots of unity and show that these specialize to the FMZV and the SMZV through an algebraic and analytic operation, respectively. This talk is based on joint work with Y. Takeyama and K. Tasaka.

45 Ryota Okano (Tokyo Univ. of Sci.)
Masanari Kida (Tokyo Univ. of Sci.)
On Fourier expansions at arbitrary cusps of theta functions of binary quadratic forms with congruence conditions. · 15

Summary: For a positive definite binary quadratic form f, the theta function with a congruence condition is defined as a restricted sum by the congruence condition of the usual theta function associated to the quadratic form. By forming a certain linear combination of these theta functions, we can construct a modular form Θ on $\Gamma_0(N)$. We compute the first terms of the Fourier expansions of the modular form Θ at any cusps by means of the Gauss sums associated with the quadratic form defined by Springer. It turns out that they can be expressed in terms of classical Gauss sums under a certain mild condition.

46 Yuichi Sakai (Kyushu Univ.)
Kiyokazu Nagatomo (Osaka Univ.)
Geoffrey Mason (UCSC)
Vertex operator algebras with central charge 8 and 16 · · · · · · · · · · · · · · 15

Summary: We will partly classify spaces of characters of vertex operator algebras with central charges 8 and 16 whose spaces of characters are 3-dimensional and each space of characters forms a basis of the space of solutions of a third order monic modular linear differential equation with rational indicial roots.

47 Yasushi Mizusawa (Nagoya Inst. of Tech.)
Kota Yamamoto (Nagoya Inst. of Tech.)
Iterated towers of number fields by a quadratic map defined over the Gaussian rationals · 10

Summary: An iterated tower of number fields is constructed by adding preimages of a base point by iterations of a rational map. A certain basic quadratic rational map defined over the Gaussian number field yields such a tower of which any two steps are relative bicyclic biquadratic extensions. Regarding such towers as analogues of a basic $\mathbb{Z}_2$-extension, we examine the parity of the class numbers (and the 2-ideal class numbers) along the towers, with some examples.

48 Yasushi Mizusawa (Nagoya Inst. of Tech.)
Kota Yamamoto (Nagoya Inst. of Tech.)
On 2-adic Lie iterated extensions of number fields arising from a Joukowski map · 10

Summary: A basic 2-adic Lie extension of a number field is constructed as an iterated tower by a conjugate of Joukowski map. If the number field is totally real, the unramified Iwasawa module over the 2-adic Lie iterated extension is conjecturally pseudo-null under Greenberg's conjecture for all intermediate cyclotomic $\mathbb{Z}_2$-extensions. The pseudo-nullity is also considered with some examples.

49 Ippei Nagamachi (Univ. of Tokyo)[♭]
On homotopy exact sequences for normal algebraic stacks · · · · · · · · · · · 15

Summary: Let $f : X \to S$ be a surjective morphism of finite type between connected locally Noetherian normal schemes whose geometric generic fiber $X_{\overline{\eta}}$ is connected. Conditions that the sequence of the étale fundamental groups $\pi_1(X_{\overline{\eta}}, *) \to \pi_1(X, *) \to \pi_1(S, *) \to 1$ becomes exact have been studied, for example, in SGA1. In this talk, I give a sufficient (respectively, necessary and sufficient) condition that the sequence becomes exact in the case where f is flat or S is regular (respectively, S is a hyperbolic curve over a field of characteristic 0) which is written in terms of algebraic stacks.

50 Shigeru Iitaka (Gakushuin Univ.[⋆])
Super perfect numbers and Mersenne perfect numbers · · · · · · · · · · · · · · 15

Summary: Given a positive integer m, if positive integers a and A satisfy $A = \sigma(a) + m$ and $\sigma(A) = 2a + m$, then a is said to be a super perfect number with translation parameter m, A its partner.
If $a = 2^e$ then A are primes. Given a positive integers m, if positive integers a and A satisfy $A = \sigma(a) - m$, $\sigma(A) = 2a - 2m + 1$ then a is said to be a Mersenne perfect number.
If a is prime then $A = 2^e$. The converse is true.

September 20th (Fri) Conference Room V

9:45–12:00

51 Kazunori Nakamoto (Univ. of Yamanashi)
Takeshi Torii (Okayama Univ.)
An application of Hochschild cohomology to the moduli of subalgebras of the full matrix ring II ····· 15

Summary: By using the first Hochschild cohomology $H^1(A, \mathrm{M}_n(k)/A)$, we can describe when the orbit morphism $P \mapsto PAP^{-1}$ from PGL_n to the moduli of subalgebras of the full matrix ring is smooth. We also calculate Hochschild cohomology $H^i(A, \mathrm{M}_3(k)/A)$ for several k-subalgebras A of $\mathrm{M}_3(k)$.

52 Kenta Sato (RIKEN) Ascending chain condition for F-pure thresholds ····· 15

Summary: For a germ of a variety in positive characteristic and a non-zero ideal sheaf on the variety, we can define the F-pure threshold of the ideal by using Frobenius morphisms, which measures the singularities of the pair. In this talk, I will show that the set of all F-pure thresholds with fixed embedding dimension satisfies the ascending chain condition. This is a positive characteristic analogue of the "ascending chain condition for log canonical thresholds" in characteristic 0, which was recently proved by Hacon, McKernan, and Xu.

53 Jun Horiuchi (Nippon Inst. of Tech.)
Kazuma Shimomoto (Nihon Univ.)
Normal hyperplane sections of normal schemes in mixed characteristic ····· 10

Summary: We proved Bertini type theorems in mixed characteristic case. As an application, we find sufficiently many normal Cartier divisors from normal arithmetic schemes.

54 Yusuke Yoshida (Hiroshima Univ.) Projective plane curves whose automorphism group is $\mathfrak{A}_6$ ····· 15

Summary: We study automorphism groups of projective plane curves over the complex number field. Recently, Harui gave a classification of automorphism groups of smooth curves. For each group G in the classification, we can ask which curves have G as their automorphism groups. Especially, we consider the projective plane curves whose automorphism group is the alternative group A_6 that is embedded in $PGL(3, \mathbb{C})$, called the Valentiner group. The invariant ring of the Valentiner group and the geometric properties of some invariant curves were studied by Wiman. We use this to find all d such that there exist nonsingular or irreducible curves of degree d whose automorphism group is the Valentiner group.

55 Kazuki Kurimoto (Kyoto Sangyo Univ.)
Akihiro Higashitani (Osaka Univ.)
Mikiya Masuda (Osaka City Univ.)
Cohomological rigidity problem of toric Fano manifolds ····· 15

Summary: We can classify toric manifolds as algebraic varieties in terms of the associated fans, but we do not know the classification of toric manifolds as differentiable manifolds. On this topic, the problem whether toric manifolds can be distinguished as differentiable manifolds in terms of cohomology rings is well studied. In this talk, we will talk about some results on this topic in the case of toric Fano manifolds.

56 Daniel Cavey (Univ. Nottingham)
Akihiro Higashitani (Osaka Univ.)
Classification of del Pezzo surfaces and singularity contents of Fano polygons ····· 15

Summary: It is conjectured that $\mathbb{Q}$-Gorenstein (qG-)deformation equivalence classes of locally qG-rigid class TG orbifold del Pezzo surfaces with Euler characteristic n and singular locus $\mathcal{B}$ are in one-to-one correspondence with mutation equivalence classes of Fano polygons with singularity content $(n, \mathcal{B})$. In this talk, for the classification of qG-deformation equivalence classes, we will classify all Fano polygons with singularity content $(0, \{\frac{1}{r}(1, s_1), \ldots, \frac{1}{r}(1, s_k)\})$, where $1 \leq s_i < r$ is coprime to r.

57 Kiwamu Watanabe (Saitama Univ.) Fano manifolds of coindex three admitting nef tangent bundle ····· 15

Summary: We prove that any Fano manifold of coindex three admitting nef tangent bundle is homogeneous.

58 Ayako Kubota (Waseda Univ.) On minimality of the invariant Hilbert scheme associated to Popov's $SL(2)$-variety 15

Summary: Any 3-dimensional affine normal quasihomogeneous $SL(2)$-variety, which was shown by Popov to be parameterized by two numbers, has an equivariant resolution of singularities given by an invariant Hilbert scheme. The main purpose of this talk is to provide a necessary and sufficient condition on the parameter for the invariant Hilbert scheme to be the minimal resolution of such an $SL(2)$-variety.

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

Yuya Matsumoto (Tokyo Univ. of Sci.)♭ Derivations on K3 surfaces in positive characteristic

Summary: It is known that K3 surfaces admit no global derivations. However, if we allow K3 surfaces to have rational double point singularities (RDPs), then there exist many examples of K3 surfaces with global derivations, at least in small positive characteristics. Derivations D satisfying $D^p = D$ (resp. $D^p = 0$) correspond to actions of the group scheme μ_p (resp. α_p), and the quotient morphism by such derivations are purely inseparable of degree p. In the case of μ_p-actions, we can show that the quotient is a K3 surface (with RDPs) if and only if the action is symplectic in the sense that the global 2-form is invariant under the action: This is an analogue of the result of Nikulin that the quotient of a K3 surface in characteristic 0 by a finite group action is a K3 surface (with RDPs) if and only if the action is symplectic. We also show that (in both cases of μ_p and α_p) the quotient singularities are related to the height of the K3 surface: This is peculiar in positive characteristic.

15:30–16:15

59 Norihiko Minami (Nagoya Inst. of Tech.) A criterion for higher-uniruledness=lower-rationality, via generalized Bott tower 15

Summary: A criterion for the existence of higher-uniruledness=lower-rationality properties, which consistute a hierachy interpolating uniruledness and unirationality, is given. This criterion is stated in terms of some numerical condition involving the Chern classes of the tangent bundle, and the proof make use of generalized Bott towers.

60 Atsushi Kanazawa (Kyoto Univ.) Stability spaces and Weil–Petersson geometry 15

Summary: The complex moduli space of a Calabi–Yau manifold is naturally a Kähler manifold with the Weil–Petersson metric. In light of the mirror duality, we expect that the Kähler moduli space carries an equivalently rich geometric structure. In this talk, I will introduce our program to develop Weil–Petersson geometry on the Kähler moduli space via the stability conditions of triangulated categories. This is a joint work with Yu-Wei Fan and Shing-Tung Yau.

61 Tomohiro Iwami (Kyushu Inst. of Tech.)♭ Higgs sheaves for semistable extremal neighborhoods with regards to the associated Chern classes 15

Summary: For 3-dimensional (semistable) extremal neighborhood (X, C), according to terminologies of [S. Mori 1988], the author reported an analogue of Miyaoka–Yau type inequality with the associated c_3 (Mar., 2018), and also reported the related Reider type theorem by the moduli space of the associated coherent systems (Sep., 2018), and moreover reported such a type inequality in which c_2, c_3 have coefficients (Mar., 2019) under the case C is not necessary irreducible nor reduced,with aim to characterize Mukai–Umemura 3-folds. In this talk, based on these studies, for the case C is not necessary irreducible nor reduced, the author will report the studies about local-to-global automorphisms of (X, C) related to such a Miyaoka–Yau type inequality with having coefficients of c_2, c_3 by inducing Higgs sheaves structure on (X, C) according to [Y. Miyaoka 2009].

Geometry

September 17th (Tue) Conference Room VI

9:10–11:40

1 Masahiro Morimoto (Osaka City Univ.) On weakly reflective PF submanifolds in Hilbert spaces ····· 15

Summary: A weakly reflective submanifold is a minimal submanifold of a Riemannian manifold which has a certain symmetry at each point. In my talk I will introduce this notion into a class of proper Fredholm (PF) submanifolds in Hilbert spaces and show that there exist so many infinite dimensional weakly reflective PF submanifolds in Hilbert spaces. In particular each fiber of the parallel transport map is shown to be weakly reflective. These imply that in infinite dimensional Hilbert spaces there exist so many homogeneous minimal submanifolds which are not totally geodesic, unlike in the finite dimensional Euclidean case.

2 Makiko Sumi Tanaka (Tokyo Univ. of Sci.)
Hiroyuki Tasaki (Univ. of Tsukuba)
Osami Yasukura (Univ. of Fukui)
Geometry of the exceptional compact symmetric space $G_2/SO(4)$ ···· 15

Summary: In a previous MSJ meeting we gave an explicit description of maximal antipodal sets of Riemannian symmetric spaces related to the exceptional compact Lie group G_2. Using this description we explain close relation between the algebraic structure of the octonions and the Fano plane.

3 Yoshio Agaoka (Hiroshima Univ.)
Takahiro Hashinaga (Kitakyushu Nat. Coll. of Tech.)
Local isometric embeddings of 3-dimensional warped product metrics ····· 15

Summary: We consider local isometric embeddings of 3-dimensional warped product metrics into $\mathbb{R}^4$. By calculating the curvature and its covariant derivative of this metric, we first obtain a necesssary condition to admit isometric embeddings of this space into $\mathbb{R}^4$. Conversely, for a generic case, we show that this condition is sufficient to ensure the existence of local isometric embeddings into $\mathbb{R}^4$. By solving an ordinary differential equation, we explicitly determine the form of warped product metric that can be locally isometrically embedded into $\mathbb{R}^4$.

4 Hiraku Nozawa (Ritsumeikan Univ.)
Subaru Nomoto (Ritsumeikan Univ.)
A hierarchy on Bishop type frames of regular curves ····· 15

Summary: It is well known that Frenet frame of a spacial curve is in Euclidian Space, but L. R. Bishop propsed that other frame is in the Euclidian Space. It is called Bishop frame. This frame is very useful for describing some particular curve. In 3-dimenssional Euclidean Space, Bishop considered 3 types of coefficient matrixs, one of them is the same as Frenet frame by changing basis. So we consider 4 types of frames in 4-dimentional Euclidian Space and we consider some kind of degree of strengths of frames by coefficient matrixs.

5 Kazuhiro Okumura (Asahikawa Nat. Coll. of Tech.)
The parallelism of a certain tensor on real hypersurfaces in a nonflat complex space form ····· 10

Summary: We introduce the classification theorem of real hypersurfaces in a nonflat complex space form (namely, a complex projective space or a complex hyperbolic space) from the viewpoint of the parallelism of a certain tensor.

6 Yosuke Kubota (RIKEN) Codimension 2 index obstruction to positive scalar curvature metrics 15

Summary: Existence of the positive scalar curvature (psc) metric has been an important topic in differential topology of higher dimensional manifolds, particularly in the presence of fundamental groups. The Rosenberg index of a closed spin manifold is a generalization of the Atiyah–Singer index, which is a topological obstruction of the existence of a psc metric. In 2014 Hanke–Pape–Schick shows that the Rosenberg index of a codimension 2 submanifold N obstructs the existence of a psc metric on M by using the coarse geometry of covering spaces. Here we give a different understanding of the argument of Hanke–Pape–Schick in order to strengthen their result; we show that the nonvanishing of the Rosenberg index of N implies that of M.

7 Masayuki Aino (Nagoya Univ.)♭ Lichnerowicz–Obata estimate, almost parallel differential form and almost product manifolds 15

Summary: It is known that the Lichnerowicz estimate for the first eigenvalue of the Laplacian acting on functions is improved when the Riemannian manifold has a non-trivial parallel differential form. In this talk, we consider the situation such that the Riemannian manifold has a non-trivial almost parallel differential form, and show that the Lichnerowicz estimate is improved then. Moreover, we give a pinching result about the almost equality case of the estimate.

8 Tsukasa Takeuchi (Tokyo Univ. of Sci.)
Kiyonori Hosokawa
(ORCA Management Organization Co., Ltd.)
An approach to integrable systems by constructing concrete examples of symplectic-Haantjes manifolds 10

Summary: Symplectic-Haantjes manifolds are constructed for several Hamiltonian systems following Tempesta–Tondo, which yields the complete integrability of systems. In this talk, we consider an approach to integrable systems by constructing concrete examples of Symplectic-Haantjes manifolds.

9 Masayuki Igarashi (Tokyo Univ. of Sci.) On a one-parameter family of the Hermite–Liouville structures on Hopf surface 10

Summary: In this talk, we discuss the Hermite–Liouville structures on Hopf surface. We construct a one-parameter family of the structures by deforming its metric and its orthonormal frame, and find the first integrals on their cotangent bundles of their geodesic flows. We also see the complete integrability of their geodesic flows by virtue of the structures and the first integrals. The argument in this talk is in relation to the previous talks given by the speaker at the MSJ Spring Meeting 2019 and at the MSJ Spring Meeting 2018.

14:15–16:30

10 Yuya Takeuchi (Osaka Univ.) Graham–Witten energy and its variation 15

Summary: In studies of the AdS/CFT correspondence, Graham and Witten have introduced the area renormalization. By using this procedure, we can define an invariant for immersions from an even-dimensional closed manifold to a conformal manifold, called the Graham–Witten energy. In this talk, we will discuss the variation of this invariant under deformations of immersions.

11 Asuka Takatsu (Tokyo Metro. Univ.)♭ Revisiting Čencov's theorem 15
Hiroshi Matsuzoe
(Nagoya Inst. of Tech.)

Summary: We construct a family of invariant Riemannian metrics and affine connections on the space of positive probability measures on a finite state space under ϕ-Markov embeddings when the space of probability measures is embedding into the Euclidean space with distortion ϕ.

12 Asuka Takatsu (Tokyo Metro. Univ.)♭ Shin-ichi Ohta (Osaka Univ.) Equality in the logarithmic Sobolev inequality · · · · · 15

Summary: We investigate the rigidity problem for the logarithmic Sobolev inequality on weighted Riemannian manifolds satisfying $\mathrm{Ric}_\infty \geq K > 0$. Assuming that equality holds, we show that the 1-dimensional Gaussian space is necessarily split off, similarly to the rigidity results of Cheng–Zhou on the spectral gap as well as Morgan on the isoperimetric inequality. The key ingredient of the proof is the needle decomposition method introduced on Riemannian manifolds by Klartag. We also present several related open problems.

13 Masahiro Kawamata (Hiroshima Univ.) Kazuhiro Shibuya (Hiroshima Univ.) On a generalization of Monge–Ampère system · · · · · 15

Summary: It is known that Monge–Ampère systems is a geometric formalization of Monge–Ampère equations using the theory of exterior differential systems. In this talk, we give a generalization of Monge–Ampère systems, Monge–Ampère equations and a relationship between such systems and equations.

14 Shinichiro Kobayashi (Tohoku Univ.) Monge mass transportation problem in Hilbert geometries · · · · · 15

Summary: I will concentrate on the Monge mass transportation problem with distance cost. The existence of optimal transport maps in non-branching metric spaces with some lower curvature bounds has been well studied. On the other hand, it does not seem that the study of the Monge problem in the branching case is adequate. In this talk, I will show the existence of an optimal transport map for some projective metrics on a convex domain in Euclidean space. The main result is applicable to metric spaces, admitting branching geodesics, such as Hilbert geometries and bounded domains in a normed space.

15 Takumi Shirakawa (Saitama Univ.) Masayoshi Nagase (Saitama Univ.) A formula for the heat kernel coefficients of the Dirac Laplacians on spin manifolds · · · · · 15

Summary: Based on Getzler's rescaling transformation, we obtain a formula for the heat kernel coefficients of the Dirac Laplacian on a spin manifold. One can compute them explicitly up to an arbitrarily high order by using only a basic knowledge of calculus added to the formula.

16 Mitsuhiro Itoh (Univ. of Tsukuba) Hiroyasu Satoh (Nippon Inst. of Tech.) Volume entropy of harmonic Hadamard manifolds of hypergeometric type · · · · · 10

Summary: We defined harmonic manifolds of hypergeometric type, which is a class of harmonic manifolds including rank-one symmetric space of non-compact type and Damek–Ricci spaces. In this talk, we present that the volume entropy Q of an n-dimensional harmonic Hadamard manifold (X, g) of hypergeometric type, normalized as $\mathrm{Ric}_g = -(n-1)g$, satisfies the inequality $\frac{2\sqrt{2}(n-1)}{3} \leq Q \leq n-1$, and the equality $Q = n-1$ holds if and only if (X, g) is the real hyperbolic space of constant sectional curvature -1.

17 Akifumi Ochiai (Tokyo Metro. Univ.) A construction of Lagrangian mean curvature flows by generalized perpendicular symmetries · · · · · 15

Summary: We show a method to construct a Lagrangian mean curvature flow from a given special Lagrangian submanifold in a Calabi–Yau manifold by generalized perpendicular symmetries. We use moment maps of the actions of Lie groups, which are not necessarily abelian. We construct some examples in $\mathbb{C}^n$ by our method.

16:45–17:45 Talk Invited by Geometry Section

Makoto Kimura (Ibaraki Univ.) Gauss map of real hypersurfaces in non-flat complex space forms and twistor space of complex 2-plane Grassmannian

Summary: It is known (by B. Palmer) that for each oriented hypersurface M^n in sphere S^{n+1}, the image of the Gauss map γ of M into complex Q^n is a Lagrangian submanifold. Moreover if M^n is isoparametric, then $\gamma(M)$ is a minimal Lagrangian submanifold in Q^n. We define the Gauss map G for real hypersurfaces M^{2n-1} in complex projective space CP^n, into complex 2-plane Grassmannian $G_2(C^{n+1})$. If M is a Hopf hypersurface in CP^n, then the $\gamma(M)$ is a half dimensional 'totally complex submanifold' in $G_2(C^{n+1})$ with respect to the quaternionic Kähler structure. Hence each Hopf hypersurface in CP^n is a total space of circle bundle over a Kähler manifold $\gamma(M)$. Also we have 'converse construction' by using the twistor space of $G_2(C^{n+1})$. We have similar results for real hypersurfaces in complex hyperbolic space CH^n.

September 18th (Wed) Conference Room VI

10:10–10:20 Presentation Ceremony for the 2019 MSJ Geometry Prize

10:30–11:30 Award Lecture for the 2019 MSJ Geometry Prize

Masaki Tsukamoto (Kyushu Univ.) Mean dimension of dynamical systems and information theory

Summary: In the late 1950's Kolmogorov discovered that Shannon's entropy can be used in ergodic theory. This is a revolutionary idea, and ever since there have been rich interactions between information theory and the study of dynamical systems. Recently we have added some new items in these interactions. A new development comes from mean dimension theory. Mean dimension is a topological invariant of dynamical systems which estimates the number of parameters per iterate for describing the orbits of dynamical systems. We have found that this dynamical invariant has the following two connections with information theory:
(1) Mean dimension turns out to be a crucial parameter when we try to encode dynamical systems into band-limited signals, say signals of telephone line. This is reminiscent of Shannon's fundamental work on communications over band-limited channels. This discovery was used to solve a problem posed by Lindenstrauss in 1999.
(2) Mean dimension theory is (in some sense) a topological version of rate distortion theory. Rate distortion theory is a branch of information theory describing a lossy data compression method achieving some distortion constraint. We study the minimax problem about the "rate distortion dimension" and shows that the minimax value is given by mean dimension at least for minimal dynamical systems. This is a mean dimensional analogue of variational principle known for dynamical entropy.

13:15–14:15 Award Lecture for the 2019 MSJ Geometry Prize

Kei Irie (Univ. of Tokyo) Symplectic capacities and periodic orbits of Hamiltonian systems

Summary: I will talk about symplectic capacities, in particular those related to periodic orbits of Hamiltonian systems. After reviewing background and some previous results, I will explain a formula which relates symplectic capacity of (fiberwise) convex domains to loop space homology, and discuss some applications and questions.

September 19th (Thu) Conference Room VI

9:10–11:45

18 Yoichi Maeda (Tokai Univ.) Three-dimensional model of $SL(2,\mathbb{R})$ and visualization of $SL(2,\mathbb{Z})$ as a pattern on the cubic lattice ····· 15

Summary: It is known that real special linear group $SL(2,\mathbb{R})$ is embedded into the three-dimensional sphere. By the stereographic projection, every matrix in $SL(2,\mathbb{R})$ is realized as a point in the three-dimensional Euclidean space $\mathbb{R}^3$. In this talk, we propose another three-dimensional model of $SL(2,\mathbb{R})$. With this model, we can visualize $SL(2,\mathbb{Z})$ as a pattern of points on cubic lattice in $\mathbb{R}^3$. In this model, the set of matrices with the fixed value of trace forms a quadratic surface (hyperboloid of two sheets, double cone, or hyperboloid of one sheet) depending on the value of trace. Hyperbolic paraboloid also comes out as the surface of the fixed value of element. With these familiar surfaces, we can analyze the pattern of $SL(2,\mathbb{Z})$.

19 Kaoru Ikeda (Keio Univ.)$^\flat$ An application of Poisson sigma model for the irreducible decomposition of the unitary representation of Heisenberg groupe ····· 15

Summary: We study the irreducible decomposition of the unitary representations of the Heisenberg group. We apply the Poisson sigma model for this purpose. By using the orbit of the parabolic Toda lattice in the target space, we can define the polarization on X=U/R, where U is the Heisenberg group and R is its center. The symplectic structure of X is defined by the Poisson relations on orbit of the Toda lattice in the target space. The central charges (s) and pull back of the target space (x) make the moduli space of the symplectic structures of X. We consider the quantization of the action of U on the moduli space.

20 Kazushi Kobayashi (Chiba Univ.) The bijectivity of mirror functors on tori ····· 15

Summary: By the SYZ construction, a mirror pair $(X, \check{X})$ of a complex torus X and a mirror partner $\check{X}$ of the complex torus X is described as the special Lagrangian torus fibrations $X \to B$ and $\check{X} \to B$ on the same base space B. Then, by the SYZ transform, we can construct a simple projectively flat bundle on X from each affine Lagrangian multi section of $\check{X} \to B$ with a unitary local system along it. However, there are non-unique choices of transition functions of it, and this fact actually causes difficulties when we try to construct a functor between the symplectic geometric category and the complex geometric category. In this talk, by solving this problem, we prove that there exists a bijection between the set of the isomorphism classes of their objects.

21 Hiroto Inoue (Kyushu Univ.) Differential equation of the element of an exponential matrix ····· 15

Summary: Many examples are known where the initial problem of differential equation is solved by exponential matrix or its matrix elements. Some of those solutions have the geometrical interpretations, e.g., Toda lattice, Calogero system and other integral systems. As such an example, we see the geodesic equation of a statistical manifold that is homogeneous but is not symmetry. We give its solution an interpretation by the adjoint representation of semisimple Lie algebras.

22 Masahiro Kawamata (Hiroshima Univ.), Hiroshi Tamaru (Osaka City Univ.) A classification of almost abelian Lie groups whose moduli spaces of left-invariant Riemmanian metrics are one-dimensional ····· 15

Summary: Lie groups with left-invariant Riemannian metrics have provided many interesting and nice examples of Riemannian manifolds, such as Einstein or Ricci soliton. For a given Lie group, the existence and non-existence problems of some nice left-invariant Riemannian metrics are interesting. In order to attack these problems, we focus on Lie groups whose moduli spaces of left-invariant Riemannian metrics are small. In this talk, we give a classification of almost abelian Lie groups whose moduli spaces of left invariant Riemannian metrics are one-dimensional.

23 Keiichi Maeta (Univ. of Tokyo) A cohomological approach to the existence problem of compact Clifford–Klein forms for some symmetric spaces of solvable type ····· 15

Summary: The classification problem of the homogeneous spaces which admit compact Clifford–Klein forms (also called compact quotients) is one of the important open problems. We consider this problem for a class of indecomposable and reducible pseudo-Riemannian symmetric space of solvable type. In previous research by I. Kath–M. Olbrich, this problem was attacked by using the property of solvable Lie group. In this talk, we show a necessary condition for the existence of compact Clifford–Klein forms for the class by another method. This method using relative cohomology was introduced by T. Kobayashi and K. Ono and was developed by Y. Morita.

24 Kosuke Ono (Tohoku Univ.)
Toshikazu Sunada (Meiji Univ./Meiji Univ.) Distributions of points in arithmetic discrete sets and applications in number theory ····· 15

Summary: In 2017, Sunada proved theorems on distribution for the set Γ_1 of primitive lattice points related to a problem in Gauss' Mathematisches Tagebuch (diary) and an arithmetic discrete set Γ_2 related to primitive Pythagorean triples (PPTs). In addition, he gave an alternative proof to Lehmer's asymptotic theorem for PPTs, using a certain "summation formula". We observe that a "summation formula" holds also for another arithmetic discrete set Γ_3 related to primitive Eisenstein triples (PETs). This allows to obtain an asymptotic behavior of PETs.

25 Tomohiro Fukaya (Tokyo Metro. Univ.) Examples of groups acting on coarsely convex spaces ····· 15

Summary: In the joint work with Oguni, we introduced a new class of "non-positively curved" metric spaces in coarse geometry. Recently Huang and Osajda showed that Artin groups of type FC and weak Garside groups of finite type act geometrically on Helly graphs. Their result gives us many examples of groups acting geometrically on coarsely convex spaces.

26 Kurando Baba (Tokyo Univ. of Sci.)
Osamu Ikawa (Kyoto Inst. Tech.) Symmetric triads with multiplicities and double Satake diagrams ····· 15

Summary: In this talk, we develop the theories of symmetric triads with multiplicities and double Satake diagrams. We give a one-to-one correspondence between compact symmetric triads and double Satake diagrams. As its applications, we obtain an alternative proof for Matsuki's classification theorem for compact symmetric triads in terms of double Satake diagrams. Further, we give a natural correspondence between commutable compact symmetric triads and symmetric triads with multiplicities.

14:15–16:15

27 Satoshi Nakamura (Fukuoka Univ.) Deformation of coupled Kähler–Einstein metrics ····· 15

Summary: The notion of coupled Kähler–Einstein metrics was introduced recently by Hultgren–W. Nyström. In this talk, we discuss deformation of coupled Kähler–Einstein metrics on Fano manifolds. In particular, we obtain a necessary and sufficient condition for a coupled Kähler–Einstein metric to be deformed to a coupled Kähler–Einstein metric for another close decomposition for anti-caonnical class of Fano manifolds admitting non-trivial holomorphic vector fields. This generalizes a result of Hultgren–W. Nyström.

28 Masaya Kawamura (Nat. Inst. of Tech., Kochi Coll.) On the Kähler-likeness on almost Hermitian manifolds ····· 15

Summary: We introduce a Kähler-like almost Hermitian metric and an almost balanced metric. We prove that on a Kähler-like almost Hermitian manifold, we have an identity between the first derivative of the torsion $(1,0)$-tensor and the Nijenhuis tensor. By applying the identity, then we figure out what the equivalent condition of being almost balanced on a compact Kähler-like almost Hermitian manifold is. Moreover, we prove that on a compact Kähler-like almost Hermitian manifold (M^{2n}, J, g), if it admits a positive $\partial\bar{\partial}$-closed $(n-2, n-2)$-form, then g is a quasi-Kähler metric.

29 Shunsuke Saito (RIKEN/Kyoto Univ.)
Yasufumi Nitta (Tokyo Univ. of Sci.)
Naoto Yotsutani (Kagawa Univ.)
Calabi's extremal Kähler metrics versus Mabuchi's Kähler–Einstein metrics 15

Summary: We clarify the relation between Calabi's extremal Kähler metrics and Mabuchi's Kähler–Einstein metrics on toric Fano manifolds by comparing the corresponding stabilities.

30 Ken Sumi (Kyoto Univ.)
The Riemann–Roch inequality for tropical abelian surfaces 15

Summary: The Riemann–Roch theorem for tropical curves was shown by Gathmann–Kerber and Mikhalkin–Zharkov in 2008. It is a very interesting problem to generalize the tropical Riemann–Roch theorem to higher dimensions, while there are few results for this problem. A main obstacle to higher dimensional generalization is to define the Euler characteristic of a tropical line bundle since the higher cohomology of line bundles cannot be defined as ordinary way. In this talk, we show the Riemann–Roch inequality for tropical abelian surfaces and more results by studying global sections of line bundles over tropical tori, called tropical theta functions.

31 Domenico Fiorenza (Univ. of Rome)
Kotaro Kawai (Gakushuin Univ.)
Hông Vân Lê (CAS)
Lorenz Schwachhöfer (TU Dortmund)
Poincaré DGA of Hodge type and its applications 15

Summary: Roughly speaking, a manifold is said to be formal if the real homotopy type is determined by its cohomology. A formal manifold has the trivial Massey product, which gives a topological obstruction for a manifold M to be formal.
The notion of the formality is defined for differential graded algebras (DGAs). We study it for special DGAs called Poincaré DGAs of Hodge type. Applying this to a manifold, we obtain some topological obstructions for a manifold to admit a geometric structure.

32 Kotaro Kawai (Gakushuin Univ.)
Conformal transformations of the pseudo-Riemannian metric of a homogeneous pair 15

Summary: We introduce the new notion of a homogeneous pair for a pseudo-Riemannian metric g and a positive function f on a manifold M. We consider the conformal transformations of g using f and study the geometric structures such as the curvature, geodesics and the metric completion (if g is positive definite).
We have many examples that admit this structure. In particular, many moduli spaces of geometric structures admit this structure. We provide the unified method for the study of geometric structures of these manifolds.

33 Nobuhiro Honda (Tokyo Tech)
Twistors, quartics, and del Pezzo fibrations 15

Summary: I will talk about our recent result on algebraic description of a wide class of twistor spaces associated to anti-self-dual metrics on compact 4-manifolds. Each of these twistor spaces is birational to the total space of a del Pezzo fibration over CP1, and may be described by a single quartic polynomial of a particular form. Generic fibers of the fibration are (possibly singular) del Pezzo surfaces of degree two.

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

Yoshihiko Matsumoto (Osaka Univ.) Geometric analysis on asymptotically hyperbolic and complex hyperbolic spaces

Summary: Asymptotically (locally) hyperbolic spaces are certain non-compact complete Riemannian manifolds with the property that the name suggests. A remarkable feature of such a space is that its boundary at infinity is naturally equipped with a conformal structure (not necessarily locally flat); it is of interest how this conformal structure affects the analytic property of the space. We can also consider asymptotically complex hyperbolic spaces, whose boundary carries a CR structure (Cauchy–Riemann structure). These two instances are actually expected to continue to (probably) an infinite number of fruitful correspondences involving various types of "parabolic geometries."

In this talk, I will try to convey general ideas about geometric analysis on asymptotically hyperbolic and complex hyperbolic spaces through discussing aspects of the "Einstein filling problem"—that is, the problem of finding such a space satisfying the Einstein equation with given conformal or CR structure on the boundary. Examples indicating the (fun and) subtleties of the problem will be presented. Of central theoretical importance is the Fredholm theorem for geometric linear elliptic differential operators due to O. Biquard, J. Lee, and J. Roth, from which some decent perturbation theorems for Einstein metrics follow. I will also propose a new approach in the complex case, which is to strengthen the filling structure by attaching compatible almost complex structures to Einstein metrics.

Complex Analysis

September 17th (Tue) Conference Room VIII

9:30–11:50

1 Saburou Saitoh (Gunma Univ.*/Inst. of Reproducing Kernels) Remarks for the Quan's identity on the analytic conjugate H^2 norm and the Bergman norm; Isoperimetric inequalities for Dirichlet integrals ····· 15

Summary: In this talk, as a direct application of Q. Guan's result on the conjugate analytic Hardy H_2 norm we will derive a new type isoperimetric inequality for Dirichlet integrals of analytic functions.

2 Kiyoki Tanaka (Daido Univ.) Estimate for the weighted m-polyharmonic Bergman kernel ····· 15

Summary: In this talk, we discuss the weighted m-polyharmonic Bergman space on the unit ball. We will give the estimate for the reproducing kernel of the orthogonal complement of the weighted $(m-1)$-polyharmonic Bergman space in the weighted m-polyharmonic Bergman space.

3 Masaharu Nishio (Osaka City Univ.) Katsunori Shimomura (Ibaraki Univ.) Reproducing property for iterated paraboplic operators of fractional order ····· 15

Summary: We consider a weighted version of Bergman type spaces for iterated parabolic operators of fractional order on the upper half space. First we verify reproducing properties for polyparabolic Bergman functions. Next we discuss some properties of polyparabolic Bergman space, for example, the completeness, the boundedness of point evaluations and norm inequalities. Finally we make a remark on the relation with polyharmonic Bergman spaces.

4 Hideaki Izumi (Chiba Inst. of Tech.) Real-analyticity of dimensioned number solutions to iterative functional equations ····· 15

Summary: The author developed the theory of dimensioned numbers, which is suitable for representing iterated power functions and iterated exponential functions. We explain how to construct dimensioned number solutions to an iterative functional equation, and discuss its real-analyticity.

5 Masakazu Shiba (Hiroshima Univ.*) Closings of an open Riemann surface —Period matrices of hydrodynamic closings and a new span— ····· 15

Summary: Let R be an open Riemann surface of genus $g\,(0 < g < \infty)$ and $\chi = \{A_j, B_j\}_{j=1}^{g}$ be a fixed canonical homology basis of R modulo dividing cycles. Suppose that a complex g-vector $\mathbf{c}$ is given and consider any hydrodynamic differential ϕ on (R, χ) whose A-period vector is $\mathbf{c}$. We first show an identity which gives the B-period vector of ϕ. As an application we characterize the Riemann period matrix of a hydrodynamic closing. We also define a new type of span and show its geometric meaning.

6 Koh Katagata (Ichinoseki Nat. Coll. of Tech.) Transcendental entire functions whose Julia sets contain any infinite collection of quasiconformal copies of quadratic Julia sets ····· 15

Summary: We prove that for any infinite collection of quadratic Julia sets, there exists a transcendental entire function whose Julia set contains quasiconformal copies of the given quadratic Julia sets. In order to prove the result, we construct a quasiregular map with required dynamics and employ the quasiconformal surgery to obtain the desired transcendental entire function.

7 Toshihiro Nakanishi (Shimane Univ.) Applications of a coordinate system of the space of twice punctured torus groups ····· 15

Summary: We introduce a coordinate system to the SL(2,C)-representation space of twice punctured torus groups to find some hyperbolic 3-manifolds which fibers over circle.

8 Yoshihiko Shinomiya (Shizuoka Univ.) Simple closed goedesics on hyperelliptic translation surfaces ····· 15

Summary: For a hyperbolic surface of genus g, the maximal number of pairwise disjoint simple closed geodesics is $3g-3$. We can also consider the maximal numbers of such geodesics for translation surfaces. A translation surface is a surface together with a singular Euclidean metric. A closed geodesic on a translation surface is either a union of segments connecting singularities or a geodesic without singularities. In the case of genus 2, the maximal numbers of pairwise disjoint and non-homotopic geodesics without singularities is studied by Nguyen. We give the maximal numbers of such geodesics for hyperelliptic translation surfaces of genus g.

14:15–15:30

9 Saburou Saitoh (Gunma Univ.*/Inst. of Reproducing Kernels) Division by zero calculus in multiply dimensions and open problems ····· 15

Summary: In this talk, we will introduce the division by zero calculus in multiply dimensions in order to show some wide and new open problems as we see from one dimensional case.

10 Tatsuhiro Honda (Senshu Univ.) Weighted composition operators from the Hardy space to the α-Bloch space ····· 15

Summary: In this talk, we consider some properties of operators from the Hardy space $H^\infty(B_X)$ to the α-Bloch space on a finite dimensional bounded symmetric domain.

11 Hidetaka Hamada (Kyushu Sangyo Univ.)
Gabriela Kohr (Babeş-Bolyai Univ.) α-Bloch mappings on bounded symmetric domains in $\mathbb{C}^n$ ····· 15

Summary: Let $\mathbb{B}_X$ be a bounded symmetric domain realized as the open unit ball of a finite dimensional JB*-triple $X = (\mathbb{C}^n, \|\cdot\|_X)$. In this talk, we give a definition of α-Bloch mappings on $\mathbb{B}_X$ which is a generalization of α-Bloch functions on the unit disc in $\mathbb{C}$. This definition is new in the case of the Euclidean unit ball $\mathbb{B}^n$ in $\mathbb{C}^n$. We generalize Bonk's distortion theorem to α-Bloch mappings on $\mathbb{B}_X$. As an application, we give a lower bound of the Bloch constant for α-Bloch mappings on $\mathbb{B}_X$.

12 Hidetaka Hamada (Kyushu Sangyo Univ.)
Gabriela Kohr (Babeş-Bolyai Univ.) Composition operators of α-Bloch spaces on bounded symmetric domains in $\mathbb{C}^n$ ····· 10

Summary: Let $\mathbb{B}_X$ be a bounded symmetric domain realized as the open unit ball $\mathbb{B}_X$ of a finite dimensional JB*-triple X. In this talk, we continue the work related to α-Bloch mappings on $\mathbb{B}_X$. We first show that α-Bloch spaces on $\mathbb{B}_X$ are complex Banach spaces. Next, we give sufficient conditions for the composition operator from the α-Bloch space into the β-Bloch space to be bounded or compact. In the case that the α-Bloch space is a Bloch space, then these conditions are also necessary.

13 Hidetaka Hamada (Kyushu Sangyo Univ.) Bloch-type spaces and extended Cesàro operators in the unit ball of a complex Banach space ····· 15

Summary: In this talk, we will generalize the Bloch-type spaces and the little Bloch-type spaces to the open unit ball $\mathbb{B}$ of a general infinite dimensional complex Banach space by using the radial derivative. Next, we define an extended Cesàro operator T_φ with holomorphic symbol φ and characterize those φ for which T_φ is bounded between the Bloch-type spaces and the little Bloch-type spaces. We also characterize those φ for which T_φ is compact between the Bloch-type spaces and the little Bloch-type spaces under some additional assumption on the symbol φ. When $\mathbb{B}$ is the open unit ball of a finite dimensional complex Banach space X, this additional assumption is automatically satisfied.

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

Katsunori Shimomura (Ibaraki Univ.) Caloric morphism —Transformation preserving solutions of the heat equation—

Summary: Caloric morphism is the transformation which preserves solutions of the heat equation. On Euclidean spaces, Appell transformation is the typical and essential example.
In this talk, we introduce the notion of caloric morphism on Euclidean domains and give several characterizations of caloric morphism. As a result, we can determine caloric morphisms explicitly under some conditions. The Schwarzian derivative and its related derivatives appear in the process of determination.
Next, we generalize the notion of caloric morphism to Riemannian manifolds and give a characterization theorem.
Finally, we generalize caloric mophism further to semi-riemannian manifolds. This generalization reveals which property of caloric morphism depends on the positivity of the Laplacian.

September 18th (Wed) Conference Room VIII

9:10–11:45

14 Atsushi Hayashimoto (Nagano Nat. Coll. of Tech.)
Kanata Hayashimoto (Nagano City High School)
Area and length in Euclidean and non-Euclidean geometry 15

Summary: We study a relation among the radius of the incircle of a convex polygon, its area and its sides length.

15 Takanori Ayano (Osaka City Univ.)
Victor M. Buchstaber (Steklov Inst. of Math.)
Hyperelliptic integrals of genus 2 and two-dimensional sigma function 15

Summary: The inversion problem of the hyperelliptic integrals of genus 2 is important in many fields such as computation of the conformal mapping of polygons and construction of exact solutions of the geodesic equations in physics. Grant gave a function which solves the inversion problem in terms of the two-dimensional sigma function. In this talk, we derive differential equations satisfied by the function and series expansion of the function. When the curves of genus 2 deform to elliptic curves, we show that the function transforms into the Weierstrass elliptic function.

16 Shinichi Tajima (Niigata Univ.*)
Katsusuke Nabeshima (Tokushima Univ.)
Torsion differential forms associated with an isolated hypersurface singularity 15

Summary: The torsion module of Kähler differential forms is considered. Relations between logarithmic differential forms and logarithmic vector fields are investigated. As an application, an effective method is proposed for computing torsion differential forms associated with a hypersurface with an isolated singularity. The main ingredients of the proposed method are logarithmic vector fields and local cohomology.

17 Masataka Tomari (Nihon Univ.) On isolated singularity property of Saito's regular system of weights in high degrees 15

Summary: A system of natural numbers $(\mathbf{a};h)=(a_1,...,a_{d+1};h)$ with $gcd(a_1,...,a_{d+1})=1$ is called a regular system of weights, if the characteristic function $\chi_{(\mathbf{a},h)}(T)=(T^{h-a_1}-1)...(T^{h-a_{d+1}}-1)/(T^{a_1}-1)...(T^{a_{d+1}}-1)$ is a polynomial function (after Kyoji Saito, 1986). We show the following:
Theorem. For a pair of numbers $\mathbf{a}=(a_1,...,a_{d+1})$, there is a number VF($\mathbf{a}$) such that a regular system of weights $(\mathbf{a};h)$ with $h>VF(\mathbf{a})$ gives a weight system for a quasi-homogeneous complex analytic isolated singularity.

18 Takayuki Koike (Osaka City Univ.) Takato Uehara (Okayama Univ.) Points of the Period domain which correspond to K3 surfaces constructed by gluing ····· 15

Summary: We have developed a new method for constructing K3 surfaces. We constructed such a K3 surface X by patching two open complex surfaces obtained as the complements of tubular neighborhoods of elliptic curves embedded in blow-ups of the projective planes at general nine points. Our construction has 19 complex dimensional degrees of freedom. By the argument based on the concrete computation of the period map, we investigate which points in the period domain correspond to K3 surfaces obtained by such construction.

19 Yusaku Tiba (Ochanomizu Univ.) Cohomology of vector bundles and non-pluriharmonic loci ····· 15

Summary: In this talk, we study cohomology groups of vector bundles on neighborhoods of a non-pluriharmonic locus in Stein manifolds and in projective manifolds. By using our results, we show variants of the Lefschetz hyperplane theorem.

20 Takeo Ohsawa (Nagoya Univ.)$^\flat$ Generalization of theorems of Nishino and Hartogs by the L^2 method ····· 15

Summary: Three different generalizations will be given for Nishino's rigidity theorem asserting the triviality of Stein families of $\mathbb{C}$ over the polydisc, in connection to generalizations of Hartogs's theorem on the analyticity criterion for continuous functions.

21 Akio Kodama (Kanazawa Univ.*)$^\flat$ Satoru Shimizu (Tohoku Univ.) Two theorems on the Fock–Bargmann–Hartogs domains ····· 15

Summary: In this talk, we announce two mutually independent results on the family of Fock–Bargmann–Hartogs domains. Let D_1 and D_2 be two Fock–Bargmann–Hartogs domains in $\mathbb{C}^{N_1}$ and $\mathbb{C}^{N_2}$, respectively. In Theorem 1, we give a complete description of an arbitrarily given proper holomorphic mapping between D_1 and D_2 in the case where $N_1 = N_2$. And, in Theorem 2, we determine the structure of $\mathrm{Aut}(D_1 \times D_2)$ using the data of $\mathrm{Aut}(D_1)$ and $\mathrm{Aut}(D_2)$ for arbitrary N_1 and N_2.

22 Akio Kodama (Kanazawa Univ.*)$^\flat$ On proper holomorphic mappings between two equidimensional FBH-type domains ····· 15

Summary: We introduce a new class of domains $D_{n,m}(\mu, p)$, called *FBH-type domains*, in $\mathbb{C}^n \times \mathbb{C}^m$, where $0 < \mu \in \mathbb{R}$ and $p \in \mathbb{N}$. In the special case of $p = 1$, these are just the Fock–Bargmann–Hartogs domains $D_{n,m}(\mu)$ introduced by Yamamori. In this talk we give a complete description of a given proper holomorphic mapping between two equidimensional FBH-type domains. In particular, we prove that the holomorphic automorphism group of any FBH-type domain $D_{n,m}(\mu, p)$ with $p \neq 1$ is a Lie group isomorphic to $U(n) \times U(m)$. Hence the structure of $\mathrm{Aut}(D_{n,m}(\mu, p))$ with $p \neq 1$ is essentially different from that of $\mathrm{Aut}(D_{n,m}(\mu))$.

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

Joe Kamimoto (Kyushu Univ.) Newton polyhedra in several complex variables

Summary: The technique of using Newton polyhedra has many significant applications in singularity theory. In this talk, we discuss some important subjects in several complex variables by using Newton polyhedra. In the strictly pseudoconvex case, as is well known, there exists local holomorphic coordinates on which the boundary can be clearly expressed. This fact plays useful roles in various analyses on strictly pseudoconvex domains; for example, construction of peak functions, boundary behaviors of the Bergman kernel and Szegö kernel, boundary behavior of squeezing functions. On the other hand, in the weakly pseudoconvex case, a serious problem is understanding what kinds of coordinates are appropriate for a given analytical issue and how to express the boundary on these coordinates. We introduce some local holomorphic coordinates through properties of the Newton polyhedron associated to the boundary and precisely investigate the two issues: determination of the D'Angelo type and boundary behavior of the Bergman kernel. We give quantitative results for these issues from simple geometrical information of the respective Newton polyhadron. Note that the above two issues can be considered as those analogous to determination of the Łojasiewicz exponent and behavior of oscillatory integrals.

Functional Equations

September 17th (Tue) Conference Room IV

9:00–12:00

1 Ichiro Tsukamoto (Toyo Univ.)♭ On solutions of $x'' = t^{-2}x^{1+\alpha}$ with $\alpha < 0$ ····· 10

Summary: As a continuation work, we consider a second order nonlinear differential equation denoted in the title. We show the domains of its solutions and have analytical expressions valid in the neighbourhoods of the ends of these domains. In this way, we clarify asymptotic behaviour of all solutions.

2 Kazuki Ishibashi (Hiroshima Nat. Coll. of Maritime Tech.) Oscillation problems for half-linear differential equations with periodic coefficients ····· 10

Summary: In this talk, we consider the damped half-linear differential equation $(\Phi_p(x'))' + a(t)\Phi_p(x') + b(t)\Phi_p(x) = 0$, where the coefficients a and b are periodic functions; the real-valued function Φ_p is the real-valued function defined by $\Phi_p(u) = |u|^{p-2}u$ for $u \neq 0$ and $\Phi_p(0) = 0$.
The purpose of this talk is to give new criteria which guarantee that all non-trivial solutions of the damped half-linear differential equation are oscillatory (or nonoscillatory).

3 Hideaki Matsunaga (Osaka Pref. Univ.) Akitomo Kawano Stability analysis of solutions of a linear integral system with two delays ····· 10

Summary: In this talk we consider a linear integral system with two delays. We present some necessary and sufficient conditions for the zero solution of the system to be asymptotically stable by using analysis of characteristic roots. We also investigate the limit of solutions in the critical case where the system loses its asymptotic stability.

4 Junya Nishiguchi (Tohoku Univ.) Some discontinuous functional differential equation and its connection to smoothness of composition operators in L^p-spaces ····· 10

Summary: The objective of this talk is to deepen the understanding of the connection between the continuous and smooth dependence of solutions on initial conditions and the regularity of the history functionals for retarded functional differential equations. We consider some differential equation with a single constant delay with the history space of L^p-type and obtain the above dependence result by assuming the growth rate of the nonlinearity and its derivative. The corresponding history functional is discontinuous, and it becomes clear that there are the continuity and the smoothness of the composition operators (also called the superposition operators or the Nemytskii operators) between L^p-spaces behind the dependence results.

5 Mitsuru Shibayama (Kyoto Univ.) Variational construction of orbits realizing sequences in the planar Sitnikov problem ····· 10

Summary: Using the variational method, Chenciner and Montgomery proved the existence of an eight-shaped orbit of the planar three-body problem with equal masses. Since then a number of solutions to the N-body problem have been discovered. The Sitnikov problem is a special case of the three-body problem. The system is known to be chaotic and was studied by using symbolic dynamics. We study the limiting case of the Sitnikov problem. By using the variational method, we show the existence of various kinds of solutions in the planar Sitnikov problem. For a given symbolic sequence, we show the existence of orbits realizing it. We also prove the existence of periodic orbits.

6 Hiroyuki Usami (Gifu Univ.) On asymptotic forms of slowly decaying positive solutions of second-order quasilinear ordinary differential equations with critical coefficients ····· 10

Summary: Second-order quasilinear ordinary differential equations with critical coefficients are considered. Asymptotic forms of slowly decaying solutions of such equations are determined.

7 Tetsutaro Shibata (Hiroshima Univ.) Asymptotic behavior of oscillatory bifurcation curves of semilinear ordinary differential equations · · · 10

Summary: We study the bifurcation problems of semilinear ordinary differential equations with special oscillatory nonlinearities. Since $\lambda = \lambda(\alpha)$ is a continuous function of $\alpha > 0$, we are interested in the global behavior of $\lambda(\alpha)$. Here, α is the maximum norm $\alpha = \|u_\lambda\|_\infty$ of the solution u_λ associated with λ. In the main theorem, we obtain the precise asymptotic behavior of $\lambda(\alpha)$ as $\alpha \to \infty$.

8 Yumiko Takei (Kobe Univ.) On the expression of Voros coefficients for hypergeometric differential equations associated with 2-dimensional Garnier systems in terms of the topological recursion, and its applications · · · 10

Summary: Voros coefficients are important objects in the exact WKB analysis for the global study of solutions of differential equations. In this talk I will report that the Voros coefficients for hypergeometric differential equations associated with 2-dimensional Garnier systems are given by the generating functions of free energies defined in terms of Eynard and Orantin's topological recursion.

9 Kohei Iwaki (Nagoya Univ.) Topological recursion and the τ-function of Painlevé I equation · · · 10

Summary: Topological recursion was originally formulated as an algorithm to compute the large N expansion of correlation / partition function of matrix models from their spectral curves. I will apply the topological recursion to a family of genus 1 spectral curves, and show that the discrete Fourier transform (with respect to the period of the spectral curve) of the topological recursion partition function gives the τ-function of the first Painlevé equation. The result is based on a relationship between the topological recursnion and the WKB analysis.

10 Kyohei Itakura (Kobe Univ.) Analysis of 1-body Stark operators · · · 10
Tadayoshi Adachi (Kyoto Univ.)
Ito Kenichi (Univ. of Tokyo)
Erik Skibsted (Aarhus Univ.)

Summary: We investigate spectral theory for one-body Stark Hamiltonian under minimum regularity and decay condition on the potential. Our results are proved in sharp form employing Besov-type spaces. For the proofs we adopt a new commutator scheme by Ito–Skibsted. A feature of this scheme is a particular choice of an escape function related to the classical mechanics. The whole setting, such as the conjugate operator and the Besov-type spaces, is generated by this single escape function. This talk is based on a joint work with T. Adachi, K. Ito and E. Skibsted.

11 Ryu Fujiwara (Meiji Univ.) Localization of graph Laplacian eigenvectors on scale free networks · · · 10

Summary: On a large scale free network, it has been observed that its graph Laplacian eigenvectors localize on the nodes with similar degrees. By using the graphon theory, the continuum limit of the graph Laplacian of scale free networks is a self adjoint operator. In the talk, we show that the operator is sectorial through determining its spectra, and the maximum principle holds. As a consequence, we verify that the singularity of eigenfunction-like objects of its continuous spectra is the origin of localization.

12 Xiaojing Liu (Ibaraki Univ./Osaka City Univ.) One dimensional weighted Hardy's inequalities and application · · · 10
Hiroshi Ando (Ibaraki Univ.)
Toshio Horiuchi (Ibaraki Univ.)

Summary: In this paper, we establish a weighted version of Hardy's inequality and improve it by adding sharp remainder terms. As weight functions we consider power type weights $t^{\alpha p}$ for $t \in [0, 1]$. Surprisingly our result on this matter is essentially dependent on the range of parameter α.

13 Masato Hashizume (Ehime Univ.) On maximization problem on Trudinger–Moser inequality with compact term 10

Summary: We consider a maximization problem on the Trudinger–Moser inequality with compact term. In this talk we study condition of the compact term on existence and nonexistence.

14 Takeyuki Nagasawa (Saitama Univ.) The cosine formula for generalized O'Hara energie 10

Summary: As one of O'Hara's energies, the Möbius energy was named after its invariant property under Möbius transformations of the surrounding space. Doyle and Schramm gave an expression of the Möbius energy in terms of the cosine of conformal angle, called the *cosine formula*. Since the conformal angle is Möbius invariant, we can see easily the invariant property of the Möbius energy from the formula. In this talk, an analogue of the cosine formula holds for generalized O'Hara's energies in spite of lack of the Möbius invariant property. This newfound formula shows quantitatively how far the energy is from the Möbius invariance.

14:15–16:15

15 Albert Rodríguez Mulet (Hokkaido Univ.)
Shuichi Jimbo (Hokkaido Univ.) Asymptotic analysis of mid-frequency vibrations of thin axis-symmetric elastic rods 10

Summary: We study the eigenvalue problem of the second order elliptic operator which arises in the linearized model of the periodic oscillations of a homogeneous and isotropic elastic body. The square of the frequency agrees to the eigenvalue. Therefore, analyzing the properties of the eigenvalue we can retrieve information on the frequency of the oscillations. Particularly, we deal with a thin rod with axial symmetry and clamped ends. It is known that there are many low-frequency eigenvalues corresponding to the bending mode of vibrations. We see as well that there appear mid-frequency eigenvalues corresponding to torsional and stretching modes of vibrations. We investigate the asymptotic behavior of these mid-frequency eigenvalues, we obtain a characterization formula of the limit equation when the thinness parameter tends to 0 and we give a result on the strong convergence of the corresponding eigenfunctions.

16 Yuta Ishii (Tokyo Metro. Univ.) Stability of multi-peak symmetric stationary solutions for the Schnakenberg model with heterogeneity 10

Summary: In this talk, we consider the one-dimensional Schnakenberg model on the interval $(-1,1)$ with periodic heterogeneity $g(x)$. Let $N \geq 1$ be an arbitrary natural number. We assume that $g(x)$ is a symmetric and periodic function, namely $g(x) = g(-x)$ and $g(x) = g(x+2N^{-1})$. Furthermore, we assume that $g(x) > 0$ and $g \in C^3(-1,1)$. We study the linear stability of N-peak symmetric stationary solutions. We reveal the effect of the periodic heterogeneity on the stability of N-peak solution. In particular, we investigate how N-peak solutions is stabilized or destabilized by the effect of periodic heterogeneity compared with the case $g(x) = 1$.

17 Yuta Ishii (Tokyo Metro. Univ.) Construction and stability of asymmetric spike patterns for the Schnakenberg model with heterogeneity 10

Summary: In this talk, we consider the one-dimensional Schnakenberg model on the interval $(-1,1)$ with heterogeneity $g(x)$. We first construct one-peak stationary solutions. Next, we study the stability of this solution. Also, we give some condition related to the existence of one-peak solution. Since $g(x)$ may be not symmetric on the interval $(-1,1)$, the constructed solution may be not symmetric. In particular, we reveal the effect of the heterogeneity on the location of a concentration point and the stability.

18 Ryuji Kajikiya (Saga Univ.)
Eunkyung Ko (Keimyung Univ.)
Existence of positive radial solutions for a semipositone elliptic equation 10

Summary: In this lecture, we study the existence of positive radial solutions for a semipositone elliptic equation with a parameter $\lambda > 0$. We give a weak and general sufficient condition on f for the existence of positive radial solutions when $\lambda > 0$ is large and for the nonexistence of positive radial solutions when $\lambda > 0$ is small.

19 Takanobu Hara (Hokkaido Univ.)
Adisak Seesanea (Hokkaido Univ.)
Existence of minimal solutions to nonlinear elliptic equations with subnatural growth terms 10

Summary: We study the existence problem for positive solutions u to the quasilinear elliptic equation

$$-\Delta_p u = \sigma u^q + \mu$$

in the sub-natural growth case $0 < q < p - 1$, where $\Delta_p u = \nabla \cdot (|\nabla u|^{p-2}\nabla u)$ is the p-Laplacian with $1 < p < \infty$ and σ, μ are nonnegative measurable functions (or measures) on $\mathbb{R}^n$. We construct solutions in Lorentz spaces with a sharp exponent. To derive existence of such solutions, we give estimates for generalized mutual energy of σ and μ. Our method can be applied for equations with several subnatural terms.

20 Naoki Sioji (Yokohama Nat. Univ.)
Satoshi Tanaka (Okayama Univ. of Sci.)
Kotaro Watanabe (Nat. Defense Acad. of Japan)
A Korman–Ouyang–Tanaka type identity and uniqueness of positive radial solutions of elliptic equations in annuli 10

Summary: We study the uniqueness of positive radial solutions of

$$\Delta u(x) + f(u(x)) = 0 \quad \text{in } A_{a,b}, \qquad u(x) = 0 \quad \text{on } \partial A_{a,b},$$

where $N \geq 2$, $A_{a,b} = \{x \in \mathbb{R}^N : a < |x| < b\}$. By changing a variable appropriately, we can transform the problem to the following two point boundary value problem

$$v_{ss}(s) = g(s, v(s)), \quad s \in (\alpha, \beta), \qquad v(\alpha) = v(\beta) = 0.$$

We study the uniqueness of positive solution of the latter problem, and we apply it to the former problem.

21 Takashi Suzuki (Osaka Univ.)
Uniform boundedness of the solution to reaction diffusion equation with quadratic growth 5

Summary: We show uniform boundedness of the solution to reaction diffusion equation with quadratic growth provided with mass dissipation. This property holds if the space dimension $n \leq 3$, and for any dimension under the additional assumption of entropy inequality.

22 Isamu Ohnishi (Hiroshima Univ.)
Microscopically fine structure of the most stable stationary state in Turing patterns (Basic theorem) 10

Summary: In 1952, Prof. A. Turing has reported a novel principle of pattern formation, so called Turing Instability nowadays, and he has theoretically shown that spatially structured pattern is created out of obvious uniformed state spontaneously. Classically and typically, RD-equation system of Activator-Inhibitor type nonlinearity is well-known to have such an interesting property. Especially, if the diffusion constant of activator is very small, then plenty of stable steady states exit (for instance, see Y. Nishiura's report in Dynamics reported 3 (new series)). Today, I reported that, if the time constant of inhibitor is also equal to 0, then the system has an effective energy by which the system can be regarded as a gradient system , and moreover, the most stable steady state is characterized by use of it. I will report it as a mathematically rigorously proved theorem which is based on the collabolation with Prof. Y. Nishiura (AIMR, Tohoku Univ.).

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

Masakazu Onitsuka (Okayama Univ. of Sci.) Ulam stability for diamond-alpha difference equations

Summary: The present talk deals with Ulam stability for the diamond-alpha difference equation

$$\Diamond_\alpha x(t) - \lambda x(t) = 0, \quad \alpha \in [0,1],\ t \in \mathbb{Z},$$

where $\lambda \in \mathbb{R}$ and

$$\Diamond_\alpha x(t) := \alpha \Delta x(t) + (1-\alpha)\nabla x(t).$$

Note here that $\Delta x(t)$ and $\nabla x(t)$ mean forward difference $x(t+1)-x(t)$ and backward difference $x(t)-x(t-1)$, respectively. The purpose of this talk is to find an explicit Ulam stability constant for the diamond-alpha difference equations.

September 18th (Wed) Conference Room IV

9:00–12:00

23 Naoyuki Ichihara (Aoyama Gakuin Univ.)
Emmanuel Chasseigne (Univ. Tours)
Sharp estimates of the generalized principal eigenvalue for superlinear viscous Hamilton–Jacobi equations with inward drift 10

Summary: We discuss the ergodic problem for viscous Hamilton–Jacobi equations with superlinear Hamiltonian, inward-pointing drift, and positive potential function vanishing at infinity. Under some radial symmetry of the drift and the potential outside a bounded region, we establish sharp estimates of the generalized principal eigenvalue with respect to a perturbation of the potential. It turns out that the asymptotic behavior of the generalized principal eigenvalue depends sensitively on the intensity of the inward drift as well as the decay order of the potential function.

24 Yasuhiro Fujita (Univ. of Toyama)
Nao Hamamuki (Hokkaido Univ.)
Norikazu Yamaguchi (Univ. of Toyama)
A self-affine property of evolutional type appearing in a Hamilton–Jacobi equation 10

Summary: Let $\{H_t\}$ be a Hamilton–Jacobi semigroup acting on functions that are bounded and uniformly continuous on $\mathbb{R}$. Let τ be the Takagi function. The Takagi function is well known as a pathological function that is everywhere continuous and nowhere differentiable on $\mathbb{R}$.
Our aim of this talk is to show that the flow $\{H_t\tau\}$ has a self-affine property of evolutional type inheriting a self-affine property of τ.

25 Hajime Koba (Osaka Univ.) Local and global solvability for advection-diffusion equation on an evolving surface with a boundary 10

Summary: We consider the existence of local and global-in-time strong solutions to the advection-diffusion equation with variable coefficients on an evolving surface with a boundary. We show the existence of local and global-in-time strong solutions to the advection-diffusion equation. Moreover, we derive the asymptotic stability of the global-in-time strong solution.

26 Keisuke Takasao (Kyoto Univ./Kyoto Univ.) Masashi Mizuno (Nihon Univ.) On existence of a solution for some evolution equation related to grain boundary motion with dynamic lattice misorientations ····· 10

Summary: Recently, some evolution equation related to grain boundary motion with dynamic lattice misorientations has been proposed by Epshteyn–Liu–Mizuno. The grain boundary moves by its mean curvature with time-dependent non-local mobility function. We show the existence of the classical solutions for the evolution equation when the grain boundary is described by a graph. Key tools are a priori gradient estimates, which is derived from the so-called monotonicity formula of Huisken type. We establish the monotonicity formula for the length element of the equation.

27 Kohei Nakamura (Saitama Univ.) Asymptotic behavior of higher order curvature flow for closed plane curves ····· 10

Summary: We consider the H^{-m} gradient flow of length for closed plane curves. This flow is a generalization of curve diffusion flow. For the flow, evolving curves may develop singularities in finite time even if the initial curve is smooth. Furthermore, very little appears to be known regarding sufficient conditions for global existence. Hence we investigate the large-time behavior assuming the global existence of the flow. Then we show that the evolving curve converges exponentially to a circle. To do this, we use interpolation inequalities between the deviation of curvature and the isoperimetric ratio, recently established by Nagasawa and the author.

28 Yuki Tsukamoto (Tokyo Tech) Yoshihiro Tonegawa (Tokyo Tech) A diffused interface with the advection term in a sobolev space ····· 10

Summary: In this talk, we consider the asymptotic limit of diffused surface energy in the van der Waals–Cahn–Hillard theory when an advection term is added and the energy is uniformly bounded. We show that the limit interface as ε tend to zero is an integral varifold and the generalized mean curvature vector is determined by the advection term. As an application of our result, a prescribed mean curvature problem is solved using the min-max method.

29 Takashi Kagaya (Kyushu Univ.) Yoshihito Kohsaka (Kobe Univ.) On non-uniqueness and non-convexity of traveling waves for surface diffusion of plane curves ····· 10

Summary: We study the traveling waves for surface diffusion of plane curves. We consider an evolving plane curve with two endpoints which can move freely on the x-axis with generating constant contact angles. For the evolution of this plane curve governed by surface diffusion, we discuss the existence, the uniqueness and the convexity of traveling waves. The main results show that the uniqueness and the convexity can be lost depending on the conditions of the contact angles, although the existence holds for any contact angles in the interval $(0, \pi/2)$.

30 Masaharu Taniguchi (Okayama Univ.) Axisymmetric traveling fronts in balanced bistable reaction-diffusion equations ····· 10

Summary: For a balanced bistable reaction-diffusion equation, the existence of axisymmetric traveling fronts has been studied by Chen, Guo, Ninomiya, Hamel and Roquejoffre (2007). This paper gives another proof of the existence of axisymmetric traveling fronts. Our method is as follows. We use pyramidal traveling fronts for imbalanced reaction-diffusion equations, and take the balanced limit. Then we obtain axisymmetric traveling fronts in a balanced bistable reaction-diffusion equation.

31 Masahiko Shimojyou (Okayama Univ. of Sci.), Amy Poh Ai Ling (Okayama Univ.) — Blow-up of radially symmetric solutions for a semilinear heat equation on hyperbolic space 10

Summary: Radially symmetric solutions of a semilinear heat equation $u_t = \Delta u + u^p$ on the hyperbolic space are considered. First universal bounds of the nonnegative solution are obtained to know the blow-up rate at the final blow-up time under the exponent p which is subcritical in the Sobolev sense. Next we derive its local blow-up profile and also analyze blow-up set of solutions.

32 Masahiko Shimojyou (Okayama Univ. of Sci.), Amy Poh Ai Ling (Okayama Univ.) — Total blow-up of a quasilinear heat equation for non-decaying initial data 10

Summary: We consider solutions of quasilinear equations $u_t = \Delta u^m + u^p$ in $\mathbb{R}^N$ with the initial data u_0 satisfying $0 < u_0 < M$ and $\lim_{|x|\to\infty} u_0(x) = M$ for some constant $M > 0$. It is known that, if $0 < m < p$ with $p > 1$, blow-up occurs only at space infinity. In this paper, we find solutions u that blow up throughout $\mathbb{R}^N$ when $m > p > 1$.

33 Junichi Harada (Akita Univ.) — Type II blowup for the energy critical heat equation in 5D and 6D 6

Summary: We discuss the existence of type II blowup solutions for the energy critical heat equation in 5D and 6D. Our main tool is inner-outer gluing method developed by del Pino–Musso–Wei and their collaborators.

34 Yukihiro Seki (Osaka City Univ.), Biernat Paweł (Univ. Bonn) — Transitions of blow-up mechanisms in k-equivariant harmonic map heat flow 10

Summary: In this talk, I will present a blow-up result for k-equivariant harmonic map heat flow from $\mathbb{R}^d$ to a unit sphere $\mathbb{S}^d \subset \mathbb{R}^{d+1}$. We prove constructively the existence ofasymptotically non-self-similar blow-up solutions with precise description of their local space-time profiles. The blow-up solutions arise from, depending on the combination of d and k, two different approximations of the nonlinear term: either through a Dirac mass supported at the origin or via a Taylor expansion around equator map $u = \pi/2$. Transition of the blow-up mechanisms arises, accordingly.

35 Takasi Senba (Fukuoka Univ.), Yūki Naito (Ehime Univ.) — Existence of peaking solutions for semilinear heat equations with blow-up profile above the singular steady state 10

Summary: We consider positive solutions of the semilinear heat equation with supercritical power nonlinearity, and construct peaking solutions by connecting a backward self-similar solution with a forward self-similar solution. In particular, we show the existence of incomplete blow-up solutions with blow-up profile above the singular steady state.

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

Takuya Watanabe (Ritsumeikan Univ.) — Semiclassical distribution of resonances above an energy-level crossing

Summary: We study the existence and location of the resonances of a 2×2 semiclassical system of coupled Schrödinger operators, in the case where the two electronic levels cross at some point,and one of them is bonding (trapping), while the other one is anti-bonding (non-trapping). Considering energy levels just above that of the crossing, we find the asymptotics of both the real parts and the imaginary parts of the resonances close to such energies. This is a continuation of our previous works where we considered energy levels around that of the crossing. This talk is based on joint works with S. Fujiié (Ritsumeikan) and A. Martinez (Bologna).

September 19th (Thu) Conference Room IV

9:00–12:00

36 Masamitsu Suzuki (Univ. of Tokyo) Local existence and nonexistence for reaction-diffusion systems with coupled exponential nonlinearities 10

Summary: We study the reaction-diffusion system with coupled exponential nonlinearities

$$\begin{cases} \partial_t u = \Delta u + e^{p_1 u + p_2 v} & \text{in } \mathbb{R}^N \times (0,T), \\ \partial_t v = \Delta v + e^{q_1 u + q_2 v} & \text{in } \mathbb{R}^N \times (0,T), \\ u(x,0) = u_0(x), v(x,0) = v_0(x) & \text{in } \mathbb{R}^N, \end{cases}$$

where $N \geq 1$, $T > 0$, $p_i \geq 0$ and $q_i \geq 0$ $(i = 1,2)$ with $(p_1, p_2) \neq (0,0)$ and $(q_1, q_2) \neq (0,0)$. The initial functions u_0 and v_0 are nonnegative and measurable. For each (p_1, p_2, q_1, q_2), we obtain integrability conditions of (u_0, v_0) which explicitly determine the existence/nonexistence of a local in time nonnegative classical solution. Our analysis can be applied to other nonlinearities including superexponential ones.

37 Junyong Eom (Tohoku Univ.)
Kazuhiro Ishige (Univ. of Tokyo) Large time behavior of ODE type solutions to a nonlinear parabolic system 10

Summary: In this talk, we obtain the precise description of the large time behavior of ODE type solutions by use of the solutions to the heat equation and reveal the relationship between the behavior of the solution and the diffusion effect nonlinear parabolic system has.

38 Nobuhito Miyake (Tohoku Univ.)
Kazuhiro Ishige (Univ. of Tokyo)
Shinya Okabe (Tohoku Univ.) Blow up of solutions for a fourth order parabolic equation with gradient nonlinearlity 10

Summary: We consider the Cauchy problem for a fourth order semilinear parabolic equation $\partial_t u + (-\Delta)^2 u = -\nabla \cdot (|\nabla u|^{p-2} \nabla u)$ on $\mathbf{R}^N$, where $p > 2$ and $N \geq 1$. In this talk we give a sufficient condition for the existence of solution u to the Cauchy problem such that its maximal existence time $T_M(u)$ is finite. We prove that, if $T_M(u) < \infty$, then the following hold:
(a) $\|\nabla u(t)\|_{L^\infty(\mathbf{R}^N)}$ blows up at $t = T_M(u)$ for $p > 2$;
(b) $\|u(t)\|_{L^\infty(\mathbf{R}^N)}$ blows up at $t = T_M(u)$ for $2 < p < 4$.
In this talk we will show you more precise statement including the lower bound of blow up rate.

39 Kensuke Yoshizawa (Tohoku Univ.)
Shinya Okabe (Tohoku Univ.) Energy structure of solutions to a fourth order semilinear parabolic obstacle problem 10

Summary: This talk is concerned with the obstacle problem for a fourth order semilinear parabolic equation. Formally, the parabolic obstacle problem can be regarded as the L^2-gradient flow for an energy functional under a constraint by the obstacle. However, since the obstacle generally causes a lack of regularity of solutions, it is not clear that the obstacle problem has a gradient structure of the energy functional. In this talk, we prove that (i) the obstacle problem possesses a unique weak solution; (ii) the weak solution has the L^2-gradient structure for the energy functional in a weak sense.

40 Masaaki Mizukami (Tokyo Univ. of Sci.)
Tatsuhiko Ono (Tokyo Univ. of Sci.)
Tomomi Yokota (Tokyo Univ. of Sci.)
Absence of gradient blow-up in a quasilinear degenerate chemotaxis system with flux limitation 10

Summary: This talk is concerned with solvability of a quasilinear degenerate chemotaxis system with flux limitation. In a special setting Bellomo–Winkler proved local existence of unique classical solutions and extensibility criterion ruling out gradient blow-up as well as global existence and boundedness of solutions in 2017. However, a general setting has not been considered yet. The purpose of the present talk is to derive local existence and extensibility criterion ruling out gradient blow-up in a slightly general setting, and moreover to show global existence and boundedness of solutions under some conditions.

41 Yuka Chiyoda (Tokyo Univ. of Sci.)
Masaaki Mizukami (Tokyo Univ. of Sci.)
Tomomi Yokota (Tokyo Univ. of Sci.)
Blow-up in a quasilinear degenerate chemotaxis system with flux limitation 10

Summary: This talk is concerned with blow-up of solutions to a quasilinear degenerate chemotaxis system with flux limitation. In a special setting Bellomo–Winkler found initial data such that a corresponding solution blows up in finite time in 2017. On the other hand, recently, local existence and extensibility criterion ruling out gradient blow-up in a general setting was proved; however, blow-up solutions in the general setting has not been studied yet. The purpose of the present talk is to give some conditions for existence of blow-up solutions in the general setting.

42 Tetsuya Yamada (Fukui Nat. Coll. of Tech.)
Global existence and blow up of solutions to an attraction-repulsion chemotaxis system in the balance case 10

Summary: We consider the Cauchy problem for an attraction-repulsion chemotaxis system in the whole space: $\partial_t u = \Delta u - \nabla \cdot (u\nabla(\beta_1 v_1 - \beta_2 v_2))$, $0 = \Delta v_1 - \lambda_1 v_1 + u$, $0 = \Delta v_2 - \lambda_2 v_2 + u$, where the constants β_1, β_2, λ_1, λ_2 are positive and the initial data u_0 is nonnegative. In this talk we will discuss the global existence and blow up for this system under the condition $\beta_1 = \beta_2$.

43 Yusuke Sugiyama (Univ. of Shiga Pref.)
Masakazu Yamamoto (Niigata Univ.)
Asymptotic stability of stationary solutions to the drift-diffusion model with the fractional dissipation 10

Summary: We study the drift-diffusion equation with fractional dissipation $(-\Delta)^{\theta/2}$ arising from a model of semiconductors. First we prove the existence of the small solution to the corresponding stationary problem in the whole space. Moreover it is proved that the unique solution of non-stationary problem exists globally in time and decays exponentially, if initial data is suitably close to the stationary solution and the stationary solution is sufficiently small.

44 Masakazu Yamamoto (Niigata Univ.)
Yuusuke Sugiyama (Univ. of Shiga Pref.)
Sharp estimates for decay of solutions to the quasi-geostrophic equation 10

Summary: The initial value problem of the quasi-geostrophic equation is studied. Upon the suitable conditions for the initial data, global existence in time of solutions is known. Sharp estimates for decay of solutions as the spatial parameter tends to infinity are shown.

45 Okihiro Sawada (Gifu Univ.)
On the reaction diffusion equations of Keener–Tyson model for Belousov–Zhabotinsky reaction 10

Summary: The time-global existence of unique smooth positive solutions to the reaction diffusion equations of the Keener–Tyson model for the Belousov–Zhabotinsky reaction in the whole space is established with bounded non-negative initial data. Deriving estimates of semigroups and time evolution operators, and applying the maximum principle, the unique existence and the positivity of solutions are ensured by construction of time-local solutions from certain successive approximation.

46 Koichi Taniguchi (Nagoya Univ.)
Masahiro Ikeda (RIKEN/Keio Univ.)
Dissipation and blow-up for semilinear heat equations in general energy spaces 10

Summary: The purpose in this talk is to determine the global behavior of solutions to the initial-boundary value problems for the focusing energy-subcritical and critical semilinear heat equations by initial data at low energy level in various situations by a unified treatment.

47 Jayson Mesitas Cunanan (Saitama Univ.)
Inhomogeneous Strichartz estimates in some critical cases 10

Summary: Strong-type inhomogeneous Strichartz estimates are shown to be false for the wave equation outside the so-called acceptable region. On a critical line where the acceptability condition marginally fails, we prove substitute estimates with a weak-type norm in the temporal variable. We achieve this by establishing such weak-type inhomogeneous Strichartz estimates in an abstract setting. The application to the wave equation rests on a slightly stronger form of the standard dispersive estimate in terms of certain Besov spaces. This talk is based on joint-work with Neal Bez and Sanghyuk Lee.

48 Haruya Mizutani (Osaka Univ.)
Wave operator on Sobolev space 10

Summary: We provide a simple sufficient condition in an abstract framework to deduce the existence and completeness of wave operators on the scale of Sobolev spaces from the existence and completeness of the ordinary wave operators. Some applications to the potential scattering on the Euclidean space as well as the scattering for a nonlinear Schrödinger equation with a linear potential are also discussed. The class of potentials satisfying our condition in case of the Sobolev space of order one includes short-range potentials with subcritical singularities, the inverse-square potential and the 1D delta type point interaction.

14:15–16:15

49 Shobu Shiraki (Saitama Univ.)
Pointwise convergence along paths generated by fractals for the fractional Schrödinger equation 10

Summary: As a generalization of Carlson's problem, Cho–Lee–Vargas considered the pointwise convergence problem for the solution of the standard Schrödinger equation along directions determined by a given compact subset of the real line. We simplify and extend their result to fractional Schrödinger equations by avoiding the use of a time localization lemma.

50 Fumihito Abe (Tokyo Univ. of Sci.)
Keiichi Kato (Tokyo Univ. of Sci.)
H^s wave front set for Schrödinger equations with sub-quadratic potential 10

Summary: We determine the H^s wave front sets of solutions to time dependent Schrödinger equations with a sub-quadratic potential by using the characterization of the H^s wave front set in terms of wave packet transform which is obtained by K. Kato, M. Kobayashi, and S. Ito (2017).

51 Tomoyuki Tanaka (Nagoya Univ./Chuo Univ./RIKEN/Keio Univ.)
Kotaro Tsugawa (Chuo Univ.)
Parabolic smoothing effect for higher order linear Schrödinger type equations on the torus 10

Summary: We establish the energy estimate for higher order linear Schrödinger type equations on the torus. The proof is based on the energy method with correction terms, but some derivative losses cannot be recovered and they may have an affect on the well-posedness. As a corollary, we can classify the Cauchy problem into three types: dispersive type, parabolic type and ill-posed type.

52 Masaru Hamano (Saitama Univ.)
Takahisa Inui (Osaka Univ.)
Kuranosuke Nishimura (Tokyo Univ. of Sci.)
Scattering solutions of the quadratic NLS system without mass-resonance condition in $\mathbb{R}^5$ 10

Summary: We deal with the quadratic nonlinear Schrödinger system in five dimensions. We consider the scattering solutions with the initial data below the ground state. When the system has the mass-resonance condition, first speaker has already given the sufficient and necessary condition. In this talk, we consider the system without the mass-resonance condition. We give a sufficient condition. We remark that if the system does not have the mass-resonance condition, then there is no Galilean transform invariance. We assume that the solutions are radially symmetric instead.

53 Kota Uriya (Okayama Univ. of Sci.)
Mamoru Okamoto (Shinshu Univ.)
Final state problem for the nonlocal nonlinear Schrödinger equation with dissipative nonlinearity 10

Summary: We consider the asymptotic behavior of solutions to the nonlocal nonlinear Schrödinger equation with dissipative nonlinearity. We prove that there exists a solution which has different behavior from that of the typical cubic nonlinear Schrödinger equation.

54 Shota Kawakami (Saitama Univ.)
Shuji Machihara (Saitama Univ.)
Blowup solutions for the nonlinear Schrödinger equation with complex coefficient 10

Summary: We construct a finite time blow up solution for the nonlinear Schrödinger equation with the power nonlinearity whose coefficient is complex number. We generalize the range of both the complex coefficient and the power for the result of Cazenave, Martel and Zhao. As a bonus, we may consider the space dimension 5. We show a sequence of solutions closes to the blow up profile which is a blow up solution of ODE. We apply the Aubin–Lions lemma for the compactness argument for its convergence.

55 Kazuyuki Yagasaki (Kyoto Univ.)
Shotaro Yamazoe (Kyoto Univ.)
Linear stability of solitary waves in coupled nonlinear Schrödinger equations 10

Summary: We consider coupled nonlinear Schrödinger (CNLS) equations with a general nonlinearity. We assume that CNLS equations possess a solitary wave of which one component is identically zero and that the pitchfork bifurcation of this solitary wave occurs. Utilizing the Evans function approach, we show that the bifurcated solitary waves are linearly (in fact, orbitally) stable if they are sign-definite and are linearly unstable if they are sign-indefinite. Our assumptions are easier to verify than previous results.

56 Masayuki Hayashi (Kyoto Univ.)
Characterization of 4π-mass condition for the derivative nonlinear Schrödinger equation 10

Summary: We consider the derivative nonlinear Schrödinger equation (DNLS) which has L^2-critical and completely integrable structure. It is known that if the initial data $u_0 \in H^1(\mathbb{R})$ satisfies $\|u_0\|_{L^2}^2 < 4\pi$, the corresponding solution is global and bounded. The main aim of this talk is to characterize this 4π-mass condition from potential well theory. We see that the mass threshold value 4π gives the turning point in the structure of potential well generated by solitons. Our approach is applicable to more general equation which contains DNLS.

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

Michiaki Onodera (Tokyo Tech)♭ Hyperbolic solutions to Bernoulli's free boundary problem

Summary: Bernoulli's free boundary problem is an overdetermined problem in which one seeks an annular domain such that the capacitary potential satisfies an extra boundary condition. This problem arises as the Euler–Lagrange equation for minimizing the capacity among all subsets of equal volume in a prescribed container. There exist two different types of solutions: elliptic and hyperbolic solutions. Elliptic solutions are "stable" solutions and tractable by variational methods and maximum principles, while hyperbolic solutions are "unstable" solutions of which the qualitative behavior is less known. I will present an implicit function theorem based on the parabolic maximal regularity, which enables us to handle the so-called loss of derivatives without losing the regularity of solutions. As an application, we prove the existence of a foliated family of hyperbolic solutions.

September 20th (Fri) Conference Room IV

9:00–12:00

57 Toshiyuki Suzuki (Kanagawa Univ.) Nonlinear Schrödinger equations with some critical inverse-square potential ····· 10

Summary: We consider the Cauchy problems for nonlinear Schrödinger equations with inverse-square potential.

$$i\frac{\partial u}{\partial t} = (-\Delta + V)u + g_0(u).$$

$V \in C(\mathbb{R}^N \setminus \{0\})$ is assumed the homogeneity of degree -2 and the threshold of the selfadjointness, for example, $V(x) = -(N-2)^2/(4|x|^2)$. We solve the Cauchy problems in the energy space $\mathcal{D} = D((1-\Delta+V)^{1/2}) \supsetneq H^1(\mathbb{R}^N)$.

58 Noriyoshi Fukaya (Tokyo Univ. of Sci.) Uniqueness and nondegeneracy of ground states for nonlinear Schrödinger equations with attractive inverse-power potential ····· 10

Summary: In this talk we consider the uniqueness and nondegeneracy of ground states for stationary nonlinear Schrödinger equations with a focusing power-type nonlinearity and an attractive inverse-power potential. We prove that all ground states are positive up to phase rotation, radial, and decreasing. Moreover, by refining the results of Shioji and Watanabe (2016), we prove the uniqueness and nondegeneracy of the positive radial solutions.

59 Hayato Miyazaki (Tsuyama Nat. Coll. of Tech.) Local well-posedness for the higher-order generalized KdV type equation with low-degree of nonlinearity ····· 10

Summary: We consider the local well-posedness for the higher-order generalized KdV type equation with low-degree of nonlinearity. The equation arises as a non-integrable and lower nonlinearity version of the higher-order KdV equation. As for the lower nonlinearity model of the KdV equation, Linares, Miyazaki and Ponce prove the local well-posedness under a non-degenerate condition introduced by Cazenave and Naumkin (2017). In this talk, we show that the well-posedness result can be extended into the higher-order equation. We also give a lower bound for the lifespan of the solution. The lifespan depends on two quantities determined by the initial data.

60 Hiroyuki Hirayama (Univ. of Miyazaki), Shinya Kinoshita (Univ. Bielefeld), Mamoru Okamoto (Shinshu Univ.) — Well-posedness for KdV type equation with second derivative nonlinearity 10

Summary: We consider the KdV type equation which contains the quadratic second derivative nonlinearity. Because the derivative loss occurs from the nonlinear term, the well-posedness in the Sobolev space $H^s(\mathbb{R})$ cannot be obtained by using the iteration argument. Harrop and Griffiths (2015) proved the well-posedness of this equation in the translation invariant Sobolev space $l^1H^s(\mathbb{R})$ for $s > 5/2$. To improve this result, we use the gauge transform which was used by Ozawa (1998) for the quadratic derivative nonlinear Schrödinger equation. We prove the well-posedness of the KdV type equation in $\mathcal{X}^s$ for $s \geq 1$, where $\mathcal{X}^s$ is the space of functions in $H^s(\mathbb{R})$ with bounded primitives.

61 Shinya Kinoshita (Univ. Bielefeld) — Well-posedness for the Cauchy problem of the Zakharov–Kuznetsov equation in 2D 10

Summary: We consider the Cauchy problem of the 2D Zakharov–Kuznetsov equation. Our aim is to show the well-posedness in a low regularity Sobolev space. In the proof of the crucial nonlinear estimate resonant interactions appear. Since their shape is very complicated (due to the linear part of Zakharov–Kuznetsov equation), it is challenging to treat all of them. To overcome this, we employ a nonlinear version of the Loomis–Whitney inequality and a suitable Whitney decomposition.

62 Isao Kato (Kyoto Univ.)[b] — The bilinear estimates for the Zakharov type system 10

Summary: In this talk, we consider the Cauchy problem for the degenerated Zakharov system. The degeneracy means lack of dispersion in one direction in the Schrödinger equation. In contrast to the Zakharov system, the degenerated Zakharov system is not so much studied yet for complexity of the nonlinear interaction. Barros–Linares (2015) showed local well-posedness of this system in certain Sobolev space by the linear estimate (the Strichartz estimate and the maximal function estimate), so they assume high regularity. The aim of this work is lower the regularity than Barros–Linares in the framework of the Fourier restriction norm method.

63 Makoto Nakamura (Yamagata Univ.) — On the Cauchy problem for the semilinear Proca equations in the de Sitter spacetime 10

Summary: The Cauchy problem for the semilinear Proca equations is considered in the de Sitter spacetime. The effects of the spatial variance are remarked through the properties of the solutions of the problem.

64 Makoto Nakamura (Yamagata Univ.), Hiroshi Takeda (Fukuoka Inst. of Tech.) — Asymptotic profiles of global solutions for the semilinear diffusion equation in the de Sitter spacetime 10

Summary: We consider the Cauchy problem of semilinear diffusion equations in the de Sitter spacetime. We show the asymptotic profiles of the global solutions according to growth order of the nonlinear term and decay property of initial data.

65 Yoshinori Nishii (Osaka Univ.), Hideaki Sunagawa (Osaka Univ.) — Remarks on Agemi-type structural condition for systems of semilinear wave equations 10

Summary: We consider a two-component system of cubic semilinear wave equations in two space dimensions satisfying the Agemi-type structural condition (Ag) but violating (Ag_0) and (Ag_+). For this system, we show that small amplitude solutions are asymptotically free as $t \to +\infty$.

66 Tadahiro Oh (Univ. of Edinburgh), Mamoru Okamoto (Shinshu Univ.), Tristan Robert (Univ. of Edinburgh) — On triviality for the two-dimensional stochastic damped nonlinear wave equation 10

Summary: We consider the two-dimensional stochastic damped nonlinear wave equation (SdNLW) with the cubic nonlinearity, forced by a space-time white noise. Without renormalization of the nonlinearity, we show that solutions to SdNLW with regularized noises tend to 0 as the regularization is removed.

67 Kimitoshi Tsutaya (Hirosaki Univ.)♭ Yuta Wakasugi (Ehime Univ.) Blow up of solutions of semilinear wave equations with scale-invariant damping relevant to nonlinear waves in FLRW spacetime ····· 10

Summary: We consider the Cauchy problem for the semilinear wave equation with scale-invariant damping. This equation generalizes the nonlinear wave equation in the FLRW (Friedmann–Lemaitre–Robertson–Walker) spacetime with zero spatial curvature in some case. We show the blow-up phenomena as well as upper bounds of the lifespan of solutions in subcritical and critical cases.

68 Ikki Fukuda (Hokkaido Univ.) Asymptotic behavior of solutions to the damped wave equation with a nonlinear convection term ····· 10

Summary: In this talk, we consider the asymptotic behavior of the global solutions to the initial value problem for the damped wave equation with a nonlinear convection term. We assume that the initial data decay polynomially at spatial infinity. When the initial data decay fast enough, it is known that the solution to this problem converges to a self-similar solution to the Burgers equation called a nonlinear diffusion wave and its optimal asymptotic rate is obtained. In this talk, we focus on the case that the initial data decay more slowly than previous works and derive the corresponding asymptotic profile. Moreover, we investigate how the change of the decay rate of the initial values affect its asymptotic rate.

69 Hironori Michihisa (Hiroshima Univ.) On some Rosenau equation ····· 10

Summary: We study the asymptotic behavior of the solution to a generalized Rosenau equation that is of regularity-loss type. Due to its structure, the solution behaves differently from the solutions of wave equations with a lower order damping term. In this talk, the author gives a new expanding method for the solution in the high-frequency region.

70 Daisuke Kawagoe (Kyoto Univ.) $W^{1,p}$ estimate for the solution to the stationary transport equation ····· 10

Summary: We consider a boundary value problem of the stationary transport equation in a two dimensional bounded convex domain with the incoming boundary condition. In this talk, we give a $W^{1,p}$ estimate of the solution to the boundary value problem with $1 \leq p < p_m$, where $W^{1,p}$ is the standard Sobolev space and p_m is a real number depending only on the shape of the domain. Moreover, we show two examples which implies that this estimate is optimal in some cases. This $W^{1,p}$ estimate for the solution is important when we discuss reliability of numerical solutions to the boundary value problem obtained by discrete-ordinate discontinuous Galerkin methods.

14:15–16:15

71 Toshiaki Hishida (Nagoya Univ.)♭ Decay estimates of gradient of a generalized Oseen evolution operator arising from time-dependent rigid motions in exterior domains ····· 10

Summary: Consider the motion of a viscous fluid past a rotating body in 3D, where the translational and angular velocities of the body are prescribed but time-dependent. In a reference frame attached to the body, we have the linearized non-autonomous system in a fixed exterior domain. We develop L^q-L^r decay estimates of the evolution operator generated by this system. Our theorem completely recovers those estimates for the autonomous case (Stokes, Oseen, ...).

72 Kenta Oishi (Nagoya Univ.) On the R-boundedness for the generalized Stokes resolvent problem in an infinite layer with Neumann boundary condition ····· 10

Summary: In this talk, we develop the R-boundedness for the generalized Stokes resolvent problem in an infinite layer, with Neumann boundary condition on both upper and lower boundary. This has not been proved for such a boundary condition, while it has been proved for Neumann and Dirichlet boundary condition on upper and lower boundary, respectively. As an application, we also establish the local well-posedness for the incompressible Navier–Stokes equation in an infinite layer with a free surface for both upper and lower boundaries.

73 Naoki Hamamoto (Osaka City Univ.) Sharp Hardy–Leray inequality for solenoidal fields ····· 10

Summary: We show the best constant of Hardy–Leray inequality for solenoidal (i.e., divergence-free) fields in $\mathbb{R}^N$. This is a complement of the former works by O. Costin and V. Maz'ya on sharp Hardy–Leray inequality for axisymmetric divergence-free fields. It turns out from our result that the assumption of axisymmetry can be removed.

74 Keiichi Watanabe (Waseda Univ.) Navier–Stokes equations in exterior Lipschitz domains ····· 10
Patrick Tolksdorf (UPEC)

Summary: We show that the Stokes operator defined on $\mathrm{L}^p_\sigma(\Omega)$ for an exterior Lipschitz domain $\Omega \subset \mathbb{R}^n$ ($n \geq 3$) admits maximal regularity provided that p satisfies $|1/p - 1/2| < 1/(2n) + \varepsilon$ for some $\varepsilon > 0$. In particular, we prove that the negative of the Stokes operator generates a bounded analytic semigroup on $\mathrm{L}^p_\sigma(\Omega)$ for such p. This enables us to prove the existence of mild solutions to the Navier–Stokes equations in the critical space $\mathrm{L}^\infty(0,T;\mathrm{L}^3_\sigma(\Omega))$.

75 Shouta Enomoto ♭ (Keio Univ./Meiji Univ.) Local existence of the linearized problem for Navier–Stokes equation around the dynamics of a spherical bubble ····· 10
Kota Ikeda (Meiji Univ.)

Summary: We consider the linearized problem for the Navier–Stokes equation around the solution for the Rayleigh–Plesset equation. Here the Rayleigh–Plesset equation is an ordinary differential equation with respect to time whose solution describe the dynamics of spherical bubble. Since the Rayleigh–Plesset equation is derived from the Navier–Stokes equation, we can describe one of the solution of the Navier–Stokes equation by the solution of the Rayleigh–Plesset equation. Then we show a local existence of the unique solution of the linearized problem for Navier–Stoeks equation around the solution of Rayleigh–Plesset equation.

76 Noboru Chikami (Osaka Univ.) Global well-posedness and time-decay estimates of the compressible Navier–Stokes–Korteweg system ····· 10
Takayuki Kobayashi (Osaka Univ.)

Summary: We consider the compressible Navier–Stokes–Korteweg system describing the dynamics of a liquid-vapor mixture with diffuse interphase. The global solutions are established under linear stability conditions in critical Besov spaces. In particular, the sound speed may be greater than or equal to zero. By fully exploiting the parabolic property of the linearized system for all frequencies, we see that there is no loss of derivative usually induced by the pressure for the standard isentropic compressible Navier–Stokes system. This enables us to apply Banach's fixed point theorem to show the existence of global solution. Furthermore, we obtain the optimal decay rates of the global solutions in the $L^2(\mathbb{R}^d)$-framework.

77 Yusuke Ishigaki (Tokyo Tech) Stability of time-periodic parallel flow of compressible viscoelastic system ····· 10
Yoshiyuki Kagei (Tokyo Tech)
Ayaka Haruki

Summary: We consider the initial boundary value problem for a compressible viscoelastic system with time-periodic external force in an infinite layer. There exists a time-periodic parallel flow if the external force has a suitable condition. We show that if the initial perturbation is sufficiently small, the time-periodic parallel flow is asymptotically stable, provided that the Reynolds and the Mach numbers are small and the propagation speed of the shear wave is large.

78 Yuka Teramoto (Tokyo Tech)
Chun-Hsiung Hsia (Nat. Tiwan Univ.)
Yoshiyuki Kagei (Tokyo Tech)
Takaaki Nishida (Kyoto Univ.)
Hopf bifurcation for artificial compressible system for doubly diffusive convection 10

Summary: We consider 2-dimensional doubly diffusive convection problem for artificial compressible system. The incompressible Navier–Stokes system is obtained as a singular limit with zero Mach number which is included in the artificial compressible system. It is known for the incompressible system that if the bifurcation parameter increases beyond a certain critical value, then the motionless state becomes unstable and a time periodic flow bifurcates. In this talk, we show that there also exists a bifurcating time periodic solution for the artificial compressible system when the Mach number is sufficiently small.

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

Yuta Wakasugi (Ehime Univ.)
L^p-L^q estimates for the damped wave equation and their application to nonlinear problems

Summary: The asymptotic behavior of solutions to the damped wave equation has been studied for a long time after a pioneering work by Matsumura (1976). He proved L^p-L^q estimates for the damped wave equation (so-called Matsumura estimates) and applied them to semilinear problems. After that, Nishihara (2003) discovered a decomposition of the solution into the heat part and the wave part, which gives a refined L^p-L^q estimates. In this talk, we give a survey of the study of the asymptotic behavior of solutions to the damped wave equation, and show sharp L^p-L^q estimates with derivative loss. Moreover, as an application of L^p-L^q estimates, we consider the Cauchy problem of the nonlinear damped wave equation with slowly decaying initial data. In particular, we give a small data global existence result including the case of critical nonlinearity. This result is based on a joint work with M. Ikeda, T. Inui, and M. Okamoto. At the end of the talk, as another application, we also introduce Strichartz estimates for the damped wave equation including the endpoint case. This part is based on a joint work with T. Inui.

Real Analysis

September 19th (Thu) Conference Room VIII

10:00–11:55

1 Koji Aoyama (Chiba Univ.) Strong convergence of Halpern's method for quasinonexpansive mappings ····· 15

Summary: In this talk, we give a simple proof and some generalizations of results in [Falset, Llorens-Fuster, and Marino, Math. Model. Anal. 21 (2016)].

2 Sachiko Atsushiba (Univ. of Yamanashi) Fixed point property and convergence theorems for iterative sequences ····· 15

Summary: In this talk, we establish the existence of absolute fixed points of normally 2-generalized hybrid mappings in a Hilbert space. We prove some fixed point theorems in a Hilbert space. We also prove convergence theorems for iterative sequences.

3 Shin-ya Matsushita (Akita Pref. Univ.) On regularized convex minimization problem ····· 15

Summary: Let H be a real Hilbert space and let $f\colon H \to (-\infty, \infty]$ and $g\colon H \to (-\infty, \infty]$ be proper, lower semicontinuous and convex functions. We consider a problem of finding the resolvent $J_{\partial(f+g)}$ of the subdifferential $\partial(f+g)$. In particular, we obtain a strong convergence result of a splitting method.

4 Kengo Kasahara (Toho Univ.)
Yasunori Kimura (Toho Univ.) Iterative sequences for a finite family of resolvent operators on geodesic spaces ····· 15

Summary: Convex minimization problem is one of the convex optimization problems. We study it by using many kinds of approximation methods in Hilbert spaces, Banach spaces and so on. In a complete CAT(0) space and a complete admissible CAT(1) space, the set of fixed points of the resolvent for the convex function coincides with the set of its minimizers. Therefore, we find a fixed point of the resolvent instead of a minimizer of the convex functions. In this talk, we consider some iteration methods for a finite family of resolvent operators.

5 Jun Kawabe (Shinshu Univ.) Convergence theorems of nonlinear integrals of p-th order integrable functions ····· 15

Summary: In this talk, we describe a methodology to derive the convergence theorems of nonlinear integrals of p-th order integrable functions converging in measure from the already established convergence theorems in nonadditive measure theory. We also discuss the completeness of the Lorentz space which is defined by a nonadditive measure.

6 Minglei Shi (Ibaraki Univ.)
Eiichi Nakai (Ibaraki Univ.) Sharp maximal function and Orlicz–Morrey spaces ····· 15

Summary: For a Young function $\Phi : [0,\infty] \to [0,\infty]$ and a growth function $\varphi : (0,\infty) \to (0,\infty)$, let $L^{(\Phi,\varphi)}(\mathbb{R}^n)$ and $\mathcal{L}^{(\Phi,\varphi)}(\mathbb{R}^n)$ be the Orlicz–Morrey and Orlicz–Campanato spaces, respectively. In this talk we give a relation between $\|M^\sharp f\|_{L^{(\Phi,\varphi)}}$ and $\|f\|_{\mathcal{L}^{(\Phi,\varphi)}}$.

7 Ryota Kawasumi
Eiichi Nakai (Ibaraki Univ.) A characterization of pointwise multipliers on weak Morrey spaces ··· 15

Summary: In this talk we give a characterization of pointwise multipliers on weak Morrey spaces $\mathrm{w}L_{p,\phi}(\mathbb{R}^n)$. We denote by $\mathrm{PWM}(\mathrm{w}L_{p_1,\phi_1}(\mathbb{R}^n), \mathrm{w}L_{p_2,\phi_2}(\mathbb{R}^n))$ the set of all pointwise multipliers from $\mathrm{w}L_{p_1,\phi_1}(\mathbb{R}^n)$ to $\mathrm{w}L_{p_2,\phi_2}(\mathbb{R}^n)$. We give a necessary condition for $\mathrm{PWM}(\mathrm{w}L_{p_1,\phi_1}(\mathbb{R}^n), \mathrm{w}L_{p_2,\phi_2}(\mathbb{R}^n)) = \mathrm{w}L_{p_3,\phi_3}(\mathbb{R}^n)$.

14:15–16:05

8 Toru Nogayama (Tokyo Metro. Univ.)
Yoshihiro Sawano (Tokyo Metro. Univ.)
Naoya Hatano (Chuo Univ.)
A characterization of the vector-valued Morrey spaces in terms of pointwise multiplier space · · · · · 15

Summary: Our goal of this talk is to show that Ho's vector-valued Morrey spaces can be realized as the special case of the pointwise multiplier space. This extends Lemarié-Rieusset's theorem. One can not extend his theorem directly because we are handling Banach lattices instead of Lebesgue spaces. It turns out that mixed Morrey spaces, Lorentz–Morrey spaces and Orlicz–Morrey spaces fall under the scope of the framework.

9 Ryutaro Arai (Ibaraki Univ.)
Eiichi Nakai (Ibaraki Univ.)
Gaku Sadasue (Osaka Kyoiku Univ.)
Commutators of fractional integrals on martingale Orlicz Spaces · · · · · 15

Summary: Let I_γ be a generalized fractional integral and b be a function in martingale Campanato spaces $\mathcal{L}^-_{1,\phi}$. We show the boundedness and compactness of the commutator $[b, I_\gamma]$ from martingale Orlicz space L_Φ to another martingale Orlicz space L_Ψ and from L_Φ to a martingale Triebel–Lizorkin space $F^\phi_{L_\Psi}$.

10 Yoichi Miyazaki (Nihon Univ.)
Gagliardo–Nirenberg inequality and Muramatu's integral formula · · · · 12

Summary: We give a proof of the Gagliardo–Nirenberg inequality (GN inequality) for Sobolev spaces using Muramatu's integral formula with the Hardy–Littlewood maximal function. GN inequality has two main forms which correspond to cases where the parameter appearing in GN inequality takes the end values. In both cases we can derive GN inequality in a few lines from Muramatu's integral formula if the integrability exponents are not 1. It is known that one of exceptional cases in GN inequality can be handled by BMO functions. We also consider such exceptional case.

11 Takeshi Iida (Fukushima Nat. Coll. of Tech.)
Orlicz-fractional maximal operators in Morrey and Orlicz–Morrey spaces · · · · · 15

Summary: In 1995, Perez introduced Bp-condition, which is necessary and sufficient condition for the boundedness of the Orlicz maximal operator on Lp spaces. After, necessary and sufficient condition of the Hardy–Littlewood–Sobolev type inequality for Orlicz-fractional maximal operator is derived by Cruz-Uribe and Moen in 2013. In this paper, we investigate the boundedness of Orlicz maximal operator, Orlicz-fractional maximal operator and fractional integral operator in Morrey and Orlicz–Morrey spaces on the assumption that each Young function satisfies these conditions, respectively. In particular, one of the main results is based on the Adams inequality in the framework of Morrey spaces.

12 Hiroki Saito (Nihon Univ.)
Boundedness of the strong maximal operator with the Hausdorff content · · · · · 15

Summary: Let n be the spatial dimension. For $d, 0 < d \leq n$, let H^d be the d-dimensional Hausdorff content. The purpose of this talk is to investigate the region (d, p) which guarantees the boundedness of the dyadic strong maximal operator on the Choquet space $L^p(H^d, \mathbb{R}^n)$.

13 Ryosuke Yamamoto (Shinshu Univ.)
Sparse form bounds for Fourier integral operators · · · · · 15

Summary: In this talk, we consider the sparse form bounds for Fourier integral operators associated with the symbol belonging to Hörmander class $S^m_{1,0}$. Furthermore, we study weighted L^p boundedness of Fourier integral operaors for Muckenhoupt weight class as an application of sparse form bounds.

14 Akihiro Nakamura (Tokai Univ.)
On complete and minimal complex exponential systems which are not bases in $L^2[-\pi, \pi]$ · · · · · 15

Summary: Young gave the example of the complete and minimal complex exponential system which is not a basis in $L^2[-\pi, \pi]$. Bases on this result, we give another examples of the complete and minimal complex exponential systems which are not bases in $L^2[-\pi, \pi]$.

16:20–17:20 Talk Invited by Real Analysis Section

Youhei Tsutsui (Shinshu Univ.)[b] A sparse bound for an time integral operator with wave propagator

Summary: We give a sparse bound for an integral operator with wave propagator by using a criterion due to Lerner and Nazarov. Our result is sharp with respect to the parameter. Since this operator dominates the maximal Riesz means, our result yields weighted bound for the maximal operator.

September 20th (Fri) Conference Room VIII

9:00–11:55

15 Masaaki Mizukami (Tokyo Univ. of Sci.) How far does small chemotactic interaction perturb the Lotka–Volterra competition dynamics on bounded convex domains? ····· 15

Summary: This work is concerned with the question that "how far does small chemotactic interaction perturb the Lotka–Volterra competition dynamics?". A two-species chemotaxis-competition system was studied by e.g., Bai–Winkler (2016) and Lin–Mu–Wang (2015). However, there are still many open problems about the two-species chemotaxis-competition system. On the other hand, the Lotka–Volterra competition system has been studied extensively. Thus the development of this work will enable us to see new properties of solutions for the chemotaxis system. The main result of this talk gives convergence of solutions for the two-species chemotaxis-competition system to those for the Lotka–Volterra competition system on bounded convex domains.

16 Shunsuke Kurima (Tokyo Univ. of Sci.) Employing a time discretization scheme for a simultaneous abstract evolution equation applying to parabolic-hyperbolic phase-field models ····· 15

Summary: This talk deals with a simultaneous abstract evolution equation. This includes a parabolic-hyperbolic phase field system as an example which has studied by e.g., Grasselli–Petzeltová–Schimperna (2006) and Wu–Grasselli–Zheng (2007). Although a time discretization of an abstract evolution equation has been studied by e.g., Colli–Favini (1996), time discretizations of simultaneous abstract evolution equations seem to be not studied yet. In this talk we focus on a time discretization of a simultaneous abstract evolution equation applying to parabolic-hyperbolic phase field systems. Moreover, we can establish an error estimate for the difference between continuous and discrete solutions.

17 Kosuke Kita (Waseda Univ.), Mitsuharu Ôtani (Waseda Univ.) On the uniform boundedness for global solutions of nonlinear heat equations with nonlinear boundary conditions in bounded domain ···· 15

Summary: We consider the uniform boundedness for global solutions of nonlinear heat equations with nonlinear boundary conditions. As for the Dirichlet boundary conditions, there are many studies on the uniform bounds for global solutions by Ôtani, Cazenave–Lions, Giga, Quittner and so on. However, it does not work these methods for the nonlinear boundary condition case due to the nonlinearity on the boundary. In this talk, we modify the abstract theory on the asymptotic behavior for global solutions by Ôtani (1981) and show that global solutions are bounded uniformly in time in appropriate norm.

18 Takanori Kuroda (Waseda Univ.), Mitsuharu Ôtani (Waseda Univ.) Periodic problem of the complex Ginzburg–Landau equation with focusing nonlinearity ····· 15

Summary: In this talk, we consider the time-periodic problem for the complex Ginzburg–Landau equation (CGL):

$$\frac{du}{dt}(t,x) - (\lambda + i\alpha)\Delta u - (\kappa + i\beta)|u|^{q-2}u - \gamma u = f(t,x),$$

where $\lambda, \kappa > 0$ and $\alpha, \beta, \gamma \in \mathbb{R}$ and $f : (0,T) \times \Omega \to \mathbb{C}$ denotes an external force with a given period $T > 0$. We identify $\mathbb{C}$ with $\mathbb{R}^2$ and formulate (CGL) as an evolution equation governed by subdifferential operators in product Lebesgue space $\mathbb{L}^2 := \mathrm{L}^2 \times \mathrm{L}^2$, which is a Hilbert space. We show the existence of time-periodic solutions of (CGL) in bounded domains with assuming suitable smallness of f and γ by modifying the argument developped in Ôtani (1984).

19 Keiichiro Kagawa (Waseda Univ.)
Mitsuharu Ôtani (Waseda Univ.)
Time periodic problem for the viscous Cahn–Hilliard equation with the homogeneous Dirichlet boundary condition ····· 10

Summary: We consider the time periodic problem for the viscous Cahn–Hilliard equation with the homogeneous Dirichlet boundary condition. There are no results on this problem, except the work by Liu–Liu–Tang (2013) for the special case of Cahn–Hilliard equation. In this talk, we show the existence of the time periodic solutions by using Schauder fixed point theorem.

20 Ryota Nakayashiki (Chiba Inst. of Tech.)
Kobayashi–Warren–Carter system of singular type with dynamic boundary condition ····· 10

Summary: In this talk, we consider a coupled system of the Kobayashi–Warren–Carter type, including the singular diffusion and dynamic boundary condition. The system is known as the mathematical model of grain boundary motion in a polycrystal, proposed by [Kobayashi et al., Physica D, 140 (2000), 141–150]. The objective of this study is to develop the mathematical theories which enable us to apply the mathematical observations for the grain boundary motion under various situations. Based on this, we set the goal to obtain the solvability of the system, including the representations of the solution.

21 Makoto Okumura (Osaka Univ.)
The existence and uniqueness for a structure-preserving scheme of the Cahn–Hilliard equation with a dynamic boundary condition ····· 15

Summary: We propose a structure-preserving scheme for the Cahn–Hilliard equation with a dynamic boundary condition by using the discrete variational derivative method (DVDM). In this method, how to discretize the energy which characterizes the equation, it is essential. Modifying the conventional manner and using another summation-by-parts formula, we can use the central difference operator as an approximation of an outward normal derivative on the discrete boundary condition of the proposed structure-preserving scheme. In this talk, we focus on the existence and uniqueness of the solution for the scheme.

22 Yutaka Tsuzuki (Hiroshima Shudo Univ.)
Solvability of problems for Vlasov–Poisson equations with angle error in magnetic field in a half-space ····· 15

Summary: We deal with initial-boundary problems for Vlasov–Poisson systems in a half-space. In 2013, Skubachevskii gives local-in-time solvability to the system. Moreover, in 2017, existence result with weaker condition were also obtained by effectively using the magnetic force whose direction is horizontal to the wall. This talk provides an existence result for the equation where the magnetic force has angle error in the vertical direction and depending on the first element of the spatial variable.

23 Noriaki Yamazaki (Kanagawa Univ.)
Nobuyuki Kenmochi (Chiba Univ.*)
Ken Shirakawa (Chiba Univ.)
Approximate problems for singular optimal control of nonlinear evolution equations governed by double time-dependent subdifferentials ····· 15

Summary: Recently, we established the abstract theory of singular optimal control problems for nonlinear evolution equations governed by double time-dependent subdifferentials. Note that the corresponding state system has multiple solutions, in general. The non-uniqueness situation of state problem makes the numerical approach to singular optimal control problems quite difficult. Therefore, in this talk, we establish an approximation procedure to singular optimal control problems from the viewpoint of numerical analysis.

24 Shobu Shiraki (Saitama Univ.)
Yosuke Aoki (Saitama Univ.)
Jonathan Bennett (Univ. of Birmingham)
Neal Bez (Saitama Univ.)
Shuji Machihara (Saitama Univ.)
Kosuke Matsuura (Saitama Univ.)
Hypercontractivity via diffusion flow monotonicity 15

Summary: One of the famous classical inequalities regarding the Ornstein–Uhlenbeck semigroup in quantum physics, Nelson's hypercontractivity inequality, has been studied from many different perspectives. We will give a new approach by identifying a quantity which is monotone under a certain diffusion flow. Our approach is effective in a substantially more general setting of Markov semigroups.

25 Kentarou Yoshii
Tomomi Yokota (Tokyo Univ. of Sci.)
On the semilinear abstract evolution equations with countable time delays under local Lipschitz condition 15

Summary: We consider the semilinear abstract evolution equations with countable time delays under local Lipschitz condition.

14:15–16:05

26 Yoshimasa Sasaki (Niigata Univ.)
Hiroki Ohwa (Niigata Univ.)
Stability of approximate solutions constructed by the wave-front tracking method 15

Summary: We consider the Cauchy problem for a single conservation law and prove that the approximate solutions constructed by the wave-front tracking methods are Cauchy sequence.

27 Hiroshi Watanabe (Oita Univ.)
Traveling wave solutions to one-dimensional initial value problems for scalar parabolic-hyperbolic conservation laws 15

Summary: We consider one-dimensional Cauchy problems (CP) for scalar parabolic-hyperbolic conservation laws. The equation is regarded as a linear combination of the hyperbolic conservation laws and the porous medium type equations. Thus, this equation has both properties of hyperbolic equations and those of parabolic equations. Accordingly, it is difficult to investigate the behavior of solutions to (CP). In this talk, we focus our attention on traveling wave solutions to (CP). More precisely, we construct concrete discontinuous traveling wave solutions and discuss the properties of its. Moreover, we show the qualitative properties for entropy solutions to (CP) using the modified traveling wave solutions.

28 Kota Kumazaki (Nagasaki Univ.)
Global solvability of a multiscale model describing moisture transport in porous materials 15

Summary: In the previous works, we proved the existence of a locally-in-time solution for a multiscale model which is given as a mathematical model describing moisture transport in porous materials. Our model consists of a diffusion equation of the relative humidity in a macro domain and the free boundary problems describing a wetting and drying process in infinite micro domains. In this talk, under the improvement of the diffusion equation of the relative humidity based on the experimental result, we discuss the global existence of a solution for our multiscale model.

29 Risei Kano (Kochi Univ.)
On the plasticity model with non-linear hardening 15

Summary: In this talk, we discuss the parabolic problem for the hardening phenomena. The unknown functions u and σ describe the displacement and stress, respectively in the one-dimensional interval. Our problem means the hardening problem that the materials are harden by plasticity. That is derived from the hardening model by Visintin (2006), and the perfect plasticity model by Duvaut–Lions (1976). In the perfect plasticity model, the function that is threshold value in the plastic deformation, is a constant. In this talk, we discuss the solvability for the above model with the threshold function depending upon time or unknown function, based on the idea of Duvaut–Lions (1976).

30 Takeshi Fukao (Kyoto Univ. of Edu.)
Pierluigi Colli (Pavia Univ.)
Hao Wu (Fudan Univ.)
On a transmission problem for equation and dynamic boundary condition of Cahn–Hilliard type 15

Summary: In this talk, we discuss the well-posedness of a transmission problem for equation and dynamic boundary condition of Cahn–Hilliard type. This problem is a sort of Cahn–Hilliard system with dynamic boundary condition, which is one of the current topics. Volume conservations in the bulk and on the boundary are the point of emphasis. For this transmission problem, the well-posedness is discussing under the prototype settings of double well potentials, recently. In this study we extend the result for wider setting of maximal monotone graphs. Based on the time-discretization and suitable approximate problem, we can find the approximate solution and discuss the convergence to the target problem.

31 Ken Shirakawa (Chiba Univ.)♭
Optimal control problem for one-dimensional semi-discrete system of Kobayashi–Warren–Carter type 15

Summary: In this talk, we consider a class of optimal control problems for state problems of one-dimensional semi-discrete systems. Each state problem is denoted by $(S)_\varepsilon$, with $\varepsilon > 0$, and is associated with the phase-field model of grain boundary motion, proposed by [Kobayashi et al.; Phys. D, 140 (2000), 141–150]. In this regard, each optimal control problem is denoted by $(OCP)_\varepsilon$, with $\varepsilon > 0$, and it is prescribed as a minimization problem of a cost. Additionally, the problems $(S)_\varepsilon$ and $(OCP)_\varepsilon$ are supposed to admit limiting profiles as $\varepsilon \downarrow 0$, and then, the limiting problems are supposed to contain no little singularityies In this talk, the main interest is in the case when $\varepsilon > 0$ (regular case), and the mathematical results concerned with the existence of the optimal control when $\varepsilon > 0$; (b) the necessary condition for the regular optimal control; (c) limiting observation as $\varepsilon \downarrow 0$; will be reported as the main theorems of this talk.

32 Makoto Nakamura (Yamagata Univ.)♭
On the Cauchy problem for the Navier–Stokes equations in the de Sitter spacetime 10

Summary: The Cauchy problem for the Navier–Stokes equations is considered in homogeneous and isotropic spaces. Local and small global solutions are constructed in the spaces, which extend the results by T. Kato. The effects of the spatial expansion and contraction are studied through the problem.

16:20–17:20 Talk Invited by Real Analysis Section

Makoto Nakamura (Yamagata Univ.)♭
Partial differential equations in homogeneous and isotropic spaces

Summary: Several partial differential equations are considered in homogeneous and isotropic spaces. The Cauchy problems for the equations are considered in Lebesgue spaces and Sobolev spaces. Dissipative and anti-dissipative effects from the spatial expansion and contraction on the problems are remarked.

Functional Analysis

September 17th (Tue) Conference Room IX

10:00–11:45

1 Hayato Arai (Nagoya Univ.)
Yuuya Yoshida (Nagoya Univ.)
Masahito Hayashi (Nagoya Univ.)
Perfect discrimination of separable states on a bipartite quantum system —From a viewpoint of general probabilistic theories— ····· 15

Summary: It is well-known in quantum theory that quantum states are perfectly distinguishable if and only if they are orthogonal. In this talk, we restrict available states to separable states and use a larger class of measurements. In this setting, we give a necessary and sufficient condition for two pure states $\rho_1^A \otimes \rho_1^B$ and $\rho_2^A \otimes \rho_2^B$ to be perfectly distinguishable. In particular, we find that there are two non-orthogonal states that are perfectly distinguishable in the above setting.

2 Noboru Chikami (Osaka Univ.)
Gagliardo–Nirenberg type inequalities in Fourier–Herz spaces ····· 15

Summary: A variant of the Gagliardo–Nirenberg inequality in Hat–Sobolev spaces is proved, which improves certain classes of classical Sobolev embeddings. Some continuation criterion for the incompressible Navier–Stokes system is established as an application. A direct proof of the fractional Gagliardo–Nirenberg inequality in end-point Besov and Fourier–Herz spaces is established.

3 Yoritaka Iwata (Kansai Univ.)
Takahiro Noi (Tokyo Metro. Univ.)
Abstract evolution equations of hyperbolic type in Besov spaces ····· 15

Summary: Abstract evolution equations are discussed in Besov spaces. By means of the logarithmic representation of infinitesimal generators [1], the solovability is extended to non-parabolic evolution equations.
[1] Y. Iwata, Methods Funct. Anal. Topology (2017) 1, 26–36.

4 Shuji Watanabe (Gunma Univ.)[b]
The second-order phase transition in the BCS-Bogoliubov model of superconductivity and its operator-theoretical proof III ····· 15

Summary: We show that the transition from a normal conducting state to a superconducting state is a second-order phase transition in the BCS-Bogoliubov model of superconductivity from the viewpoint of operator theory. Here we have no magnetic field. Moreover we obtain the exact and explicit expression for the gap in the specific heat at constant volume at the transition temperature.

5 Hisashi Morioka (Ehime Univ.)
Generalized eigenfunctions and scattering matrices for one-dimensional two-state quantum walks ····· 15

Summary: We consider the scattering theory for one-dimensional two-state quantum walks. The S-matrix appears in the Fourier transform of the scattering operator associated with the position-dependent QWs. Usually, the scattering operator is defined by the wave operator in a time-dependent manner. In this talk, we consider the spectral theory for QW in the time-independent argument. Moreover, we show that the S-matrix appears in the singularity expansion of the generalized eigenfunction in $\ell^\infty(\mathbf{Z}; \mathbf{C}^2)$.

6 Yohei Tanaka (Flinders Univ.)
Akito Suzuki (Shinshu Univ.)
The Witten index for a one-dimensional two-phase quantum walk ····· 15

Summary: It is recently shown by A. Suzuki (Shinshu University) that chirally symmetric discrete-time quantum walks possess supersymmetry, and that their associated Witten indices can be naturally defined. Such quantum walks are referred to as supersymmetric quantum walks (SUSYQWs). In this talk, we are going to consider a well-known one-dimensional two-phase model (split-step quantum walk) as a prototype example of a SUSYQW. A complete classification of the Witten index associated with this model will be given.
*This is joint work with A. Suzuki.

14:15–16:15

7 Naoya Yoshida (Ritsumeikan Univ.)[b] Bohr–Sommerfeld type quantization condition for the two dimensional Schrödinger operator with strong magnetic field ····· 15

Summary: We consider the spectrum of the two dimensional Schrödinger operator with homogeneous magnetic field. The non-perturbed operator has eigenvalues with infinite multiplicity called Landau levels. The perturbation, which decays at infinity, may create eigenvalues with finite multiplicity around each Landau level. In this talk, we give the Bohr–Sommerfeld type quantization condition for the two dimensional magnetic Schrödinger operator as the strength of the magnetic field tends to infinity.

8 Masahiro Kaminaga (Tohoku Gakuin Univ.)
Takuya Mine (Kyoto Inst. Tech.)
Fumihiko Nakano (Gakushuin Univ.)
Spectrum of the Schrödinger operator with point interactions of Poisson type ····· 15

Summary: We give a self-adjointness criterion of the Schrödinger operator with infinitely many point interactions, which is applicable in the case the support of the point interactions is the Poisson configuration. We also calculate the spectrum of the Schrödinger operator with point interactions of Poisson–Anderson type.

9 Kouichi Taira (Univ. of Tokyo) Spectral theory for repulsive Schrödinger operators and an application to limit circle problem ····· 15

Summary: In this session, we talk about existence of the outgoing/incoming resolvents of repulsive Schrödinger operators which may not be essentially self-adjoint on the Schwartz space. As a consequence, we construct L^2-eigenfunctions associated with complex eigenvalues by a standard technique of scattering theory. In particular, we give another proof of the classical result via microlocal analysis: The repulsive Schrödinger operators with large repulsive exponent are not essentially self-adjoint on the Schwartz space.

10 Hideki Inoue (Nagoya Univ.)
Naohiro Tsuzu (Nagoya Univ.)
Schrödinger wave operators on the discrete half-line ····· 15

Summary: In the last 10 years, explicit formulas for wave operators have been obtained for several continuous quantum scattering systems, namely Schrödinger operators on a Euclidean space. Such formulas enable us to give a topological interpretation to Levinson's theorem, which relates the scattering part to the number of bound states of the underlying system. In this talk we report new formulas for the wave operators associated with a discrete Schrödinger operators on the half-line.

11 Masaki Kawamoto (Tokyo Univ. of Sci.) Mourre theory for time-periodic magnetic fields ····· 15

Summary: We consider the quantum dynamics of a charged particle on the plane $\mathbf{R}^2$ in the presence of a time-periodic magnetic field $\mathbf{B}(t) = (0, 0, B(t))$ with $B(t+T) = B(t)$ which is always perpendicular to this plane. Then the charged particle has the following three states accordingly to the mass of the particle, charge of the particle and $B(t)$; (I). For any t, the particle is in some compact region (bound state). (II). The particle goes to a distance with velocity $O(t)$. (III) The particle goes to a distance with velocity $O(e^{|t|})$. In this talk, we focus on the case (III) and see that the Hamiltonian of case (III) is closely related to so called homogeneous repulsive Hamiltonian. By using this similarity, we prove the Mourre estimate for the case (III).

12 Noriaki Teranishi (Hokkaido Univ.)
Itaru Sasaki (Shinshu Univ.)
Akito Suzuki (Shinshu Univ.)
Daiju Funakawa (Hokkai-Gakuen Univ.)
Yasumichi Matsuzawa (Shinshu Univ.)
On the deficiency indices and the spectrum of time operators ····· 15

Summary: We determine the deficiency indices and the spectrum of a time operator of unitary operator. We show that, for a discrete-time quantum walk, the time operator can be self-adjoint if the time evolution operator has a non-zero winding number.

13 Fumio Hiroshima (Kyushu Univ.) Pointwise bounds on eigenvectors in quantum field theory ····· 15

Summary: In this talk we show pointwise bounds of eigenvectors in quantum field theory. Upper and lower bounds of eigenvectors are given by using Feynman–Kac formula.

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

Yoshihisa Miyanishi (Osaka Univ.)[♭] The spectral theory of the Neumann–Poincaré operator and its applications

Summary: The Neumann–Poincaré operator (abbreviated by NP) is a boundary integral operator naturally arising when solving classical boundary value problems using layer potentials. If the boundary of the domain, on which the NP operator is defined, is $C^{1,\alpha}$ smooth, then the NP operator is compact. Thus, the Fredholm integral equation, which appears when solving Dirichlet or Neumann problems, can be solved using the Fredholm index theory.

Regarding spectral properties of the NP operator, the spectrum consists of eigenvalues converging to 0 for $C^{1,\alpha}$ smooth boundaries. Our main purpose here is to deduce eigenvalue asymptotics of the NP operators in three dimensions. This formula is the so-called Weyl's law for eigenvalue problems of NP operators. Then we discuss relationships among the Weyl's law, the Euler characteristic and the Willmore energy on the boundary surface. Furthermore, we present the asymptotic behavior of positive and negative NP eigenvalues separately under the condition of infinite smoothness of the boundary in three dimensions.

As an application, we analyze the localized surface plasmon resonance via the spectral theory of the NP operator. This is a particular class of metamaterials that allow the presence of negative material parameters such as negative permittivity and permeability in electromagnetism, and negative density and refractive index in acoustics, etc. Brief observations of NP operators reveal the mathematical meaning of these phenomena.

September 18th (Wed) Conference Room IX

9:00–12:00

14 Cid Reyes-Bustos (Tokyo Tech)
Kazufumi Kimoto (Univ. of Ryukyus)
Masato Wakayama (Kyushu Univ.)
Spectral determinant and G-function of the asymmetric quantum Rabi model ····· 10

Summary: The quantum Rabi model (QRM), and its generalization, asymmetric quantum Rabi model (AQRM), are the simplest models used in quantum optics to describe the interaction of light and matter. Both models were shown to be integrable in 2011 by showing the existence of a G-function whose zeros correspond to a part of the spectrum of QRM. We show that the remaining eigenvalues, called exceptional correspond to removable singularities of the G-function for certain values of the parameters. In the general case, we define a complete G-function that captures the complete spectrum of QRM. Moreover, we show that this completed G-function is, up to an entire non-vanshing function, equal to the spectral determinant of the QRM, defined in terms of the zeta regularized product of its spectral zeta function.

15 Cid Reyes-Bustos (Tokyo Tech) Heat kernel and spectral zeta function of the quantum Rabi model
Masato Wakayama (Kyushu Univ.) 15

Summary: The quantum Rabi model (QRM) is one of simplest and most fundamental systems describing quantum light-matter interaction. In this talk we give a closed form of the heat kernel of the Hamiltonian of the QRM using the Trotter–Kato product formula. To the best knowledge of the authors, this is the first explicit derivation of the heat kernel for any non-trivial interacting quantum system. From the explicit expression of the heat kernel we also obtain a formula for the partition function of the QRM. As an application, we investigate basic properties of the spectral zeta function for the QRM via the Mellin transform of the partition function of the QRM.

16 Kazufumi Kimoto (Univ. of Ryukyus) Modularity appearing in the non-commutative harmonic oscillator ··· 15
Masato Wakayama (Kyushu Univ.)

Summary: We talk about the number theoretic properties of the special values of the spectral zeta functions of the non-commutative harmonic oscillators (NcHO), especially in relation to modular forms and elliptic curves from the viewpoint of Fuchsian differential equations, mainly on an observation on a relation between the generating functions of the Apery-like numbers arising from the special values of the spectral zeta function and the logarithmic Mahler measures for certain Laurent polynomials and the automorphic integrals used to describe the generating functions.

17 Atsumu Sasaki (Tokai Univ.) Visible actions on complex Heisenberg homogeneous spaces ····· 15

Summary: In this talk, we give a brief summary that any complex Heisenberg homogeneous space has a strongly visible action of some closed subgroup of the Heisenberg Lie group.

18 Masaki Hidaka The Schur polynomials in all nth primitive roots of unity ····· 15
Minoru Itoh (Kagoshima Univ.)

Summary: We show that the values of the Schur polynomials in all nth primitive roots of unity are 1, 0, or -1, if n has at most two distinct odd prime factors. This result can be regarded as a generalization of properties of the cyclotomic polynomial.

19 Ryo Tabata (Ariake Nat. Coll. of Tech.) Symmetric functions and immanant identities ····· 15

Summary: The immanant of a matrix is a generalization of both the determinant and the permanent in terms of the representations of the symmetric group. Since the discovery of the correspondence between the product of Schur functions and the minor expansion of immanants, it has played the important role in the representation theory and the invariant theory, etc.
In this talk, we consider some immanant identities corresponding to plethysm, another type of the product of Schur functions, which arises in the representations of the general linear group. Following Littlewood's approach, we review invariant matrices and the contribution of immanants to the plethysm. We give the immanant identities corresponding to the most simplest formula of the plethysm, and discuss more general cases.

20 Ryosuke Nakahama (Univ. of Tokyo) Weighted Bergman inner products on subspaces of bounded symmetric domains ····· 15

Summary: We realize the Hermitian symmetric space $U(p,q)/U(p)\times U(q)$ as a bounded symmetric domain $D_{p,q}\subset M(p,q;\mathbb{C})$, and consider the weighted Bergman space $\mathcal{H}_\lambda(D_{p,q})\subset\mathcal{O}(D_{p,q})$. In this talk we present a result on the computation of the inner product of a polynomial on the subspace $M(p',q';\mathbb{C})\oplus M(p'',q'';\mathbb{C})$ and an exponential function on $M(p,q;\mathbb{C})$. Also, as an application, we present a result on explicit construction of intertwining operators from representations of $U(p,p)$ to those of the subgroup $U(p',p'')\times U(p'',p')$.

21 Yoshiki Oshima (Osaka Univ.)♭ On the asymptotic support of Plancherel measures for homogeneous spaces 15

Summary: Let G be a real reductive group and X a homogeneous G-manifold. The Plancherel measure for X describes how $L^2(X)$ decomposes into irreducible unitary representations of G. We show that the support of Plancherel measure looks like asymptotically the moment map image of the cotangent bundle of X via correspondence between the unitary dual of G and the coadjoint orbits. In particular, we obtain a sufficient condition for the existence of discrete series. This is a joint work with Benjamin Harris.

22 Nobukazu Shimeno (Kwansei Gakuin Univ.)
Hiroshi Oda (Takushoku Univ.) Spherical transform for minuscule K-types (case of 1st order invariant differential operator) 15

Summary: Let G be a noncompact connected simple Lie group of finite center and K a maximal compact subgroup. For a certain class of K-type, associated elementary spherical functions can be expressed by Opdam's nonsymmetric hypergeometric function. As an application, we give an explicit inversion formula for the spherical transform.

23 Kyo Nishiyama (Aoyama Gakuin Univ.)
Lucas Fresse (Univ. Lorraine) A generalization of the Steinberg theory for type A 15

Summary: Let $G = GL_n$ be a general linear group. We generalize the Steinberg theory, which gives a geometric interpretation of Robinson–Schensted correspondence for permutations, to the case of partial permutations.

24 Kyo Nishiyama (Aoyama Gakuin Univ.)
Lucas Fresse (Univ. Lorraine) Exotic Robinson–Schensted correspondence for a symmetric pair of type A 15

Summary: Let $G = GL_{2n}$ be a general linear group and $K = GL_n \times GL_n$ a symmetric subgroup. Let P be a parabolic subgroup of G stabilizing n dimensional subspace of $\mathbb{C}^{2n}$ whose Levi part is isomorphic to K. We consider a double flag variety $X = K/B_k \times G/P$, where B_K denotes a Borel subgroup of K.
We study the conormal variety of the diagonal action of K in X and its moment map. It leads us to the study of combinatorial correspondence involving partial permutations and signed Young diagrams, which we call exotic Robinson–Schensted correspondence.

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

Yuichiro Tanaka (Univ. of Tokyo) Visible actions on complex spherical varieties and some applications

Summary: With the aim of uniform treatment of multiplicity-free representations of Lie groups, T. Kobayashi introduced the notion of visible actions on complex manifolds in the early 2000s. As an application of his propagation theorem of multiplicity-freeness property we can find that if a Lie group acts on a connected complex manifold strongly visibly then the space of holomorphic functions is multiplicity-free. I will show that the converse holds in an algebraic setting, namely, a complex spherical variety admits a strongly visible action of a compact real form.

This result and its proof have several applications. Huckleberry and Wurzbacher (1990) proved that for a connected compact Kähler manifold with a Kähler–Poisson action of a connected compact Lie group U the U-action is coisotropic if and only if it is an embedding of a complex spherical variety. Hence in this setting we can see that the coistropicity implies the visibility.

The proof of the visibility for spherical varieties has an application to harmonic analysis on Riemannian weakly symmetric spaces. By the same argument as the proof of the visibility in the affine homogeneous case we can show a KAK-decomposition for Gelfand pairs and from this we obtain an induction formula of spherical functions.

We also have an application to double coset decompositions. Again by the same argument we can show a Cartan decomposition for a real spherical reductive homogeneous space as conjectured by Kobayashi (1995). Further, we can describe generic double cosets with respect to pairs of absolutely spherical reductive subgroups under some conditions by using T. Matsuki's results on double coset decompositions for symmetric pairs (1995).

September 19th (Thu) Conference Room IX

9:00–11:45

25 Kengo Matsumoto (Joetsu Univ. of Edu.) Subshifts, λ-graph bisystems and their C^*-algebras ····· 15

Summary: We introduce a notion of λ-graph bisystem, that consists of a pair $(\mathfrak{L}^-, \mathfrak{L}^+)$ of two labeled Bratteli diagrams $\mathfrak{L}^-, \mathfrak{L}^+$, respectively, and satisfy certain compatibility condition of their labeling on edges. It yields a pair of C^*-algebra written $\mathcal{O}^+_{\mathfrak{L}^-}, \mathcal{O}^-_{\mathfrak{L}^+}$. If a λ-graph bisystem comes from a λ-graph system of a finite directed graph, then $\mathcal{O}^+_{\mathfrak{L}^-}$ is isomorphic to $\mathcal{O}_A$, whereas $\mathcal{O}^-_{\mathfrak{L}^+}$ is isomorphic to $C(\Lambda_A) \times_{\sigma_A^*} \mathbb{Z}$ of the two-sided topological Markov shift (Λ_A, σ_A).

26 Taro Sogabe (Kyoto Univ.)♭ The homotopy groups of the automorphism groups of Cuntz–Toeplitz algebras ····· 10

Summary: The Cuntz–Toeplitz algebra is a C*-algebra generated by isometries with mutually orthogonal ranges. We consider the automorphism group of the Cuntz–Toeplitz algebra and compute its homotopy groups. In this talk, we would like to introduce the above result and explain its relation between M. Dadarlat's work about Cuntz algebras.

27 Hiroyuki Osaka (Ritsumeikan Univ.)
Hyun Ho Lee (Ulsan Univ.) On dualities of actions and inclusions ····· 15

Summary: Following the results known in the case of a finite abelian group action on C*-algebras we prove the following two theorems;

(1) an inclusion $P \subset A$ of (Watatani) index-finite type has the Rokhlin property (is approximately representable) if and only if the dual inclusion is approximately representable (has the Rokhlin property).

(2) an inclusion $P \subset A$ of (Watatani) index-finite type has the tracial Rokhlin property (is tracially approximately representable) if and only if the dual inclusion is tracially approximately representable (has the tracial Rokhlin property).

28 Hiroshi Ando (Chiba Univ.) Polish groups of unitaries ····· 15
Yasumichi Matsuzawa (Shinshu Univ.)

Summary: We study structures of Polish groups which arise as closed subgroups of the unitary group on an infinite-dimensional Hilbert space.

29 Michiya Mori (Univ. of Tokyo) On 2-local isometries on normed spaces and C*-algebras ····· 15

Summary: I will explain that, if the closed unit ball of a normed space X has sufficiently many extreme points, then every mapping Φ from X into itself with the following property is affine: For any pair of points in X, there exists a (not necessarily linear) surjective isometry on X that coincides with Φ at the two points. We also consider properties of such a mapping in the setting of C*-algebras.

30 Yusuke Isono (Kyoto Univ.) Unitary conjugacy for type III subfactors and W*-superrigidity ····· 15

Summary: Let $A, B \subset M$ be inclusions of σ-finite von Neumann algebras such that A and B are images of faithful normal conditional expectations. In this article, we investigate Popa's intertwining condition $A \preceq_M B$ using their modular actions. In the main theorem, we prove that if $A \preceq_M B$ holds, then an intertwining element for $A \preceq_M B$ also intertwines some modular flows of A and B. As a result, we deduce a new characterization of $A \preceq_M B$ in terms of their continuous cores. Using this new characterization, we prove the first W*-superrigidity type result for group actions on amenable factors. As another application, we characterize stable strong solidity for free product factors in terms of their free product components.

31 Norio Nawata (Osaka Kyoiku Univ.) Rohlin actions of finite groups on the Razak–Jacelon algebra ····· 15

Summary: Let A be a simple separable nuclear C*-algebra with a unique tracial state and no unbounded traces, and let α be a strongly outer action of a finite group G on A. We show that $\alpha \otimes \mathrm{id}$ on $A \otimes \mathcal{W}$ has the Rohlin property.

32 Toshihiko Masuda (Kyushu Univ.) On the relative bicentralizer flows and the relative flow of weights of inclusions of factors of type III_1 ····· 15

Summary: We show the relative bicentralizer flow and the relative flow of weights are isomorphic for an inclusion of injective factors of type III_1 with finite index, or an irreducible discrete inclusion whose small algebra is an injective factor of type III_1.

33 Tsuyoshi Kajiwara (Okayama Univ.) Dimension groups of the C*-algebra associated with self-similar maps
Watatani Yasuo (Kyushu Univ.*) with branch points ····· 15

Summary: In this talk, we present a method to represent the dimension group of the core of the C*-algebra associated with self-similar maps using model traces. In particular, for the case of Sierpinski Gasket, the K_0 group of the core is isomorphic to $\mathbb{Z}^\infty$, and the canonical endomorphism on the K_0 group is isomorphic to a unilateral shift of multiplicity 3.

12:15–12:35 Presentation Ceremony for the 2019 MSJ Analysis Prize

14:15–16:00

34 Akiko Yazawa (Shinshu Univ.) The strong Lefschetz property for simple graphic matroids ····· 15
Takahiro Nagaoka (Kyoto Univ.)

Summary: Anari, Oveis Gharan, and Vinzant proved (complete) log-concavity of the basis generating functions for all matroids. In this talk, we show this strictness for simple graphic matroids, that is, we show that Kirchhoff polynomials of simple graphs are strictly log-concave. Our key observation is that the Kirchhoff polynomial of a complete graph can be seen as the (irreducible) relative invariant of a certain prehomogeneous vector space. Furthermore, we prove that an algebra associated to a graphic matroid satisfies the strong Lefschetz property at degree one.

35 Masatoshi Ito (Maebashi Inst. of Tech.) A new family of weighted operator means including the weighted Heron, logarithmic and Heinz means ····· 15

Summary: The weighted power and Heron means are well known as generalizations of the weighted arithmetic, geometric and harmonic ones, and also the logarithmic and Heinz means are known as kinds of non-weighted means. Recently, Pal, Singh, Moslehian and Aujla introduced the weighted logarithmic mean of two positive numbers or operators.
In this talk, we propose the notion of a transpose symmetric path of weighted $\mathfrak{M}$-means for a symmetric operator mean $\mathfrak{M}$, and we introduce a new family of operator means including the weighted logarithmic mean by Pal et al. This family also includes the weighted Heron mean, and newly produces the weighted Heinz mean.

36 Shigeru Furuichi (Nihon Univ.) On reverses of operator Aczél inequality ····· 15
Venus Kaleibary (Tabriz Univ.)

Summary: In this talk, we present some inequalities involving operator decreasing functions and operator means. These inequalities provide some reverses of operator Aczél inequality dealing with the weighted geometric mean.

37 Yuki Seo (Osaka Kyoiku Univ.) Estimates of operator power means due to Lawson–Lim–Pálfia ····· 15

Summary: In this talk, we discuss a difference counterpart to the information monotonicity and variants of Ando–Hiai type inequality for operator power means due to Lawson–Lim–Pálfia.

38 Toshikazu Abe (Ibaraki Univ.) Gyrogroups for means on $\mathbb{R}^+$ ····· 15

Summary: Some means can be expressed as algebraic midpoints. For example, the geometric mean can be expressed as the gyromidpoint of a gyrgroup. In this talk, we study gyrogroups for means.

39 Hiroshi Isa (Maebashi Inst. of Tech.) The n-th operator valued divergences ····· 15
Eizaburo Kamei
Hiroaki Tohyama
(Maebashi Inst. of Tech.)
Masayuki Watanabe
(Maebashi Inst. of Tech.)

Summary: Let A and B be strictly positive operators on a Hilbert space, $n \in \mathbb{N}$ and $x \in \mathbb{R}$. A path $A \natural_x B \equiv A^{\frac{1}{2}}(A^{\frac{-1}{2}}BA^{\frac{-1}{2}})^x A^{\frac{1}{2}}$ passing through A and B. We have defined the n-th relative operator entropy $S^{[n]}(A|B) \equiv \frac{1}{n!}A^{\frac{1}{2}}(\log A^{\frac{-1}{2}}BA^{\frac{-1}{2}})^n A^{\frac{1}{2}}$ and the n-th Tsallis relative operator entropy $T_x^{[1]}(A|B) \equiv \frac{A \natural_x B - A}{x}$ and $T_x^{[n]}(A|B) \equiv \frac{T_x^{[n-1]}(A|B) - S^{[n-1]}(A|B)}{x}$ for $n \geq 2$. We have also introduced the n-th Petz–Bregman divergence $D_{FK}^{[n]}(A|B) \equiv T_1^{[n]}(A|B) - S^{[n]}(A|B)$. In this talk, we regard the differences between the n-th relative operator entropies as n-th operator divergences and show relations between these n-th operator divergences and the n-th Petz–Bregman divergence.

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

Masatoshi Fujii (Osaka Kyoiku Univ.*) Some inequalities on operator geometric mean

Summary: Throughout this talk, an operator A means a bounded linear operator acting on a complex Hilbert space H. An operator A is positive, denoted by $A \geq 0$, if $(Ax, x) \geq 0$ for all $x \in H$. We denote $A > 0$ if A is positive and invertible. The α-geometric mean $\#_\alpha$ for $\alpha \in [0, 1]$ is defined by $A\#_\alpha B = A^{\frac{1}{2}}(A^{-\frac{1}{2}}BA^{-\frac{1}{2}})^\alpha A^{\frac{1}{2}}$ for $A > 0$ and $B \geq 0$.

The core of log-majorization theorem due to Ando–Hiai is that $A\#_\alpha B \leq 1$ implies $A^r\#_\alpha B^r \leq 1$ for $r \geq 1$. It holds for positive operators A, B on a Hilbert space, and is called the Ando–Hiai inequality (AH). A binary operation $\natural_\alpha$ is defined by the same formula as the α-geometric mean for $\alpha \notin [0, 1]$. Very recently (AH) is extended by Seo as follows: For $\alpha \in [-1, 0]$, $A\natural_\alpha B \leq 1$ for $A, B > 0$ implies $A^r\natural_\alpha B^r \leq 1$ for $r \in [0, 1]$.

In this talk, we present two variable extension of it. As an application, we pose operator inequalities of type of Furuta inequality and grand Furuta inequality. Moreover, related to them, we propose norm inequalities of Bebiano–Lemos–Providência type.

Statistics and Probability

September 17th (Tue) Conference Room I

9:30–11:50

1 Isamu Dôku (Saitama Univ.) An estimate on good historical paths of historical process ····· 15

Summary: When a Brownian motion is given as underlying process and a stable random measure is given as basis of continuous additive functional for locally admissible branching rate functional, then we can construct a superprocess with those data and the initial measure. We discuss the corresponding historical process and give an estimate on good paths of the historical superprocess.

2 Johannes Jaerisch (Shimane Univ.), Hiroki Sumi (Kyoto Univ.) Multifractal Formalism for generalised local dimension spectra of Gibbs measures on the real line ····· 15

Summary: We establish the multifractal formalism for the generalised local dimension spectrum of a Gibbs measure μ supported on the attractor Λ of a conformal iterated functions system on the real line. Namely, for $\alpha \in R$, we prove a formula for the Hausdorff dimension of the set of $x \in \Lambda$ for which the μ-measure of a ball of radius r_n centred at x obeys a power law ${r_n}^{\alpha}$, for a sequence $r_n \to 0$.

3 Kanji Inui (Kyoto Univ.) Non-autonomous iterated function systems and the fractals ····· 15

Summary: Recently, some researchers have started to study the limit sets (for short, fractals) generated by non-autonomous iterated function systems (for short, NAIFSs). However, the NAIFSs in such studies are genereted by the functions defined on some compact set, which deduces that the fractals are always uniformly bounded with respect to the base points. In this talk, we consider the NAIFSs genereted by the functions defined on a complete metric space and we construct the fractals (which are not uniformly bounded with respect to the base points in general) generated by the NAIFSs. In addition, we discuss some basic properties of the fractals.

4 Toru Sera (Kyoto Univ.), Kouji Yano (Kyoto Univ.) Multiray generalization of the arcsine laws for intermittent maps ····· 15

Summary: In this talk, we focus on interval maps with two or more indifferent fixed points, and present a strong distributional limit theorem for the joint-law of the occupation times for neighborhoods of indifferent fixed points. The scaling limit is a multidimensional version of Lamperti's generalized arcsine distribution, which is the joint-law of occupation times of a skew Bessel diffusion processes moving on multiray.

5 Takuya Murayama (Kyoto Univ.) Loewner chains and evolution families on parallel slit half-planes ····· 15

Summary: In this talk, we shall consider a generalization of the Loewner equation to parallel slit half-planes. This equation describes the evolution of conformal mappings and, these days, is paid much attention due to the great success of Schramm–Loewner evolution (SLE). SLE is now extended toward two directions: One direction is to consider multiple SLE paths simultaneously, and the other is to consider SLE on multiply connected domains. In view of the modern Loewner theory in complex analysis, we shall discuss a framework broad enough to include both the directions by establishing the Komatu–Loewner equation with measure-valued driving sources. One of our key tools is Brownian motion with darning (BMD).

6 Naoki Kubota (Nihon Univ.) Continuity for the asymptotic shape in the frog model with random initial configurations ····· 15

Summary: In this talk, we consider the so-called frog model with random initial configurations, which is described by the following evolution mechanism of simple random walks on the multidimensional cubic lattice: Some particles are randomly assigned to any site of the multidimensional cubic lattice. Initially, only particles at the origin are active and they independently perform simple random walks. The other particles are sleeping and do not move at first. When sleeping particles are hit by an active particle, they become active and start doing independent simple random walks. We observe how initial configurations affect the asymptotic shape of the set of all sites visited by active particles up to a certain time, and present the continuity for the asymptotic shape in the law of the initial configuration.

7 Yoshinori Kamijima (Hokkaido Univ.)
Satoshi Handa (Fujitsu Laboratories Ltd.)
Katsuhiro Kamakura (Hokkaido Univ.)
Akira Sakai (Hokkaido Univ.)
Finding optimal solutions by stochastic cellular automata ····· 15

Summary: Finding a ground state of a given Hamiltonian is an important. One of the potential methods is to use a Markov chain Monte Carlo (MCMC) to sample the Gibbs distribution whose highest peaks correspond to the ground states. In this talk, we use stochastic cellular automata (SCA) and see if it is possible to find a ground state faster than the Glauber dynamics. We show that, if the temperature is sufficiently high, it is possible for SCA to have more spin-flips per update in average than Glauber and, at the same time, to have an equilibrium distribution "close" to the Gibbs distribution. We also propose a new way to characterize how close a probability measure is to the target Gibbs.

8 Yuuki Ida (Ritsumeikan Univ.)
Jiro Akahori (Ritsumeikan Univ.)
Ju-Yi Yen (Univ. of Cincinnati)
PCOCs with fractional Brownian motion ····· 15

Summary: PCOC (pronounced as peacock) is an acronym for French words *Processus Croissant pour l'Ordre Convexe*, words for an integrable process which is increasing in the convex order. In this presentation, we prove that the time-average of exponential of a fractional Brownian motion is a PCOC.

14:15–15:10

9 Yuri Imamura (Kanazawa Univ.) Carr–Nadtochiy's weak reflection principle for Markov chains on $\mathbf{Z}^d$ ····· 15

Summary: The present paper establishes a discrete version of the result obtained by P. Carr and S. Nadtochiy for 1-dimensional diffusion processes. Our result is for Markov chains on multi-dimmensional lattice.

10 Jiro Akahori (Ritsumeikan Univ.)
Andrea Collevecchio (Monash Univ.)
Masato Takei (Yokohama Nat. Univ.)
Phase transitions for edge-reinforced random walks on the half-line ··· 15

Summary: We study the behavior of a class of edge-reinforced random walks on the half-line, with heterogeneous initial weights, where each edge weight can be updated only when the edge is traversed from left to right. We provide a description for different behaviors of this process and describe phase transitions that arise as trade-offs between the strength of the reinforcement and that of the initial weights. Our result aims to complete the ones given by Davis (1989, 1990), Takeshima (2000, 2001), and Vervoort (2000).

11 Kei Noba (Kyoto Univ.)
José-Luis Pérez (CIMAT)
Xiang Yu (PolyU)
On the bail-out dividend problem for spectrally negative Markov additive models · · · · · 15

Summary: We studied the bail-out optimal dividend problem with regime switching under the constraint that the cumulative dividend strategy is absolutely continuous. We confirm the optimality of the regime-modulated refraction-reflection strategy when the underlying risk model follows a general spectrally negative Markov additive process. To verify the conjecture of a barrier type optimal control, we first introduce and study an auxiliary problem with the final payoff at an exponential terminal time. Second, we transform the problem with regime-switching into an equivalent local optimization problem with a final payoff up to the first regime switching time. The refraction-reflection strategy with regime-modulated thresholds can be shown as optimal by using results in the first step and some fixed point arguments for auxiliary recursive iterations.

15:25–16:25 Talk Invited by Statistics and Probability Section

Kenkichi Tsunoda (Osaka Univ.) Scaling limits for exclusion processes

Summary: We discuss in this talk recent progress on scaling limits for exclusion processes. In particular, this talk shall focus on some sort of law of large numbers for the empirical measure of the particle system, which is often referred to as hydrodynamic limit. Corresponding fluctuations and large deviations are also discussed. The scaling limits for additive functionals and a tagged particle are also mentioned.

16:40–17:40 Talk Invited by Statistics and Probability Section

David Croydon (Kyoto Univ.) Scaling limits of random walks on random graphs in critical regimes

Summary: In describing properties of disordered media, physicists have long been interested in the behaviour of random walks on random graphs that arise in statistical mechanics, such as percolation clusters and various models of random trees. Random walks on random graphs are also of interest to computer scientists in studies of complex networks. In 'critical' regimes, many of the canonical models exhibit large-scale fractal behaviour, which mean it is often a challenge to describe their geometric properties, let alone the associated random walks. However, in recent years, the deep connections between electrical networks and stochastic processes have been advanced so that tackling some of the key examples of random walks on random graphs is now within reach. In this talk, I will introduce some recent work in this direction, and describe some prospects for future developments.

September 18th (Wed) Conference Room I

9:10–11:30

12 Toshiyuki Katsuda (Kwansei Gakuin Univ.)
Diffusion approximations for many-server queues with abandonment under the general scaling of abandonment distribution · · · · · 15

Summary: We consider the diffusion approximation of a G/Ph/n queue with customer abandonment in the Halfin–Whitt heavy-traffic regime and extend the conventional locally Lipschitz hazard-type scaling of abandonment distribution to a more general scaling under which not only the non-locally Lipschitz hazard-type case but also a wider range of abandonment distributions can be treated. For our objective, we first show the C-tightness of scaled customer-count processes and then prove that the stochastic equation satisfied by any limit process has the uniqueness in law of the solution by applying the Girsanov transformation to the localized equation.

13 Kazuhiro Yoshikawa (Hirosaki Univ.) Modified log-concavity for discrete distributions ····· 15

Summary: In this talk, we give a definition of unimodality to discrete distributions on the real line according to a modification of strong unimodality on the lattice. Then, we can also consider a definition of linear unimodal for discrete distributions, where one generalization of linear independence over the rationals plays an important role to linear combinations of discrete valued random variables.

14 Haruyoshi Tanaka (Wakayama Med. Univ.) Some properties of Perron complements of Ruelle operators ····· 15

Summary: In this talk we introduce the notion of Perron complements of Ruelle operators and investigate its some properties. This notion was first given to nonnegative matrices by Meyer in [Lin. Alg. Appl., 114, 69–94 (1989)]. We extend his notion to Perron complements of operators. The complements we give have properties similar to the original complements: a hereditary property and decomposition theorems of eigenvectors and of Gibbs measures. Our results are useful for applications in a system with holes.

15 Shigeyoshi Ogawa (Ritsumeikan Univ.) Numerical evaluation of the stochastic integral by an interpolation scheme ····· 10

Summary: The aim of the talk is twofold: first, we intend to present a simple but nontrivial example of the numerical integration whose precision level exceeds the limit $O(n^{-1})$, second we like to emphasize that this new scheme is constructed in the framework of the noncausal stochastic calculus introduced by the author in 1979.

16 Yuki Chino (NCTS) Asymptotic behaviour of random walk in cooling random environment ····· 15

Summary: One-dimensional Random Walk in Cooling Random Environment (RWCRE) is obtained by starting from one-dimensional Random Walk in Random Environment (RWRE) and resampling the environment along a sequence of deterministic times. In this talk, we focus on how the recurrence versus transience criterion known for RWRE changes for RWCRE and explore the fluctuations for RWCRE when RWRE is either recurrent or satisfies a classical central limit theorem. An "overarching" goal of this topic is to investigate how the behaviour of a random process with a rich correlation structure can be affected by re-settings.

17 Hiroshi Takahashi (Tokyo Gakugei Univ.)
Yozo Tamura (Keio Univ.) Brox's diffusion processes in disconnected self-similar fractal sets in $\mathbb{R}$ ····· 15

Summary: On disconnected self-similar fractal sets, random processes can be defined as limit of suitably scaled random walks. The scaled random walks lead to a super-diffusion, that is, the diffusion exponent is larger than one. In this talk, we consider Brox's diffusion processes on the sets, which move much slower than the random processes influenced by random environments which are independent from the random processes.

18 Kouhei Matsuura (Kyoto Univ.) Compactness of semigroups of explosive symmetric Markov processes ····· 15

Summary: In this talk, we study spectral properties of explosive symmetric Markov processes. Under a condition on its life time, we prove the L^1-semigroup of Markov processes become compact operators.

19 Masaki Wada (Fukushima Univ.) Asymptotic behavior of spectral functions ····· 15

Summary: Consider the Schrödinger form with a perturbation which consists of two measures. We establish the precise asymptotic behavior of the spectral function for the Schrödinger form. This result extends the preceding one by Nishimori which treated the differentiability of the spectral function.

20 Yuichi Shiozawa (Osaka Univ.)
Yasuhito Nshimori (Nat. Inst. of Tech., Anan Coll.)
Limiting distributions for the maximal displacement of branching Brownian motions 15

Summary: In this talk, we determine the long time behavior and the exact order of the tail probability for the maximal displacement of a branching Brownian motion in Euclidean space in terms of the principal eigenvalue of the associated Schrödinger type operator. We also prove the existence of the Yaglom type limit for the distribution of the population outside the forefront. To establish our results, we show a sharp and locally uniform growth order of the Feynman–Kac semigroup.

11:30–12:00 Research Section Assembly

13:10–14:15

21 Takaaki Toyoshima (Tokyo Tech)
Yumiharu Nakano (Tokyo Tech)
Heath–Jarrow–Morton–Musiela equation with boundary condition driven by Lévy Process 15

Summary: Heath–Jarrow–Morton model is the most general model of interest rate in mathematical finance. Musiela (1993) derived that this model reduces to a stochastic partial differential equations (SPDE). This SPDE is called by Heath–Jarrow–Morton–Musiela (HJMM) equation. In this talk, we consider the existence and uniqueness of the solution of HJMM equation driven by Lévy noise. Kusuoka (2000) showed the existence and uniqueness of weak solution of this equation under the boundary condition in the case of Wiener process. We extend this approach to Lévy Process.

22 Yushi Hamaguchi (Kyoto Univ.)
Flow of forward-backward stochastic differential equations 15

Summary: Motivated from time-inconsistent stochastic control problems, we introduce a new type of coupled forward-backward stochastic systems, namely, flows of forward-backward stochastic differential equations. They are systems consisting of a single forward stochastic differential equation (SDE) and a continuum of backward SDEs (BSDEs), which are defined on different time intervals and connected via an equilibrium condition. We formulate a notion of equilibrium solutions in a general framework and discuss the well-posedness of the equations.

23 Takuji Arai (Keio Univ.)
Ryoichi Suzuki (Keio Univ.)
A Clark–Ocone type formula via Itô calculus and its application to finance 15

Summary: An explicit martingale representation for random variables described as a functional of a Lévy process will be given. The Clark–Ocone theorem shows that integrands appeared in a martingale representation are given by conditional expectations of Malliavin derivatives. Our goal is to extend it to random variables which are not Malliavin differentiable. To this end, we make use of Itô's formula, instead of Malliavin calculus. As an application to mathematical finance, we shall give an explicit representation of locally risk-minimizing strategy of digital options for exponential Lévy models. Since the payoff of digital options is described by an indicator function, we also discuss the Malliavin differentiability of indicator functions with respect to Lévy processes.

24 Masayuki Kageyama (Nagoya City Univ./Tsinghua Univ.)
Bayesian Markov decision processes 15

Summary: In this presentation, we formulate the Bayesian Markov decision processes with disturbances. We introduce the Bayesian approach to investigate decision process with disturbances where the transition probability depends on some parameter.

September 19th (Thu) Conference Room I

9:00–12:00

25 Yuichi Goto (Waseda Univ.) Kolmogorov–Smirnov tests for Laplace spectral density kernels ····· 15
Marc Hallin (Univ. libre de Bruxelles)
Masanobu Taniguchi (Waseda Univ.)

Summary: The Laplace spectral density kernels are a new type of spectral density, which characterize the collection of all marginal bivariate distribution in a given stationary time series, in the absence of moment assumptions. In this talk, we consider a Kolmogorov–Smirnov (KS) test for Laplace spectral density kernels. This test, thus, is a goodness-of-fit test for the collection of all bivariate marginals of an observed series. First, we derive the asymptotic null distribution of the KS statistic which, however, is not distribution-free. We therefore propose a numerical method, combined with the estimation of a covariance kernel, for the computation of critical values. Finally, we show that our testing procedure is consistent.

26 Yujie Xue (Waseda Univ.) Modified LASSO estimators for high-dimensional linear quantile regression models with long-memory disturbances ····· 10

Summary: It is the fundamental task of statistics to find out internal relationship of diversity of scientific observations. Quantile regression offers the opportunity for a more complete view of the relationships among stochastic variables. In this talk, the asymptotic properties of modified LASSO estimators for linear quantile regression models are developed, when the disturbances are long-memory which implies the dependence on the disturbances before decays very slowly, and when the dimension of regressor p varies with respect to the observation length n. Especially, when p increases as n increases, it corresponds to a high-dimensional case.

27 Akitoshi Kimura (Waseda Univ.) The asymptotic properties of the correlation estimator between latent processes ····· 15

Summary: In this talk, we treat a model in which the finite variation part of a two-dimensional semimartingale is expressed by time-integration of latent processes. We propose a correlation estimator between the latent processes and show its consistency and asymptotic mixed normality. Moreover, we propose two types of estimators for asymptotic variance of the correlation estimator and show their consistency in a high frequency setting. Our model includes doubly stochastic Poisson processes whose intensity processes are correlated Itô processes.

28 Shogo H Nakakita (Osaka Univ.) Quasi-likelihood analysis for noisily observed diffusion processes ····· 15
Yusuke Kaino (Osaka Univ.)
Masayuki Uchida (Osaka Univ.)

Summary: We study the polynomial-type large deviation inequalities for quasi-likelihood functions for discretely and noisily observed diffusion processes by applying the results in Yoshida (2011, AISM). The inequalities lead to the mathematical validity of the adaptive Bayes-type estimators with the same asymptotic distributions as adaptive maximum-likelihood-type estimators in Nakakita and Uchida (2019, SJS). Furthermore, it is shown that both the adaptive maximum-likelihood-type estimators and the adaptive Bayes-type estimators have the convergence of moments. We also examine the behaviours of adaptive Bayes-type estimators in computational simulation, and check that their performance is indeed equivalent to that of the adaptive maximum-likelihood-type estimators.

29 Kou Fujimori (Waseda Univ.)
Sota Sakamoto (Waseda Univ.)
Yasutaka Shimizu (Waseda Univ.)
Generalized maximum composite likelihood estimator for determinantal point processes 15

Summary: The maximum composite likelihood estimator parametric models of determinantal point processes will be discussed. Since the joint intensities of these point processes are given by determinant of positive definite kernels, we have the explicit form of the joint intensities for every order. This fact enables us to consider the generalized maximum composite likelihood estimator for every order. In this talk, the two step generalized composite likelihood estimator will be introduced. Moreover, the moment convergence of the estimator will be proved for stationary case.

30 Koji Tsukuda (Univ. of Tokyo)
Error bounds for the normal approximation to the length of a Ewens partition 15

Summary: Let $K(=K_{n,\theta})$ be a positive integer-valued random variable whose distribution is given by $\mathrm{P}(K=x)=\bar{s}(n,x)\theta^x/(\theta)_n$ $(x=1,\dots,n)$, where θ is a positive number, n is a positive integer, $(\theta)_n=\theta(\theta+1)\cdots(\theta+n-1)$, and $\bar{s}(n,x)$ is the coefficient of θ^x in $(\theta)_n$ for $x=1,\dots,n$. This formula describes the distribution of the length of a Ewens partition. As n tends to infinity, K asymptotically follows a normal distribution. Moreover, as n and θ simultaneously tend to infinity, if $n^2/\theta\to\infty$, K also asymptotically follows a normal distribution. In this presentation, error bounds for the normal approximation are provided. The result shows that the decay rate of the error changes due to asymptotic regimes.

31 Yoshihide Kakizawa (Hokkaido Univ.)
Recursive asymmetric kernel density estimators 15

Summary: For the data supported on $[0,\infty)$ or $[0,1]$, asymmetric kernel density estimation has been well-studied in the recent literature. Such a density estimator is non-recursive, by construction. In this talk, we consider its recursive version and then discuss some desirable asymptotic properties under suitable conditions.

32 Yoshihiko Maesono (Chuo Univ.)
Masanori Shimizu
(Sumitomo Mitsui Banking Corp.)
Kernel type estimation of hazard function with covariates 10

Summary: In this talk, we discuss the nonparametric estimation of the hazard function when the data has covariates. After removing the effect of the covariates, we estimate the baseline hazard function, using kernel type estimators. We also obtain asymptotic mean squared error of the hazard function estimator.

33 Tomonari Sei (Univ. of Tokyo)
Existence and nonuniqueness of exponential-type distributions corresponding to copulas 15

Summary: The space of probability density functions on the Euclidean space is decomposed into orbits with respect to coordinate-wise transformations. By Sklar's theorem, each orbit has a unique copula density. In this research, we consider a problem of whether similar results hold for exponential-type distributions instead of copulas. It is shown that, under regularity conditions, the existence holds whereas the uniqueness fails.

34 Eiichiro Funo (Kanto Gakuin Univ.)
Decomposition of the Kullback–Leibler information based on statistical mathematics 10

Summary: Consider discrete multivariate probability models where some parameters from the first sample and those from the second sample are proportional. In two sample problems under the the null hypothesis where the samples are from the same population is tested against the hypothesis where the samples are from the different population. It is found that the total information is equal to the sum of the within information and the between information in some case, but not equal in several cases. To investigate this phenomenon, we found some interesting results. Relationships between the above problems and the Fisher Information are also discussed.

35 Ayaka Yagi (Tokyo Univ. of Sci.)
Takashi Seo (Tokyo Univ. of Sci.)
Yasunori Fujikoshi (Hiroshima Univ.*)
AIC for selecting degree in growth curve model with three-step monotone missing data pattern 15

Summary: We consider AIC for selecting the degree in a growth curve model when the data set has a three-step monotone missing pattern. Throughout this talk, we assume that the data are missing completely at random (MCAR). In this talk, we prove that the AIC is an exact unbiased estimator of the AIC-type risk function defined by the expected log-predictive likelihood when the maximum likelihood estimator of unknown mean parameter vector with known covariance matrix is used.

36 Hirofumi Wakaki (Hiroshima Univ.)
Laplace expansion of the distribution funciton of Bartlett–Nanda–Pillai test and its error bound 15

Summary: Bartlett–Nanda–Pillai test is one of the famous test for the linear hypothesis about the regression coefficients of the multivariate linear model. Under normality assumption, the null distribution function can be represented as an integral of a matrix beta function on some region. Using Laplace's approximation method for integrals, an asymptotic expansion formula of the null distribution function is derived under a large sample and high dimensional asymptotic framework. An error bound for the derived approximation formula is also derived.

14:15–14:55

37 Aki Ishii (Tokyo Univ. of Sci.)
Kazuyoshi Yata (Univ. of Tsukuba)
Makoto Aoshima (Univ. of Tsukuba)
High-dimensional two-sample test procedures under the uni strongly spiked eigenvalue model 15

Summary: In this talk, we consider a two-sample test for high-dimensional data. Aoshima and Yata (2018, Sinica) proposed two eigenvalue models for high-dimensional data. One is called strongly spiked eigenvalue (SSE) model and the other one is called non-SSE (NSSE) model. Ishii (2017, HMJ) considered uni-SSE (USSE) and gave a two-sample test procedure by using the noise-reduction method given by Yata and Aoshima (2012, JMVA). However, Ishii (2017, HMJ) assumed the equality of the first eigenspaces. In this talk, we give a new test procedure without assuming the condition. We also give numerical results of our new test procedure and data analysis by using microarray data sets.

38 Kazuyoshi Yata (Univ. of Tsukuba)
Makoto Aoshima (Univ. of Tsukuba)
Geometric consistency for high-dimensional mixture data 15

Summary: In this talk, we consider clustering based on principal component analysis (PCA) for high-dimensional mixture data. First, we derive a geometric representation of high-dimension, low-sample-size (HDLSS) data taken from a mixture model. With the help of the geometric representation, we give geometric consistency properties of sample principal component scores in the HDLSS context. We show that PCA can cluster HDLSS data under certain conditions in a surprisingly explicit way. Finally, we demonstrate the performance of the clustering by using gene expression data sets.

15:10–16:10 Talk Invited by Statistics and Probability Section

Xiaoling Dou (Waseda Univ.) Baker's distribution, Bernstein copula and B-spline copulas

Summary: A method that uses order statistics to construct multivariate distributions with fixed marginals is proposed by Baker (2008). We investigate the properties of Baker's bivariate distributions. The properties include the weak convergence to the Fréchet–Hoeffding upper bound, the product-moment convergence and the totally positivity of order 2. As Baker's distribution utilizes a representation of the Bernstein copula in terms of a finite mixture distribution, we propose expectation-maximization (EM) algorithms to estimate the Bernstein copula and give illustrative examples using real data sets and a 3-dimensional simulated data set. These studies show that the Bernstein copula is able to represent various distributions flexibly and that the proposed EM algorithms work well for such data.

Using B-spline functions, we construct a new class of copulas, B-spline copulas, that includes the Bernstein copulas as a special case. The range of correlation of the B-spline copulas is examined, and the Fréchet–Hoeffding upper bound is proved to be attained when the number of B-spline functions goes to infinity. As the B-spline functions are well-known to be an order-complete weak Tchebycheff system, we show that the property of total positivity of any order (TP_∞) follows for the maximum correlation case. These results extend the classical results for the Bernstein copulas. In addition, we derive in terms of the Stirling numbers of the second kind an explicit formula for the moments of the related B-spline functions on $[0, \infty)$.

16:25–17:25 Talk Invited by Statistics and Probability Section

Shintaro Hashimoto (Hiroshima Univ.) Bayesian inference based on general posterior distributions and their applications

Summary: Bayesian inference under model misspecification has been developed in recent years. In such cases, the usual Bayesian updating is meaningless, and one of the strategies is the use of the general posterior distributions based on the general Bayesian updating. In this talk, we give an overview of this framework, and talk about applications to robust statistics.

Applied Mathematics

September 17th (Tue) Conference Room VII

9:50–12:00

1 Tatsuya Tsurii (Osaka Univ. of Human Sci.)
Naoharu Ito (Nara Univ. of Edu.)
Toyoki Matsuyama (Nara Univ. of Edu.)
Periodicity of Grover walks on complete graphs with n vertices and with self-loop at each vertex 10

Summary: We investigate a periodicity of Grover walk on complete graphs with self-loop at each vertex. We study an evolution matrix which steps forward a state of probability amplitude vector by using algebraic method. Then we find a periodic behaviour that the probability amplitude vector at each vertex gets back to initial state after some steps. It is shown that its fundamental period is $2n$ for the walk which has n vertices.

2 Itsuki Watanabe (Waseda Univ.)
Difference of the deterministic and stochastic model for data-diffusion 15

Summary: We discuss the difference of two mathematical models of data-diffusion; the deterministic and stochastic models. The deterministic model is given by a reaction-diffusion partial differential equation, and the stochastic model is given by a multi-dimensional jump Markov process. In this talk, by scaling the state and fluidizing data-pieces, we show that the difference of two models converges to 0 in probability on bounded time intervals by a law of large numbers.

3 Aoi Honda (Kyushu Inst. of Tech.)
Tsuyoshi Okita (Kyushu Inst. of Tech.)
Parameter estimation using backpropagation for Möbius type inclusion-exclusion integral mathematical model 15

Summary: The Möbius type inclusion-exclusion integral is a representation of nonlinear integral with respect to nonadditive measures through the Möbius translation. We propose parameter estimation with backpropagation method of the Möbius type inclusion-exclusion integral mathematical model. Using this method, not only parameter determination but also data preprocessing can be performed automatically. We also attempt to interpret the sparse regularization of neural networks by representing this model as a discrete graph.

4 Noboru Nomura (Kochi Univ.)
Reducing truncation error in the evaluation of orthant probability of elliptical distributions 15

Summary: In this talk, we analyze truncation errors in the evaluation of orthant probabilities of elliptical distributions. The procedure analyzed consists of repeated integration. The truncation error proliferate if some issues are left. Methods to settle these issues were proposed. Probabilities up to four dimensional cases, which can be evaluated precisely by another procedure, were evaluated using the proposed methods and compared. The result showed that proposed methods aids to reduce truncation error.

5 Yasuyoshi Tsutsumi (Oshima Nat. Coll. of Maritime Tech.)
Kazuaki Nakane (Osaka Univ.)
On acquisition of 3-dimensional information from the projection images · · · · · 15

Summary: In the fields of engineering and medicine, three-dimensional tissue (structure) is needed to be analyzed. There are CT and MRI equipment to analyze three-dimensional tissue, but they are expensive and have limited spatial resolution. On the other hand, although optical projection images such as a microscope are relatively inexpensive and have high spatial resolution, it is very difficult to reconstruct three-dimensional structure from the obtained image. In this talk, we treat structure of silicon gel and chromatin in the cell nucleus as an example. Using the topological information from the projection image of them, we acquire and analyze the three-dimensional information required for practical use. If this method can be arranged mathematically, we will be able to discover many applications in the future.

6 Hiroshi Takeuchi (Chubu Univ.)
Persistence analysis of sampled maps and 2-dimensional persistent homology · · · · · 15

Summary: When we consider a deformation of point cloud data, the deformation can be formalized as a sampled map, which is a finite subset of an underlying continuous map. In this talk, we provide a new construction of persistent homology for sampled maps, which can capture the homology induced map of the underlying map. The key idea is block matrix form of persistence modules on commutative ladders, and the functoriality of (1:3, 1:3) submatrices ensures the well-definedness of the persistent homology. Moreover, the functoriality can be generalized for arbitrary length and arbitrary diagonal submatrices, and enables to analyze 2-dimensional persistent homology.

7 Masaji Watanabe (Okayama Univ.*)
Fusako Kawai (Okayama Univ.*)
Shuji Jimbo (Okayama Univ.)
Computational study on biodegradability of xenobiotic polymer · · · · · · 15

Summary: This study demonstrates mathematical techniques for biodegradation of xenobiotic polymers. A mathematical model in terms of the weight distribution of a polymer is described. Inverse problem for a time factor and a molecular factor of a degradation rate are illustrated. Once the inverse problems are numerically solved, an initial value problem leads to a simulation of the microbial depolymerization process.

8 Patrick van Meurs (Kanazawa Univ.)
Discrete-to-continuum limits of particles with an annihilation rule · · · · 15

Summary: In the recent trend of extending discrete-to-continuum limit passages for gradient flows of single-species particle systems with singular and nonlocal interactions to particles of opposite sign, any annihilation effect of particles with opposite sign has been side-stepped. We present the first rigorous discrete-to-continuum limit passage which includes annihilation. This result paves the way to applications such as vortices, charged particles, and dislocations.

14:15–16:40

9 Fuminori Sakaguchi (Univ. of Fukui)
A method for removeing extra solutions in an integer-type algorithm for solving higher-order linear ODEs with general algebraic coefficient functions · · · · · 15

Summary: A kind of generalization was proposed by the author for an integer-type algorithm for solving higher-order linear ODEs, which was proposed by the author and M. Hayashi several years ago, by means of algebraic extensions of the field of rational functions. By this generalization, for example, we can solve the higher-order linear ODEs whose coefficient functions are general algebraic functions, by means only of four arithmetical operations among integers. However, this generalization may cause extra solutions, because this generalization increases the orders of the ODEs. In this study, the author proposes a general method for removing these extra-solution components effectively from numerical results. Moreover, some successful numerical examples are given for the Schrodinger equations whose potential functions belong to the simple extension of the field of rational functions.

10 Hiroki Ishizaka (Ehime Univ.) Takuya Tsuchiya (Ehime Univ.) Error analysis of Crouzeix–Raviart finite element method without the shape regularity condition 15

Summary: We present an error analysis of piecewise linear nonconforming Crouzeix–Raviart finite element method (CR FEM) for the Poisson problem in 3dim without the shape regularity condition. First, we show that in this case, Crouzeix–Raviart finite element method is equivalent to the lowest order Raviart–Thomas finite element method (RT FEM). Next, using the Babuška–Aziz technique, we present error estimates of RT interpolation. Since RT FEM is confirming, a Céa type lemma is valid and error estimates of RT FEM are obtained from that of RT interpolation. Using the obtained equivalence of CR and RT FEMs, we finally present the targeted error estimates of CR FEM. We again emphasise that we do not impose the shape-regular condition for the mesh partition.

11 Yuki Chiba (Univ. of Tokyo) Discontinuous Galerkin methods for a generalized Robin boundary condition 15

Summary: For simulations of various problems, we need to consider complex boundary conditions. For example, boundary conditions involving a Laplace–Beltrami operator, such as a dynamic boundary condition and a generalized Robin condition play important roles for application to reduced-FSI model and Cahn–Hilliard equations. There are several works for error estimates of discontinuous Galerkin methods for a dynamic boundary condition and a generalized Robin condition. However, that study considers only a rectangle domain, so it is difficult to apply it to practical problems. In this study, we show the analysis and some numerical results of a discontinuous Galerkin method for Poisson equations with a generalized Robin boundary condition in a smooth domain.

12 Toru Nakanishi (Univ. of Tokyo) Norikazu Saito (Univ. of Tokyo) New finite element schemes of mass-lumping type for computing spherically symmetric solutions of N-dimensional semilinear heat equations 15

Summary: This paper proposes new finite element schemes of mass-lumping type for computing spherically symmetric solutions of multi-dimensional semilinear heat equations. We prove the positivity conservation property and error estimates. In particular, we are able to remove some obstructions in the standard finite element schemes. Moreover, the convergence of blow-up time is established.

13 Xuefeng Liu (Niigata Univ.) Pointwise error estimation for finite element solution to boundary value problems 15

Summary: In an early paper (Contribution to the theory of upper and lower bounds in boundary value problems, J. Phys. Soc. Jpn., 1955, 10:1–8), based on the hypercircle-like method, H. Fujita proposed a novel method to provide pointwise error estimation for the boundary value problems. This paper is published in the dawning era of the finite element method (FEM), but it seems that the idea therein has never been applied to the error estimation for FEM. In this talk, we show the possibility to apply Fujita's method to develop pointwise error estimation for FEM solutions to boundary value problems.

14 Hajime Koba (Osaka Univ.) Kazuki Sato (Osaka Univ.) Truncation error analysis of approximate operators for a moving particle semi-implicit method 15

Summary: We consider several approximate operators used in a particle method based on a Voronoi diagram. Under some assumptions on a weight function, we derive truncation error estimates for our approximate gradient and Laplace operators. Our results show that our approximate gradient and Laplace operators tend to the usual gradient and Laplace operators when the ratio (the radius of the interaction area/the radius of a Voronoi cell) is sufficiently large.

15 Takehiko Kinoshita (Kyushu Univ.)
Yoshitaka Watanabe (Kyushu Univ.)
Nobito Yamamoto (Univ. of Electro-Comm.)
Mitsuhiro T. Nakao (Waseda Univ.)
On the optimal constants for second order error estimates of orthogonal polynomial approximation for H_0^1 functions 15

Summary: We present the method of interval inclusion of optimal constants for second order error estimates of H_0^1 function to its finite degree polynomial approximation.

16 Koya Sakakibara (Kyoto Univ.)
Mathematical analysis of the method of fundamental solutions applied to Helmholtz-type equations 15

Summary: The method of fundamental solutions (MFS) is a mesh-free numerical solver for solving homogeneous linear partial differential equations, and it has been applied to solve Laplace equation, Helmholtz equation, modified Helmholtz equation, and so on. In this talk, we establish mathematical results on unique existence and exponential decay of approximation error of the MFS for Helmholtz-type equation.

17 Tomoya Kemmochi (Nagoya Univ.)
SAV approach for Hamiltonian systems 15

Summary: The scalar auxiliary variable (SAV) approach is a numerical method to solve gradient flows, which ensures some kind of stability by introducing a scalar auxiliary variable. This method is linear and unconditionally stable. In this study, we consider extending the SAV approach to Hamiltonian systems and propose a numerical scheme that is linear and energy conservative in a sense.

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

Ken'ichiro Tanaka (Univ. of Tokyo)
Estimate of the best approximation of analytic functions and construction of approximation formulas for them by mathematical optimization

Summary: This talk is concerned with approximation theory of analytic functions with prescribed decay on a strip region including the real axis. Such functions appear when we use numerical methods with variable transformations. Typical examples of such methods are provided by double-exponential (DE) sinc formulas for function approximation and DE formulas for numerical integration. They are based on variable transformations yielding double-exponential decay of functions on the real axis, which improves the accuracy of the approximation of functions or their integrals. It has been known that the formulas are nearly optimal on Hardy spaces with a double-exponential weight on the strip region, which are regarded as spaces of transformed functions by the variable transformations. However, optimal formulas have not been known explicitly so far. Then, we consider approximation theory of analytic functions in weighted Hardy spaces for a general weight on the strip region. More precisely, our objectives are (i) precise estimate of the best approximation of functions and their integrals in the space and (ii) finding general procedure to construct accurate approximation formulas based on the estimate. In particular, the first objective includes estimating an analogue of the linear n-width of the unit ball in the weighted Hardy space. We show some results about the first objective. Furthermore, with a view to the second objective, we have recently proposed a simple method for obtaining sampling points for approximating functions and numerical integration. This method is based on a convex minimization problem of a discrete energy. By solving the problem with a standard optimization technique, we obtain sampling points that realize accurate formulas for approximating functions and numerical integration. We also provide theoretical convergence analyses of the formulas via a duality theorem of the continuous counterpart of the minimization problem.

September 18th (Wed) Conference Room VII

9:15–11:45

18 George Miyake (Ube Nat. Coll. of Tech.)
Yuji Katsuta (Ube Nat. Coll. of Tech.)
Integration of three analytic methods, namely, analysis of periodic solutions in non-autonomous system, equilibrium points in autonomous system, and periodic solutions in autonomous system ····· 10

Summary: The contents of three analytic methods, namely, analysis of periodic solutions in non-autonomous system, equilibrium points in autonomous system, and periodic solutions in autonomous system, are virtually identical. These individual method have been intended utilizing a new perspective algorithm for individual analytic method. Three individual programs are forming an unified program. The unified program has been made improving easy to grasp source code and to modify source code.

19 Yukihiko Nakata (Shimane Univ.)
Periodic solutions of distributed delay differential equations ····· 15

Summary: We present a class of distributed delay differential equations that has periodic solutions of period 2, where the maximum delay of the equation is 1. The existence of the periodic solutions is proven, following the idea by Kaplan and Yorke (1974): an ansatz deduces a second order ordinary differential equation. We show that, for some special equations, there exist periodic solutions that can be expressed in terms of the Jacobi elliptic functions explicitly.

20 Tetsuya Ishiwata (Shibaura Inst. of Tech.)
Emiko Ishiwata (Tokyo Univ. of Sci.)
Yukihiko Nakata (Shimane Univ.)
Blow-up of solutions to distributed delay differential equations ····· 15

Summary: We consider blow-up problem for delay differential equations with distributed delay. We discuss several types of distribution of the delay and show blow-up of solutions for the target problems.

21 Koichi Anada (Waseda Univ. Senior High School)
Tetsuya Ishiwata (Shibaura Inst. of Tech.)
Takeo Ushijima (Tokyo Univ. of Sci.)
A remark on asymptotic behavior of blow-up solutions to a quasi-linear parabolic equation for a curve shortening problem ····· 15

Summary: In this talk, we consider asymptotic behavior of blow-up solutions to a quasi-linear parabolic equation $v_t = v^\delta(v_{\theta\theta} + v)$ for a curve shortening problem. It is known that solutions blow up regionally. Our purpose is to investigate a relation between behavior of solutions at the maximum point and ones on the boundary of the blow-up set.

22 Makoto Nakamura (Yamagata Univ.)
On the Cauchy problem for a semilinear ordinary differential equation in homogeneous and isotropic spaces ····· 10

Summary: The Cauchy problem for a semilinear second order differential equation is considered. The effects of the spatial expansion and contraction are studied through the problem.

23 Makoto Nakamura (Yamagata Univ.)
On global solutions for the semilinear complex Ginzburg–Landau type equation in homogeneous and isotropic spaces ····· 10

Summary: Global solutions for the semilinear complex Ginzburg–Landau type equation are considered in homogeneous and isotropic spaces. The Asymptotic behaviors of the solutions are also considered.

24 Kei Nishi (Kyoto Sangyo Univ.)
Yasumasa Nishiura (Tohoku Univ.)
Takashi Teramoto
(Asahikawa Med. Univ.)
The dynamics of a 2-pulse solution arising in a bistable three-component reaction-diffusion system. · · · · · 15

Summary: In this talk, we consider the dynamics of a 2-pulse solution arising in a bistable three-component reaction-diffusion system, for which two stable pulse solutions are glued together and bounded in a finite region. First, we numerically investigate the PDE system to explore the dynamics of the 2-pulse solution, and then clarify their mechanism, especially the bifurcation structure behind them, by means of seven-dimensional ODEs which describe the interface motions of the 2-pulse solution.

25 Harunori Monobe (Okayama Univ.)
Tetsuya Ishiwata
(Shibaura Inst. of Tech.)
Behavior of solutions to an interface equation with exponential nonlinearity · · · · · 10

Summary: In this talk, we treat an interface equation related to some mathematical models of material science. In particular, we show the existence of traveling wave solutions of it, that is, planer wave solution, V-shaped traveling wave solution, inverse U-shaped traveling wave solution. Moreover, it is shown that the solution to the interface equation with prescribed contact angle eventually converges to a portion of one of such three traveling waves.

26 Isamu Ohnishi (Hiroshima Univ.)
The application to heterocist cell differenciation of a terrestrial cyanobacteria of Nostochineae of microscopically fine structure theorem of the most stable stationary state in Turing patterns · · · · · 15

Summary: Report that the simple but robust mathematical principle of so-called “Turing instability” is important also here as a design manner, which can be a useful principle to understand a part of the rationality of a kind of life creature’s activities in post-transcrition-translation process since Professor Alan Turing wrote his very famous paper. Terrestrial cyanobacteria of Nostochineae, while unicellular, makes a group of population, adapts to the environment and makes various efforts to survive. For example, when performing Biological Nitrogen Fixation (BNF), some of them will make differentiation into “heterocysts” cells, if nitrogen compounds feel poor in themselves. These are cells specialized for the above BNF, wherein cyanobacteria protects nitrogenase, which is an enzyme protein of the above reaction, from oxygen. They make BNF in those cells, as pattern formation is accompanied. We have a fundamental interest of its mathematical mechanism.

27 Kota Ikeda (Meiji Univ.)
Delphine Salort (Sorbonne Univ.)
Pierre Roux
(Sorbonne Univ. / Univ. Paris-Sud)
A periodic motion of a spatially nonconstant solution in the Fokker–Planck equation for the LIF model · · · · · 15

Summary: The Leaky Integrate and Fire (LIF) model is widely used to describe the dynamics of neural networks. We can derive the Fokker–Planck equation from the LIF model after a diffusive approximation of the mean-field limit of a stochastic differential equation system. In this talk, we show that the Fokker–Planck equation generates a spatially nonconstant solution with a time-periodical motion induced by a delay in the effect of the total activity on the neurons.

13:10–14:10 Talk Invited by Applied Mathematics Section

Hiroshi Matsuzawa (Numazu Nat. Coll. of Tech.) — Spreading profile of solutions for a free boundary problem of a reaction diffusion equation with a multi-stable nonlinearity

Summary: In this talk, I will treat propagation phenomena in a free boundary problem of reaction diffusion equation of the form : $u_t = u_{xx} + f(u)$ $(t > 0,\ 0 < x < h(t))$ where $h(t)$ is the unknown moving boundary (free boundary) which is determined by the Stefan condition of the form $h'(t) = -\mu u_x(t, h(t))$. In the work of Du and Lin (2010), this type of problem was introduced as a model which describes the spreading of new or invasive species. From this work, propagating phenomena in the free boundary problems attract more and more attention of mathematicians. Among the various studies on the free boundary problems, recent work of Du, Matsuzawa and Zhou (2014) showed that the profile of any spreading solution (which corresponds to the success of invasion) approaches a traveling wave solution associated with the free boundary problem, which was introduced by Du and Lou (2015) and is called *semi-wave*.

In this talk, I will give some recent study on propagation profiles of solutions for the free boundary problem of reaction-diffusion equation with some class of multi-stable nonlinearity. In particular, under certain condition, the profile of the spreading solution approaches a so-called *propagating terrace*. I will also present a result about radially symmetric solutions in high space dimensions.

This talk is based on some joint works with Dr. Yuki Kaneko (Japan Women's University) and Professor Yoshio Yamada (Waseda University).

September 19th (Thu) Conference Room VII

9:15–11:55

28 Sho Fujimura (Fukuoka Univ.), Shuji SHIRAISHI (Fukuoka Univ.) — On a new method of finding an Euler tour in a graph with an even number of edges 10

Summary: Let G be an eulerian. Then each 2-chain cover in G generates distinct Euler tours in G.

29 Masato Kobayashi (Kanagawa Univ.) — When does a strict inequality of Kazhdan–Lusztig polynomials hold? 15

Summary: This talk is on my result in 2013 about when a strict inequality of Kazhdan–Lusztig polynomials such as $P_{uw}(1) > P_{vw}(1)$ hold in a crystallographic Coxeter system W. I will show how to prove it with Deodhar inequality and certain positivity of R-polynomials at $q = 1$.

30 Masato Kobayashi (Kanagawa Univ.) — Weighted counting of inversions on alternating sign matrices 15

Summary: I will present my two formulas on the bigrassmannian statistic, certain enumeration of bigrassmannian permutations, as interactions of matrix, lattice, and Coxeter group theories. The first is over the set of permutations under Bruhat order while the second is over alternating sign matrices as a natural generalization of the first. We can interpret both formulas as weighted counting of the classical inversion statistic.

31 Hiromichi Ohno (Shinshu Univ.) — Parameterization of translation-invariant two-dimensional two-state quantum walks 15

Summary: This study investigates the unitary equivalence classes of translation-invariant two-dimensional two-state quantum walks. We show that unitary equivalence classes of such quantum walks are essentially parameterized by two real parameters.

32 Yusuke Ide (Kanazawa Inst. of Tech.) Analysis of continuous time quantum walk search by using a graph partition and spectral decomposition 15

Summary: We consider a quantum search problem on graphs using a type of continuous time quantum walk. In this talk, we show a scheme to determine the effectiveness of the search on given graphs. The scheme consists of equitable partition of given graphs and the framework of perfect state transfer problem. By combining the two methods and spectral decomposition technique, we give a condition to determine the effectiveness of the search.

33 Sho Kubota (Tohoku Univ.)
Etsuo Segawa (Yokohama Nat. Univ.)
Tetsuji Taniguchi (Hiroshima Inst. of Tech.)
Yusuke Yoshie (Sendai Nat. Coll. of Tech.)
A quantum walk on edge signed graphs 15

Summary: A quantum walk has been studied as a quantum analogue of a classical random walk. One of the most effective applications of quantum walks is searching probrem. It is known that quantum walks can propose more efficient system to find a target in a graph than that given by classical random walks. In this talk, we present a quantum walk on edge signed graphs in which every edge is declared positive or negative. In addition, we describe qunatum searching model which efficiently find a negatively signed edge on an edge signed complete graph.

34 Sho Kubota (Tohoku Univ.)
Etsuo Segawa (Yokohama Nat. Univ.)
Tetsuji Taniguchi (Hiroshima Inst. of Tech.)
Quantum walks defined by digraphs and generalized Hermitian adjacency matrices 15

Summary: We propose a quantum walk defined by digraphs (mixed graphs). This is essentially a special case of twisted Szegedy walks, and is equipped with a 1-form function defined by digraphs. The discriminant of this quantum walk is a matrix that is a certain normalization of generalized Hermitian adjacency matrices. Furthermore, we give definitions of the positive and negative supports of the transfer matrix, and clarify explicit formulas of their supports of the square. In addition, we give a consideration by computer on the identification of digraphs by their eigenvalues.

35 Ryota Hanaoka (Yokohama Nat. Univ.)
Takashi Komatsu (Kanagawa Univ.)
Norio Konno (Yokohama Nat. Univ.)
Stationary measures for quantum walks determined by singular continuous measures 10

Summary: We consider stationary measures of quantum walks on a half line determined by singular continuous measures, in particular, the Riesz and Cantor measures, respectively. Our approach is based on mainly transfer matrix method.

36 Takashi Komatsu (Kanagawa Univ.)
Takako Endo (Yokohama Nat. Univ.)
Norio Konno (Yokohama Nat. Univ.)
Distributions of eigenvalues for space-inhomogeneous quantum walks 10

Summary: It is well known that the spectrum of the Hadamard walk in one dimension is just continuous one. In this talk, we discuss the existence of point spectrum for the Hadamard walk with defects.

37 Kei Saito (Yokohama Nat. Univ.)
Akito Suzuki (Shinshu Univ.)
Narimatsu Akihiro (Yokohama Nat. Univ.)
Fuda Toru (Kokushikan Univ.)
The birth eigenspace and long time behavior of the quantum walk on cycles 10

Summary: Quantum walks were proposed as quantum mechanical counterparts of random walks and expected to realize topological phenomena. Here we consider position depending split-step quantum walks on cycles defined as a finite version of Kitagawa's model, which include two-phase quantum walks given by Balu et al. In this talk, we show the necessary and sufficient condition that the birth eigenspace is nontrivial. Moreover, we investigate an evaluation of the long-time behavior of the two-phase quantum walk by using a spectral mapping theorem.

38 Akihiro Narimatsu (Yokohama Nat. Univ.)
Kei Saito (Yokohama Nat. Univ.)
Akito Suzuki (Shinshu Univ.)
Toru Fuda (Kokushikan Univ.)
The spectrum of the one-defected quantum walk on the multi-dimensional lattice 15

Summary: Quantum walks have been intensively studied as quantum versions of classical random walks. The time evolution of the quantum walk is defined by a unitary operator, which is expressed as a product of coin and shift operators. In this study, we analyze a one-defected quantum walk on the multi-dimensional lattice by using the quantum walk version of spectral mapping theorem. We get some different results from the previous study by Fuda et al.

14:15–17:45 Special Session "Games and Mathematics"

Naoki Matsumoto (Keio Univ.)
Combinatorial games on graphs 45

Summary: A combinatorial game is a two-player game with perfect information (i.e., no hidden information), no chance moves (i.e., no probabilistic matter) and outcome restricted to (lose, win) and (draw, draw) for the two players who move alternately. Combinatorial games include well-known games such as Chess, Checkers, Go, and also include an elementary puzzles and games (enjoyed by children) such as Sudoku, tic-tac-toe and Geography. So far, a lot of combinatorial games are introduced and analyzed, and then lots of them are also considered on graphs as one of generalizations of those games. On the other hand, many mathematicians created combinatorial games on graphs which are deeply related to typical graph invariants. Thus, in this talk, we first briefly classify combinatorial games on graphs and introduce typical combinatorial games on graphs. Moreover, we also provide open problems on those games.

Ryuhei Uehara (JAIST) Games, puzzles, and complexity · 60

Summary: A computation consists of algorithm, which is a sequence of basic operations. When you consider an algorithm, you assume some computation model that has "usual" arithmetic operations. On the other hand, when you enjoy a puzzle, you have to find an algorithm by combining reasonable basic operations to its goal. From the viewpoint of theoretical computer science, puzzles give us some insight to computation and computational complexity classes in various way.
Some puzzles and games give reasonable characterizations to computational complexity classes. For example, "pebble game" is a classic model that gives some complexity classes in a natural way, and "constraint logic" is recent model that succeeds to solve a long standing open problem due to Martin Gardner that asks the computational complexity of sliding block puzzles. Such puzzles gives us "typical" and characterization and "intuitive" understanding for some computational complexity classes.
On the other hand, there are some puzzles and games that give nontrivial interesting aspects of computational complexity classes. For example, let us consider "14-15 puzzle" which is classic well known sliding puzzle. By parity, we can determine if one arrangement can be slid to the other in linear time. Moreover, we can always find a way for sliding between them in quadratic time. However, interestingly, finding the optimal solution is NP-complete in general. Through such classic puzzles, the reconfiguration problems are recently well investigated as a new framework of characterization of computational complexity classes. I give some recent results for these games and puzzles on graphs from the viewpoint of theoretical computer science.

Hiro Ito (Univ. of Electro-Comm.) Generalized janken —Useless signs, measure of amusement, ties between different signs, etc.— · 60

Summary: We present research on generalized janken. Janken is a very simple and well-known game in Japan. It is originated in China, and many variants are seen throughout the world. A variant of janken can be represented by an asymmetric digraph, where a vertex corresponds to a sign and an arc (x, y) indicates that sign x defeats sign y. However, not all asymmetric digraphs define useful janken variants, i.e., some janken variants may include a useless sign, which is strictly inferior to another sign in any case. We show research on janken variants in terms of useless signs, a measure of amusement, and ties between different signs.

September 20th (Fri) Conference Room VII

9:15–11:55

39 Hirotaka Ebisui (Geomathes Res. Center) Calcuration of TTTTTTwin and some data on prime · · · · · · · · · · · · · · · 15

Summary: On Prime Number, we propose New Twin Prime Number Concept and have gotten some numbers named as TTTTTTwins prime number sets. That is defined as 6Twin prime numbers. These TTTTTT mean no prime between T and T. (NOT TTpTTTT or NOT TTTTpTT etc.) and 6 continued Twins. One of these sets of prime is [[10099096127, 10099096129], [10099096169, 10099096171], [10099096307, 10099096309], [10099096349, 10099096351], [10099096361, 10099096363], [10099096367, 10099096369]] by Maple PG. We have 4sets of TTTTTTwins now. And more, we present Some New Prime Number sets which are calucurated by Maple PG.

40 Ginji Hamano (Tokyo Denki Univ.) Existence of a regular unimodular triangulation of the edge polytopes of finite graphs —Improvement of the criteria— 15

Summary: Let G be a finite connected simple graph and P_G be the edge polytope of G. The combinatorial structure of P_G, especially the types of triangulations that P_G admits, is an interesting problem, which has been studied extensively. A necessary and sufficient condition for P_G to possess a regular unimodular triangulation is obtained. However, this condition is not easy to apply to a given graph by merely inspecting the graph. Then, for a graph G, we will obtain several criteria for the existence of a regular unimodular triangulation of P_G in terms of simple data related to the graph.

41 Hiroyuki Yamagishi (Tokyo Metro. Coll. of Ind. Tech.)
Hiroto Sekido (Kyoto Univ.)
Yoshinori Kametaka (Osaka Univ.*)
The best constant of discrete Sobolev inequality corresponding to Hamilton path on the regular polyhedra 15

Summary: We have obtained the best constant of discrete Sobolev inequality corresponding to Hamilton path on the regular polyhedra. Let N be the number of vertices. We introduce the discrete Laplacian which is $N \times N$ real symmetric matrix. The discrete Laplacian has an eigenvalue 0 whose corresponding eigenspace is 1 dimension. If we introduce the pseudo Green matrix, then the matrix is reproducing kernel by setting appropriate vector space and inner product. The maximum of the diagonal values of the pseudo Green matrix is the best constant of this discrete Sobolev inequality.

42 Kohei Tanaka (Shinshu Univ.) Topological and combinatorial approach to symmetric motion planning 15

Summary: The topological complexity is a numerical invariant closely related to robot motion planning. If the motion is required certain symmetricity, the symmetric topological complexity plays an important role to design algorisms. This talk will present a combinatorial approximation of symmetric topological complexity using a categorical model of configuration space.

43 Shohei Satake (Kobe Univ.) On ranking pseudo-random tournaments 15

Summary: Pseudo-randomness of (di)graphs is a measure of "randomness" of given deterministic (di)graphs. This has been widely applied to various problems in graph theory and combinatorial optimization. For example, Alon (SIAM J. Discrete Math., 2006) proved that the feedback arc set problem for tournaments is NP-hard by focusing on ranking tournaments and pseudo-randomness of Paley tournaments.
In this talk, we give a generalized version of the Alon's proof by focusing on a tight relationship between the pseudo-random property and (di)graph spectra.

44 Shuhei Tsujie (Hiroshima Kokusai Gakuin Univ.)
Norihiro Nakashima (Nagoya Inst. of Tech.)
Enumeration of flats of the extended Catalan and Shi arrangements 10

Summary: The number of flats of the braid arrangement, a typical hyperplane arrangement, coincides with the Bell number and the Stirling number of the second kind. In this talk, we enumerate the flats of the extended Catalan and Shi arrangements, which are deformations of the braid arrangements.

45 Akiko Yazawa (Shinshu Univ.) The Hessian of the generating function for the forests of the complete bipartite graph 15

Summary: Let us consider the forests consisting k connected components which are subgraphs of the complete bipartite graph. For these forests, consider the generating function. We show that the Hessian of the generating function does not vanish by calculating the eigenvalues of the Hessian matrix of the generating function.

46 Iwao Sato (Oyama Nat. Coll. of Tech.)
Norio Konno (Yokohama Nat. Univ.)
Hideo Mitsuhashi (Hosei Univ.)
Hideaki Morita (Muroran Inst. of Tech.)
A new weighted Ihara zeta function of a graph ····· 15

Summary: We define a new weighted Ihara zeta function and a new weighted Ihara L-function of a graph G, and present their determinant expressions. As a corollary, we present a decomposition formula for the new weighted Ihara zeta function of a regular covering of G by its new weighted Ihara L-functions. As applications, we give the spectrum of the transition probability matrices of non-backtracking random walks for regular graphs and semiregular bipartite graphs.

47 Daiju Funakawa (Hokkai-Gakuen Univ.)
Keisuke Asahara (Hokkaido Univ.)
Yohei Tanaka (Flinders Univ.)
Akito Suzuki (Shinshu Univ.)
The spectrum of the non-unitary quamtum walk, Part 1 —Mochizuki Kim Obuse model— ····· 15

Summary: We consider the spectrum of a 1-dimensional 2-state non-unitary quantum walk which is defined by Mochizuki, Kim and Obuse. This time-evolution operator acts on the Hilbert space $\ell^2(\mathbb{Z};\mathbb{C}^2)$. This model depends on a parameter $\gamma > 0$. The loss and gain of the photon is controlled by γ in this model. If $\gamma = 0$, then the photon energy does not either lose or gain. In particular, the model is a unitary operator in the case of $\gamma = 0$. However, in the case of $\gamma > 0$, the model is not unitary. Moreover, it is not a normal operator. This fact means that we can not use some general theorems of the unitary operator when we analyze some properties of this model. I this talk, we classify the spectrum of the model into three different cases according to the size of γ.

48 Keisuke Asahara (Hokkaido Univ.)
Daiju Funakawa (Hokkai-Gakuen Univ.)
Etsuo Segawa (Yokohama Nat. Univ.)
Akito Suzuki (Shinshu Univ.)
Noriaki Teranishi (Hokkaido Univ.)
The spectrum of the non-unitary quantum walk, Part2 —Application for the Ihara zeta function— ····· 15

Summary: In this talk, we consider the spectral mapping theorem of an abstract non-unitary quantum walk. In particular, we focus on the continuous spectrum of the time evolution since we already have got the result for the point spectrum of it. Our time evolution is not always normal, so that we can not use some general theorems for the spectral analysis. We also talk about the relation between our model and the Ihara zeta function, which has been intensively investigated in the graph theory.

14:15–16:25

49 Shinya Fujita (Yokohama City Univ.)
Boram Park (Ajou Univ.)
Tadashi Sakuma (Yamagata Univ.)
Stable networks and connected safe set problem ····· 15

Summary: Some recent results on safe set problems in vertex-weighted graphs will be reviewed.

50 Kiyoshi Yoshimoto (Nihon Univ.)
Structures of edge-colored complete bipartite graphs and the applications ····· 15

Summary: Let G be a graph. A mapping $c : E(G) \to \mathbb{N}$ is called an *edge-coloring* of G and $c(e)$ is called the *color* of an edge e. A graph with an edge-coloring map is called an edge-colored graph and denoted by (G, c). A subgraph H of G is called *rainbow* if every pair of edges in H have distinct colors and H is said to be *properly colored*, or shortly *PC*, if any two adjacent edges have different colors.
In this talk, first we will consider structures of edge-colored complete bipartite graphs $(K_{n,m}, c)$ without PC cycles of length four, and next the number of disjoint PC cycles in $(K_{n,m}, c)$ will be discussed related with Bermond–Thomassen Conjecture. Finally several problems and results around this topic will be given.

51 Akira Saito (Nihon Univ.) Chorded cycles in dense graphs 15

Summary: A cycle of order k is called a k-cycle. A non-induced cycle is called a chorded cycle. A graph G of order $n \geq 4$ is chorded pancyclic if G contains a chorded k-cycle for every integer k with $4 \leq k \leq n$. Cream, Gould and Hirohata (2017) conjectured that a hamiltonian graph G of order $n \geq 4$ satisfying $|E(G)| \geq \frac{1}{4}n^2$ is chorded pancyclic unless G is either $K_{\frac{n}{2},\frac{n}{2}}$ or $K_3 \times K_2$. In this talk, we affirmatively answer this conjecture by showing that if a graph G of order n with $|E(G)| \geq \frac{1}{4}n^2$ contains a k-cycle, then G contains a chorded k-cycle, unless $k = 4$ and G is either $K_{\frac{n}{2},\frac{n}{2}}$ or $K_3 \times K_2$, Then observing that $K_{\frac{n}{2},\frac{n}{2}}$ and $K_3 \times K_2$ are exceptions only for $k = 4$, we further relax the density ondition for sufficiently large k.

52 Yumiko Ohno (Yokohama Nat. Univ.)
Naoki Matsumoto (Keio Univ.) Locally connected graphs with chromatic and achromatic numbers both 3 15

Summary: A proper n-coloring $c : V(G) \to \{1, \ldots, n\}$ of a graph G is a *complete n-coloring* if every pair of colors appears on at least one edge. The maximum number n such that G has a complete n-coloring is called the *achromatic number* of G. A graph G is *locally connected* if the neighbourhood of every vertex of G is connected. In this talk, we shall show that both the chromatic and the achromatic numbers of connected and locally connected graph G are exactly 3 if and only if G is isomorphic to a complete tripartite graph.

53 Kengo Enami (Yokohama Nat. Univ.)
Yumiko Ohno (Yokohama Nat. Univ.) Ranges of facial achromatic number of triangulations on closed surfaces 15

Summary: For positive integers t and n, a *facial t-complete n-coloring* of a graph G embedded on a closed surface is a color assignment $c : V(G) \to \{1, \ldots, n\}$ of the vertices such that any t-tuple of colors appears on the boundary of some face of G. The *facial t-achromatic number* of G, denoted by $\psi_t(G)$, is the maximum number n such that G has a facial t-complete n-coloring. The facial t-achromatic number depends on the embedding of G in genetral. That is, for another embedding $f(G)$ of G, $\psi_t(f(G))$ may not be equal to $\psi_t(G)$. In this talk, we evaluate the difference between $\psi_3(G)$ of a triangulation G on a closed surface and $\psi_3(f(G))$ of another triangulation of G.

54 Yusuke Suzuki (Niigata Univ.)
Naoki Matsumoto (Keio Univ.) Non-1-planarity of lexicographic products of graphs 15

Summary: In this talk, we show the non-1-planarity of the lexicographic product of a theta graph and K_2. This result completes the proof of the conjecture that a graph $G \circ K_2$ is 1-planar if and only if G has no edge belonging to two cycles.

55 Hidefumi Ohsugi (Kwansei Gakuin Univ.)
Akiyoshi Tsuchiya (Univ. of Tokyo) Two enriched poset polytopes 15

Summary: In 1986, Stanley introduced two classes of lattice polytopes associated to finite partially ordered sets, which are called order polytopes and chain polytopes. It is known that the Ehrhart polynomials of these polytopes coincide with some counting polynomials of P-partitions. In this talk, from the theory of (left) enriched P-partitions, which are introduced and studied by Stembridge and Petersen, we introduce enriched order polytopes and enriched chain polytopes. In particular, we show that the Ehrhart polynomials of these polytopes coincide with some counting functions of left enriched P-partitions.

56 Masashi Shinohara (Shiga Univ.)
Hiroshi Nozaki (Aichi Univ. of Edu.) Maximal 2-distance sets containing a regular simplex 15

Summary: A finite subset X of the Euclidean space is called an s-distance set if the number of the distances of two distinct vectors in X is equal to s. An s-distance set X is said to be maximal if any vector cannot be added to X while maintaining s-distance. We investigate a necessary and sufficient condition for vectors to be added to the regular simplex such that the set has only 2 distances. We construct several maximal 2-distance sets that contain the regular simplex.

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

Hiroshi Nozaki (Aichi Univ. of Edu.) Linear programming bounds for regular uniform hypergraphs

Summary: Delsarte (1973) gave the linear programming method to find bounds for the cardinality of codes with given distances. Delsarte's method is useful to solve some optimization problems of maximizing the cardinality of a code in the Euclidean sphere or certain special association schemes, like Johnson schemes or Hamming schemes. A particular example of applications of the bound is the determination of the kissing number for a sphere. In this talk, we introduce an analogous theory of Delsarte's method for regular graphs. This method gives bounds for the order of a regular graph with given eigenvalues. The optimal graphs for this bound are distance-regular graphs with high girth, like Moore graphs. We also introduce recent results on a generalization of this bound for regular uniform hypergraphs.

Topology

September 17th (Tue) Conference Room III

9:30–12:00

1 Haruko Miyazawa (Tsuda Coll.) Classification of string links up to $2n$-moves and link-homotopy ····· 10
Kodai Wada (Osaka Univ.)
Akira Yasuhara (Waseda Univ.)

Summary: Two string links are equivalent up to $2n$-moves and link-homotopy if and only if their all Milnor link-homotopy invariants are congruent modulo n. Moreover, the set of the equivalence classes forms a finite group generated by elements of order n.

2 Shin Satoh (Kobe Univ.) Shell moves for 2-component virtual links ····· 10
Takuji Nakamura (Osaka Electro-Comm. Univ.)
Yasutaka Nakanishi (Kobe Univ.)

Summary: The writhe polynomial is a fundamental invariant of an oriented virtual knot. It is known that two oriented virtual knots have the same writhe polynomial if and only if they are related by a finite sequence of shell moves. The aim of this talk is to classify oriented 2-component virtual links up to shell moves by using several invariants of virtual links such as the linking numbers, n-writhes, and linking class.

3 Atsuhiko Mizusawa (Waseda Univ.) Link-homotopy classes of 4-component links and claspers ····· 15
Yuka Kotorii (RIKEN/Osaka Univ.)

Summary: The link-homotopy classes of 4-component links were classified by Levine. We modify the result by using the clasper theory. This classification gives schematic and symmetric points of view to link-homotopy classes of 4-component links. We also give some new subsets of link-homotopy classes of 4-component links which are classified by invariants.

4 Jun Murakami (Waseda Univ.) Quantized SL(2) representations of knot groups ····· 15

Summary: Let A be a braided Hopf algebra A with braided commutativity. We introduce the space of A representations of a knot K by generalizing the G representation space of K defined for a group G. By rebuilding the G representation space from the view point of Hopf algebras, it is extended to any braided Hopf algebra with braided commutativity. Applying this theory to BSL(2) which is the braided quantum SL(2) introduced by S. Majid, we get the space of BSL(2) representations, which is a non-commutative algebraic scheme which provides quantized SL(2) representations of K. This is a joint work with Roland van der Veen.

5 Ippei Ishii Combed 3-manifolds as viewed from virtual knot diagrams ····· 10
Takuji Nakamura (Osaka Electro-Comm. Univ.)
Toshio Saito (Joetsu Univ. of Edu.)

Summary: A combed 3-manifold is a pair of a closed oriented 3-manifold M and a homotopy class of non-singular vector fields on M. Viewing combed 3-manifolds from virtual knot diagrams, we introduce an invariant of 3-manifolds.

6 Yoshiyuki Ohyama (Tokyo Woman's Christian Univ.)
Migiwa Sakurai (Shibaura Inst. of Tech.)
Virtualization and n-writhes for virtual knots 10

Summary: Satoh and Taniguchi introduced the n-writhe J_n for each non-zero integer n, which is an invariant for virtual knots. They give a necessary and sufficient condition for a sequence of integers to be that of the n-writhes of a virtual knot. It is obvious that the virtualization of a real crossing is an unknotting operation for virtual knots. The unknotting number by a virtualization is called a virtual unknotting number and denoted by $u^v(K)$. We have shown that for any given non-zero integer n and N, there exists a virtual knot K with $u^v(K) = 1$ and $J_n(K) = N$ in a previous paper. In this talk, we show that if $\{c_n\}_{n\neq 0}$ is a sequence of integers with $\sum_{n\neq 0} nc_n(K) = 0$, then there exists a virtual knot K with $u^v(K) = 1$ and $J_n(K) = c_n$ for any $n \neq 0$. It is an extension of the previous result, and is a more powerful result.

7 Taizo Kanenobu (Osaka City Univ.)
Hideo Takioka (Kobe Univ.)
4-move distance of knots 10

Summary: 4-move is a local change for knots which changes 4 half twists to 0 half twists or vice versa. In 1979, Yasutaka Nakanishi conjectured that 4-move is an unknotting operation. This is still an open problem. In this talk, we consider 4-move distance of knots, which is the minimal number of 4-moves needed to deform one into the other. In particular, the 4-move unknotting number of a knot is the 4-move distance to the trivial knot. We give a lower bound of the 4-move unknotting number and a table of the 4-move unknotting number of knots with up to 9 crossings. This is a joint work with Taizo Kanenobu.

8 Masaki Taniguchi (Univ. of Tokyo)
Nozaki Yuta (Meiji Univ.)
Kouki Sato (Univ. of Tokyo)
The homology cobordism group of homology 3-spheres and Chern–Simons functional 15

Summary: In this talk, Y. Nozaki, K. Sato and I introduce a new family of invariants of homology 3-spheres. These invariants are defined by using some filtered version of instanton Floer homology. Moreover, we show important properties of the invariants which give a family of subgroups of the homology cobordism group parametrized non-negative real numbers. In this point of view, we give a reproof of the result of Furuta and Fintushel–Stern and its generalization.

9 Kouki Sato (Univ. of Tokyo)
Yuta Nozaki (Meiji Univ.)
Masaki Taniguchi (Univ. of Tokyo)
Simply connected definite cobordisms and the homology cobordism group 15

Summary: Y. Nozaki, M. Taniguchi and the speaker introduced new homology cobordism invariants $\{r_s\}_{s\in[-\infty,0]}$ of homology 3-spheres. In particular, for any sequence of homology 3-spheres $\{Y_n\}_{n=1}^{\infty}$, if (1) Y_1 has a non-trivial r_s, (2) $-Y_1$ has trivial r_s, and (3) there exists a simply connected negative definite cobordism with boundary $Y_n \amalg -Y_{n+1}$ for each n, then we can conclude the Y_n are linearly independent in the homology cobordism group. As an application, we give a sufficient condition for the linear independence of all positive $1/n$-surgeries on a knot in S^3. As another application, we prove that the Whitehead doubles of all $(2, q)$-torus knots with odd $q \geq 3$ are linearly independent in the knot concordance group.

10 Yuta Nozaki (Meiji Univ.)
Kouki Sato (Univ. of Tokyo)
Masaki Taniguchi (Univ. of Tokyo)
Computation of a homology cobordism invariant of a hyperbolic manifold 10

Summary: K. Sato, M. Taniguchi and I constructed a homology cobordism invariant of integral homology 3-spheres to study the homology cobordism group. The invariant was computed only for some Brieskorn manifolds. In this talk, we compute the invariant of a certain hyperbolic 3-manifold and the resulting value seems to be irrational.

11 Teruaki Kitano (Soka Univ.) Yuta Nozaki (Meiji Univ.) Finiteness of the image of the Reidemeister torsion of a splice ····· 10

Summary: We consider the Reidemeister torsion of a 3-manifold M for $SL(2,\mathbf{C})$-representations as a $\mathbf{C}$-valued function on the character variety of M and the image $RT(M) \subset \mathbf{C}$ of this function. We prove that $RT(M)$ is a finite set if M is the splice of two certain knots in S^3. The proof is based on an observation on the character varieties and A-polynomials of knots. This is a joint work with Yuta Nozaki.

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

Tamás Kálmán (Tokyo Tech)♭ The Homfly polynomial, Floer homology, and combinatorics

Summary: All oriented links L have special diagrams. Based on such a diagram we construct a sutured handlebody M which is closely related to the branched double cover of the link. From the sutured Floer homology of M we recover the Alexander polynomial Δ of L via a simple forgetful map. More surprisingly, in cases when the diagram is also positive (so that L is a special alternating link), $\mathrm{SFH}(M)$ can be used to compute those coefficients of the Homfly polynomial of L whose sum is the leading coefficient of Δ. To extract this information algebraically, we need the notion of the interior polynomial of a bipartite graph. Geometrically, this entails the cutting of some handles of M and identifying the resulting handlebody with a Seifert surface complement for another special alternating link. The talk involves joint results with A. Juhász, H. Murakami, A. Postnikov, J. Rasmussen, and D. Thurston.

15:30–17:10

12 Tomoyuki Yasuda (Nara Nat. Coll. of Tech.) Ribbon 2-knots of ribbon crossing number four ····· 10

Summary: A 2-knot is a surface in $\mathbf{R^4}$ that is homeomorphic to $\mathbf{S^4}$, the standard sphere in 3-space. A ribbon 2-knot is a 2-knot obtained from m 2-spheres in $\mathbf{R^4}$ by connecting them with $m-1$ annuli. Let K^2 be a ribbon 2-knot. The ribbon crossing number, denoted by $r\text{-}cr(K^2)$ is a numerical invariant of the ribbon 2-knot K^2. We showed that there exist just 17 ribbon 2-knots of the ribbon crossing number up to three. In this lecture we show that there exist no more than 111 ribbon 2-knots of ribbon crossing number four.

13 Inasa Nakamura (Kanazawa Univ.) Branched covering surfaces with degree three have the simplifying numbers less than three ····· 10

Summary: A branched covering surface in 4-space (a branched covering surface-knot) is a surface in 4-space in the form of a branched covering over a surface. For a branched covering surface, we have a numerical invariant called the simplifying number. We show that branched covering surfaces with degree three have the simplifying numbers less than three.

14 Motoo Tange (Univ. of Tsukuba) Youlin Li (Shanghai Jiao Tong Univ.) Smoothly non-isotopic Lagrangian disk fillings of Legendrian knots ··· 15

Summary: We prove that a Legendrian knot K has two smoothly non-isotopic Lagrangian disks which fill K. This implies that result of Ekholm that K has two Lagrangian disks which are non-Hamiltonian isotopic. The exteriors of two disks are diffeomorphic each other. This means that an included involution on the boundary (0-surgery on K) homeomorphically extends inside but cannot diffeomorphically extend inside.

15 Ken'ichi Yoshida (Saitama Univ.) An example of degeneration of 3-dimensional hyperbolic cone structures with decreasing cone angles ····· 15

Summary: For deformation of 3-dimensional hyperbolic cone structures about cone angles θ, the local rigidity is known for $0 \leq \theta \leq 2\pi$, but the global rigidity is known only for $0 \leq \theta \leq \pi$. The proof of the global rigidity by Kojima is based on the fact that hyperbolic cone structures do not degenerate in deformation with decreasing cone angles. In this talk, we will construct hyperbolic cone structures on a link in $T^2 \times I$ explicitly. Then we will obtain an example of degeneration of hyperbolic cone structures with decreasing cone angles $\pi < \theta < 2\pi$.

16 Yusuke Inagaki (Osaka Univ.) A slice of $\mathrm{PSL}_n\mathbb{R}$-Hitchin components ····· 15

Summary: Hitchin components are prefered connected components of $\mathrm{PSL}_n\mathbb{R}$-character varieties of surface groups, which are higher dimensional analogs of Teichmüller spaces. By definition, they contain a subset corresponding to Teichmüller spaces, which is called the Fuchsian locus. In this talk, we show that the Fuchsian locus of Hitchin components corresponds to certain affine slice of the interior of a convex polytope under the Bonahon–Dreyer parameterization.

17 Tsuyoshi Kato (Kyoto Univ.) Rigidity of the mod 2 families Seiberg–Witten invariants ····· 15
Hokuto Konno (RIKEN)
Nobuhiro Nakamura (Osaka Med. Coll.)

Summary: We show a rigidity theorem for the Seiberg–Witten invariants mod 2 for families of spin 4-manifolds. We also give a family version of 10/8-type inequality using this rigidity theorem. As an application, we shall prove the existence of a non-smoothable topological family of 4-manifolds whose fiber, base space, and total space are smoothable as manifolds. As its consequence, it follows that the inclusion map $\mathrm{Diff}(M) \hookrightarrow \mathrm{Homeo}(M)$ is not a weak homotopy equivalence for an oriented smooth 4-manifold M which is homeomorphic to $K3\#nS^2 \times S^2$ for $n \geq 0$.

18 David Baraglia (Univ. of Adelaide) The diffeomorphism and homeomorphism groups of $K3$ ····· 15
Hokuto Konno (RIKEN)

Summary: Using finite dimensional approximations of families of Seiberg–Witten equations and Steenrod square operations, we shall give a new non-smoothable family of the $K3$ surface. This implies the non-triviality of the fundamental group of the homotopy quotient of the homeomorphism group of $K3$ divided by the diffeomorphism group of $K3$.

September 18th (Wed) Conference Room VI

10:10–10:20 Presentation Ceremony for the 2019 MSJ Geometry Prize

10:30–11:30 Award Lecture for the 2019 MSJ Geometry Prize

Masaki Tsukamoto (Kyushu Univ.) Mean dimension of dynamical systems and information theory

Summary: In the late 1950's Kolmogorov discovered that Shannon's entropy can be used in ergodic theory. This is a revolutionary idea, and ever since there have been rich interactions between information theory and the study of dynamical systems. Recently we have added some new items in these interactions. A new development comes from mean dimension theory. Mean dimension is a topological invariant of dynamical systems which estimates the number of parameters per iterate for describing the orbits of dynamical systems. We have found that this dynamical invariant has the following two connections with information theory:
(1) Mean dimension turns out to be a crucial parameter when we try to encode dynamical systems into band-limited signals, say signals of telephone line. This is reminiscent of Shannon's fundamental work on communications over band-limited channels. This discovery was used to solve a problem posed by Lindenstrauss in 1999.
(2) Mean dimension theory is (in some sense) a topological version of rate distortion theory. Rate distortion theory is a branch of information theory describing a lossy data compression method achieving some distortion constraint. We study the minimax problem about the "rate distortion dimension" and shows that the minimax value is given by mean dimension at least for minimal dynamical systems. This is a mean dimensional analogue of variational principle known for dynamical entropy.

13:15–14:15 Award Lecture for the 2019 MSJ Geometry Prize

Kei Irie (Univ. of Tokyo) Symplectic capacities and periodic orbits of Hamiltonian systems

Summary: I will talk about symplectic capacities, in particular those related to periodic orbits of Hamiltonian systems. After reviewing background and some previous results, I will explain a formula which relates symplectic capacity of (fiberwise) convex domains to loop space homology, and discuss some applications and questions.

September 19th (Thu) Conference Room III

9:30–12:00

19 Katsuya Eda (Waseda Univ.) Making spaces wild 15

Summary: Let X be a path-connected separable metric space and D a countable dense subset of X. For each $d \in D$, let C_d be a circle and attach C_d to a point d so that the diameters of C_d converge to 0. We call the resulting space earring space $E(X, D)$. If X is locally simply-connected and simply-connected, then $\pi_(E(X, D))$ is a subgroup of the Hawaiian earring group. Since X is restored from $\pi_1(E(X, D))$, we can investigate subgroups of the Hawaiian earring group using spaces X.

20 Hayato Imamura (Waseda Univ.) Markov-like set-valued functions on finite graphs and their inverse limits 15

Summary: We introduce Markov-like functions on finite graphs and define the notation of the same pattern between those Markov-like functions. Then we show that two generalized inverse limits with Markov-like bonding functions on finite graphs having the same pattern are homeomorphic.

21 Katsuhisa Koshino (Kanagawa Univ.) Topological manifolds modeled on absorbing sets in Hilbert spaces and general position properties 15

Summary: In this talk, we shall characterize infinite-dimensional manifolds modeled on absorbing sets in non-separable Hilbert spaces by using the discrete cells property, which is a general position property based on their density.

22 Masaki Tsukamoto (Kyushu Univ.) Mean dimension of full shifts 15

Summary: We calculate the mean dimension of full shifts over finite dimensional alphabets. We propose a problem which seems interesting from the viewpoint of infinite dimensional topology.

23 Takahiro Matsuyuki (Tokyo Tech) Space of Chen's isomorphisms as a classifying space 15

Summary: According to K. T. Chen's theory, we can obtain an isomorphisms between the Malcev Lie algebra of a manifold and a certain Lie algebra. We shall consider the space of such an isomorphims and its cohomology. The space can be regarded as a classifying space of a certain automorphism group of the fundamental group, and its cohomology gives characteristic classes of a fiber bundle.

24 Katsuhiko Kuribayashi (Shinshu Univ.) On the de Rham theorem and simplicial cochain algebras for diffeological spaces 15

Summary: Diffeological spaces have been introduced by Souriau in the early 1980s. The notion generalizes that of a manifold. More precisely, the category Mfd of finite dimensional manifolds embeds into Diff the category of diffeological spaces, which is complete, cocomplete and cartesian closed. As an advantage, we can very naturally define a function space of manifolds in Diff so that the evaluation map is smooth without arguments on infinite dimensional manifolds. We introduce a de Rham complex endowed with an integration map into the singular cochain complex which gives the de Rham theorem for *every* diffeological space.

25 Syunji Moriya (Osaka Pref. Univ.) On cohomology of space of knots in manifold 15

Summary: We give a spectral sequence converging to the space of knots in an oriented, simply connected closed manifold of dimension greater than 3. This spectral sequence has a computable E2-term. Construction of it is based on Goodwillie's embedding calculus which approximates an embedding space of codimension greater than 2 by a homotopy limit of configuration spaces.

26 Takahito Naito (Nippon Inst. of Tech.) A generating set of the rational loop homology algebra of $\mathbb{C}P^2\#\mathbb{C}P^2$ 10

Summary: In this talk, we will discuss a generating set of the rational loop homology algebra of the connected sum $\mathbb{C}P^2\#\mathbb{C}P^2$ and the rational loop product of simply-connected rationally elliptic closed 4-manifolds.

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

Shunsuke Tsuji (Kyoto Univ.)$^\flat$ A method to compute the Johnson homomorphism on a homology 3-cylinder using a skein algebra

Summary: Let Σ be a compact connected oriented surface with nonempty boundary. We consider a homology cylinder (C, c) of Σ where C is a compact connected 3-manifold and $c : \partial(\Sigma \times [0.1]) \to \partial C$ is a diffeomorphism such that $c_1 : \Sigma \to C, x \mapsto c(x, 1)$ and $c_0 : \Sigma \to C, x \mapsto c(x, 0)$ induce the same isomorphism in their homology groups. For $i = 0, 1$, the embedding c_i induces the isomorphism $c_{i*} : \widehat{\mathbb{Q}\pi_1}(\Sigma \times \{i\}, (*, i)) \to \widehat{\mathbb{Q}\pi_1}(C, (*, i))$ where $* \in \partial\Sigma$. Here, for a manifold M and a base point P, we denote $\widehat{\mathbb{Q}\pi_1}(M, P) = \lim_{n\to\infty}\mathbb{Q}\pi_1(M, P)/(\ker\epsilon)^n$ where ϵ is the augmentation map $\mathbb{Q}\pi_1(M, P) \to \mathbb{Q}, r \in \pi_1(M, P) \mapsto 1$. For an embedding from a handlebody H_g of genus g into $\Sigma \times [0, 1]$ and an element ξ of the Torelli group of ∂H_g, we denote by $\Sigma \times [0.1]_{(e,\xi)}$ the 3-manifold H_g and the closure of $\Sigma \times [0, 1]\backslash e(H_g)$ glued by $e_{|\partial H_g} \circ \xi$. We remark the pair $(\Sigma \times [0, 1]_{(e,\xi)}, \mathrm{id}_{\partial(\Sigma\times[0.1])})$ is a homology cylinder. In this talk, we obtain an invariant for homeomorphic classes of the set consisting of $\Sigma \times [0, 1]_{(e,\xi)}$ for any embedding e of a handlebody and any element ξ of the Torelli group of the boundary of the handlebody using some skein algebra. This invariant depends only on the map ${c_1}_*{c_0}_*^{-1}$. As an application, using this invariant, we give a method to compute the map ${c_1}_*{c_0}_*^{-1}$.

15:30–17:10

27 Ryoma Kobayashi (Ishikawa Nat. Coll. of Tech.)
Genki Omori (Tokyo Univ. of Sci.)
An infinite presentation for the twist subgroup of the mapping class group of a non-orientable surface 15

Summary: Let $N_{g,n}$ be a compact non-orientable surface of genus g with n boundary components. We give an infinite presentation for the subgroup of the mapping class group of $N_{g,1}$ generated by all Dehn twists, for $g \geq 3$.

28 Takuya Sakasai (Univ. of Tokyo)
Masaaki Suzuki (Meiji Univ.)
Shigeyuki Morita (Univ. of Tokyo*/Tokyo Tech*)
Two filtrations of the Torelli group 10

Summary: We consider two filtrations of the Torelli group: the lower central series and the Johnson filtration. We show the related graded Lie algebras are isomorphic up to degree 6.

29 Norihisa Takahashi (Ritsumeikan Univ.)
Hiraku Nozawa (Ritsumeikan Univ.)
On presentaions of hyperelliptic periodic diffeomorphisms by Dehn twists 15

Summary: A diffeomorphism of surfaces is called hyperelliptic if it commutes with a hyperelliptic involution. Such diffeomorphisms naturally appear in the study of hyperelliptic curves. On the other hand, periodic diffeomorphisms play an important role in the study of mapping class groups of surfaces. Ishizaka classified up to conjugation hyperelliptic periodic diffeomorphisms of surfaces and gave Dehn twist presentations in terms of Humphries generators. In this talk, we will give an explicit decomposition of surfaces into pentagonal fundamental domains of hyperelliptic periodic diffeomorphisms. We apply it to obtain Dehn twist presentations which are different from those obtained by Ishizaka in general.

30 Norikazu Hashiguchi (Nihon Univ.)
Hiroyuki Minakawa (Yamagata Univ.)
Construction of genus one Birkhoff sections for the geodesic flows of hyperbolic spheres with singularities 10

Summary: A hyperbolic 2-sphere is made from the double of an n-gon in Poincaré disc ($n \geq 3$). Its geodesic flow is a transitive Anosov flow on a closed 3-manifold. Birkhoff generalized a concept of a section for a flow. We call it Birkhoff section, that is an immersed surface with boundaries. We construct genus one Birkhoff sections for the geodesic flows of hyperbolic 2-spheres with n singularities.

31 Shuhei Maruyama (Nagoya Univ.)
The central extension relating to flux homomorphism and the Euler class of flat $\mathrm{Diff}_+(S^1)$-bundle 15

Summary: We exhibit a relationship between the flux homomorphism on unit disk and the Euler class of flat $\mathrm{Diff}_+(S^1)$-bundle. We give a geometric construction of group cohomology class e_{Flux} using the flux homomorphism and prove that e_{Flux} is equal to the (universal) real Euler class of flat $\mathrm{Diff}_+(S^1)$-bundle up to constant multiple. Even as cocycles, we clarify a relation between them, which leads to the transgression formula connecting the flux homomorphism and the Euler cocycle.

32 Naoki Kitazawa (Kyushu Univ.)
Explicit construction of a smooth function on a 3-dimensional closed and orientable manifold inducing a given graph as its Reeb graph 10

Summary: Reeb graphs of maps are fundamental tools in the theory of Morse functions, their higher dimensional versions and application to geometry of manifolds. A Reeb space is defined as the space of all connected components of inverse images of the map. In this talk, we consider the following fundamental and important problem: can we construct a smooth function satisfying several geometric conditions inducing a given graph as its Reeb graph? As a main result, we demonstrate construction of a smooth function satisfying several differential topological conditions on a 3-dimensional closed and orientable manifold inducing a given graph as the Reeb graph.

33 Shunsuke Ichiki (Kyushu Univ.)
Naoki Hamada
(Fujitsu Laboratories Ltd./RIKEN AIP-FUJITSU Collaboration Center)
On strongly convex multi-objective optimization problems of class C^1 15

Summary: In the industrial world, it is important to optimize several objectives such as cost, quality, safety and environmental impact. A multi-objective optimization problem is an optimization problem for such several objective functions. In this talk, we give a topological property of the set of optimal solutions of a strongly convex problem of class C^1. Moreover, if we have time, then we also introduce an application of Singularity Theory to the problem. This talk is based on joint work mainly with Naoki Hamada.

Infinite Analysis

September 17th (Tue) Conference Room II

14:15–16:00

1 Ayumu Hoshino (Hiroshima Inst. of Tech.)
Jun'ichi Shiraishi (Univ. of Tokyo)
Conjecture concerning B_n q-Toda eigenfunctions 15

Summary: We present a conjecture for the asymptotically free eigenfunctions for the B_n q-Toda operator, which can be regarded as a brunching formula from the B_n q-Toda eigenfunction restricted to the A_{n-1} q-Toda eigenfunctions.

2 Yusuke Ohkubo (Univ. of Tokyo)
Jun'ichi Shiraishi (Univ. of Tokyo)
Masayuki Fukuda (Univ. of Tokyo)
Matrix element formula for 2N-valent intertwining operators of Ding–Iohara–Miki algebra 15

Summary: In this talk, I will explain a duality formula for the matrix elements of 2N-valent intertwining operators of the Ding–Iohara–Miki algebra. This formula gives an algebraic description of 5D (K-theoretic) AGT correspondence and shows a spectral duality with respect to the Ding–Iohara–Miki algebra arising from string theory.

3 Masayuki Fukuda (Univ. of Tokyo)
Yusuke Ohkubo (Univ. of Tokyo)
Jun'ichi Shiraishi (Univ. of Tokyo)
Realization of Koornwinder operator on Fock space 15

Summary: The Koornwinder operator is a multi-variable generalization of the Askey–Wilson operator. In this talk, we will talk about the realization of Koornwinder operator on the Fock space. We also briefly discuss the relations between the currents to define the Koornwinder operator and the Drinfeld currents of the Ding–Iohara–Miki algebra.

4 Masaru Sugawara (Tohoku Univ.)
Universal R-matrix for the affine quantum group of type $A_2^{(1)}$ and wall-crossing formula 15

Summary: Dimofte, Gukov, Soibelman discovered remarkable identities for quantum dilogarithm functions on a non-commutative algebra as wall-crossing formulas, which are of the form "infinite product = finite product". We derived one of the identities algebraically by using explicit product presentations of the universal R-matrix of the affine quantum group $U_q(\widehat{\mathfrak{sl}_3})$. The presentations were constructed by K. Ito, which correspond to convex orders of positive roots. We calculated explicitly all the root vectors determined by certain convex orders, and obtained two different presentations of the universal R-matrix. Equating them and projecting both sides by a certain good representation yields an "infinite product = finite product" type identity. Specializing it gives the wall-crossing formula proposed by Dimofte et al.

5 Yousuke Ohyama (Tokushima Univ.)
q-Stokes problems on basic hypergeometric equations 15

Summary: We study q-Stokes problems on basic hypergeometric equations with one regular singular points. We solve the q-Stokes problems of basic hypergeometric equations whose the Newton diagram has three segments at an irregular singular point.

6 Naoya Hatano (Chuo Univ.)
Ryuya Matsunawa (Chuo Univ.)
Tomoki Sato (Chuo Univ.)
Kouichi Takemura (Ochanomizu Univ.)
Variants of q-hypergeometric equation 15

Summary: We introduce two variants of q-hypergeometric equation. We obtain several explicit solutions of variants of q-hypergeometric equation. We show that a variant of q-hypergeometric equation can be obtained by a restriction of q-Appell equation of two variables.

16:20–17:20 Talk Invited by Infinite Analysis Special Session

Ryo Fujita (Kyoto Univ.) Quantum affine Schur–Weyl duality associated with a Dynkin quiver

Summary: The classical Schur–Weyl duality produces a strong representation-theoretic connection between the complex simple Lie algebra $\mathfrak{sl}_n$ and the symmetric group $\mathfrak{S}_d$. Its natural quantum affine analogue, called the quantum affine Schur–Weyl duality, is played by their quantum affinizations: the quantum affine algebra $U_q(\widehat{\mathfrak{sl}}_n)$ and the affine Hecke algebra of GL_d. It induces a functor with several good properties between the categories of finite-dimensional modules. Moreover it has a beautiful geometric interpretation via the equivariant K-theory of flag varieties. The main topic of this talk is a further variant of the quantum affine Schur–Weyl duality associated with a Dynkin quiver, which was originally introduced by Kang–Kashiwara–Kim as a special case of their general construction. Here the players are replaced by the quantum affine algebra and the quiver Hecke algebra (also known as Khovanov–Lauda–Rouquier algebra) of the corresponding ADE type. We see that the induced functor enjoys good properties just like the usual case. Also we present its geometric interpretation via the equivariant K-theory of Nakajima's graded quiver varieties.

September 18th (Wed) Conference Room II

10:00–11:30

7 Ryo Okawa (Waseda Univ.) (−2) blow-up formula ····· 15

Summary: We consider the minimal resolution of A_1 singularity and the quotient stack of the plane by $\{\pm 1\}$, and moduli spaces of framed sheaves on them. We want to propose (-2) blow-up formula relating integrals over these moduli spaces for some cases.

8 Yasuaki Gyoda (Nagoya Univ.) Uniqueness of clusters by F-matrices in cluster algebras of triangulated surface type
Toshiya Yurikusa (Nagoya Univ.) ····· 15

Summary: For a given marked surface (S, M) and a fixed tagged triangulation T of (S, M), we show that each tagged triangulation T' of (S, M) is uniquely determined by the intersection numbers of tagged arcs of T and tagged arcs of T'. As an application, each cluster in the cluster algebra $\mathcal{A}(T)$ is uniquely determined by its F-matrix which is a new numerical invariant of the cluster introduced in Fujiwara and Gyoda.

9 Soichi Okada (Nagoya Univ.) Birational rowmotion and Coxeter-motion on minuscule posets ····· 15

Summary: Birational rowmotion is a discrete dynamical system associated with a finite poset P, which provides a birational lift of combinatorial rowmotion acting on order ideals of P. If P is a product of two chains, then birational rowmotion has nice properties such as periodicity and homomesy. In this talk we extend these properties to minuscule posets. One of our results asserts that, if P is a minuscule poset arising from a simple Lie algebra $\mathfrak{g}$, then the birational rowmotion map on P has order equal to the Coxeter number of $\mathfrak{g}$. Also, as a generalization of promotion, we introduce birational Coxeter-motion on minuscule posets, and prove similar properties.

10 Hiroshi Naruse (Univ. of Yamanashi) Dual factorial Schur P-functions are solutions of BKP hierarchy ····· 15

Summary: We prove that dual factorial Schur P-functions provide solutions of BKP hierarchy. For the proof we used the criteria of Shigyo on the recursive relations of the coefficients of expansion in terms of Schur Q-functions.

11 Genki Shibukawa (Kobe Univ.) Multivariate Bernoulli polynomials ····· 15

Summary: We introduce a multivariate analogue of Bernoulli polynomials and give their fundamental properties: difference and differential relations, symmetry, explicit formula, inversion formula, multiplication theorem, and binomial type formula.

13:00–14:00 Talk Invited by Infinite Analysis Special Session

Teruhisa Tsuda (Hitotsubashi Univ.) Birational Weyl group actions via mutation combinatorics in cluster algebras

Summary: Cluster algebra is an algebraic structure generated by operations of a quiver called the mutations and their associated simple birational mappings, and it was introduced by Fomin and Zelevinsky in 2000. We present a systematic derivation of tropical (i.e., subtraction-free birational) realization of Weyl groups for various Dynkin diagrams. Our result is related with a class of tropical Weyl groups actions defined on certain rational varieties and also (higher-order) q-Painlevé equations. Key ingredients of the argument are the combinatorial aspects of reflections associated with n-cycles in the quiver. This talk is based on a joint work with Tetsu Masuda and Naoto Okubo.