

 **Mathematical Society of Japan**

2013 AUTUMN MEETING

Titles and Short Summaries of the Talks

September, 2013

at Ehime University

2013 Mathematical Society of Japan

AUTUMN MEETING

Dates: September 24th–27th, 2013

Venue: Ehime University, Johoku Campus

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Mathematical Society of Japan

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	I Green Hall	II General Edu. L.H. Rm 11	III General Edu. L.H. Rm 21	IV General Edu. L.H. Rm 24	V General Edu. L.H. Rm 35	VI General Edu. L.H. Rm 45	VII Law & Letters L.H. Rm 201	VIII Engineering Bldg.4 Rm E411	IX Engineering Bldg.4 Rm E421
24th (Tue)	Algebra 9:00–12:00 14:15–16:45	Functional Equations 9:20–12:00 14:15–16:30	Real Analysis 9:00–12:05 14:20–16:15	Functional Analysis 9:30–11:50	Topology 9:00–12:00 14:15–16:00	Geometry 9:15–12:00 14:15–16:00	Applied Mathematics 9:45–12:00 14:15–16:30	Statistics and Probability 9:30–12:00 14:15–14:45	Infinite Analysis 9:30–12:00 14:15–16:20
	Featured Invited Talks					13:00–14:00			
	Invited Talk 17:00–18:00	Invited Talk 16:45–17:45	Invited Talk 16:30–17:30	Invited Talk 14:15–15:15	Invited Talk 16:20–17:20	Invited Talk 16:15–17:15	Invited Talk 16:50–17:50	Invited Talks 15:00–16:00 16:15–17:15	Invited Talk 16:30–17:30
25th (Wed)	Algebra 9:00–12:00	Functional Equations 9:00–12:00	Real Analysis 9:00–11:55 13:00–13:15	Functional Analysis 9:30–11:50	Geometry / Topology (Edu. Bldg.2, Large Lect. Room)		Applied Mathematics 9:45–12:00	Statistics and Probability 9:15–11:50	Infinite Analysis 9:30–12:00
	Invited Talk 13:15–14:15	Invited Talk 13:15–14:15	Invited Talk 13:20–14:20		Invited Talks 10:50–11:50 13:15–14:15		Invited Talk 13:00–14:00		Invited Talk 13:00–14:00
	MSJ Prizes Presentation (Himegin Hall, Sub-hall) (15:00–15:30) Plenary Talks (Himegin Hall, Sub-hall) MSJ Autumn Prize Winner (15:45–16:45) Toshio Oshima (Univ. of Tokyo) (17:00–18:00) Official Party (Alumni Association Hall Café Restaurant “Se·tolian”) (18:20–20:20)								
26th (Thu)	Algebra 9:00–11:25 14:15–16:00	Functional Equations 9:00–12:00 14:15–16:30	Complex Analysis 10:00–12:00 14:15–15:00	Functional Analysis 9:30–12:00 14:15–15:45	Topology 9:00–12:00 14:15–16:00	Geometry 9:00–12:00 14:15–16:00	Applied Mathematics 9:30–10:20 14:15–17:45 Special Session 10:30–12:00	Statistics and Probability 9:00–12:00	Found. of Math. and History of Math. 9:30–10:55 15:25–16:50
	Featured Invited Talks					13:00–14:00			
	Invited Talk 16:15–17:15	Invited Talk 16:45–17:45	Invited Talk 15:10–16:10	Invited Talk 16:00–17:00	Invited Talk 16:20–17:20	Invited Talk 16:15–17:15		Invited Talks 14:30–15:30 15:45–16:45	Invited Talk 14:15–15:15
27th (Fri)	Algebra 9:30–12:00 14:15–15:30	Functional Equations 9:00–12:00 14:15–16:30	Complex Analysis 9:00–10:45	Functional Analysis 9:30–12:00			Applied Mathematics 9:00–12:00 14:15–16:45	Statistics and Probability 9:15–12:00	Found. of Math. and History of Math. 10:00–11:25
	Featured Invited Talks					13:00–14:00			
	Invited Talk 15:45–16:45	Invited Talk 16:45–17:45	Invited Talk 11:00–12:00	Invited Talk 14:15–15:15			Invited Talk 17:00–18:00		Invited Talk 14:15–15:15

Plenary Talks

September 25th (Wed) Himegin Hall, Sub-hall

MSJ Autumn Prize Winner (15:45–16:45)

Toshio Oshima (Josai Univ.) Linear ordinary differential equations with polynomial coefficients (17:00–18:00)

Summary: A recent study enables us to analyze the general structure of linear ordinary differential equations with polynomial coefficients. We study the operations on the equations, such as, the middle convolutions by Katz, Gauge transformations, Laplace transformations, confluences and unfoldings of the equations. We define generalized Riemann schemes which describe local structure of the equations at their singular points and classifies the equations by their spectral types. The important invariant is the index of rigidity, which corresponds to the dimension of the moduli space describing the difference between the local structure and global structure. When the dimension is zero, the spectral type is called rigid. When the equation is Fuchsian, the operations correspond to the Weyl group of a Kac-Moody root system and it is possible for us to understand the problems to get series expansions and integral representations of their solutions, connection formula, contiguity relations, polynomial solutions, structure of the monodromy and its irreducibility. If the equation is Fuchsian and has a rigid spectral type, we give a simple explicit algorithm to have explicit answers to these problems. A similar study is now developing to equations having irregular singularities. For example, the structure of equations with unramified irregular singularities are classified by a Kac-Moody root system and a classical limit of our study corresponds to resolutions of singularities of plane algebraic curves in a two-dimensional symplectic vector space under symplectic birational transformations.

Featured Invited Talks

September 24th (Tue)

Conference Room I

Toshiaki Shoji [#] Exotic symmetric spaces and Kostka polynomials (13:00–14:00)
(Nagoya Univ./Dongji Univ.)

Summary: It is well-known that the set of nilpotent orbits for GL_n is canonically in bijection with the set of irreducible representations of the symmetric group S_n of degree n , through the Springer correspondence. It is also known that Kostka polynomials are realized geometrically in terms of the intersection cohomology of the closure of nilpotent orbits. The Springer correspondence and Kostka polynomials are mutually closely related via the theory of character sheaves on GL_n . The theory of character sheaves for reductive algebraic groups was established by Lusztig in 1980's. After that Ginzburg extended the notion of character sheaves to the case of symmetric spaces.

These are already classical results. However, recently interesting generalizations were found by various people. First, let $G = GL(V)$ for a finite dimensional vector space V . We consider the variety $X_0 = G \times V$ with the diagonal G -action. It was shown by Finkelberg–Ginzburg–Travkin, and Achar–Henderson, that there exists a natural generalization of the classical results to the case of X_0 . Next, let V be a symplectic vector space, and put $G = GL(V)$, $K = Sp(V)$. We consider the variety $X = G/K \times V$, with the diagonal K -action. We call X an exotic symmetric space, based on the relationship with the exotic nilpotent cone introduced by Kato. X is a generalization both of the symmetric space G/K and of $G \times V$. The specific symmetric space G/K was studied extensively by Bannai–Kawanaka–Song, Grojnowski, and Henderson. One can show that there exists a natural generalization of classical results also to X , more natural in some sense than the case of G/K or of $G \times V$. In this talk, I would like to explain about these subjects.

Conference Room II

Yoshikazu Kobayashi (Chuo Univ.) [#] Nonlinear evolution operators and ordinary differential equations in Banach spaces (13:00–14:00)

Summary: In this talk we are concerned with the relationship between nonlinear nonautonomous differential equations and nonlinear evolution operators in Banach spaces.

The existence and uniqueness of local solutions of initial value problems for the differential equations are discussed in a general setting. The continuous dependence of solutions on the initial conditions and global existence of solutions are also investigated.

The associated evolution operators turn out to be quasi-contractive with respect to metric-like functionals. One of the main theorems gives a characterization of the continuous generators of the evolution operators in a wide class.

The results are applied to the initial value problem for a quasilinear wave equation with weak dissipation.

September 26th (Thu)

Conference Room I

Guest Talk from Korean Mathematical Society

Seok-Jin Kang (Seoul Nat. Univ.) Khovanov–Lauda–Rouquier algebras and 2-representation theory (13:00–14:00)

Conference Room VII

Hitoshi Matsubara [#] Shogi programs have beat human professional players (13:00–14:00)
 (Future Univ.-Hakodate)

Summary: Artificial intelligence (AI) is a branch of computer science that studies and develops intelligent programs and robots. Games are considered as good targets of AI research. From about 1950 many AI researchers developed (western) chess programs and computer chess “Deep Blue” beat the human chess world champion “Gary Kasparov” in 1997. One of the next games to chess is Shogi (Japanese chess). Shogi is similar to chess, but in Shogi players can reuse pieces captured from the opponents. So search space of Shogi is much larger than that of chess and to develop strong Shogi programs is much difficult than to develop strong chess programs. From about 1975 some AI researchers developed Shogi programs and “Ponanza”, “Tsutsukana” and “GPS shogi” beat human professional players this year. In this talk history of computer Shogi and some effective computer Shogi techniques are presented. We believe some Shogi program will beat top class professional players in several years.

September 27th (Fri)

Conference Room I

Tetsuji Miwa (Kyoto Univ.)[#] Algebraic analysis and exactly solvable models (13:00–14:00)

Summary: I review the method of algebraic analysis in the study of special functions which arise from exactly solvable models in statistical mechanics. Theories, successfully applied, are deformation theory of holonomic systems of differential equations and representation theory of quantum affine Lie algebras.

Conference Room II

Koji Fujiwara (Kyoto Univ.)[#] Group actions on quasi-trees (13:00–14:00)

Summary: Geometric group theory studies (mostly discrete) groups using geometric viewpoints and tools. It has been successful in the last 30 years and hyperbolicity in the sense of Gromov has been playing an essential role.

Before that time Serre realized that actions on simplicial trees are very useful to study groups, and developed a rich theory on the structure of group with actions on trees.

In a joint work with Bestvina and Bromberg I study group actions on “quasi-trees”. A quasi-tree is a graph which is “quasi-isometric” to a tree. They are more flexible than trees, a vast class of groups admits actions on them, and it turns out that actions on quasi-trees also give much information on the groups.

I will discuss a construction of group actions on quasi-trees and its application. The construction is elementary and the hyperbolicity is behind the construction.

Conference Room VIII

Ichiro Hasuo (Univ. of Tokyo)[#] Verification of cyber-physical systems via nonstandard analysis: from discrete to continuous and hybrid (13:00–14:00)

Summary: Hybrid systems are those which exhibit both discrete “jump” and continuous “flow” dynamics. Their importance—as components of cyber-physical systems—is paramount now that more and more physical systems (cars, airplanes, etc.) are controlled with computers.

There are naturally two directions towards the study of hybrid systems: from control theory (originally continuous) and from formal verification (originally discrete). Our approach belongs to the latter camp—in particular it originates from deductive verification, where properties of systems are proved as theorems (desirably automatically). For us a big challenge is therefore how to incorporate continuous “flow” dynamics. Many existing techniques cope with this challenge by including differential equations explicitly. This incurs a difficult (and very interesting) question of how to handle differential equations in a deductive framework that is originally discrete.

In our project we take a different path of “turning flow into jump”—more precisely into infinitely many jumps each of which is infinitesimal (i.e. infinitely small). This makes everything discrete, to which all the discrete techniques accumulated in the community of formal verification readily apply. This venture is mathematically supported by nonstandard analysis, where we can rigorously speak about infinites and infinitesimals. To put it differently: the celebrated transfer principle in nonstandard analysis states that reals and hyperreals (including infinitesimals) have the same logical theory; our results extend this coincidence to semantics of programs and program logics such as the Floyd–Hoare one.

The talk is based on the speaker’s joint work with Kohei Suenaga (Kyoto U.) and Hiroyoshi Sekine (U. Tokyo).

Foundation of Mathematics and History of Mathematics

September 26th (Thu) Conference Room IX

9:30–10:55

- 1 Shigeru Masuda (Kyoto Univ.)[#] The Kepler problems affected the Schrödinger equations 20

Summary: Kepler (1571–1630) proposes laws on the motions of planets in reserving many analytical open problems. Many mathematicians devote themselves to the Kepler problems. Lagrange calculates the elliptic orbit with the trigonometric series. Laplace studies many sorts of celestial mechanics, including the problem of secular inequality (secular variation). Poisson discuss the problem of secular inequality of Kepler’s third law problem. Gauss calculates the perturbation of a planet in accordance with the Kepler’s second law. On the other hand, Boltzmann proposes the gas theory and the entropy theory in 1898, as the last microscopically descriptive type of equations such as the original Navier–Stokes equations. Schrödinger (1887–1961), in 1926, bases his original quantum theory on these classical mechanics of Kepler motion and the molecular motion theory. We like to document these mathematical topics.

- 2 Shigeru Masuda (Kyoto Univ.)[#] The Fourier’s heat communication theory and Boltzmann’s gas transport equations 20

Summary: Fourier (1768–1830)’s first academic work is about the communication of heat of disjoint masses, namely, n -body problem, in which he extends it from the disjoint masses to continuum, however, he discuss only the infinitesimal material without the word: molecule, while the contemporaries, such as Navier, Poisson and Cauchy, use it discussing the formulation of fluid dynamics. After his manuscript version 1807–11, Fourier published “The Analytical Theory of Heat” in 1822, in which he arranges the theory of trigonometric series before the communication theory and adds the new conception: continuum. As another paper 1820, (unpublished until 3 years after his death,) he proposes finally the equations of motion of heat in fluid in handling the molecular action, that is the topics we like to document as one of the preceding modeling of the transport equations by Boltzmann (1844–1906) in 1895.

- 3 Shotaro Tanaka * Representation of fractional functions using power series 3 20

Summary: This work will be a branch of high school mathematics. We shall investigate the history of that. J. Bernoulli “Tractatus” is the historical starting point. $\Sigma_0(a + nc)/bd^n \Rightarrow (ad^2 - ad - cd)/(bd^2 - 2bd + b)$. De Moivre “Miscellanea” $a + bx + P + Q + \dots \Rightarrow \{a + (b - fa)x\}/(1 - fx - gx^2)$. L. Euler “Infinitorum” $(1 - z)/(1 - z - 2z^2) \Rightarrow (1/3)\Sigma_0\{(-1)^n + 2^{n+1}\}z^n$. It is said that A. Laurent found his series in 1843, i.e. {function \Rightarrow Laurent’s series}. G. H. Hardy “Course” {equations $a_n - a_{n-1} - 2a_{n-2} = 0, (a_0, a_1) : \text{any}$ } $\Rightarrow \Sigma_0\{(-1)^n A_1 + (n + 1)A_2\}x^n$. M. Fujiwara “Algebra I” $(x - 1)/(2x^2 + x - 1) \Rightarrow \Sigma_0(-1)^n x^{-n-1} + (-1/3)\Sigma_0(1/2)^n x^{-n-1}$. How is the fraction $(1 - z)/(1 - z - 2z^2)$ represented in whole domain?

- 4 Hideyuki Majima (Ochanomizu Univ.)[#] When did Takebe Katahiro verify the calculation of Pi by Seki Takakazu? 20

Summary: We gave some remarks on the calculation by Takakazu Seki a few years. Seki found the so-called Aitken’s delta-sequenced process in his theory, but there were some errors in his calculation and he only claimed that his approximate number of pi was a bit less than 3.14159265359. Katahiro Takebe followed Seki’s method and discovered another method of calculation of pi. When did Takebe verify Seki’s calculation?

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

Tatsuhiko Kobayashi [#] Takakazu Seki, Katahiro Takebe, and Genkei Nakane
(Maebashi Inst. of Tech.* / Yokkaichi Univ.)

Summary: Takakazu Seki (?–1708) who calls a founder of pre-modern Japanese mathematics was a vassal of the Kofu Clan. It seems that he served his master, Tsunashige Tokugawa, around 1665. Main affairs in his young age was guarding the Clan master, and in his middle age he engaged in survey of the Kofu Clan estates or in an auditor. Then occasionally he complied with request of Japanese confectionery storekeepers want to meet his master. Work of his later years was keeping assets of a successor of the sixth shogun as an auditor in Nishi-no-maru of Edo castle. Katahiro Takebe (1664–1739) became a pupil of T. Seki in 1676. And he also served as a vassal of the Kofu Clan to Tsunatoyo Tokugawa in 1692. His main business at the Kofu Clan house was of taking care his master. After Yoshimune Tokugawa was inaugurated as the eighth shogun of the Edo shogunate, K. Takebe helped calendar reform by Y. Tokugawa as a mathematical science adviser. On the other hand, he had participated making of Japanese map. Genkei Nakane (1662–1733) has first studied calendar under Harumi Shibukawa in Kyoto, while learned mathematics from Yoshizane Tanaka. Then he got a position as a public official at the Kyoto silver foundry in 1711. He also contributed to calendar reform by the eighth shogun Y. Tokugawa, since he had encountered with K. Takebe. As slightly above-mentioned, in this lecture we would like to refer to life of three mathematicians and role in the Edo shogunate.

15:25–16:50

- 5 Toshio Suzuki (Tokyo Metro. Univ.) [#] Street pattern complexity based on affine compressibility 15
Yuji Hatakeyama (GREE, Inc.)

Summary: Given a polygon, its isoperimetric ratio denotes the ratio of the square of the perimeter to the area. Let c be the isoperimetric ratio of the regular triangle. We observe (1) Every convex quadrilateral is affine-equivalent to a quadrilateral whose isoperimetric ratio is less than c . (2) This result is optimal; We cannot replace c by a smaller number. We discuss an application of the above result to complexity measure of street patterns. The talk is a summary of our paper in the proceeding of The World Congress on Engineering 2013, July 2013, Imperial College London, UK.

- 6 Akitoshi Kawamura (Univ. of Tokyo) [#] Polynomial-time randomness and differentiability 15
Kenshi Miyabe (Univ. of Tokyo)

Summary: Brattka, Miller, and Nies showed in 2011 that a real number is computably random if and only if every nondecreasing computable real function is differentiable at it. They asked whether the same thing can be said for polynomial-time randomness and polynomial-time computability. We point out that much of the ideas in their argument can be organized into several computational steps related to martingales with various “bases” for real numbers, in a slightly generalized sense. We then show that a simple modification in one of the steps makes the computation efficient and yields the polynomial-time version of the theorem. (A. Nies has also obtained the polynomial-time version using different techniques.)

- 7 Toshihiko Kurata (Hosei Univ.) [#] Sheaf-theoretical representation of concrete domains 15

Summary: We concentrate on the class of sheaves satisfying a certain finiteness condition on sections, and give a both-way translation between such sheaves and concrete domains which is known as models of the sequentiality of higher-order computation. This viewpoint enables us to remove several technical conditions required in the ordinary definition of concrete domains.

- 8 Ryo Kashima (Tokyo Tech)[#] On axiomatizations of subsystems of the full computation tree logic
 Shu Iwanami (Tokyo Tech) CTL* 15

Summary: Temporal logics ECTL and ECTL⁺ are subsystems of the full computation tree logic CTL*. Last year, the first author gave a Hilbert-style axiomatization for ECTL. We extend this result to ECTL⁺, and we try to extend it to CTL*. We hope this will refine the results by Reynolds (2001, 2005).

- 9 Nobu-Yuki Suzuki (Shizuoka Univ.)[#] The Prawitz–Doorman term existence property in intermediate predicate logics 20

Summary: To show the term existence property (TEP) of intuitionistic predicate logic, Prawitz first proved a weak variant of TEP and next applied the disjunction property. Doorman extended this result to the setting of languages having function symbols. We call this weak variant of TEP the Prawitz–Doorman term existence property (PD-TEP), and consider this property in intermediate predicate logics with languages having function symbols. We give a sufficient condition of PD-TEP by making use of Kripke semantics. Then, We show that TEP does not follow from the PD-TEP. That is, PD-TEP is definitely a weak variant of TEP.

September 27th (Fri) Conference Room IX

10:00–11:25

- 10 Takashi Oyabu Fundamental thoughts 5

Summary: DIFF(M): -MATHEMATICS:
 AUT(M): -MATHEMATICS:

- 11 Makoto Kikuchi (Kobe Univ.)[#] On proofs of the incompleteness theorem based on liar-type inconsistency
 Taishi Kurahashi (Kobe Univ.) tency 10

Summary: We shall define liar-type inconsistency within propositional logic and show a proof of the incompleteness theorem based on the existence of a liar-type inconsistency, which is a generalization of the standard proof of the incompleteness theorem based on the liar paradox. We shall expand these argument to predicate logic and generalize proofs of the incompleteness theorem based on Yablo's paradox which is a liar-like paradox without self-reference. Furthermore, we show that there is no liar-type inconsistency without self-reference in the sense of Yablo which can be formalized within propositional logic.

- 12 Taishi Kurahashi (Kobe Univ.)[#] Formalizations of Yablo's paradox using Rosser's provability predicates 15

Summary: Priest showed that arithmetical formalization of Yablo's paradox leads to Gödel's first incompleteness theorem. Kikuchi and Kurahashi, and Cieśliński and Urbaniak gave proofs of the second incompleteness theorem based on Priest's formalization of Yablo's paradox. We investigate the incomplete phenomenon of the formalizations $Y^R(x)$ of Yablo's paradox using Rosser's provability predicates, and prove that for each theory which is not Σ_1 -sound, the undecidability of each instance of $Y^R(x)$ is dependent on the choice of a standard proof predicate. We prove our results by using the technique of Guaspari and Solovay.

- 13 Yoshihiro Horihata (Yonago Nat. Coll. of Tech.)[#] Theories of concatenation and weak essentially undecidable theories 10
 Kojiro Higuchi (Chiba Univ.)

Summary: We prove that the concatenation theory WTC minus the axiom of identity is a minimal essentially undecidable theory. Moreover, we prove that Grzegorzczuk’s theory TC is also a minimal essentially undecidable theory. This result is a positive answer to the question raised by Grzegorzczuk and Zdanowski.

- 14 Yoshihiro Abe (Kanagawa Univ.)[#] Unbounded sets of $\mathcal{P}_\kappa\lambda$ with cardinality $< \lambda^{<\kappa}$ 15

Summary: For κ regular $< \lambda$ a cardinal, let $\mathcal{P}_\kappa\lambda = \{x \subset \lambda : |x| < \kappa\}$. $X \subset \mathcal{P}_\kappa\lambda$ is unbounded if $\forall x \in \mathcal{P}_\kappa\lambda \exists y \in X(x \subset y)$. If κ is not inaccessible, there can be unbounded sets with cardinality $< |\mathcal{P}_\kappa\lambda|$. We observe the ideal generated by such unbounded sets and the bounded sets.

- 15 Teruyuki Yorioka (Shizuoka Univ.)[#] A comment on Asperó–Mota iteration 15

Summary: Recently, David Asperó and Miguel Angel Mota discover a new method of iterated forcing using models as side conditions. The side condition method of models is introduced by Stevo Todorčević in 1980s. Asperó–Mota iteration enable us to force some Π_2 -statements with the continuum greater than \aleph_2 . By using Asperó–Mota iteration, it is proved that it is consistent that \mathfrak{U} fails, there are no weak club guessing ladder systems, $\mathfrak{p} = \text{add}(\mathcal{N}) = 2^{\aleph_0}$ which are greater than \aleph_2 and MA_{\aleph_1} fails.

- 16 Yu-ichi Tanaka (Univ. of Tsukuba)[#] A new method for constructing real closed fields 10
 Akito Tsuboi (Univ. of Tsukuba)

Summary: There are several ways of constructing the structure \mathbf{R} of real numbers as an ordered field. Among such constructions, one using Dedekind cuts and one using Cauchy sequences are particularly well-known. A somewhat less known alternative is one using nonprincipal ultrafilter: Let \mathbf{Q}^* be the ultrapower of the field \mathbf{Q} of rationals by a non-principal ultrafilter. If we set F to be the set of finite elements in \mathbf{Q}^* and I to be the set of infinitesimals, then F/I becomes a complete ordered field, hence it is isomorphic to \mathbf{R} .

We modify this ultrapower construction and present a new method for constructing countable real closed fields from a \mathbf{Q} -type ordered field.

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

- Koichiro Ikeda (Hosei Univ.)[#] On generic structures

Summary: In the late 1980s, Hrushovski modified the Fraïssé construction of homogeneous universal relational structures to obtain counter-examples to two famous conjectures by Lachlan and Zilber. He defined a class \mathbf{K} of finite L -structures derived from a predimension, and constructed new infinite structures by amalgamating the elements of \mathbf{K} . His structures are called \mathbf{K} -generic, and his techniques are still being applied to construct new ones. However, all known generic structures were strictly stable or ω -stable. In 1993, Baldwin asked a question whether there is a strictly superstable generic structure or not. To his question, I gave a generic structure whose theory is strictly superstable. In my talk, I will explain related topics to this result.

Algebra

September 24th (Tue) Conference Room I

9:00–12:00

- 1 Yasutoshi Nomura * On divisibility of differences of binomial coefficients ······ 10

Summary: Given positive integers n, m, s and a prime p , we consider a problem whether certain differences of binomial coefficients depending on m, n , and p are divisible by the s -th power of p or not and we state some results which is obtained by numerical experiments.

- 2 Fuminori Kawamoto (Gakushuin Univ.)[#] Continued fraction expansions with even period and primary symmetric
Yasuhiro Kishi (Aichi Univ. of Edu.) parts with extremely large end ······ 15
Hiroshi Suzuki (Nagoya Univ.)
Koshi Tomita (Meijo Univ.)

Summary: For continued fraction expansions with even period, we introduce a notion of primary symmetric parts of extremely large end (ELE) for solving Gauss' class number problem for real quadratic fields.

- 3 Fuminori Kawamoto (Gakushuin Univ.)[#] Construction of primary symmetric parts of extremely large end ······ 15
Yasuhiro Kishi (Aichi Univ. of Edu.)
Hiroshi Suzuki (Nagoya Univ.)
Koshi Tomita (Meijo Univ.)

Summary: We give a construction of primary symmetric parts of extremely large end (ELE).

- 4 Soichi Ikeda (Nagoya Univ.)^{*} Mean values of the double zeta function ······ 10
Kaneaki Matsuoka (Nagoya Univ.)
Yoshikazu Nagata (Nagoya Univ.)

Summary: Let $s_1 = \sigma_1 + it$ and $s_2 = \sigma_2 + it$ with $\sigma_1, \sigma_2, t \in \mathbb{R}$. For certain σ_1 and σ_2 we study mean values $\int_2^T |\zeta_2(s_1, s_2)|^2 dt_1$ and $\int_2^T |\zeta_2(s_1, s_2)|^2 dt_2$, where $\zeta_2(s_1, s_2)$ is Euler double zeta function.

- 5 Shin-ya Koyama (Toyo Univ.)[#] The deep Riemann hypothesis for Selberg zeta functions ······ 10
Fumika Suzuki
(Univ. of British Columbia)

Summary: Convergence of Euler products in the critical strip is directly related to a proof of the Riemann hypothesis. Moreover its behavior on the critical line, which is called the deep Riemann hypothesis, was recently proved by Kimura–Koyama–Kurokawa over function fields in case the L-function is regular at $s = 1$. In this talk we generalize their results to the Selberg zeta functions of principal congruence subgroups over function fields. We show the convergence of Euler products and establish the relation to the values of Selberg zeta functions.

- 6 Yoshikatsu Yashiro (Nagoya Univ.)[#] Mertens' theorem and prime number theorem for Selberg class ······ 10

Summary: Mertens gave the approximate formula of partial Euler product for Riemann zeta function at $s = 1$, which is called Mertens' theorem. In this talk, we shall consider Mertens' theorem and prime number theorem for Selberg class.

- 7 Takahiro Wakasa (Nagoya Univ.)* Explicit supremum of the function $S_1(t)$ in short intervals on the Riemann Hypothesis 10

Summary: We prove upper and lower bounds on the supremum of the function $S_1(t)$ under the Riemann Hypothesis. The function $S_1(t)$ is defined by the integration of the argument of the Riemann zeta-function. The same type of results on the supremum of $S(t)$ under the Riemann Hypothesis have already been obtained by Korolev. Our result is based on the idea of the paper of Korolev.

- 8 Tomokazu Onozuka (Nagoya Univ.)# The asymptotic behavior of multiple zeta-functions at non-positive integers 10

Summary: We give a result on the asymptotic behavior of multiple zeta-functions near non-positive integers. By using that result, we evaluate limit values of multiple zeta-functions at non-positive integers.

- 9 Takuya Okamoto (Ritsumeikan Univ.)# Mean value theorems for the Mordell–Tornheim double zeta-function
Tomokazu Onozuka (Nagoya Univ.) 15

Summary: Matsumoto and Tsumura proved mean value theorems for the Euler–Zagier double zeta-function. In this talk, we consider mean value theorems for the Mordell–Tornheim double zeta-function.

- 10 Ryo Tanaka (Nagoya Univ.)# Functional equations for general multiple zeta functions including Hurwitz–Lerch and Mordell–Tornheim types 15

Summary: Although the functional equation for the Euler–Zagier double zeta function $\zeta_{EZ,2}$ has been developed by previous studies, there is not enough information known about the functional equation of the other multiple zeta functions. Here, firstly I am going to introduce a general multiple zeta function ψ_{Ω}^{Δ} and show its functional equation. Secondly, since the class of ψ_{Ω}^{Δ} does not include some important multiple zeta functions such as $\zeta_{EZ,2}$, I am going to explain how to approximate such functions by using ψ_{Ω}^{Δ} and construct their functional equations. By this method, we can obtain functional equations for a huge range of multiple zeta functions including Mordell–Tornheim type which is generalization of $\zeta_{EZ,2}$.

- 11 Daisuke Shiomi (Yamagata Univ.)* Non-ordinary cyclotomic function fields 10

Summary: In this talk, we talk about the p -rank of the Jacobian of cyclotomic function fields. The main result of this talk is to prove that there are infinity many non-ordinary cyclotomic function fields.

- 12 Takeshi Kurosawa (Tokyo Univ. of Sci.)# Transcendence of infinite products with Fibonacci numbers 10

Summary: We discuss transcendence of certain infinite products including Fibonacci and Lucas sequence. These infinite products are expressed by special values of Mahler functions. Using the Mahler theory, we give necessary and sufficient conditions for the algebraicity of the infinite products and concrete expressions for the infinite products to be algebraic.

- 13 Yohei Tachiya (Hirosaki Univ.)[‡] Irrationality of Lambert series associated with periodic sequence 10

Summary: Let q be an integer with $|q| > 1$ and $\{a_n\}_{n \geq 1}$ be an eventually periodic sequence of rational numbers, not identically zero from some point on. Then the number $\sum_{n=1}^{\infty} a_n/(q^n - 1)$ is irrational. This generalizes a result of Erdős who treated the case of $a_n = 1$ ($n \geq 1$).

14:15–16:45

- 14 Hirofumi Nagoshi (Gunma Univ.)^{*} Independence of L -functions and the Nevanlinna characteristic 10

Summary: In 1900 Hilbert stated that the Riemann zeta-function $\zeta(s)$ does not satisfy any nontrivial algebraic differential equation whose coefficients are rational functions. This property of $\zeta(s)$ has been strengthened (at least) in two directions. One is due to Voronin and the other is from the viewpoint of the Nevanlinna theory. In this talk, further extensions of these results will be given. The case of not only the Riemann zeta-function $\zeta(s)$ but also general L -functions will be discussed.

- 15 Hidehiko Mishou (Tokyo Denki Univ.)^{*} Examples of any number of automorphic L -functions with joint universality property 10
Hirofumi Nagoshi (Gunma Univ.)

Summary: It is known that the joint universality theorem holds for a pair of automorphic L -functions. In this talk, we give two examples of any number of automorphic L -functions with joint universality property.

- 16 Takehito Yoshiki (Univ. of Tokyo)[‡] A general formula for the discriminant of polynomials over \mathbb{F}_2 determining the parity of the number of prime factors 10

Summary: In order to find irreducible polynomials over \mathbb{F}_2 efficiently, the method using Swan's theorem is known. Swan's theorem determines the parity of the number of irreducible factors of a polynomial f over \mathbb{F}_2 with no repeated root, by using the discriminant $D(\tilde{f}) \pmod{8}$, where \tilde{f} is a monic polynomial over \mathbb{Z}_2 such that $\tilde{f} \equiv f \pmod{2}$. In the lecture, we will give the formula for the discriminant $D(\tilde{f}) \pmod{8}$ for a polynomial f over \mathbb{F}_2 with no repeated root. By applying this formula to various types of polynomials, we shall get the parity of the number of irreducible factors of them.

- 17 Keisuke Arai (Tokyo Denki Univ.)^{*} Non-existence of elliptic points on Shimura curves of $\Gamma_0(p)$ -type 15

Summary: In previous works we proved that, over number fields, there are at most elliptic points on Shimura curves of $\Gamma_0(p)$ -type for every sufficiently large prime number p under a mild assumption. In this talk, we report the non-existence of elliptic points on Shimura curves of $\Gamma_0(p)$ -type. We also give a numerical example.

- 18 Kenichi Shimizu^{*} Imaginary quadratic fields whose exponents are equal to two 10
(Kenmei Girls' Junior and Senior High School)

Summary: In imaginary quadratic fields, we consider conditions such that exponents of ideal class groups are equal to two.

- 19 Jerome T. Dimabayao (Kyushu Univ.)[‡] On the vanishing of cohomologies of p -adic Galois representations associated with elliptic curves 15

Summary: Let K be a p -adic field and E an elliptic curve over K with potentially good reduction. In this talk, we show that for some large Galois extension L containing the field $K(\mu_{p^\infty})$ in a fixed algebraic closure of K , all the cohomology groups of $\rho(G_L)$ with values in $V_p(E)$ vanish; where ρ is the homomorphism giving the action of G_K on the vector space $V_p(E)$.

- 20 Yuken Miyasaka (Tohoku Univ.)[‡] Honda theory for formal groups of abelian varieties over \mathbb{Q} of GL_2 -type 10

Summary: Honda proved that a formal group associated to the formal completion along the zero section of the Néron model over \mathbb{Z} of an elliptic curve E over \mathbb{Q} is strongly isomorphic over \mathbb{Z} to the formal group obtained from the L -series attached to the l -adic representations of $\text{Gal}(\bar{\mathbb{Q}}/\mathbb{Q})$ on E . Deninger–Nart generalized Honda’s theorem to abelian varieties over \mathbb{Q} of GL_2 -type with real multiplication. In this talk, we give a generalization of that with complex multiplication. As an application, we give a method to calculate the coefficients of the L -series attached to the l -adic representations on Jacobian varieties of GL_2 -type.

- 21 Hiroshi Sakata * A remark on the trace formula for Jacobi forms of prime power level (Waseda Univ. Senior High School) 15

Summary: We describe the trace formula for Jacobi forms of prime odd power level, and consider about the ‘Hecke structure’ of the Jacobi form space in the case of prime power level. Moreover, we discuss about the existence of the level-index changing operator on Jacobi forms in the case of prime odd power level.

- 22 Hirotaka Kodama (Kinki Univ.)[‡] A congruence property of a Siegel cusp form of odd weight 10
Shoyu Nagaoka (Kinki Univ.)

Summary: In the previous meeting, we introduced a strange mod 23 congruence property satisfied by Igusa’s cusp form of weight 35. At that time, we remarked that there is another mod 23 congruence at weight 12. Namely, it is interpreted that the weight 35 comes from the sum of the congruence prime 23 and the corresponding weight 12. Mizumoto proved the existence of a similar congruence mod 31 at weight 16. Therefore it is expected that there is a cusp form of weight $47 = 16 + 31$. In this talk, we report that we can construct the cusp form explicitly. Finally, we present a conjecture concerning the congruence property.

- 23 Takao Watanabe (Osaka Univ.)^{*} A construction of fundamental domains for arithmetic quotients of reductive algebraic groups 10

Summary: Let G be a connected reductive algebraic group defined over a number field k . We introduce the Ryshkov domain R for the arithmetical minimum function m_Q defined from a height function associated to a maximal k -parabolic subgroup Q of G . The domain R is a $Q(k)$ -invariant subset of the adèle group $G(A)$. We show that a fundamental domain Ω for $Q(k)\backslash R$ gives a fundamental domain for $G(k)\backslash G(A)$. Furthermore, we see that any local maximum m_Q is attained in the boundary of Ω .

- 24 Kohei Katata (Ehime Univ.)* On Ramanujan circulant graphs 15
 Miki Hirano (Ehime Univ.)
 Yoshinori Yamasaki (Ehime Univ.)

Summary: It is known that Ramanujan graphs are good graphs not only in communication network but also in number theory. Because they are closely related to the Riemann conjecture for the Ihara zeta function. For example, a complete graph which has more than three vertices is a Ramanujan graph. Now, consider a given family of graphs and \mathfrak{X}_n the subset of graphs which have n vertices. In each \mathfrak{X}_n , what we want to know is the greatest lower bound of a valency which guarantees the Ramanujan property. We study the set of all connected Cayley graphs on cyclic groups of odd order. Then we obtain that our question is related to the Hardy–Littlewood conjecture.

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

- Yuval Flicker [‡] Counting local systems via automorphic forms
 (Ohio State Univ./Ariel Univ.)

Summary: In the talk, we shall state precisely, explain and motivate the following result.

Let X_1 be a curve of genus g , projective and smooth over \mathbb{F}_q . Let $S_1 \subset X_1$ be a reduced divisor consisting of N_1 closed points of X_1 . Let (X, S) be obtained from (X_1, S_1) by extension of scalars to an algebraic closure \mathbb{F} of \mathbb{F}_q . Fix a prime ℓ not dividing q . The pullback by the Frobenius endomorphism Fr of X defines a permutation Fr^* of the set of isomorphism classes of rank n irreducible $\overline{\mathbb{Q}}_\ell$ -local systems on $X - S$. It maps to itself the subset of those classes for which the local monodromy at each $s \in S$ is unipotent, with a single Jordan block. Let $T(X_1, S_1, n, m)$ be the number of fixed points of Fr^{*m} acting on this subset. When $N_1 \geq 2$ we show that $T(X_1, S_1, n, m)$ is given by a formula reminiscent of a Lefschetz fixed point formula: the function $m \mapsto T(X_1, S_1, n, m)$ is of the form $\sum n_i \gamma_i^m$ for suitable integers n_i and “eigenvalues” γ_i . We use Lafforgue to reduce the computation of $T(X_1, S_1, n, m)$ to counting automorphic representations of $\text{GL}(n)$, and the assumption $N_1 \geq 2$ to move the counting to the multiplicative group of a division algebra, where the trace formula is easier to use.

September 25th (Wed) Conference Room I

9:00–12:00

- 25 Hidefumi Ohsugi (Rikkyo Univ.)[‡] Quadratic toric ideals and quadratic Gröbner bases of graphs 15
 Akihiro Shikama (Osaka Univ.)
 Kenta Nishiyama (Univ. of Shizuoka)
 Takayuki Hibi (Osaka Univ.)

Summary: Let G be a finite connected simple graph and I_G the toric ideal of the edge ring $K[G]$ of G . In the present paper we study finite graphs G with the property that I_G is generated by quadratic binomials and I_G possesses no quadratic Gröbner basis. First, we give a nontrivial infinite series of finite graphs with the above property. Second, we implement a combinatorial characterization for I_G to be generated by quadratic binomials and, by means of the computer search, we classify the finite graphs G with the above property, up to 8 vertices.

- 26 David A. Cox (Amherst Coll.)[#] Some invariants on normality of dilated polytopes 15
 Christian Haase
 (Goethe-Univ. Frankfurt)
 Takayuki Hibi
 (Osaka Univ./JST CREST)
 Akihiro Higashitani (Osaka Univ.)

Summary: Let $\mathcal{P} \subset \mathbb{R}^N$ be an integral convex polytope of dimension d and write $k\mathcal{P}$, where $k = 1, 2, \dots$ for dilations of \mathcal{P} . We say that \mathcal{P} is normal if, for any integer $k = 1, 2, \dots$ and for any $\alpha \in k\mathcal{P} \cap \mathbb{Z}^N$, there exist $\alpha_1, \dots, \alpha_k$ belonging to $\mathcal{P} \cap \mathbb{Z}^N$ such that $\alpha = \alpha_1 + \dots + \alpha_k$. A fundamental question is to determine the integers $k > 0$ for which the dilated polytope $k\mathcal{P}$ is normal. In this talk, combinatorial invariants related to the normality of dilated polytopes will be proposed and studied.

- 27 Akihiro Higashitani (Osaka Univ.)[#] Ehrhart polynomials of reflexive polytopes and orthogonal polynomial systems 15

Summary: In this talk, for the investigation of the behavior of roots of Ehrhart polynomials of reflexive polytopes, we consider the problem of which Ehrhart polynomials of reflexive polytopes form an orthogonal polynomial system with respect to some positive-definite moment functional. In particular, we concentrate on the Ehrhart polynomials of reflexive polytopes satisfying a certain three-terms recurrence formula. Moreover, we present several examples of reflexive polytopes whose Ehrhart polynomials satisfy such a three-terms recurrence formula.

- 28 Hiroyasu Takeda (Hokkaido Univ.)[#] For Hilbert basis of semi-group ring associated with the main diagonal sum model 15

Summary: Ohsugi and Hibi [1] showed that semi-group rings arising from two way subtable sum problems are normal if and only if the subtables are either diagonal or triangular. In this lecture, I talk about Hilbert basis of semi-group ring if the subtable is main diagonal and $n \geq 3$, call the main diagonal model.

- 29 Masahide Konishi (Nagoya Univ.)[#] A classification of cyclotomic KLR algebras of type $A_n^{(1)}$ 15

Summary: In KLR algebras, there are trivial idempotents called KLR idempotents. It is clear that there exists KLR idempotent which is not primitive in general. But in cyclotomic KLR algebras, it can be happen that all nonzero KLR idempotents are primitive. In this talk, we will determine when that happens in the type is essentially $A_n^{(1)}$.

- 30 Hirotaka Higashidaira (Meiji Univ.)[#] Sequentially Cohen–Macaulay bipartite graphs and cycle graphs 10

Summary: Let G be a simple undirected graph on n vertices, S polynomial ring in n variables over field K , and $I(G) \subset S$ denote associated edge ideal of G . We say a graph G is (sequentially) Cohen–Macaulay if $S/I(G)$ is has this property. A classification of Cohen–Macaulay finite graphs is given for bipartite graphs by Herzog and Hibi. In this talk, we give a necessary graph's condition for bipartite graph G to be sequentially Cohen–Macaulay.

- 31 Kyouko Kimura (Shizuoka Univ.)* Arithmetical rank of Gorenstein squarefree monomial ideals of height
Naoki Terai (Saga Univ.) three 15

Summary: Let S be a polynomial ring over a field K and I a squarefree monomial ideal of S . The arithmetical rank of I is defined as a minimum number u of elements $q_1, \dots, q_u \in I$ which generate I up to radical. If it is equal to the height of I , then I is said to be set-theoretic complete intersection. In this talk, we will show that a Gorenstein monomial ideal of height 3 is set-theoretic complete intersection.

- 32 Masataka Tomari (Nihon Univ.)* On Demazure's construction of finite Abelian coverings of normal graded rings 15

Summary: We will study finite Abelian cover of normal graded singularities in terms of Pinkham–Demazure's construction. We will define the new subgroup $Cl^0(R)$ of the torsion part of the divisor class group $Cl(R)$ of normal graded ring. For a finite subgroup G of $Cl(R)$, we show $G/Cl^0(R) \cap G$ is cyclic. Taking the Kummer cover of $\text{Proj}(R)$ by $Cl^0(R) \cap G$, the standard generator of $G/Cl^0(R) \cap G$ gives the Demazure divisor of an Abelian cover of R by G .

- 33 Yusuke Nakajima (Nagoya Univ.)[#] Dual F -signature of Cohen–Macaulay modules over cyclic quotient surface singularities 15

Summary: The notion of F -signature is defined by Huneke and Leuschke. It is known that the F -signature characterizes some singularities. This notion is extended to finitely generated modules and called dual F -signature. In this talk, we determine the dual F -signature of a certain class of Cohen–Macaulay modules (so-called “special”) over cyclic quotient surface singularities.

- 34 Manabu Matsuoka * Rings with direct summand conditions and linear codes 10
(Osaka Shoin Women's Univ.)

Summary: For a ring R , we consider the condition that every finitely generated free submodule N of a finitely generated free R -module M is a direct summand of M . For example QF rings satisfy this condition. Y. Hirano studied this rings. By the way, since several years, codes over finite Frobenius rings draw considerable attention in coding theory. J. A. Wood established the extension theorem and MacWilliams identities over finite Frobenius rings. In this talk, we study the rings with the direct summand condition and give the applications to coding theory.

- 35 Noritsugu Kameyama (Shinshu Univ.)[#] Constructions of Auslander–Gorenstein local rings 10
Mitsuo Hoshino (Univ. of Tsukuba)
Hirotaka Koga (Univ. of Tsukuba)

Summary: We provide a systematic construction of $\mathbb{Z}/n\mathbb{Z}$ -graded rings A starting from an arbitrary ring R and show that under mild assumptions A is an Auslander–Gorenstein local ring if and only if so is R . Next, for each A we construct a ring Λ containing A as a fixed subring of a certain automorphism and show that all the rings R , A and Λ are Auslander–Gorenstein if so is one of them.

13:15–14:15 Talk invited by Algebra SectionShunsuke Takagi (Univ. of Tokyo)[#] F -singularities and singularities in the minimal model program

Summary: F -singularities are classes of singularities in positive characteristic defined using the Frobenius morphism. F -singularities (partly) conjecturally correspond via reduction modulo $p > 0$ to singularities associated to the minimal model program in characteristic zero. In this talk, I will explain recent developments on this conjectured correspondence and how it relates to a problem on the existence of a positive density set of places with ordinary reduction for a projective variety over a number field.

September 26th (Thu) Conference Room I

9:00–11:25

- 36 Sho Matsuzawa (Shizuoka Univ.)[#] Classification of 3-dimensional quadratic AS-regular algebras 10
 Gahee Kim (Shizuoka Univ.)
 Hidetaka Matsumoto (Shizuoka Univ.)

Summary: Noncommutative algebraic geometry is the field of studying noncommutative rings by using methods of algebraic geometry. Algebras having a “one-to-one” correspondence with geometric pairs (E, σ) are called geometric. Since 3-dimensional quadratic AS-regular algebras are geometric, they can be classified by (E, σ) . In this talk, we will try to answer the question which 3-dimensional quadratic AS-regular algebras are isomorphic or Morita equivalent in terms of their defining relations.

- 37 Kenta Ueyama (Shizuoka Univ.)[#] Finite Cohen–Macaulay representation type and noncommutative graded isolated singularities 15

Summary: Isolated singularities play an important role both in algebraic geometry and commutative ring theory. Moreover, a commutative local Cohen–Macaulay ring of finite Cohen–Macaulay representation type is known to be an isolated singularity. In this talk, we give a noncommutative graded analogue. Namely, we show that if A is an AS-Cohen–Macaulay algebra of finite Cohen–Macaulay representation type, then A is a noncommutative graded isolated singularity.

- 38 Takahiko Furuya (Meikai Univ.)[#] Some self-injective algebras with finite Hochschild cohomology 10
 Takao Hayami (Hokkai-Gakuen Univ.)

Summary: In this talk, we give the dimensions of the Hochschild cohomology groups of some self-injective special biserial algebras whose Grothendieck groups are of rank four. This result provides us with a negative answer to a question of D. Happel.

- 39 Hirotaka Koga (Univ. of Tsukuba)[#] Finiteness of selfinjective dimension and associated invariants under derived equivalences 15

Summary: We provide some conditions which are stable under derived equivalences. Using these conditions, we characterize artin algebras of finite selfinjective dimension.

- 40 Daiki Obara (Tokyo Univ. of Sci.)[‡] One point extension of a quiver algebra defined by two cycles and a quantum-like relation 10

Summary: I talk about a one point extension algebra of a quiver algebra over a field defined by two cycles and a quantum-like relation. We determine the Hochschild cohomology ring modulo nilpotence.

- 41 Yasuhiko Takehana (Hakodate Nat. Coll. of Tech.)[‡] A generalization of Goldie torsion theory 10

Summary: If B is the class of all modules M/N such that N is essential in M , a torsion theory $(\mathcal{T}, \mathcal{F})$ generated by B is called the Goldie torsion theory. In this talk we generalize the Goldie torsion theory by using a hereditary torsion theory.

- 42 Ryo Kanda (Nagoya Univ.) Atom spectrum and classification of subcategories 15

Summary: We define the extension group between an atom and an object in a locally noetherian Grothendieck category as a module over a skew field. We show that the dimension of the i -th extension group between an atom and an object coincides with the i -th Bass number of the object with respect to the atom. As an application, we give a bijection between E -stable subcategories closed under arbitrary direct sums and direct summands and subsets of the atom spectrum and show that such subcategories are also closed under extensions, kernels of epimorphisms, and cokernels of monomorphisms.

- 43 Kenichi Shimizu (Nagoya Univ.)[‡] Canonical pivotal objects in finite tensor categories 15

Summary: A pivotal object is a pair (X, ϕ) consisting of an object X of a tensor category and an isomorphism ϕ from X to the double dual of X . Motivated by the Frobenius–Schur theory, I am interested in pivotal objects which are “canonical” in a certain sense. In this talk, I introduce a canonical pivotal object (A_C, ϕ_C) in a finite tensor category, which I call the adjoint object. The adjoint object extends the notion of the adjoint representation of Hopf algebras and has some interesting properties. For example, for each n , there is an isomorphism between $\text{Hom}_{\mathcal{C}}(1, A_C^{\otimes n})$ and the endomorphism algebra of the functor $\mathcal{C}^n \rightarrow \mathcal{C}$ induced by the tensor product.

- 44 Hiroaki Komatsu (Okayama Pref. Univ.)^{*} A characterization of coseparable corings by generalized coderivations 10

Summary: For an A -coring C and a B -coring D , we define a *generalized coderivation* and a *generalized inner coderivation* between (C, D) -bicomodules. We show that an A -coring C is coseparable if and only if, for any B -coring D , all generalized coderivations between (C, D) -bicomodules are generalized inner coderivations.

- 45 Yuji Tsuno (Chiba Inst. of Tech.)^{*} Central cleft extensions for free Hopf algebras 15

Summary: This is joint work with Akira Masuoka. Hopf–Galois extensions are quantum analogues of torsors. Moreover, the concept of cleft extensions, or equivalently of crossed products, for a Hopf algebra is a generalization of Galois extensions with normal basis and of crossed products for a group. Mitsuhiro Takeuchi constructed free Hopf algebras generated by coalgebras. Let $H(C)$ be the free Hopf algebra generated by a coalgebra C . Then we obtain that every central $H(C)$ -cleft extension over an arbitrary commutative algebra is trivial.

14:15–16:00

- 46 Takashi Niwasaki (Ehime Univ.)* A characterization of exceptional 2-groups by the numbers of the endomorphisms 10
 Tsunenobu Asai (Kinki Univ.)

Summary: This is a joint work with Yugen Takegahara (Muroran Institute of Technology) and Naoki Chigira (Kumamoto University). As an application of our results on the crossed homomorphisms of groups, we can prove the following.

Let P be a 2-group. If the number of the endomorphisms of P is not divisible by 8, then P is an exceptional 2-group, namely, one of a cyclic, a dihedral, a generalized quaternion and a semidihedral 2-group.

- 47 Akihiko Hida (Saitama Univ.)* On the mod p cohomology of the extraspecial p -group and the action of the double Burnside algebra 10

Summary: Let p be an odd prime. Let E be the extraspecial p -group of order p^3 and exponent p . We consider the action of the double Burnside algebra on the mod p cohomology ring of E and determine the composition factors.

- 48 Shigeo Koshitani (Chiba Univ.) The Alperin weight conjecture and Broue conjecture in modular representation theory 15
 Radha Kessar (City Univ. London)
 Markus Linckelmann (City Univ. London)

Summary: We will be discussing Alperin's weight conjecture and Broué's abelian defect group conjecture for perfect isometries for 2-blocks of finite groups with elementary abelian defect group of order 8. This is joint work with R. Kessar and M. Linckelmann.

- 49 Shigeo Koshitani (Chiba Univ.) Broue's abelian defect group conjecture for finite sporadic simple groups 15
 Jürgen Müller (RWTH Aachen Univ.)
 Felix Noeske (RWTH Aachen Univ.)

Summary: We will be discussing Broué's abelian defect group conjecture in modular representation theory of finite groups. We will be talking about especially three cases, namely, the Harada–Norton sporadic simple group, the double cover of the Higman–Sims sporadic simple group and the third Conway sporadic simple group.

- 50 Takanori Sakamoto * Some properties of factorized Lie algebras 10
 (Fukuoka Univ. of Edu.)
 Masanobu Honda (Nigata Univ. of Pharm. & App. Life Sci.)

Summary: Let $L = A + B$ be a factorized Lie algebra by two subalgebras A and B . For a subalgebra H of L we introduced its factorizer $X(H)$ and investigated some basic properties of $X(H)$. We also proved that if A satisfies the maximal (resp. minimal) condition on ideals and B satisfies the maximal (resp. minimal) condition on subalgebras, then L satisfies the maximal (resp. minimal) condition on ideals.

- 51 Masanari Okumura (Univ. of Tokyo)[#] Vertex algebras and the equivariant Lie algebroid cohomology 15

Summary: Lian–Linshaw–Song introduced a vertex-algebraic analogue of the equivariant cohomology of smooth manifolds with an action of a Lie group by using their small chiral de Rham complex. We generalize the small chiral de Rham complex by using Lie algebroids and construct a vertex-algebraic analogue of the equivariant Lie algebroid cohomology. We introduce a special kind of complex and present its property to compute in the case of some class of Lie algebroids associated with an infinitesimal action of a Lie algebra on a manifold.

- 52 Kazuya Kawasetsu (Univ. of Tokyo)^{*} The intermediate vertex subalgebras of the lattice vertex operator algebras 15

Summary: We introduce a notion of intermediate vertex subalgebras of lattice vertex operator algebras, as a generalization of the notion of principal subspaces. We give bases and the graded dimensions of such subalgebras. As an application, we show that the characters of some modules of an intermediate vertex subalgebra between E_7 and E_8 lattice vertex operator algebras satisfy some modular differential equations. This result is an analogue of the result concerning the “hole” of the Deligne dimension formulas and the intermediate Lie algebra between the simple Lie algebras E_7 and E_8 .

16:15–17:15 Talk invited by Algebra Section

- Masahiko Miyamoto [#] On orbifold conjecture about vertex operator algebras
(Univ. of Tsukuba)

Summary: In order to explain the moonshine phenomenon on the monster simple group and the modular functions, Bocherds has introduced a concept of vertex operator algebra (shortly VOA) as an algebraic version of conformal field theory. One of the main targets in the research of VOA is a construction of VOAs V of finite type, that is, V has only finitely many simple modules and every finitely generated module (including weak module) has a composition series. An orbifold conjecture says that for a simple vertex operator algebra V of finite type and a finite automorphism group G , a fixed point subVOA V^G is also of finite type. We prove that this orbifold conjecture is true for solvable automorphism groups G . We will also discuss cases where G are non-abelian simple groups.

September 27th (Fri) Conference Room I

9:30–12:00

- 53 Hiroko Yanaba (Hiroo Gakuen)[#] On pseudo primes 10
Inoru Shioya (Hiroo Gakuen)

Summary: Let $\sigma(a)$ denote the number of divisors of a positive integer a .
 $5\sigma(a) = 9a + 90$, if $a = 10p$, where p is a prime $\neq 2, 5$.
Conversely, suppose that $5\sigma(a) = 9a + 90$. If $a = 10n$, n being a positive integer, then i) n is a prime $\neq 2, 5$ or ii) $n = 2^2, 5^2$, which are called pseudo primes.

- 54 Shigeru Iitaka (Gakushuin Univ.)[#] Hartshorne’s identities and their applications 2 15

Summary: Some relations among birational invariants of algebraic plane curves are discussed. Four Hartshorne’s identities are presented. As applications, types where $\omega - g \leq 10$ are enumerated.

- 55 Kenta Watanabe (Osaka Univ.)* On extensions of a double covering of plane curves and Weierstrass semigroups of the double covering type 10

Summary: Let C be a smooth plane curve of degree d , P be a point on C , and let $\pi : \tilde{C} \rightarrow C$ be a double covering of the curve C with the branch point P . In this talk, we give a best possible sufficient condition for the double covering π to extend to a double covering $\tilde{\pi} : X \rightarrow \mathbb{P}^2$ branched along a reduced divisor of degree six which intersects transversally the curve C at $6d$ smooth points containing P , by computing the Weierstrass semigroup of the ramification point $\pi^{-1}(P)$.

- 56 Masaaki Homma (Kanagawa Univ.)[#] Numbers of points of surfaces in the projective 3-space over finite fields 15

Summary: We establish an elementary bound for numbers of points of surfaces in the projective 3-space over finite fields, and also give the complete list of surfaces that attain the elementary bound. This is a joint work with Seon Jeong Kim (Gyeongsang National University, Korea).

- 57 Shinya Kitagawa (Gifu Nat. Coll. of Tech.)* On certain pencils of plane curves of degree thirteen with a quintuple point and nine quadruple points II 15

Summary: Any genus two fibration on rational surface with Picard number eleven can be considered as a pencil of plane curves of degree thirteen with a quintuple point and nine quadruple points through a birational morphism. We consider the case where the fibrations have three singular fibres of types (V) in the sense of Horikawa, and write down the defining equations of the pencils with three parameters. Furthermore, we describe irreducible singular fibres, which are at most two.

- 58 Shingo Taki (Tokyo Denki Univ.)* On Oguiso's $K3$ surface 15

Summary: It is known that a non-symplectic automorphism of order 32 on a $K3$ surface does not act trivially on the Néron–Severi lattice. Oguiso gave an example of a $K3$ surface with a non-symplectic automorphism of order 32 which acts on the Néron–Severi lattice as an involution. In this talk, we see that a pair of a $K3$ surface and its non-symplectic automorphism of order 32 is isomorphic to Oguiso's example.

- 59 Humihiko Watanabe (Kitami Inst. of Tech.)* Twisted cohomology groups associated to configuration of two theta divisors on Jacobian variety of dimension 2 10

Summary: Let D_1 and D_2 be two distinct theta divisors on a two-dimensional Jacobian variety X , and let \mathcal{L} be the locally constant sheaf associated to a many-valued function on X infinitely ramified along $D_1 \cup D_2$. We discussed the cohomology group $H^p(X - D_1 \cup D_2, \mathcal{L})$, and made clear the structure of the non-vanishing cohomology group $H^2(X - D_1 \cup D_2, \mathcal{L})$.

- 60 Hiromu Tanaka (Kyoto Univ.) Cone theorem and minimal models for threefolds in positive characteristic 15

Summary: In this talk, I explain recent results on the minimal model theory in positive characteristic. The main theorem is the minimal model program for threefolds in characteristic $p > 5$. More precisely, if $p > 5$, then every smooth projective threefold is birational to a terminal projective threefold which is minimal or has a structure of Mori fiber space. This is a joint work with Paolo Cascini and Chenyang Xu.

61 Katsuhisa Furukawa (Waseda Univ.)[‡] Cohomological characterization of hyperquadrics of odd dimensions in characteristic two 15

Summary: S. Mori gave characterization of projective spaces in arbitrary characteristic $p \geq 0$ by ampleness of tangent bundles. J. Wahl characterized projective spaces in $p = 0$ by a cohomological condition; also, he remarked that a counter-example in $p = 2$ is constructed from hyperquadrics Q_{2n-1} ($n > 1$). This is caused by a common point which every embedded tangent space to the quadric contains. In general, a projective variety in P^N is said to be strange if it admits such a common point. A non-linear smooth curve is strange if and only if it is conic in $p = 2$ (E. Lluís, P. Samuel). S. Kleiman and R. Piene showed that a non-linear smooth hypersurface in P^N is strange if and only if it is Q_{2n-1} in $p = 2$. We prove that, a non-linear smooth complete intersection in P^N is strange if and only if it is a quadric in P^N of odd dimension in $p = 2$; these are also equivalent to a cohomological condition.

62 Michio Amano[‡] On the kernels of certain homomorphisms of the Witt vectors 10

Summary: In this talk, we discuss on kernels of T -map defined by T. Sekiguchi and N. Suwa. T -map is a homomorphism on the Witt vectors. Our main result is a relation between a kernel of the T -map and a certain Frobenius type kernel. After this, we consider its application.

14:15–15:30

63 Aiichi Yamasaki (Kyoto Univ.)[‡] Rationality of $z^2 = P(x)y^2 + Q(x)$ 10

Summary: The necessary and sufficient condition for the rationality of the surface $z^2 = P(x)y^2 + Q(x)$ is given as follows. Let $s = s_1 + s_2 + s_3 + s_4$, where s_1 (resp. s_2 , resp. s_3) is the number of $c \in \bar{k}$ such that $P(c) = 0$ and $Q(c) \notin k(c)^2$ (resp. $Q(c) = 0$ and $P(c) \notin k(c)^2$, resp. $P(c) = Q(c) = 0$ and $-Q/P(c) \notin k(c)^2$). $s_4 = 0$ or 1 and $s_4 = 1$ if and only if one of the following three conditions is satisfied (1) $\deg P$ even, $\deg Q$ odd, $p_0 \notin k^2$, (2) $\deg P$ odd, $\deg Q$ even, $q_0 \notin k^2$, (3) $\deg P$ odd, $\deg Q$ odd, $-q_0/p_0 \notin k^2$. Here p_0 (resp q_0) is the coefficient of the highest degree term of P (resp. Q).

(1) When $s \geq 4$, $k(x, y, z)$ is not rational over k . (2) When $s = 2$ or 3 , $k(x, y, z)$ is rational over k . (3) The case $s = 1$ can not happen. (4) When $s = 0$, $k(x, y, z)$ is rational over k except the following case. Both of $\deg P$ and $\deg Q$ are even and $a^2p_0 + b^2q_0 = c^2$ has no non-zero solution (a, b, c) in k .

64 Tatsuki Hayama[‡] Boundary component structure of period domains 15
(National Tsing Hua Univ.)

Summary: I will introduce recent results on boundary component structures of period domains and Mumford–Tate domains.

65 Tomohiro Iwami^{*} A Variant of Iskovskikh’s rationality criterion for conic bundles in the case of polarized (log) pairs 10
(Kyushu Sangyo Univ.)

Summary: S. Mori and Yu. Prokhorov positively proved the conjectural form of the rationality criterion for conic bundles posed by V. A. Iskovskikh, recently. Moreover, as succeeding to their works, V. V. Shokurov proposed some kinds of coarse moduli for several equivalence relations involving to Fano type varieties as outputs on running LMMP, based on his “geography of log models”. In this talk, I will try to consider a variant of Iskovskikh’s rationality criterion for conic bundles in the case of some kinds of limiting polarized (log) pairs.

- 66 Roberto Muñoz* Rational curves, Dynkin diagrams and Fano manifolds with nef tangent bundle 15
 (Univ. Rey Juan Carlos)
 Gianluca Occhetta (Univ. di Trento)
 Luis Eduardo Solá Conde
 (Univ. Rey Juan Carlos)
 Kiwamu Watanabe (Saitama Univ.)
 Jarek Wiśniewski (Warsaw Univ.)

Summary: A Fano manifold X with nef tangent bundle is of flag-type if it has the same type of elementary contractions as a complete flag manifold. In this talk we present a method to associate a Dynkin diagram $\mathcal{D}(X)$ with any such X , based on the numerical properties of its contractions. We then show that $\mathcal{D}(X)$ is the Dynkin diagram of a semisimple Lie group. As an application we prove that Campana–Peternell conjecture holds when X is a flag-type manifold whose Dynkin diagram is of classical type.

- 67 Kazunori Yasutake (Meiji Univ.)* On Fano n -folds with nef vector bundle $\Lambda^3 T_X$ having a birational contraction 10

Summary: In this talk, I will talk about the classification of Fano manifolds with a birational type extremal contraction whose third exterior power of tangent bundle $\Lambda^3 T_X$ is nef on every rational curves.

- 68 Sinichi Matsumura (Kagoshima Univ.)[#] A Nadel vanishing theorem for metrics with minimal singularities on big line bundles 10

Summary: In this talk, we study singular metrics of line bundles with non-algebraic singularities, their multiplier ideal sheaves and a Nadel type vanishing theorem, from the view point of complex geometry. The Nadel vanishing theorem can be seen as an analytic version of the Kawamata–Viehweg vanishing theorem of algebraic geometry. The main purpose of this talk is to establish such a theorem for the multiplier ideal sheaf of a metric with minimal singularities, for the cohomology with values in a big line bundle.

15:45–16:45 Talk invited by Algebra Section

- Yoshiaki Fukuma (Kochi Univ.)[#] A study on the dimension of global sections of adjoint bundles by invariants of quasi-polarized varieties

Summary: Let X be a projective variety of dimension n and let L be a nef and big Cartier divisor on X . Then the pair (X, L) is called a quasi-polarized variety. In this talk, we consider the case where X is smooth and we study the dimension of global sections of adjoint bundles. In particular, we focus on the following two cases: (a) $h^0(K_X + mL)$ and (b) $h^0(m(K_X + L))$, where m is a positive integer. First, as an example of the case (a), we consider Beltrametti–Sommese’s conjecture whose statement is the following: “If X is smooth, L is ample and $K_X + (n - 1)L$ is nef, then $h^0(K_X + (n - 1)L) > 0$.” In order to study this conjecture, we use the i th sectional geometric genus $g_i(X, L)$ of (X, L) , which is defined for every integer i with $0 \leq i \leq n$. This invariant is thought to be a generalization of classical invariants (the degree L^n and the sectional genus of (X, L)). In this talk, we explain how this conjecture relates to the sectional geometric genus. Next, as an example of the case (b), we study the following problem: “For fixed positive integer n , let $N(n)$ be the smallest positive integer among natural numbers P which satisfy the following: $h^0(m(K_X + L)) > 0$ holds for any integer m with $m \geq P$ and any smooth quasi-polarized varieties (X, L) with $\dim X = n$ such that $K_X + L$ is nef. Then study an upper bound for $N(n)$.” In order to consider this problem, we need another invariant which is the multiple line bundles’ version of the sectional geometric genus. So we introduce this invariant and explain the proof of the most recent result about this problem.

Geometry

September 24th (Tue) Conference Room VI

9:15–12:00

- 1 Hiroaki Izumi (Elpida Memory, Inc.)[#] The elucidation of the business cycle as a phase transition II 10

Summary: With Mr. Mikio Sato's words, we succeeded in an understanding of the physical concept of "phase transition", "mean field approximation", "symmetry", "symmetry breaking", "scale invariance", "renormalization", while solving economic phenomena. We feel that it stepped forward one step with new economics, physics, mathematics, history, etc.

- 2 Tetsuya Nagano (Univ. of Nagasaki)[#] On the tangent vector of geodesics in Finsler space 10

Summary: Generally geodesics of Finsler space depends on the direction. For two points p, q in the space, the geodesic line which leaves from q for p is different from a geodesic line toward q from p . In my lecture, I consider the relations of the tangent vectors at endpoints p, q of each geodesic line. Finally, using a provided result, I show one proposition about the conjugate point.

- 3 Tomonori Fukunaga (Hokkaido Univ.)^{*} Evolutes and involutes of fronts 15
Masatomo Takahashi
(Muroran Inst. of Tech.)

Summary: In this talk, we define an evolute and an involute of a front in the Euclidean plane and we consider about relationship between evolutes and involutes of fronts. By using a moving frame of a front and the curvature of the Legendre immersion, we can observe that the evolute and the involute of the front are corresponding to the differential and integral in classical calculus.

- 4 Yoshinori Machida ^{*} Geometry of conformal triality from the D_4 diagram and singularities
(Numazu Nat. Coll. of Tech.) 15
Goo Ishikawa (Hokkaido Univ.)
Masatomo Takahashi
(Muroran Inst. of Tech.)

Summary: It is well known that the projective duality can be understood in the context of A_n -type. In this talk, we construct explicitly a flag manifold, its triple-fibration and a differential system which have D_4 symmetry and conformal triality. Then we give the generic classification result for singularities of the tangent surfaces to associated integral curves, which exhibits the triality. The classification is performed in terms of the classical theory on root systems combined with the singularity theory of mappings.

- 5 Goo Ishikawa (Hokkaido Univ.)[#] Singular path duality for Cartan distributions from geometric control
Yumiko Kitagawa theory 15
(Oita Nat. Coll. of Tech.)
Wataru Yukuno (Hokkaido Univ.)

Summary: We show a duality which arises from distributions of Cartan type with growth (2, 3, 5) from the view point of geometric control theory. In fact we consider the space of singular (or abnormal) paths on a given five dimensional space endowed with a Cartan distribution, which form another five dimensional space with a cone structure. We regard the cone structure as a control system and show that the space of singular paths of the cone structure is naturally identified the original space. Moreover we observe the asymmetry on this duality in terms of singular paths.

- 6 Sadahiro Maeda (Saga Univ.)[#] Sectional curvatures of ruled real hypersurfaces in a nonflat complex space form 10
 Hiromasa Tanabe (Matsue Coll. of Tech.)

Summary: We compute sectional curvatures of all ruled real hypersurfaces in a nonflat complex space form.

- 7 Sadahiro Maeda (Saga Univ.)[#] Normal real hypersurfaces in a nonflat complex space form 15
 Hiromasa Tanabe (Matsue Coll. of Tech.)
 Byung Hak Kim (Kyung Hee Univ.)

Summary: We classify all normal real hypersurfaces in a nonflat complex space form and investigate their geometric properties.

- 8 Aya Ishizeki (Saitama Univ.)^{*} Decomposition of the Möbius energy and its Möbius invariance 15
 Takeyuki Nagasawa (Saitama Univ.)

Summary: The Möbius energy was introduced by O’Hara in 1991 as an energy of knots. It is well-known that the energy has the Möbius invariance. In this talk, a decomposition theorem of the Möbius energy is shown. The energy is decomposed into three terms, each of which has the Möbius invariance. The first term of decomposition characterizes the natural domain $H^{1,\infty} \cap H^{\frac{3}{2}}$ of the energy, where $H^{\alpha,p}$ is the fractional order Sobolev space, and $H^{\alpha,2} = H^\alpha$. The second term defines a functional which is essentially the same as the O’Hara–Solanes energy which was introduced by them in the different approach.

- 9 Ryosuke Mineyama (Osaka Univ.)[#] On Cannon–Thurston maps for Coxeter groups 15

Summary: For a Coxeter group W we have an associating bi-linear form B on suitable real vector space. We assume that B has signature $(n - 1, 1)$ and for any sub-matrix whose rank $n' \geq 3$ has also signature $(n' - 1, 1)$. Under these assumptions, we see that there exists the Cannon–Thurston map for W , that is, a W -equivariant continuous surjection from the Gromov boundary of W to the limit set of W . To see this we construct an isometric action of W on an ellipsoidal region with the Hilbert metric. As a consequence, we see that the limit set of W coincides with the set of accumulation points of roots of W .

- 10 Akihiro Higashitani (Osaka Univ.)[#] Asymptotic behavior of roots of infinite Coxeter groups 15
 Ryosuke Mineyama (Osaka Univ.)
 Norihiro Nakashima (Hokkaido Univ.)

Summary: In this talk, we investigate the set of accumulation points of normalized roots of infinite Coxeter groups. We prove the conjecture on the limit set of roots of infinite Coxeter groups of rank n in the case where the equipped Coxeter matrices have the signature $(n - 1, 1)$.

14:15–16:00

- 11 Tomoaki Yatsui[#] On the prolongation of sub-conformal fundamental graded Lie algebras 10

Summary: We first introduce the notion of subconformal fundamental graded Lie algebras. Further we investigate the structure of the prolongation of subconformal fundamental graded Lie algebras. In particular we state the classification of the prolongations of sub-conformal fundamental graded Lie algebras of semisimple type.

- 12 Yuto Imai (Waseda Univ.)[#] On the quarternification of the Lie algebra $Map(S^3, \mathfrak{g})$ and its extensions 10
 Tosiaki Kori (Waseda Univ.)

Summary: Let $(\mathfrak{g}, [\cdot, \cdot]_{\mathfrak{g}})$ be a complex Lie algebra and $U(\mathfrak{g})$ be the enveloping algebra of \mathfrak{g} . Let \mathbf{H} be the quaternions and $S^3\mathbf{H}$ be the space of \mathbf{H} -valued mappings on S^3 . We introduce a Lie algebra structure on $S^3\mathfrak{g}^{\mathbf{H}} = S^3\mathbf{H} \otimes U(\mathfrak{g})$. Then we introduce a 2-cocycle on $S^3\mathfrak{g}^{\mathbf{H}}$ and the corresponding central extension $S^3\mathfrak{g}^{\mathbf{H}} \oplus (\mathbf{C}a)$. As a Lie subalgebra of $S^3\mathbf{H}$ we have the Lie algebra of Laurent polynomial spinors $\mathbf{C}[\phi^{\pm(m,l,k)}]$. Then $\mathbf{C}[\phi^{\pm(m,l,k)}] \otimes U(\mathfrak{g})$ is a Lie subalgebra of $S^3\mathfrak{g}^{\mathbf{H}}$. Its central extension $\widehat{\mathfrak{g}}(a)$ is obtained as a Lie subalgebra of $S^3\mathfrak{g}^{\mathbf{H}} \oplus (\mathbf{C}a)$. Finally we have a Lie algebra $\widehat{\mathfrak{g}}$ which is obtained by adding to $\widehat{\mathfrak{g}}(a)$ a derivation d . When \mathfrak{g} is a simple Lie algebra, $\widehat{\mathfrak{g}}$ is an infinite dimensional simple Lie algebra. We shall investigate the root space decomposition and Chevalley generator of $\widehat{\mathfrak{g}}$.

- 13 Takahiro Hashinaga (Hiroshima Univ.)[#] Homogeneous Ricci soliton hypersurfaces in complex hyperbolic spaces 10
 Akira Kubo (Hiroshima Univ.)
 Hiroshi Tamaru (Hiroshima Univ.)

Summary: A Lie hypersurface in a complex hyperbolic space is an orbit of a cohomogeneity one action without singular orbit. In this talk, we present a classification of Ricci soliton Lie hypersurfaces in complex hyperbolic spaces.

- 14 Hiroyuki Tasaki (Univ. of Tsukuba)* Antipodal sets in oriented real Grassmann manifolds 10

Summary: An antipodal set in a Riemannian symmetric space is a subset where the restriction of the symmetry at each point is the identity, which was introduced by Chen and Nagano. We reduce the problem of classifying all maximal antipodal sets in the oriented real Grassmann manifold $\tilde{G}_k(\mathbf{R}^n)$ consisting of oriented subspaces of dimension k in the real vector space of dimension n to that of classifying all maximal subsets satisfying certain conditions in the set consisting of subsets of cardinality k in $\{1, \dots, n\}$. Using this reduction we classify all maximal antipodal sets in $\tilde{G}_k(\mathbf{R}^n)$ for $k \leq 4$.

- 15 Jost-Hinrich Eschenburg* Maximal tori of extrinsic symmetric spaces and meridians 15
 (Univ. of Augsburg)
 Peter Quast (Univ. of Augsburg)
 Makiko Tanaka (Tokyo Univ. of Sci.)

Summary: We give a different proof of a theorem of O. Loos which characterizes maximal tori of extrinsically symmetric spaces. On the way we show some facts on certain symmetric subspaces, so called meridians, which previously have been known only using classification.

- 16 Yuriko Umemoto (Osaka City Univ.)[#] Growth rates of cocompact hyperbolic Coxeter groups and 2-Salem numbers 15

Summary: The group generated by reflections with respect to facets of a Coxeter polytope in n -dimensional hyperbolic space \mathbb{H}^n is called a hyperbolic Coxeter group. By the results of Cannon, Wagreich and Parry, it is known that the growth rate of a cocompact Coxeter group in \mathbb{H}^2 and \mathbb{H}^3 is a Salem number. On the other hand, Kerada defined a j -Salem number, which is a generalization of a Salem number. In this talk, I will present that we realize infinitely many 2-Salem numbers as the growth rates of cocompact Coxeter groups in \mathbb{H}^4 . Our Coxeter polytopes are constructed by successive gluing of Coxeter polytopes which we call Coxeter dominoes.

- 17 Yu Kitabeppu (Tohoku Univ.)[#] Dirichlet problem on graphs with nonnegative Ricci curvature 10

Summary: In this talk, we consider the Dirichlet problem on weighted graphs with nonnegative coarse Ricci curvature. For a finite region, if a lower bound of the coarse Ricci curvature is nonnegative and if the given function on the boundary is 1-Lipschitz, so is the solution of the problem. As an application, we prove that the existence of a solution for the Dirichlet problem on infinite region.

- 18 Hikaru Yamamoto (Univ. of Tokyo)[#] Type I singularities of mean curvature flows over cone manifolds 10

Summary: Huisken studied the mean curvature flow when the ambient space is the Euclidean space and proved that if the mean curvature flow has the type I singularity then there exists a smoothly convergent subsequence of the rescaling such that its limit satisfies the self-similar solution equation. In our previous work, we proved the similar results of Huisken when the ambient space is a Riemannian cone manifold. At that time, we added some more conditions to the original definition of type I singularity and we called it the type I_c singularity. In this talk, we report that the definition of the type I_c singularity in our previous work can be improved.

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

Hisashi Kasuya (Tokyo Tech)[#] Cohomologies and deformations of solvmanifolds

Summary: Let G be a simply connected solvable Lie group with a cocompact discrete subgroup Γ . We call G/Γ a solvmanifold. In this talk, I explain how to compute the de Rham, Dolbeault and Bott–Chern cohomologies of solvmanifolds. Moreover, by these computations, I explain our study of Hodge theory and deformations of solvmanifolds.

September 25th (Wed) Edu. Bldg.2, Large Lect. Room

10:50–11:50 Award Lecture for 2013 Geometry Prize

Katsutoshi Yamanoi (Tokyo Tech)[#] Value distribution of derivatives of meromorphic functions

Summary: We discuss about the following two problems in value distribution of derivatives of meromorphic functions in the plane:

Conjecture of Gol'dberg, middle 1980-s: For every transcendental meromorphic function in the plane, the frequency of distinct poles is governed by the frequency of zeros of the second derivative.

Conjecture of Mues, 1971: For every non-constant meromorphic function in the plane which has primitive, the summation of the defects $\delta(a)$ over all complex numbers a is not greater than 1.

Our discussion is based on two developments in Nevanlinna theory, which are interesting for their own sake. The first one is a generalization of the second main theorem (SMT) for small moving targets, which gives a complete answer to Nevanlinna's old question dating back to 1920s. The other is a solution to reversion problem of SMT.

We shall also discuss about the background of the theory and related topics.

13:15–14:15 Award Lecture for 2013 Geometry Prize

Toshitake Kohno (Univ. of Tokyo)[#] Braids, quantum symmetry and hypergeometric integrals

Summary: The idea of constructing representations of fundamental groups by the monodromy of logarithmic connections goes back to Poincaré and Lappo-Danilevsky. In 1970’s a relationship between nilpotent completions of fundamental groups and iterated integrals was established by K. T. Chen. Subsequently, Aomoto described the unipotent monodromy of the fundamental group of the complement of a complex hypersurface by iterated integrals of logarithmic forms.

After reviewing these historical aspects, I will apply such technique to representations of braid groups. For braid groups there is an important flat connection called KZ connection. On the other hand, there is a topological way to construct representations of braid groups, namely homological representations. These representations of braid groups are defined as the action of the mapping class group of a punctured disk on the homology of an abelian covering of its configuration space. They were extensively studied by Krammer and Bigelow.

We show that specializations of the homological representations of braid groups are equivalent to the monodromy of the KZ equation with values in the space of null vectors in the tensor product of Verma modules when the parameters are generic. Here the representations of the solutions of the KZ equation by hypergeometric integrals due to Schechtman, Varchenko and others play an important role. By this construction we recover quantum symmetry of the monodromy of KZ connection due to Drinfel’d and myself by means of the action of the quantum groups on twisted cycles. In the case of special parameters corresponding to conformal field theory, we show that KZ connection can be regarded as Gauss–Manin connection.

We also discuss the representations of mapping class groups appearing in the monodromy of conformal field theory for Riemann surfaces. We explain a joint work with Funar concerning a description of the image and the kernel of the monodromy of conformal field theory and give some applications.

September 26th (Thu) Conference Room VI

9:00–12:00

19 Kiyohisa Tokunaga [#] Triangular integrals for 2-, 3- and 4-variable functions 15
(Fukuoka Inst. of Tech.)

Summary: Triangular integrals for given 2-, 3- and 4-variable functions are respectively and precisely defined as the single limits of double, triple and quadruple sums in detail. A corollary of the divergence theorem is used to verify the triangular integral value. In the calculation processes of triangular integrals for 2-, 3- and 4-variable functions, the indices of the sequence of the integrand must coincide with those of the corresponding integral variable to calculate the correct integral value. In triangular triple integral, one kind of the two sets of increments is inappropriate for the convergence of numerical values, but the other kind is able to calculate numerical values by a computer algebra system.

20 Yoshio Agaoka (Hiroshima Univ.)* Langr’s problem and the similarity invariants of quadrangles 15

Summary: We investigate the Langr’s problem in elementary geometry from the viewpoint of invariant theory. We first determine the generators of invariants of quadrangles in terms of coordinates, and next find the relations of these fundamental invariants. The ratio of two quadrangles appeared in Langr’s problem can be expressed in terms of these invariants, and from the viewpoint of invariant theory, we may consider these two quadrangles to be “almost” similar in spite of their appearance.

- 21 Jin-ichi Itoh (Kumamoto Univ.)* Every graph is a cut locus 15
 Costin Vilcu (IMAR, Bucharest)

Summary: We show that every connected graph can be realized as the cut locus of some point on some Riemannian surface S which, in some cases, has constant curvature. We study the stability of such realizations, and their generic behavior.

- 22 Ayato Mitsuishi (Tohoku Univ.)* A de Rham's theorem of metric spaces 15

Summary: We introduce the notion of weakly locally Lipschitz contractibility for metric spaces. Many fundamental objects in metric geometry, for instance, normed spaces, CAT-spaces and Alexandrov spaces satisfy this condition. We consider the category of all pairs of weakly locally Lipschitz contractible spaces as objects together with all locally Lipschitz maps as morphisms. We report that the singular Lipschitz (and usual singular) homology is naturally isomorphic to the homology of integral currents with compact support on this category.

- 23 Ayato Mitsuishi (Tohoku Univ.)* Stability of strongly Lipschitz contractible balls in Alexandrov spaces
 Takao Yamaguchi (Univ. of Tsukuba) 10

Summary: We consider the set \mathcal{M} of all isometry classes of Alexandrov spaces of curvature ≥ -1 and of fixed dimension having upper diameter bound and lower volume bound, and prove that there exists a constant N depending on the parameters determining \mathcal{M} such that every space in \mathcal{M} can be covered by at most N strongly Lipschitz contractible balls. Also, we prove that there exists a constant N' depending on \mathcal{M} such that every space in \mathcal{M} can be covered by at most N' strongly Lipschitz contractible and convex regions.

- 24 Tetsu Toyoda * Optimal realizations with respect to nonlinear spectral gaps 15
 (Suzuka Nat. Coll. of Tech.)
 Takefumi Kondo (Tohoku Univ.)

Summary: We can define an optimal metric on a finite connected weighted graph from the viewpoint of nonlinear spectral gaps. Such metrics may not be unique, but, among them, there is a path metric which is invariant under the graph automorphism group. By using this, we can obtain the exact value of the infimum of the nonlinear spectral gaps for edge-transitive graphs.

- 25 Takefumi Kondo (Tohoku Univ.)* $\text{Cycl}_k(0)$ space and Wir_k space 10
 Tetsu Toyoda
 (Suzuka Nat. Coll. of Tech.)

Summary: M. Gromov introduced the notions of $\text{Cycl}_k(0)$ spaces and Wir_k spaces for $k \geq 4$, and he asked whether the $\text{Cycl}_4(0)$ property implies the Wir_k property for any $k \geq 5$. We partly answer this question. We also present characterizations of $\text{Cycl}_4(0)$ spaces and Wir_4 spaces by means of the nonlinear spectral gaps.

- 26 Masato Mimura (Tohoku Univ.)* Multi-way isoperimetries, expanders, and finite Cayley graphs 15

Summary: We study universal inequalities among multi-way isoperimetric constants of a finite Cayley graph, on which Koji Fujiwara has raised a question. As a byproduct, we show that the corresponding group action has a certain symmetry if a vertex-transitive finite graph has a large gap between n -way and $(n - 1)$ -way isoperimetric constants.

27 Masato Mimura (Tohoku Univ.)* Extrapolation of Banach spectral gaps of finite graphs 15

Summary: We study the Banach spectral gaps of exponent p of a finite graph. For a Banach space whose unit sphere is biuniformly homeomorphic to that of the Hilbert space, we make a estimate of that of exponent any p in $[1, \infty)$ from the classical spectral gap of the combinatorial Laplacian. As byproducts, we obtain generalizations of Ozawa’s nonembeddability result of expander graphs, Matousek’s extrapolation, and Matousek’s result on the worst order of the distortion of expander graphs into L^p -spaces.

28 Naotaka Kajino (Kobe Univ.)[#] Geometry of the measurable Riemannian structure on the Sierpiński gasket: structure of geodesics and lower unbounded Ricci curvature 15

Summary: On the Sierpiński gasket, Kigami [Math. Ann. **340** (2008), 781–804] has introduced the notion of the measurable Riemannian structure, with which the “gradient vector fields” of functions, the “Riemannian volume measure” and the “geodesic metric” are naturally associated. Kigami has also proved in the same paper the two-sided Gaussian bound for the corresponding heat kernel, and the author has further shown several detailed heat kernel asymptotics, such as Varadhan’s asymptotic relation, in a recent paper [Potential Anal. **36** (2012), 67–115]. In the talk, a complete description of the structure of minimal geodesics is presented for this case, and as an application the curvature-dimension condition of Sturm and Lott–Villani and the measure contraction property of Ohta and Sturm, which both refer to Ricci curvature lower bound, are shown to be invalid in this setting.

29 Yushi Okitsu (Tokyo Tech)[#] The construction of non-compact toric Kähler manifolds and its applications 10

Summary: We introduce cutting construction of possibly non-compact symplectic toric manifolds and describe explicitly canonical Kähler structure on symplectic toric manifolds, in particular, symplectic cones that correspond to a weakly convex good cone. As an application we define canonical almost contact metric structure on compact connected contact toric manifolds of non-Sasakian type. We further prove there are no toric Sasakian structures on these manifolds.

30 Hiroshi Iriyeh (Tokyo Denki Univ.)* Homological rigidity of Lagrangian submanifolds of a complex projective space with an intermediate minimal Maslov number 15

Summary: We prove a result about homological rigidity of Lagrangian submanifolds whose first homologies are 3-torsion of a complex projective space. In the case that the dimensions are 5, 8 and 26, each cohomology group with $\mathbb{Z}/2\mathbb{Z}$ -coefficient is isomorphic to that of a certain homogeneous Lagrangian submanifold under a little additional conditions.

14:15–16:00

31 Mitsuhiro Itoh (Univ. of Tsukuba)[#] Quaternionic mean curvature of horospheres in quaternionic Kähler
 Hiroyasu Satoh (Tokyo Denki Univ.) Hadamard manifolds 15
 Young Jin Suh (Kyungpook Nat. Univ)

Summary: We define the quaternionic mean curvature of a hypersurface in a quaternionic Kähler manifold. For a family of horospheres orthogonal to a geodesic γ , quaternionic mean curvature satisfies the Riccati type inequality along γ . By applying the Sturm–Green-type lemma, we show the rigidity theorem for asymptotically harmonic quaternionic Kähler Hadamard manifolds, which characterizes quaternionic hyperbolic spaces.

- 32 Mitsuhiro Imada (Keio Univ.)[‡] Complex almost contact metric structures on $S^{4p+3} \times S^{4q+3}$ 15

Summary: At first, we introduce the definition of complex almost contact metric structures on odd-dimensional complex manifolds. For example, it is known that \mathbb{C}^{2n+1} and $\mathbb{C}P^{2n+1}$ admit this structure. Roughly speaking, a complex almost contact metric structure on a complex manifold is a pair of two almost contact metric structures which transform to each other by its complex structure. In this presentation, we focus on the product space of two odd-dimensional spheres, and show that 3-Sasakian structures on S^{4p+3} and S^{4q+3} induce a complex almost contact metric structure on $S^{4p+3} \times S^{4q+3}$.

- 33 Shin Kikuta (Sophia Univ.) The limits on boundary of orbifold Kähler–Ricci flows and Kähler–Einstein metrics over quasi-projective manifolds 15

Summary: In this talk, we consider a sequence of orbifold Kähler–Einstein metrics or orbifold normalized Kähler–Ricci flows on a projective manifold with ample log-canonical bundle for a simple normal crossing divisor. Tian–Yau, S. Bando and H. Tsuji established that the sequence of the orbifold Kähler–Einstein metrics converged to the complete Kähler–Einstein metric of negative Ricci curvature on the complement of the boundary divisor. The main purpose of this talk is to show that such a convergence is also true on the boundary for both of the orbifold Kähler–Einstein metrics and the orbifold normalized Kähler–Ricci flows.

- 34 Yohsuke Imagi (Kyoto Univ.)* A topological characterization of Lawlor necks 15

Summary: I suppose that n is an integer > 2 and that P_1, P_2 are two special Lagrangian planes in \mathbb{C}^n intersecting transversely at one point. Lawlor constructs (supposing an angle condition) a properly embedded special Lagrangian submanifold of \mathbb{C}^n diffeomorphic to $\mathbb{R} \times S^{n-1}$ and asymptotic at infinity to $P_1 \cup P_2$ with multiplicity 1. I’ll talk about its uniqueness (up to re-scaling and translation) under certain topological conditions.

Here is a sketch of the proof; I’d like to thank Dominic Joyce for his useful suggestion. From a computation by Abouzaid–Smith we get the uniqueness of the quasi-isomorphism class of exact special Lagrangian necks in a certain Fukaya category. It suffices therefore to make a non-compact version of a uniqueness theorem of Thomas–Yau. I’ll do it under a certain topological condition.

- 35 Masashi Hamanaka (Nagoya Univ.)[‡] ADHM construction of noncommutative instantons 15
Toshio Nakatsu (Setsunan Univ.)

Summary: We would like to discuss the ADHM construction of noncommutative instantons.

- 36 Kenta Hayano (Osaka Univ.)[‡] Logarithmic transformations and generalized complex structures of 4-
Ryushi Goto (Osaka Univ.) manifolds 15

Summary: Generalized complex structures are geometric structures on a manifold introduced by Hitchin which are hybrids of ordinary complex structures and symplectic structures. In this talk, we will explain a new construction of generalized complex 4-manifolds by logarithmic transformations with arbitrary multiplicity. This construction is a generalization of Cavalcanti and Gualtieri’s construction for logarithmic transformations with multiplicity 0. Applying a technique of (broken) Lefschetz fibrations, we also give twisted generalized complex structures with arbitrary large numbers of connected components of type changing loci.

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

Shoichi Fujimori (Okayama Univ.)[#] Zero mean curvature embeddings in the Lorentz–Minkowski 3-space

Summary: In any robust surface theory, it is essential to have a large collection of interesting examples. One of the interesting classes of surfaces to study are the zero mean curvature surfaces of mixed type in Lorentz–Minkowski 3-space, which, roughly speaking, are smooth surfaces of mixed causal type with mean curvature, wherever it is well defined, equal to zero. Several authors have found such examples, all of which have simple topology. The main goal of this talk is to provide a concrete example of a family of such surfaces with nontrivial topology.

Complex Analysis

September 26th (Thu) Conference Room III

10:00–12:00

- 1 Kiyoki Tanaka (Osaka City Univ.)[#] Representations and interpolating sequence for harmonic Bergman functions 10

Summary: We consider the harmonic Bergman spaces on a smooth bounded domain. It is well known that the harmonic Bergman space has the reproducing kernel called the harmonic Bergman kernel. In this talk, we discuss the interpolating sequence for harmonic Bergman functions.

- 2 Tatsuhiro Honda (Hiroshima Inst. of Tech.)[#] Starlike harmonic mappings on the unit disc 15
 Hidetaka Hamada (Kyushu Sangyo Univ.)
 Kwang Ho Shon (Pusan Nat. Univ.)

Summary: Let f be a harmonic mapping on the unit disc Δ in \mathbb{C} . We give some condition for f to be a quasiconformal homeomorphism on Δ and to have a quasiconformal extension to the whole plane $\overline{\mathbb{C}}$. We also obtain quasiconformal extension results for starlike harmonic mappings of order $\alpha \in (0, 1)$.

- 3 Hideki Miyachi (Osaka Univ.)[#] Unification of extremal length geometry of Teichmüller space via intersection number and its application 15

Summary: In this talk, I will talk Thurston theory with extremal length on Teichmüller space. As an application, I will give a rigidity theorem for certain mappings on Teichmüller space. Indeed, I will introduce a class of mappings which are recognized as “coarsification” of isometries which are rigid at infinity.

- 4 Yohei Komori (Waseda Univ.)^{*} On degenerate families of Riemann surfaces over elliptic curves 15

Summary: We construct degenerate families of Riemann surfaces over elliptic curves and study singular fibers and holomorphic sections of them.

- 5 Masahiro Yanagishita (Waseda Univ.)[#] Introduction of a complex structure on the p -integrable Teichmüller space —application of a partition of the unit disk by fundamental regions 15

Summary: The Teichmüller space is the deformation space of Fuchsian groups acting on the unit disk of the complex plane and the p -integrable Teichmüller space is the metric subspace of the Teichmüller space, which is composed of the Teichmüller equivalence classes with p -integrable Beltrami coefficients as their representatives. Here a Beltrami coefficient is p -integrable if it is p -integrable with respect to the Poincaré metric on the unit disk. A complex structure is introduced on the Teichmüller space by a canonical embedding into a Banach space. In this talk, we introduce a complex structure on the p -integrable Teichmüller space by the similar method. In this argument, we apply a partition of the unit disk by fundamental regions.

- 6 Shunsuke Morosawa (Kochi Univ.)[#] Dynamical convergence of a certain polynomial family to $f_a(z) = z + e^z + a$ 15

Summary: Transcendental entire functions $f_a(z) = z + e^z + a$ may have Baker domains or wandering domains, which never appear in a dynamics of polynomials. We consider a sequence of polynomials $P_{a,d}(z) = (1 + a/d)z + (1 + z/d)^{d+1} + a$, which converges uniformly on compact sets to f_a as $d \rightarrow \infty$. We show its dynamical convergence under an assumption on *hyperbolicity*, even though f_a has a Baker domain or a wandering domain.

14:15–15:00

- 7 Yūsuke Okuyama (Kyoto Inst. Tech.)[#] Equilibrium measures and ergodic properties for uniformly quasiregular dynamics 10

Summary: We construct the equilibrium measure of a uniformly quasiregular endomorphism on an oriented, connected, and closed Riemannian manifold of dimension more than one, and establish its dynamical and ergodic properties.

- 8 Yūsuke Okuyama (Kyoto Inst. Tech.)[#] A rescaling principle for an isolated essential singularity of a quasiregular mapping 10

Summary: We establish a rescaling principle for an isolated essential singularity of a quasiregular mapping.

- 9 Yūsuke Okuyama (Kyoto Inst. Tech.)[#] Accumulation of periodic points in local uniformly quasiregular dynamics 10

Summary: We generalize the *density of repelling periodic points in the Julia set* in complex dynamics to a class of *local* uniformly quasiregular mappings introduced by Hinkkanen, Martin, and Mayer.

15:10–16:10 Talk invited by Complex Analysis Section

- David Drasin (Purdue Univ.)[#] Sharpness of Rickman’s Picard theorem

September 27th (Fri) Conference Room III

9:00–10:45

- 10 Katsusuke Nabeshima[#] On the computation of Tjurina stratification using local cohomology with parameters 15
 (Univ. of Tokushima)
 Shinichi Tajima (Univ. of Tsukuba)

Summary: Algebraic local cohomology classes attached to semi-quasihomogeneous hypersurface isolated singularities are considered. A new effective method to compute Tjurina stratifications associated with μ -constant deformation $f_t \in (\mathbb{C}[t_1, \dots, t_m])[x_1, \dots, x_n]$ of weighted homogeneous isolated singularities is proposed, where x_1, \dots, x_n are variables and t_1, \dots, t_m are parameters. In 1989, B. Martin and G. Pfister constructed an algorithm of computing parameter dependency of Tjurina numbers of μ -constant deformations of quasi-homogeneous hypersurface isolated singularities. We propose an alternative approach, in a context of computational algebraic analysis, to compute Tjurina stratifications of μ -constant deformations. The key idea in this approach is the use of algebraic local cohomology classes (with parameters). The proposed method has already been implemented in a computer algebra system Risa/Asir.

- 11 Shinichi Tajima (Univ. of Tsukuba)* Newton filtration and local cohomology 15

Summary: A new framework to study, in the context of Computational Algebraic Analysis, local analytic properties of Newton non-degenerate hypersurface isolated singularities is proposed. The key idea in this approach is notion of Newton filtration on local cohomology.

- 12 Shizuo Nakane (Tokyo Polytechnic Univ.)[‡] Relations between saddle sets for Axiom A polynomial skew products on \mathbb{C}^2 15

Summary: We give a sufficient condition for Axiom A polynomial skew products on \mathbb{C}^2 to have no relations between the saddle sets over base Julia set and over base sink set. Non-existence of the relations is closely related to the continuity of the fiber Julia sets. We also give a sufficient condition for them to be vertically expanding over base filled julia set.

- 13 Akio Kodama (Kanazawa Univ.)* On the holomorphic automorphism group of a generalized complex ellipsoid 15

Summary: In this talk, we completely determine the structure of the holomorphic automorphism group of a generalized complex ellipsoid. This is a natural generalization of a result due to Landucci. Also this gives an affirmative answer to an open problem posed by Jarnicki and Pflug.

- 14 Yoshikazu Nagata (Nagoya Univ.)[‡] On Hölder type estimates for $\bar{\partial}$ on infinite type convex domains 10

- 15 Yukitaka Abe (Univ. of Toyama)* A generalization of Weierstrass' \wp -function to quasi-abelian varieties
Atsuko Kogie (Univ. of Toyama) 15

Summary: Weierstrass' \wp -function was generalized as a $\bar{\partial}$ -closed $(n-1, n-1)$ -form \wp^{ij} on an abelian variety by Zappa. We further generalize Zappa's result to quasi-abelian varieties.

11:00–12:00 Talk invited by Complex Analysis Section

- Tetsuo Ueda (Kyoto Univ.)[‡] Semi-parabolic fixed points and their bifurcations in complex dimension 2

Summary: We investigate bifurcations of semi-parabolic fixed points of mappings in complex dimension 2. The intrinsic structure of a semi-attracting fixed point is analyzed and applied to show the discontinuity properties of (filled) Julia sets of Hénon mappings on the parameters.

Functional Equations

September 24th (Tue) Conference Room II

9:20–12:00

- 1 Mika Tanda (Kinki Univ.)[#] Borel sums of the Voros coefficients of the Gauss hypergeometric differential equation in all Stokes regions 15
Takashi Aoki (Kinki Univ.)

Summary: We define the Voros coefficients of the Gauss hypergeometric differential equation with a large parameter for each regular singular point. Explicit forms of the Voros coefficients are given. Moreover, we compute the Borel sums of the Voros coefficients in each Stokes region.

- 2 Toshinori Takahashi (Kinki Univ.)[#] The Voros coefficients of the confluent hypergeometric differential equations 15
Mika Tanda (Kinki Univ.)
Takashi Aoki (Kinki Univ.)

Summary: We define the Voros coefficients of the Kummer confluent hypergeometric differential equation with a large parameter for each singular point. Explicit forms of them and their Borel sums are given.

- 3 Kohei Iwaki (Kyoto Univ.)[#] Quasi-linear Stokes phenomenon for the second Painlevé transcendents and the exact WKB analysis 15

Summary: Alexander Its and Andrei Kapaev derived certain formulas which describe “quasi-linear Stokes phenomena” occurring to solutions of the second Painlevé equation, through the Riemann–Hilbert method. In this talk we show that these formulas can be derived through the exact WKB analysis.

- 4 Yoshikatsu Sasaki (Hiroshima Univ.)[#] Value distribution of the string equation of type (2,5) 10

Summary: In this talk, we study the string equation of type (2,5), which is an analogue of the first Painlevé equation in some sense. By use of the ordinary notations and well known results of the value distribution theory or the Nevanlinna theory, we show that the string equation of type (2,5) admits no rational solution, and we give a lower estimate of the growth order of the arbitrary solution to the equation.

- 5 Kunihiko Taniguchi (Kokoranishi High School)^{*} Permanence for a nonautonomous Lotka–Volterra competition system with finite delays 10

Summary: We consider non autonomous Lotka–Volterra competition systems with finite delays. Under certain conditions we show that such systems are permanent.

- 6 Ichiro Tsukamoto (Toyo Univ.)^{*} On asymptotic behaviour of positive solutions of $x'' = -t^{-\alpha/2-2}x^{1+\alpha}$ ($\alpha > 0$) 15

Summary: We consider an initial value problem of the differential equation denoted in the title. For this, we transform the differential equation into a two dimensional autonomous system which has a centre as its critical point. Depending on its orbit, we state the analytical expressions of the solutions of the initial value problem which show the asymptotic behaviour of the solutions.

- 7 Masakazu Onitsuka (Okayama Univ. of Sci.)[#] Attractivity and stability for two-dimensional nonautonomous half-linear differential systems 10

Summary: The system considered in this talk is $x' = -e(t)x + f(t)\phi_{p^*}(y)$, $y' = -g(t)\phi_p(x) - h(t)y$ where p and p^* are positive numbers satisfying $1/p + 1/p^* = 1$, and $\phi_p(z) = |z|^{p-2}z$. This system is referred to as a half-linear system. In the special case in which $p = 2$, the system mentioned above becomes a two-dimensional linear system. As is well known, the zero solution of the linear system is stable if it is attractive. This relation is given by the estimates of a fundamental matrix for the linear system. In the general case, where $p \neq 2$, however, the concept of fundamental matrices does not apply, because the solution space of the half-linear system is not additive. Will the attractivity guarantee the stability of the zero solution of the half-linear system?

- 8 Kodai Fujimoto (Osaka Pref. Univ.)[#] Naoto Yamaoka (Osaka Pref. Univ.) Global existence of solutions for second-order nonlinear differential equations 15

Summary: We consider the second-order nonlinear differential equation $(\varphi(x'))' + \lambda\varphi(x) = 0$, where λ is positive and φ is strictly increasing, odd, bijective and continuous function. Using phase plane analysis and time maps, we obtain necessary and sufficient conditions for the initial value problem to have a unique global solution. Moreover, we also show that the equation with the damping term $(\varphi(x'))' - \mu\varphi(x') + \lambda\varphi(x) = 0$ ($\mu > 0$) has no global nontrivial solutions under certain conditions.

- 9 Hideaki Matsunaga (Osaka Pref. Univ.)[#] Asymptotic behavior of solutions of integral equations with infinite delay 15

Summary: For integral equations with infinite delay, we obtain some results on the asymptotic behavior of solutions under sufficiently small nonlinear perturbations, which correspond to Perron-type theorems for functional differential equations.

- 10 Toshiki Naito (Univ. of Electro-Comm.^{*})[#] Periodic solutions and its successive approximations in nonlinear oscillations 15
 Rinko Miyazaki (Shizuoka Univ.)
 Jong Son Shin (Hosei Univ.)
 Dohan Kim (Seoul Nat. Univ.)

Summary: We consider the periodic ordinary differential system $x' = A(t)x + \epsilon f(t, x, \epsilon)$, where $t, \epsilon \in \mathbb{R}$, $x, f(t, x, \epsilon) \in \mathbb{C}^d$, $A(t)$ is a continuous $d \times d$ matrix, $A(t)$ and $f(t, x, \epsilon)$ are periodic in t of period $\tau > 0$, and $f(t, x, \epsilon)$ is continuous in (t, x, ϵ) and continuously differentiable in x . A general representation on the existence of periodic solutions $x(t, \epsilon)$ of period τ for small $|\epsilon|$ together with the successive approximations is given from the viewpoint of Fredholm operators, the bifurcation equation and the implicit function theorem under the condition that $x' = A(t)x$ has nontrivial periodic solutions of period τ .

14:15–16:30

- 11 Satoshi Tanaka (Okayama Univ. of Sci.)[#] A note on the symmetry-breaking and Morse index for positive solutions of one-dimensional Hénon type equations 15

Summary: The two-point boundary value problem for one-dimensional Hénon type equations is considered. There always exists a positive even solution. The problem has also the positive least energy solution. It is known that the Morse index of the least energy solution equals 1. Therefore, if we prove that the Morse index of positive even solutions is greater than or equal to 2, then the positive least energy solution is non-even, and hence symmetry-breaking phenomena occur. On the other hand, it is shown that if every positive solution is nondegenerate and its Morse index equals 1, then the positive solution is unique and even. In this talk, existence and nonexistence of positive non-even solutions are studied.

- 12 Tomoyuki Tanigawa (Kumamoto Univ.)[#] On the existence of generalized regularly varying solutions of second order half-linear functional differential equations 15

Summary: The sharp sufficient conditions of the existence of generalized regularly varying solutions (in the sense of Karamata) of a class of functional differential equations are established.

- 13 Jitsuro Sugie (Shimane Univ.)[#] Asymptotical stability of a simple pendulum affected by viscous pressure resistance 15

Summary: The equation considered in this talk is $x'' + h(t)x'|x'| + \omega^2 \sin x = 0$, where $h(t)$ is continuous and nonnegative for $t \geq 0$ and ω is a positive real number. This may be regarded as an equation of motion of an underwater pendulum. The damping force is proportional to the square of the velocity. The purpose of this talk is to report necessary and sufficient conditions on the time-varying coefficient $h(t)$ for the origin to be asymptotically stable. The phase plane analysis concerning the positive orbits of an equivalent planar system to the above-mentioned equation is used to obtain the main results. In addition, solutions of the system are compared with a particular solution of the first-order nonlinear differential equation $u' + h(t)u|u| + 1 = 0$.

- 14 Kazuyuki Yagasaki (Hiroshima Univ.)[#] Bifurcation diagram of interior single-peak solutions in the Neumann problem of $u'' + \lambda(-u + u^p) = 0$ ($p > 1$ is a real number) 15

Summary: We consider the Neumann boundary value problem of $u'' + \lambda(-u + u^p) = 0$ in $(-1, 1)$ with $u'(\pm 1) = 0$, where $p > 1$ is a real number and λ is a control parameter. We provide a theorem giving a complete bifurcation diagram of interior single-peak solutions. To prove this theorem we show the monotonicity of the period function for $u'' - u + u^p = 0$.

- 15 Tetsutaro Shibata (Hiroshima Univ.)[#] Global and local behavior of bifurcation curve for semilinear eigenvalue problem 15

Summary: We consider the bifurcation problem related to sine-Gordon equation. We show that the asymptotic behavior of bifurcation curve $\lambda(\xi)$ as $\xi \rightarrow \infty$ is effected by the oscillation property of the nonlinear term. We also give the asymptotic expansion formula for $\lambda(\xi)$ as $\xi \rightarrow 0$.

- 16 Tatsuki Mori (Ryukoku Univ.)[#] Global bifurcation structure of stationary solutions for cubic nonlinear equations with nonlocal constraint 15
 Kousuke Kuto (Univ. of Electro-Comm.)
 Tohru Tsujikawa (Univ. of Miyazaki)
 Shoji Yotsutani (Ryukoku Univ.)

Summary: We investigate global bifurcation structure of stationary solutions for cubic nonlinear equations with nonlocal constraint which appears as a shadow-system of a reaction-diffusion model for cell polarization by Y. Mori, A. Jilkin and L. Edelstein-Keshet in SIAM J. Appl. Math (2011). Some mathematical local bifurcation results are obtained by Kuto and Tsujikawa (Nonlinearity (2013) and Proc. 9th AIMS Conf.). We propose a new method to represent the bifurcation sheets which determine the global bifurcation structure.

- 17 Shingo Takeuchi[#] Basis problems of generalized Jacobian elliptic functions 15
 (Shibaura Inst. of Tech.)

Summary: We define a generalization of Jacobian elliptic function $\operatorname{sn}(x, k)$. The generalized function $\operatorname{sn}_{pq}(x, k)$ coincides with the classical Jacobian elliptic function $\operatorname{sn}(x, k)$ if $p = q = 2$ and the generalized trigonometric function $\sin_{pq} x$ if $k = 0$. The main topic of this talk is the basis property of the generalized Jacobian elliptic functions. We will obtain a theorem, which improves the results of Craven in 1971 and Edmunds et al. in 2012. In particular, as a corollary of the theorem, we will show that the classical Jacobian elliptic functions is a basis for any Lebesgue spaces if $0 \leq k \leq 0.99$.

- 18 Hiroyuki Usami (Gifu Univ.) Inverse blow-up time problem 15
 Yutaka Kamimura (Tokyo Univ. of Marine Sci. and Tech.)

Summary: We consider an inverse problem to determine a nonlinearity of a nonlinear equation from a blow-up time of solutions of the equation. We show that this inverse problem is locally well-posed near a typical superlinearity.

16:45–17:45 Talk invited by Functional Equations Section

- Hayato Chiba (Kyushu Univ.)[#] The Painlevé equations on weighted projective spaces

Summary: The Painlevé equations are second order ordinary differential equations with the Painlevé property; the only movable singularities are poles. In this talk, the Painlevé equations are regarded as three dimensional vector fields on weighted projective spaces, which are obtained by projective compactification of C^3 in some weighted manner. The vector field has a few fixed points at infinity, which determine the asymptotic behavior of solutions of the Painlevé equation. Furthermore, it is shown that the cellular decomposition of the weighted projective space gives a new expression of the initial value space of the Painlevé equation.

September 25th (Wed) Conference Room II

9:00–12:00

- 19 Fumio Hiroshima (Kyushu Univ.)[#] Lieb–Thirring bound for Schrödinger operator with a Bernstein function of Laplacian 15

Summary: We derive a Lieb–Thirring type bound for Schrödinger operator with a Bernstein function of Laplacian, which is a generalization of the standard Lieb–Thirring bound.

- 20 Yuya Dan (Matsuyama Univ.)[‡] Lieb–Thirring inequalities for Schrödinger operators 15

Summary: We introduce the Riesz mean of eigenvalues of Schrödinger operators in Euclidean spaces. In particular, we investigate the upper bound for the sum of all bounded state energy, then estimate the sharp coefficient in Lieb–Thirring inequalities. It is conjectured by Lieb and Thirring that the optimal coefficient for three or higher dimensional spaces is equal to the value obtained from the semiclassical approximation. Then, we propose the new approach which may improve the best possible coefficient according to the Rumin–Solovej method.

- 21 Hiroaki Niikuni (Doshisha Univ.)^{*} On the spectrum of periodic Schrödinger operators on a nanotube with δ - δ - δ vertex conditions 15

Summary: In this talk, we consider the Schrödinger operators with a periodic potential and the δ - δ - δ type vertex conditions on a quantum graph and discuss its spectrum. We demonstrate that the spectrum has the band structure. Moreover, we give the asymptotics of the band edges.

- 22 Takuya Watanabe (Ritsumeikan Univ.)[‡] Characterization of PDE reducible to ODE under a certain homogeneity
Jiichiroh Urabe (Doshisha Univ.) and applications to singular Cauchy problems 15

Summary: We give a necessary and sufficient condition for a homogeneous partial differential equation in two variables to be reduced to a homogeneous ordinary one under a certain change of variables. It is described by means of the commutator with a first order partial differential operator which characterizes a homogeneity. Moreover we obtain the explicit representation of the reduced ordinary differential equation. This result is a generalization of such a reduction which had been applied to singular Cauchy problems in our previous works.

- 23 Aya Ishizeki (Saitama Univ.)^{*} Decomposition of the Möbius energy and its variational formula 10
Takeyuki Nagasawa (Saitama Univ.)

Summary: The Möbius energy was introduced by O’Hara in 1991 as an energy of knots. It is well-known that the energy has the Möbius invariance. In this talk, a decomposition theorem of the Möbius energy is shown. The energy is decomposed into three terms, each of which has the Möbius invariance. The first term of decomposition characterizes the natural domain $H^{1,\infty} \cap H^{\frac{3}{2}}$ of the energy. Since the decomposition does not include terms described by the distance on curves, it enables us to calculate the variational formula easily. The absolute integrability of energy density and variational formula on $H^{1,\infty} \cap H^{\frac{3}{2}}$ is derived by using the decomposition.

- 24 Daisuke Naimen (Osaka City Univ.)[‡] Positive solutions of Kirchhoff type elliptic equations involving a critical Sobolev exponent 15

Summary: We study a Kirchhoff type elliptic equations involving a critical Sobolev exponent. Our goal is proving the existence of a positive solution of our problem. The nonlocal coefficient which characterizes the Kirchhoff type equations, causes some difficulties in proving the existence. The main argument lies in ensuring the PS condition for the associated functional.

- 25 Daisuke Naimen (Osaka City Univ.)[‡] Two sequences of solutions for indefinite superlinear-sublinear elliptic
Ryuji Kajikiya (Saga Univ.) equations with nonlinear boundary conditions 15

Summary: In this talk, we investigate a semilinear elliptic equation with a nonlinear Neumann boundary condition. In particular we show the existence of two sequences of solutions for our problem. To this aim, we introduce a local superlinear-sublinear condition for our nonlinear terms. This is some generalization of the convex-concave nonlinearities. Our method is based on the variational method.

- 26 Mieko Tanaka (Tokyo Univ. of Sci.)* Generalized eigenvalue of nonhomogeneous elliptic operators 15
 Dumitru Motreanu
 (Univ. de Perpignan)

Summary: We prove the existence of $\lambda \in \mathbb{R}$ for which the equation $-\operatorname{div}(a(x, |\nabla u|)\nabla u) = \lambda|u|^{p-2}u$ in a bounded domain Ω under the Dirichlet boundary condition, has a non-trivial solution. As a special case, this equation coincides with the p -Laplace equation (that is, $a(x, t) = t^{p-2}$). In particular, it is shown that generally the spectrum of the operator $-\operatorname{div}(a(x, |\nabla u|)\nabla u)$ on $W_0^{1,p}(\Omega)$ is not discreet.

- 27 Mieko Tanaka (Tokyo Univ. of Sci.)* Existence of the generalized Fućik spectrum for nonhomogeneous elliptic operators 15

Summary: By variational methods and Morse theory, we prove the existence of uncountably many $(\alpha, \beta) \in \mathbb{R}^2$ for which the equation $-\operatorname{div}a(x, |\nabla u|)\nabla u = \alpha u_+^{p-1} - \beta u_-^{p-1}$ in Ω , has a sign changing solution under the Neumann boundary condition. As a special case, the above equation contains the p -Laplace equation. However, the function a is not supposed to be $(p-2)$ -homogeneous in the second variable. In particular, it is shown that generally the Fućik spectrum of the operator $-\operatorname{div}a(x, |\nabla u|)\nabla u$ on $W_0^{1,p}(\Omega)$ contains some open unbounded subset of \mathbb{R}^2 .

- 28 Ryuji Kajikiya (Saga Univ.)[#] Partially symmetric solutions of the generalized Hénon equation 15

Summary: We study the generalized Hénon equation in a symmetric domain. For two closed subgroups H and G of the orthogonal group such that $H \subset G$, we prove the existence of a positive solution which is H invariant but G non-invariant.

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

- Naohito Tomita (Osaka Univ.)[#] On the boundedness of bilinear Fourier multiplier operators

Summary: In this talk, we consider the boundedness of bilinear Fourier multiplier operators. Our aim is to find the regularity conditions for bilinear Fourier multipliers that are as small as possible to ensure the boundedness. In particular, the minimal conditions in terms of the Sobolev spaces of product type are given. We also discuss the boundedness of bilinear pseudo-differential operators.

September 26th (Thu) Conference Room II

9:00–12:00

- 29 Masataka Shibata (Tokyo Tech)[#] The existence of a positive solution to semilinear elliptic equations with
 Yohei Sato periodic potential 15
 (Tokyo Tech/Osaka City Univ.)

Summary: We talk about the existence of a positive solution to semilinear elliptic equations with periodic potential, in which the super-linear term does not satisfy the Ambrosetti–Rabinowitz growth condition or some kind of monotonicity condition for using the Nehari manifold.

- 30 Atsushi Kosaka (Osaka Pref. Univ.)[#] Bifurcation of solutions to semilinear elliptic problems on caps of \mathbf{S}^2 15

Summary: In this talk, we consider the bifurcation problem of semilinear equations $\Delta u + \lambda u + u^p = 0$ defined on a geodesic ball in 2-dimensional sphere. We are interested in the bifurcation of non-trivial solutions from a trivial solution. For our purpose, we are required to investigate the multiplicity of eigenvalues of linear elliptic problems. In general, it seems difficult to investigate that. Thus we consider the case that 2-dimensional sphere is almost covered by a geodesic ball. In this case, by investigating zeros of the associated Legendre functions, we can prove that there exist bifurcation solutions.

- 31 Francesca Gladiali[#] Morse indices of multiple blow-up solutions to the Gel'fand problem
(Univ. degli Studi di Sassari) 15
Massimo Grossi
(Univ. di Roma, La Sapienza)
Hiroshi Ohtsuka (Kanazawa Univ.)
Takashi Suzuki (Osaka Univ.)

Summary: Blow-up solutions to the two-dimensional Gel'fand problem are studied. It is known that the location of the blow-up points of these solutions is related to a Hamiltonian function involving the Green function of the domain. We show that this implies an equivalence between the Morse indices of the solutions and the associated critical points of the Hamiltonian.

- 32 Kousuke Kuto[#] Coexistence steady-states of the Lotka–Volterra competition model with
(Univ. of Electro-Comm.) diffusion and advection 15
Tohru Tsujikawa (Univ. of Miyazaki)

Summary: We study the stationary problem of the Lotka–Volterra competition model with diffusion and advection. Sufficient conditions of the existence/nonexistence of nonconstant solutions are obtained by using the a priori estimates for solutions and the degree theory. Next we derive a limiting system as the diffusion and the advection terms tend to infinity, which characterizes nonconstant solutions in case when the activity of one of competitors is sufficiently large.

- 33 Yasuhito Miyamoto (Univ. of Tokyo)[#] Structure of the positive radial solutions for the supercritical Neumann
problem $\varepsilon^2 \Delta u - u + u^p = 0$ in a ball 10

Summary: We are interested in the structure of the positive radial solutions of a supercritical Neumann problem in a unit ball. We show that this problem has infinitely many singular solutions and that nonconstant regular solutions consist of infinitely many smooth curves. It is shown that each curve blows up and that each curve has infinitely many turning points under a certain condition.

- 34 Futoshi Takahashi (Osaka City Univ.)[#] Asymptotic behavior of least energy solutions for a 2D nonlinear Neu-
mann problem with large exponent 12

Summary: We study the asymptotic behavior of least energy solutions to a 2D nonlinear Neumann problem when the nonlinear exponent p gets large. Following the arguments of X. Ren and J. C. Wei, we show that the least energy solutions remain bounded uniformly in p , and it develops one peak on the boundary, the location of which is controlled by the Green function associated to the linear problem.

- 35 Ryuji Kajikiya (Saga Univ.)[#] Stability of stationary solutions for a sublinear parabolic equation ···· 15
Goro Akagi (Kobe Univ.)

Summary: We study the stability analysis of stationary solutions of the Cauchy–Dirichlet problem for a sublinear parabolic equation. We prove that sign-changing solutions with high energy are not asymptotically stable and the unique positive stationary solution is exponentially stable.

- 36 Takefumi Igarashi (Nihon Univ.)^{*} Life span of solutions for a quasilinear parabolic equation with initial data having positive limit inferior at infinity ··········· 15

Summary: We present a new upper bound of the life span of positive solutions of a quasilinear parabolic equation for the initial data having positive limit inferior at space infinity. The upper bound is expressed by the data in limit inferior, not in every direction, but around a specific direction.

- 37 Jin Takahashi (Tokyo Tech)[#] Removability of time-dependent singularities in the heat equation ···· 10
Eiji Yanagida (Tokyo Tech)

Summary: In this talk, we consider solutions of the linear heat equation with time-dependent singularities. It is shown that if a singularity is weaker than the order of the fundamental solution of the Laplace equation, then it is removable. We also consider the removability of higher dimensional singular sets. An example of a non-removable singularity is given, which implies the optimality of the condition for removability.

- 38 Yoshihito Kohsaka[#] Traveling spots of singular limit problems of FitzHugh–Nagumo type
(Muroran Inst. of Tech.) equations ··········· 10
Yan-Yu Chen (Tamkang Univ.)
Hirokazu Ninomiya (Meiji Univ.)

Summary: Localized patterns are often observed in the nature. In this talk, we consider traveling spots observed in two-dimensional excitable media. First, we introduce the singular limit problem of the FitzHugh–Nagumo type equations. Then we explain the existence of the traveling spot including the front and the back.

- 39 Masaharu Taniguchi (Okayama Univ.)[#] An N -dimensional traveling front solution in the Allen–Cahn equation associated with an $(N - 2)$ -dimensional surface ··········· 15

Summary: We study the Allen–Cahn equation in the N -dimensional Euclidean space. Let D be a compact and convex domain in $(N - 1)$ -dimensional Euclidean space and its boundary S is of class C^2 and the principal curvatures are positive at every point. Then we prove that there exists a unique N -dimensional traveling front solution in the Allen–Cahn equation associated with S .

14:15–16:30

- 40 Keisuke Takasao (Hokkaido Univ.)^{*} Existence of mean curvature flow with external force term ········· 10

Summary: In this talk we consider the mean curvature flow with external force term. In 1978, Brakke proved the existence of weak solutions defined by using geometric measure theory, for the mean curvature flow. The weak solution is called Brakke’s mean curvature flow. In 1993, Ilmanen proved the existence of Brakke’s mean curvature flow by the use of phase field method. We study Brakke’s mean curvature flow with external force term and phase field method for the problem. Moreover we study the Allen–Cahn equation which approximates the mean curvature flow with external force term.

- 41 Hiroyoshi Mitake (Fukuoka Univ.)* A dynamical approach to the large-time behavior of solutions to weakly coupled systems of Hamilton–Jacobi equations 10
 Hung Vinh Tran (Univ. of Chicago)

Summary: We investigate the large-time behavior of the value functions of the optimal control problems on the n -dimensional torus which appear in the dynamic programming for the system whose states are governed by random changes. From the point of view of the study on partial differential equations, it is equivalent to consider viscosity solutions of quasi-monotone weakly coupled systems of Hamilton–Jacobi equations. We establish a convergence result to asymptotic solutions as time goes to infinity under rather general assumptions by using dynamical properties of value functions.

- 42 Hiroyoshi Mitake (Fukuoka Univ.)* The large-time asymptotic analysis by a nonlinear adjoint technique: semilinear degenerate parabolic equations 10
 Filippo Cagnetti (Univ. of Sussex)
 Diogo Gomes (Univ. Tecnica de Lisboa/KAUST)
 Hung Vinh Tran (Univ. of Chicago)

Summary: We introduce a new machinery to study the large time behavior for general classes of Hamilton–Jacobi type equations, which include degenerate parabolic equations and weakly coupled systems. We establish the convergence results by using the nonlinear adjoint method and identifying new long time averaging effects. These methods are robust and can easily be adapted to study the large time behavior of related problems.

- 43 Masakazu Yamamoto (Hiroaki Univ.)* Space-time structure of solutions to the drift-diffusion equation with anomalous diffusion 15

Summary: The Cauchy problem for the drift-diffusion equation with the fractional Laplacian is considered. This fractional dissipation describes the anomalous diffusion. Indeed it is well-known that the spatial-decay of solutions to the Cauchy problem is not governed by the initial-data. This property makes it difficult to derive the large-time behavior of solutions. The goal is to derive the difference between solutions and their asymptotic expansion. Since the dissipative effect is anomalous, some coefficients on the asymptotic expansion seem to diverge. The renormalization with space-time variables avoids this crux.

- 44 Tsukasa Iwabuchi (Chuo Univ.)* Ill-posedness for the drift diffusion system of bipolar type 15
 Takayoshi Ogawa (Tohoku Univ.)

Summary: We consider the Cauchy problems for the drift-diffusion system of bipolar type to study the ill-posedness by showing that the continuous dependence on initial data does not hold generally in the scaling invariant Besov spaces. The scaling invariant Besov spaces are $\dot{B}_{p,\sigma}^{-2+\frac{n}{p}}(\mathbb{R}^n)$ with $1 \leq p, \sigma \leq \infty$ and we show the optimality of the case $p = 2n$ to obtain the well-posedness and the ill-posedness for the drift-diffusion system of bipolar type. On the other hand, the optimal case is $p = \infty$ for the drift-diffusion system of monopolar type and we compare with two types.

- 45 Tetsuya Yamada ^{*} Non-trivial ω -limit sets and oscillating solutions in a chemotaxis model
(Fukui Nat. Coll. of Tech.) in \mathbb{R}^2 with critical mass 15
- Julián López-Gómez
(Univ. Complutense de Madrid)
- Toshitaka Nagai (Hiroshima Univ.)

Summary: In this talk we consider the Cauchy problem for a parabolic-elliptic system in \mathbb{R}^2 modeling chemotaxis as well as self-attracting particles, and show that in the critical mass case the fine dynamics of the model is ascertained in terms of the ω -limit sets. Moreover, a general class of nonnegative initial data is constructed for which the associated solutions exhibit a complex oscillatory behavior.

- 46 Sachiko Ishida (Tokyo Univ. of Sci.)[#] Global-in-time bounded solutions to degenerate Keller–Segel systems
Xinru Cao with chemotaxis sensitivity 15
(Univ. Paderborn/Dalian Univ. of Tech.)

Summary: In this talk we deal with the system which describes the movement of the swimming bacteria and its positive chemotaxis, for example, bacteria with upward oxygentaxis living in thin fluid layers near solid-air-water (like Escherichia col). More specifically, we consider the quasilinear degenerate Keller–Segel systems with chemotaxis sensitivity. The purpose of this talk is to discuss the existence of global bounded solutions.

- 47 Kentarou Fujie (Tokyo Univ. of Sci.)[#] Global existence and boundedness of solutions to Keller–Segel systems
Michael Winkler (Univ. Paderborn) with signal-dependent sensitivity 15
Tomomi Yokota (Tokyo Univ. of Sci.)

Summary: This talk deals with the parabolic-elliptic Keller–Segel system (KS) with chemotactic sensitivity function. The global existence and L^∞ -boundedness of classical solutions to (KS) are established when (KS) has a generalized chemotactic sensitivity function $\chi(v)$. The result improves Biler (1999) in which the global existence without L^∞ -boundedness is shown in the special case $\chi(v) = \frac{\chi_0}{v}$. The key lies in lower bounds for v .

- 48 Noriko Mizoguchi [#] Boundedness of global solutions in the two-dimensional parabolic Keller–
(Tokyo Gakugei Univ.) Segel system 15
Michael Winkler (Univ. of Paderborn)

Summary: We consider the parabolic-parabolic Keller–Segel system in the two dimension. Let (u, v) be a solution of the system starting at (u_0, v_0) with $\|u_0\|_{L^1} > 8\pi$. We show that (u, v) exists globally in time, then it is uniformly bounded and converges to a stationary solution. Based on this result, we give a criterion for blowup using energy which seems to be optimal.

16:45–17:45 Talk invited by Functional Equations Section

- Shuji Machihara (Saitama Univ.)[#] On the Cauchy problems for the system of Dirac equations with quadratic nonlinearities in 1d

Summary: We will consider the Cauchy problem for the quadratic nonlinear Dirac equations, Dirac-Klein-Gordon equation and Chern-Simons-Dirac equation in spatial one dimension. We discuss the well-posed results and ill-posed results for those problems. We determine the range of indices of Sobolev spaces which the solutions of the problems belong to. We give some a priori estimates to have the time global well-posed results.

September 27th (Fri) Conference Room II

9:00–12:00

- 49 Yusuke Sugiyama (Tokyo Univ. of Sci.)[‡] Remark on global solvability for some 1-D quasilinear wave equation 10

Summary: We consider global solvability for the the Cauchy problem of the quasilinear wave equation: $\partial_t^2 u = \partial_x(c(u)^2 \partial_x u)$ under the assumption that $c(u(0, x)) \geq \delta$ for some $\delta > 0$.

- 50 Yuta Wakasugi (Osaka Univ.)^{*} Blow-up of solutions to the semilinear wave equation with damping depending on time and space variables 10

Summary: We give a blow-up result for the one-dimensional semilinear wave equation with damping depending on both time and space variables. We show that if the damping term can be regarded as perturbation, then small data blow-up holds for any power of nonlinearity.

- 51 Mohammad Rammaha (Univ. of Nebraska–Lincoln)^{*} Blow-up of solutions to semilinear wave equations with non-zero initial data 10

Hiroyuki Takamura (Future Univ.-Hakodate)
Hiroshi Uesaka (Nihon Univ.)
Kyouhei Wakasa (Hokkaido Univ.)

Summary: In this talk, we consider the initial value problem for semilinear wave equations with non-compactly supported data. With the initial data of zero initial position, the solution blows up for any power nonlinearity. This was first shown by Asakura (1986) under the assumption that the spatial decay is weak at infinity. On the other hand, Takamura & Uesaka & Wakasa (2010) have obtained the blow up result for non-zero initial position by making use of “time-derivative reduction”. Our aim in this talk is to show the blow up result when both the initial position and the initial velocity do not identically vanish.

- 52 Takamori Kato (Nagoya Univ.)[‡] Unconditional well-posedness of the fourth order Schrödinger equation with periodic boundary condition 10

Summary: We consider the well-posedness of the Cauchy problem for the fourth order Schrödinger equation in the periodic setting when initial data is given in the Sobolev space H^s . This equation is one of the Schrödinger hierarchies. The direct iteration method does not work for any $s \in \mathbb{R}$ because two derivatives are included in the resonant parts. To overcome this difficulty, we use the algebraic structure of the nonlinear terms. Strong nonlinear interactions are canceled by symmetry of the nonlinear terms and we obtain the unconditional well-posedness for $s \geq 1$. This result is optimal in some sense.

- 53 Nobu Kishimoto (Kyoto Univ.)[‡] Unconditional well-posedness for the periodic cubic nonlinear Schrödinger equation 15

Summary: We consider the Cauchy problem for the cubic NLS on the torus \mathbb{T}^d . For $d = 1$, Guo–Kwon–Oh (preprint, arXiv:1103.5271) improved Bourgain’s L^2 well-posedness (1993), proving unconditional uniqueness in $H^{1/6}$, i.e., the uniqueness of solutions holds in $C([0, T]; H^{1/6})$ without intersecting with any auxiliary space such as Bourgain’s $X^{s,b}$ spaces. They achieved this by implementing an infinite iteration scheme for the Poincaré–Dulac normal form reductions. Our goal is to extend this result to the case $d \geq 2$. The main difficulty in higher dimensional settings is that the structure of the resonances is much more complicated than that in 1d. We employ the estimate on the number of integer points on a circle as the crucial tool for the key multilinear estimates.

- 54 Satoshi Masaki (Hiroshima Univ.)[#] On minimal blow-up solution for L^2 subcritical nonlinear Schrödinger equation 15

Summary: We consider L^2 subcritical nonlinear Schrödinger equation with an initial data belonging to a scale-invariant homogeneous weighted L^2 space. We give a sharp criterion for scattering by showing that there exists a spatial solution which does not scatter for positive time and whose initial data attains minimal value of the weighted L^2 norm in all nonscattering solutions. In previous report, a very similar results was shown for the case where the power of nonlinearity is bigger than a so-called Strauss exponent. We remove this restriction by making use of some tools of harmonic analysis and real analysis.

- 55 Mamoru Okamoto (Kyoto Univ.)[#] Ill-posedness for the Chern–Simons–Dirac system in one dimension ... 10
Shuji Machihara (Saitama Univ.)

Summary: We consider the Cauchy problem for the Chern–Simons–Dirac system in spatial one dimension. As an available result, Bournaveas, Candy, and Machihara proved that the local in time well-posedness of this Cauchy problem in $H^s(\mathbb{R}) \times H^r(\mathbb{R})$ with $-1/2 < r \leq s \leq r + 1$. So in this talk, we prove ill-posedness for almost all exponent pairs (s, r) outside of the well-posedness region. The proof based on the fact that the solution is explicitly written for specific initial data and the argument of Iwabuchi and Ogawa. In the remaining exponent pairs, we show the flow map is not twice differentiable at zero.

- 56 Kazumasa Fujiwara (Waseda Univ.)[#] Well posedness of the Cauchy problem for a semirelativistic system with quadratic nonlinearity 15
Shuji Machihara (Saitama Univ.)
Tohru Ozawa (Waseda Univ.)

Summary: We study the well-posedness of the Cauchy problem for systems of semirelativistic equations with quadratic nonlinearity. The problem is shown to be locally well-posed in H^s for any $s \geq 0$. In addition, under some constraints of coupling constants, the Cauchy problem is shown to be globally well-posed. The local well-posedness is obtained by a contraction argument with Bourgain method. The global well-posedness is shown by the L^2 conservatoin law and the persistence of regularity. We also obtained new bilinear estimates on Bourgain norms and auxiliary norms for semirelativistic propagators.

- 57 Hiroyuki Hirayama (Nagoya Univ.)[#] Well-posedness for a system of quadratic derivative nonlinear Schrödinger equations at the scaling critical regularity 15

Summary: In this talk, we consider the Cauchy problem of a system of quadratic derivative nonlinear Schrödinger equations (NLS-sys for short). A derivative loss arising from the nonlinear terms makes the problem difficult. For instance, it is known that the single quadratic derivative nonlinear Schrödinger equation is ill-posed in any Sobolev space H^s due to the derivative loss. We prove that if the coefficients of Laplacian in NLS-sys satisfy some conditions, then we can recover the derivative loss and get the well-posedness of NLS-sys. In particular, we prove the well-posedness of NLS-sys at the scaling critical regularity by using the U^2, V^2 type Bourgain spaces.

- 58 Tomoya Kato (Nagoya Univ.)* The global Cauchy problems for the nonlinear dispersive equations on modulation spaces 10

Summary: We discuss decay estimates and Strichartz estimates for dispersive equations with non-homogeneous symbols on modulation spaces $M_{p,q}^s$ to obtain the global well-posedness of the Cauchy problems for nonlinear dispersive equations. As a result, we have a generalization of the result by Wang which treated the Cauchy problems for the Schrödinger equations with a nonlinearity of wider class on modulation spaces $M_{p,q}^s$.

- 59 Gaku Hoshino (Waseda Univ.)# Analytic smoothing effect for a system of nonlinear Schrödinger equations
Tohru Ozawa (Waseda Univ.) 15

Summary: We prove global existence of analytic solutions to the Cauchy problem for a system of nonlinear Schrödinger equations with quadratic interaction in space dimension $n \geq 3$ under the mass resonance condition.

- 60 Nakao Hayashi (Osaka Univ.)* Scattering problem for the supercritical nonlinear Schrödinger equation in 1d 10

Summary: We consider the one dimensional nonlinear Schrödinger equation

$$iu_t + \frac{1}{2}u_{xx} = u^{p+1}, (t, x) \in \mathbf{R}^2$$

with a fractional order nonlinearity with exponent $p > 2$. Our purpose in this talk is to construct the scattering operators.

14:15–16:30

- 61 Masashi Ohnawa (Waseda Univ.)* Asymptotic stability of shock waves in a radiating gas model for initial data with multiple discontinuities 15

Summary: We study the asymptotic behavior of perturbations around shock waves to the Hamer model system of a radiating gas. Here we assume that the initial data contains finite number of discontinuities and the shock can be stronger than previous studies. We obtain the global solution for small initial perturbations and jump quantities, and observe that every discontinuity approach the center of mass of the initial data without colliding and that the solution converges uniformly to the corresponding traveling wave.

- 62 Yoshiyuki Kagei (Kyushu Univ.)# Existence and stability of time-periodic solution of the compressible
Kazuyuki Tsuda (Kyushu Univ.) Navier–Stokes equation 15

Summary: We consider the compressible Navier–Stokes equation on the whole space under a time-periodic external force. We show that there exists a time periodic solution if the external force is sufficiently small and satisfies a symmetric condition. Furthermore, we prove that the time-periodic solution is stable under sufficiently small perturbations in some Sobolev space. The decay rate of the perturbation is also established.

- 63 Yasunori Maekawa (Tohoku Univ.)# Remark on the Helmholtz decomposition in domains above Lipschitz
Hideyuki Miura (Osaka Univ.) graphs 15

Summary: We consider the Helmholtz decomposition in a domain whose boundary is given as a Lipschitz graph. For such a domain it is well known that the Helmholtz decomposition is not always valid in standard L^p spaces except for $p = 2$. In this talk we will show that certain anisotropic Lebesgue spaces still admit the Helmholtz decomposition.

- 64 Helmut Abels (Univ. of Regensburg)[#] Existence of weak solutions for a diffuse interface model of non-Newtonian two-phase flows 15
 Lars Diening (LMU Munich)
 Yutaka Terasawa (Univ. of Tokyo)

Summary: We consider a phase field model for the flow of two partly miscible incompressible, viscous fluids of non-Newtonian (power law) type. In the model it is assumed that the densities of the fluids are equal. We prove existence of weak solutions for general initial data and arbitrarily large times with the aid of a parabolic Lipschitz truncation method, which preserves solenoidal velocity fields and was recently developed by Breit, Diening, and Schwarzacher.

- 65 Jan Prüss (Univ. Halle)* Stability of equilibria for incompressible two-phase flows with phase transitions —The case of variable surface tension— 15
 Senjo Shimizu (Shizuoka Univ.)
 Gieri Simonett (Univ. Vanderbilt)
 Mathias Wilke (Univ. Halle)

Summary: A basic model for incompressible two-phase flows with phase transitions consistent with thermodynamics in a bounded domain in the case of variable surface tension is considered. The negative total entropy of the problem serves as a Ljapunov functional and hence we know that the equilibria are zero velocity, constant temperature, a finite number of nonintersecting balls of equal size. We prove that an equilibrium is stable if and only if the phases are connected, otherwise it is unstable.

- 66 Hirokazu Saito (Waseda Univ.)[#] On the Stokes equations with surface tension in the half space 10
 Yoshihiro Shibata (Waseda Univ.)

Summary: In this talk, we would like to consider some decay property of solution operators for the Stokes equations with surface tension in the half space which arises from a free boundary problem for the Navier–Stokes equations. We divide the solution operators into three parts which are the low, high and middle frequency part in the Fourier space. Crucial part is the analysis of the low frequency part because the roots of Lopatinski determinant converge on the origin, but the polynomial decay of the solution operator can be proved thanks to the $N - 1$ dimensions heat kernel. We, on the other hand, can show the exponential stability of the solution operators in the middle and high frequency part.

- 67 Miho Murata (Waseda Univ.)[#] On the sectorial \mathcal{R} -boundedness of the Stokes operator for the compressible viscous fluid flow and its application 10
 Yoshihiro Shibata (Waseda Univ.)

Summary: We consider the initial boundary value problem of the Stokes equations for the compressible viscous fluid flow with slip boundary condition in a bounded domain. In order to consider a global in time unique existence theorem for a nonlinear problem with some initial data close to a constant state in a bounded domain, the exponential stability of solutions to the Stokes equations is required. In this talk, we prove the exponential stability employing the sectorial \mathcal{R} -boundedness of the Stokes operator and a homotopic argument.

- 68 Yoshihiro Shibata (Waseda Univ.)[#] On the \mathcal{R} -boundedness of the solution operators in the study of the
 Dario Goetz (atesio GmbH) compressible viscous fluid flow with free boundary conditions 10

Summary: We talk about the \mathcal{R} -bounded solution operators for the model problem of the Stokes equations with free boundary condition without surface tension in the half space, which is obtained by the linearization of the Lagrangean description of the free boundary problem for the compressible viscous fluid flow. This problem was studied by Secchi and Valli in the L_2 framework and by Tani in the Hölder spaces. Our purpose is to study the same problem in the L_q framework. For this purpose, the generation of analytic semigroup and maximal regularity result play an essential role and our main result concerning the \mathcal{R} -bounded solution operators automatically imply them.

- 69 Yoshihiro Shibata (Waseda Univ.)[#] On the \mathcal{R} -boundedness of solution operators for the compressible-
 Takayuki Kubo (Univ. of Tsukuba) incompressible two phase problem 10
 Kohei Soga (Waseda Univ.)

Summary: We talk about the existence of \mathcal{R} -bounded solution operators for the compressible-incompressible two phase problem in the half space, which is the linearized problem of the Lagrangean description of the evolution of compressible and incompressible viscous fluid flow separated by an interface. To treat the nonlinear problem, the generation of analytic semigroup and maximal regularity for the linearized problem play an essential role and our main theorem automatically implies them by the definition of \mathcal{R} -boundedness and the Weis operator valued Fourier multiplier theorem.

16:45–17:45 Talk invited by Functional Equations Section

- Goro Akagi (Kobe Univ.)[#] Asymptotic behavior of solutions for nonlinear diffusion equations

Summary: This talk is concerned with the asymptotic behavior of (possibly sign-changing) solutions of the Cauchy-Dirichlet problem for the fast diffusion equation. It is well known that every solution of the problem vanishes in finite time at a common power rate, and moreover, asymptotic profiles of such vanishing solutions can be characterized as nontrivial solutions of some semilinear elliptic equation. This talk particularly addresses the stability analysis for asymptotic profiles of vanishing solutions. We first formulate the notions of stability and instability of (possibly sign-changing) asymptotic profiles, and then, we present some stability criteria by investigating fast diffusion flows on an implicit surface in an energy space. Furthermore, we also discuss an annular domain case, which does not fall within the criteria, by developing some perturbation method for radially symmetric functions.

Real Analysis

September 24th (Tue) Conference Room III

9:00–12:05

- 1 Fumiaki Kohsaka (Oita Univ.)[#] Saddle points of two variable functions and fixed points of nonlinear mappings 15

Summary: The aim of this talk is to apply fixed point and convergence theorems for firmly nonexpansive type mappings to the problem of finding saddle points of two variable functions.

- 2 Ryotaro Tanaka (Niigata Univ.)[#] Orthonormal bases for finite dimensional normed linear spaces 10
Kichi-Suke Saito (Niigata Univ.)

Summary: In this talk, we consider orthonormal bases for finite dimensional normed linear spaces which are related to Birkhoff orthogonality. The relationship between orthonormal bases and a structure of finite dimensional normed linear spaces is given.

- 3 Ryotaro Tanaka (Niigata Univ.)[#] The norm structure of finite dimensional spaces 15
Kichi-Suke Saito (Niigata Univ.)

Summary: In this talk, we consider regular norms on \mathbb{R}^n . It is shown that the class of regular norms is a natural generalization of generalized Day–James type norms. Furthermore, using certain convex functions, some characterizations of regular norms are given.

- 4 Yasunori Kimura (Toho Univ.)[#] Convergence of approximate sequences generated by the shrinking projection method with errors 15

Summary: In this talk, we investigate approximate sequences to a fixed point of a mapping generated by the shrinking projection method with errors. We show that the sequence still has a nice property even if we do not suppose any summability condition for the error terms.

- 5 Sachiko Atsushiba[#] Attractive point and convergence theorems for families of nonlinear
(Univ. of Yamanashi) mappings 15

Summary: In this talk, we study the common attractive points of a family of nonlinear mappings. We also prove convergence theorems without convexity for the families of nonexpansive mappings by iterations. Using these results, we obtain new and well-known convergence theorems.

- 6 Yasuji Takahashi^{*} On a new geometric constant of a Banach space 15
(Okayama Pref. Univ.)*
Mikio Kato (Shinshu Univ.)

Summary: We shall discuss a new geometric constant $C_{s,t}(X)$ of a Banach space X , $1 < s \leq \infty$, $-\infty \leq t < \infty$.

- 7 Yasuyuki Oka (Kushiro Nat. Coll. of Tech.)[#] The Schwartz kernel theorem for the tempered distributions on the Heisenberg group 15

Summary: The aim of our talk is to give the Schwartz kernel theorem for the tempered distributions on the Heisenberg group by means of the heat kernel method on the Heisenberg group. The heat kernel method, introduced by T. Matsuzawa, is the method to characterize the generalized functions on the Euclidean space by the initial value of the solutions of the heat equation. On the Heisenberg group, J. Kim and M. W. Wong showed the heat kernel method for the tempered distributions. We apply the heat kernel method for the tempered distributions on the Heisenberg group to the proof of the Schwartz kernel theorem for the tempered distributions on the Heisenberg group.

- 8 Machihara Shuji (Saitama Univ.)[#] Logarithmic Hardy inequalities on Sobolev–Lorentz–Zygmund spaces in the limiting case 20
 Tohru Ozawa (Waseda Univ.)
 Hidemitsu Wadade (Gifu Univ.)

Summary: In this talk, we establish the Hardy type inequality on the critical Sobolev–Lorentz–Zygmund space, which generalizes the critical Sobolev–Lorentz space and the critical Sobolev space. Our purpose is to prove the Hardy type inequalities on the critical Sobolev–Lorentz–Zygmund space involving double logarithmic weight-functions by giving the necessary and sufficient conditions with which these inequalities hold or not.

- 9 Takanori Yamamoto (Hokkai-Gakuen Univ.)^{*} Normal singular integral operators with Cauchy kernel on L^2 15
 Takahiko Nakazi (Hokusei Gakuen Univ.)

Summary: Let α and β be functions in $L^\infty(\mathbb{T})$, where \mathbb{T} is the unit circle. Let P denote the orthogonal projection from $L^2(\mathbb{T})$ onto the Hardy space $H^2(\mathbb{T})$, and $Q = I - P$, where I is the identity operator on $L^2(\mathbb{T})$. This paper is concerned with the singular integral operators $S_{\alpha,\beta}$ on $L^2(\mathbb{T})$ of the form $S_{\alpha,\beta}f = \alpha Pf + \beta Qf$, for $f \in L^2(\mathbb{T})$. In this paper, we study the normality of $S_{\alpha,\beta}$ which is related to the Brown–Halmos theorem for the normal Toeplitz operator on $H^2(\mathbb{T})$.

- 10 Toshikazu Watanabe (Niigata Univ.)[#] Note on the regularity of non-additive measure 15

Summary: In this paper, we consider the regularity for non-additive measures. We prove that the non-additive measures which satisfy Egoroff’s theorem and has psuedmetric generating property implies Radon property (strong regularity) on a complete or locally compact, separable metric space.

- 11 Jun Kawabe (Shinshu Univ.)[#] The Choquet integral representation problem 15

Summary: Let X be a locally compact space. Let $C_{00}(X)$ denote the space of all continuous functions on X with compact support. In this talk, firstly we will give an improvement of the Choquet integral representation of a functional J defined only on the positive cone $C_{00}^+(X)$. This has been done using the Greco theorem, which is the most general Daniell–Stone type integral representation theorem for functionals on function spaces. Next, we will introduce the notion of the asymptotic translatability of a functional J and reveal that this simple notion is equivalent to the Choquet integral representability of J defined on the whole space $C_{00}(X)$ with respect to a nonadditive measure on X with appropriate regularity.

14:20–16:15

- 12 Gaku Sadasue (Osaka Kyoiku Univ.)[#] Pointwise multipliers on martingale Campanato spaces 15
 Eiichi Nakai (Ibaraki Univ.)

Summary: We introduce generalized Campanato spaces $\mathcal{L}_{p,\phi}$ on a probability space (Ω, \mathcal{F}, P) , where $p \in [1, \infty)$ and $\phi : (0, 1] \rightarrow (0, \infty)$. If $p = 1$ and $\phi \equiv 1$, then $\mathcal{L}_{p,\phi} = \text{BMO}$. We give a characterization of the set of all pointwise multipliers on $\mathcal{L}_{p,\phi}$.

- 13 Gaku Sadasue (Osaka Kyoiku Univ.)[#] Maximal function on generalized martingale Lebesgue spaces with variable exponent 10
 Eiichi Nakai (Ibaraki Univ.)

Summary: We show the boundedness of the maximal operator for martingales on generalized Lebesgue spaces with variable exponent.

- 14 Aoi Honda (Kyushu Inst. of Tech.)[#] Doubling dimension and Linearity of the sequence space $\Lambda_2(f)$ 15
 Yoshiaki Okazaki (Kyushu Inst. of Tech.)
 Hiroshi Sato (Kyushu Univ.*)

Summary: A metric sequence space $(\Lambda_p(f), d_p^f)$ is derived from a function $f(\neq 0) \in L_p$. $\Lambda_p(f)$ includes various interesting sequence spaces. But in general, $\Lambda_p(f)$ is not a linear space, nor is the explicit structure clear. In this talk, specifying the case to $p = 2$, we discuss the linearity and the characterization as a sequence space of $\Lambda_2(f)$ by defining the doubling dimension and the inner (resp. outer) approximation $\Lambda_2^0(f)$ (resp. $\Lambda_2^\varphi(f)$) of $\Lambda_2(f)$ which satisfy $\Lambda_2^0(f) \subset \Lambda_2(f) \subset \Lambda_2^\varphi(f) \subset \ell_2$. $\Lambda_2^0(f)$ is the maximum linear subspace of $\Lambda_2(f)$. We give a necessary and sufficient condition for $\Lambda_2^0(f) = \Lambda_2^\varphi(f)$, which means that $\Lambda_2(f)$ is a linear space, by the doubling dimension.

- 15 Yoshihiro Sawano (Tokyo Metro. Univ.)[#] A remark on Morrey spaces for metric measure spaces 10
 Tetsu Shimomura (Hiroshima Univ.)

Summary: In the talk, the speaker will explain that the modification made for the definition of Morrey spaces no longer works in the general metric measure spaces.

- 16 Katsuo Matsuoka (Nihon Univ.)[#] On the boundedness for commutators in B_σ -Morrey spaces 15

Summary: In this talk, we will unify the results of boundedness for commutators of Calderón–Zygmund operators in L^p spaces, Morrey spaces and the central Morrey spaces. In order to do this, we will show the boundedness for them in B_σ -Morrey spaces.

- 17 Hiroki Saito (Tokyo Metro. Univ.)[#] Directional maximal operators and radial weights on the plane 10
 Hitoshi Tanaka (Univ. of Tokyo)

Summary: Let Ω be the set of unit vectors and w be a radial weight on the plane. We consider the weighted directional maximal operator defined by $M_{\Omega,w}f(x) := \sup_{x \in R \in \mathcal{B}_\Omega} \frac{1}{w(R)} \int_R |f(y)|w(y) dy$, where \mathcal{B}_Ω denotes the all rectangles on the plane whose longest side is parallel to some unit vector in Ω and $w(R)$ denotes $\int_R w$. In this paper we prove an almost-orthogonality principle for this maximal operator under certain conditions on the weight. The condition allows us to get weighted norm inequality $\|M_{\Omega,w}f\|_{L^2(w)} \leq C \log N \|f\|_{L^2(w)}$, when $w(x) = |x|^a$, $a > 0$, and when Ω is the set of unit vectors on the plane with cardinality $N \gg 1$.

- 18 Hitoshi Tanaka (Univ. of Tokyo)[#] A characterization of two-weight trace inequalities for positive dyadic operators in the upper triangle case 15

Summary: Two-weight trace inequalities for positive dyadic operators are characterized in terms of discrete the Wolff potentials in the upper triangle case $1 < q < p < \infty$.

- 19 Yuichi Kanjin (Kanazawa Univ.)[#] On orthogonal polynomial expansions with nonnegative Fourier coefficients 15

Summary: We establish Wiener type theorems and Paley type theorems for Laguerre polynomial expansions and disk polynomial expansions with nonnegative coefficients.

16:30–17:30 Talk invited by Real Analysis Section

Shinya Moritoh (Nara Women's Univ.)^{*} Microlocal Besov spaces and dominating mixed smoothness

Summary: We considered two-microlocal Besov spaces in 2004. In this talk, we define more general microlocal spaces in terms of wavelets and give their characterization by using dominating mixed smoothness.

September 25th (Wed) Conference Room III

9:00–11:55

- 20 Akio Ito (Kinki Univ.)[#] Large-time behavior of non-negative time-global solutions to ODE system describing cardiac hypertrophy 15
Kazuhiko Yamamoto (Kinki Univ.)

Summary: In this talk, we consider a system of nonlinear ODEs, which describes cardiac hypertrophy. And we investigate the large-time behavior of non-negative time-global solutions to our system. Actually, we show the existence of a global attractor for the dynamical system associated with our system. Moreover, we investigate the structure of the ω -limit set for each fixed initial datum.

- 21 Kota Kumazaki[#] Large time behavior of a solution for carbon dioxide transport model in concrete carbonation process 15
(Tomakomai Nat. Coll. of Tech.)

Summary: From the civil engineering point of view, it is important to construct and analyze a mathematical model of concrete carbonation process. On this subject, we propose a mathematical model for carbon dioxide transport in the process, and showed the existence and uniqueness of a global solution of the model. In this talk, we show that the solution converges to a solution of the steady state problem, and clarify the structure of the solution of the steady state problem considering two cases for boundary data.

- 22 Takesi Fukao (Kyoto Univ. of Edu.)[#] Application to nonlinear PDE of the abstract theory of variational inequality 15
Nobuyuki Kenmochi (Bukkyo Univ.)

Summary: The existence of solutions for a class of abstract evolution equations generated by maximal monotone operators with non-local convex constraint is considered. Moreover, its application to nonlinear PDE is considered. This result is a generalization of the theory of Lagrange multiplier related to variational inequalities. Based on the concept of optimization problems, the theory of Lagrange multiplier has strong relevance to various minimizing problems for some cost functionals with constraint. The objective of this paper is to give an extension of the well-known theory to a more general setting, in order to apply to nonlinear parabolic partial differential inclusions.

- 23 Yutaka Tsuzuki (Tokyo Univ. of Sci.)[‡] Solvability of p -Laplace heat equations with unbounded obstacles coupled with Navier–Stokes equations 15

Summary: This talk is concerned with the system of nonlinear heat equations with constraints coupled with Navier–Stokes equations in two-dimensional domains. In 2012, Sobajima, Tsuzuki and Yokota proved the existence and uniqueness of solutions to the system with heat equations include diffusion term $\Delta\theta$, where θ represents the temperature. This paper gives the existence result in which Laplace operator Δ is replaced with p -Laplace operator Δ_p , where $p > 2$.

- 24 Shun Uchida (Waseda Univ.)[‡] The solvability of double-diffusive convection system coupled with Mitsuharu Ôtani (Waseda Univ.) Brinkman–Forchheimer equations under the Neumann boundary condition 15

Summary: This talk is concerned with the initial boundary value problem and the time periodic problem of a system which describes double-diffusive convection in some porous medium. The global solvability of these problems is already obtained for the homogeneous Dirichlet boundary condition.

The main purpose of this talk is to report that the global solvability of the system under the homogeneous Neumann boundary value condition also holds true. The methods of proofs rely on the theory of the non-monotone perturbations for subdifferential operators. However, the lack of the coercivity of the Laplacian with the Neumann boundary condition causes some difficulties in this procedure. Especially for the periodic problem, we need to introduce some approximation procedures for this system with two approximation parameters.

- 25 Ken Shirakawa (Chiba Univ.)[‡] Smoothing effects and energy dissipations for parabolic systems associated with grain boundary motions 15
Hiroshi Watanabe (Salesian Polytech.)
Jose Salvador Moll (Univ. Valencia)

Summary: In this talk, a parabolic type system derived as a gradient flow of an energy functional is considered. Regarding to this system, the existence of solutions starting from the energy-domain was already known. Based on the previous result, we here focus on the verifications of the smoothing effects and the energy-dissipations, i.e. the key-properties as a parabolic type gradient flow. Furthermore, as an extended topic, we mention about the result concerned with the large-time behavior of solutions that dissipate the governing energy in time.

- 26 Hiroshi Watanabe (Salesian Polytech.)[‡] Qualitative properties for a one dimensional grain boundary motion
Ken Shirakawa (Chiba Univ.) model with degeneracy 15

Summary: In this talk, a coupled system of a parabolic type initial-boundary value problem and an elliptic-parabolic type one is considered under one-dimensional setting of the spatial domain. This system is based on a phase field model of grain boundary. The results of this talk are concerned with the existence of solutions with energy dissipation and the large time behavior of solutions.

- 27 Noriaki Yamazaki (Kanagawa Univ.)[‡] Control problems of phase field systems associated with total variation
Ken Shirakawa (Chiba Univ.) energy 15

Summary: In this talk we consider optimal control problems for onedimensional phase field system with total variation functional as the interfacial energy. Our system consists of two parabolic PDEs: a heat equation and a singular diffusion equation of an order parameter. We prove the existence of an optimal control that minimizes the nonlinear and nonsmooth cost functional. Moreover, we show the necessary condition of the optimal pair by using the optimal control problem of the approximating system.

- 28 Makoto Nakamura (Yamagata Univ.)* The Cauchy problem for nonlinear Klein–Gordon equations in de Sitter spacetime 10

Summary: The Cauchy problem for nonlinear Klein–Gordon equations is considered in de Sitter spacetime. The nonlinear terms are power type or exponential type. The local and global solutions are shown in the energy class.

- 29 Makoto Nakamura (Yamagata Univ.)* Remarks on a weighted energy estimate and its application to nonlinear wave equations in one space dimension 10

Summary: A weighted energy estimate with tangential derivatives on the light cone is applied for the Cauchy problem of semilinear wave equations in one space dimension.

- 30 Yoshifumi Ito (Univ. of Tokushima)*[‡] Fourier transformation of L^2_{loc} -functions and its applications 8

Summary: In this paper, we study the definition of Fourier transformation of L^2_{loc} -functions and its fundamental properties. These are the new results for the Fourier transformation of L^2_{loc} -functions. As its applications, we study the characterizations of the local Sobolev spaces using the methods of Fourier transformation.

Further, the Fourier transformations of L^2_{loc} -functions are very essential in order to study the theory of natural statistical physics.

- 31 Yoshifumi Ito (Univ. of Tokushima)*[‡] What is the impact force? 7

Summary: In this paper, we study what the impact force is. In the studies of the phenomena of potential barrier and the phenomena of potential well, the force acting on an electron is considered to be an impact force. The impact force is the force $-\delta(x)$ which acts on an electron only at the point $x = 0$ and its work is concentrated only at this point. This means that this force is just the impact force.

13:00–13:15

- 32 Yoshifumi Ito (Univ. of Tokushima)*[‡] The study on the phenomena of infinitely deep potential well in the view point of the natural statistical physics 8

Summary: In this paper, we study the phenomena of infinitely deep potential well in the view point of the natural statistical physics.

Under the action of infinitely deep potential in the 1-dimensional space \mathbf{R} , an electron moves in the interval of finite length whose end points are the complete reflection walls on both sides. We prove that the motion of the physical system composed of such electrons is understood by virtue of the natural statistical physics for the periodic motion.

- 33 Yoshifumi Ito (Univ. of Tokushima)* The study on the motion of the system of free particles in the view point of the natural statistical physics 7

Summary: In this paper, we study the motion of the system of free particles in the view point of the natural statistical physics.

Thereby, we obtain the new results on the specific heats of an ideal gas in the view point of atomism. In this case, we need the theory of Fourier transformation of L^2_{loc} -functions because the Schrödinger operator of the system of free particles has the continuous spectrum.

13:20–14:20 Talk invited by Real Analysis Section

Risei Kano (Kochi Univ.)[#] The existence of solutions for the tumor invasion models

Summary: We discuss that the solvability for the tumor invasion models. This problem was proposed by Chaplain and Anderson which is equipped by the some dependence for the variables.

Functional Analysis

September 24th (Tue) Conference Room IV

9:30–11:50

- 1 Hiroshi Ito (Ehime Univ.)* Dirac operators with potentials with diverging at infinity 15

Summary: In this talk we consider a Dirac operator with a dilation analytic matrix-valued potential diverging at infinity. We first show that the spectrum of the operator coincides with the whole real line and that there is no singular continuous spectrum. Moreover, there is no resonance in the lower half-plane. We next consider the locations of resonances of the operator and show that there are some relationships of spectra and resonances between two Schrödinger operators and the Dirac operator as the nonrelativistic limit

- 2 Akito Suzuki (Shinshu Univ.)* Spectral analysis of the Laplacian on a covering graph obtained from the one dimensional lattice by adding pendant vertices 15

Summary: We consider a covering graph that are obtained from the one dimensional lattice by adding pendant vertices. We show that the Laplacian on the graph has a spectral gap and establish a necessary and sufficient condition under which the Laplacian has an eigenvalue.

- 3 Akito Suzuki (Shinshu Univ.) Supersymmetric aspects of the Laplacian on the graph obtained from the lattice by adding pendant vertices 15

Summary: We consider the graph obtained from the d dimensional lattice by adding pendant edges. We study the property of the ground state of the supersymmetric Hamiltonian defined from the Laplacian on such a graph and show the existence of the spectral gap.

- 4 Itaru Sasaki (Shinshu Univ.)# Jacobi matrix and the multiplicity of eigenvalues of the non-commutative harmonic oscillator 10

Summary: The non-commutative harmonic oscillator is defined by the Hamiltonian

$$Q(\alpha, \beta) := \begin{pmatrix} \alpha & 0 \\ 0 & \beta \end{pmatrix} \otimes \left(-\frac{1}{2} \frac{d^2}{dx^2} + \frac{1}{2} x^2 \right) + \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \otimes \left(x \frac{d}{dx} + \frac{1}{2} \right),$$

where α, β are positive parameters such that $\alpha\beta > 1$. We study the multiplicity of eigenvalues of $Q(\alpha, \beta)$. It is shown that the multiplicity of the lowest eigenvalue is one for all values of α and β . Moreover, we show that $Q(\alpha, \beta)$ can be decomposed into four self-adjoint Jacobi matrices.

- 5 Itaru Sasaki (Shinshu Univ.)# On the binding condition of the semi-relativistic Pauli–Fierz model ... 10

Summary: We study a quantum system of charged particle interacting with a quantized radiation field. The Hamiltonian of the system is defined by

$$H^V := \sqrt{(\mathbf{p} - q\mathbf{A}(\mathbf{x}))^2 + m^2} - m + H_f + V(\mathbf{x})$$

which acts in the Hilbert space $\mathcal{H} = L^2(\mathbb{R}^3) \otimes \mathcal{F}$ where \mathcal{F} is the Fock space over $L^2(\mathbb{R}^3 \times \{1, 2\})$. Let $E^V := \inf \sigma(H^V)$ be the ground state energy. The difference $E^0 - E^V$ is called a binding energy. We show that the binding energy is positive under natural condition on V . Moreover we discuss the binding energy of the many particle system.

- 6 Fumio Hiroshima (Kyushu Univ.)[#] Spin-boson model through a Poisson-driven stochastic process 15

Summary: It is shown that the spin-boson model has a unique ground state by means of a functional integration. The Gibbs measure associated with the ground state is constructed and its applications are given.

- 7 Fumio Hiroshima (Kyushu Univ.)[#] Functional integral approach to semi-relativistic Pauli–Fierz models . . . 10

Summary: The functional integral representation of the semigroup generated by the so-called semi-relativistic Pauli–Fierz model H is constructed. It is shown that H is essential self-adjoint, and 1) spatial decay of bound states, 2) Gaussian domination of the ground state and 3) existence of a probability measure associated with the ground state are shown.

- 8 Fumio Hiroshima (Kyushu Univ.)[#] UV renormalization of the Nelson model by functional integrations . . . 10

Summary: The Nelson model is defined as a self-adjoint operator by introducing UV cutoff. It is shown that by functional integrations UV cutoff can be renormalized. This result is a functional integral version of [E. Nelson JMP 5 (1964) 1190–1197].

- 9 Koichi Kaizuka (Univ. of Tsukuba)[#] A characterization of the L^2 -range of the Poisson transform on symmetric spaces of noncompact type 15

Summary: Characterizations of the joint eigenspaces of invariant differential operators have been one of the central problems in harmonic analysis on symmetric spaces. Helgason (Advan. Math. (1970)) conjectured that any joint eigenfunction on symmetric spaces of noncompact type is expressed as the image of the Poisson transform of an analytic functional on the boundary, and this conjecture was proved by Kashiwara et al. (Ann. of Math. (1978)). For real and regular spectral parameter, we consider an image characterization for the Poisson transform of the L^2 -functions on the boundary of symmetric spaces of noncompact type. Our approach is based on techniques in the scattering theory and harmonic analysis on symmetric spaces.

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

- Chisato Iwasaki (Univ. of Hyogo)^{*} The symbol of the fundamental solution for the degenerate parabolic operators and its application

Summary: We give the exact symbol the fundamental solution of degenerate parabolic operators as pseudo-differential operators. We apply this representation to two subjects. One is to study the heat kernel trace and the spectral function on a sub-Laplace operator $\Delta_{L \setminus G}^{sub}$ on a compact nilmanifold $L \setminus G$. Here G is an arbitrary nilpotent Lie group of step 2 and L is a lattice. We can show the spectral function has only one pole. The another one is to get the eigen function expansion of the heat kernel to the Fokker–Planck operator.

September 25th (Wed) Conference Room IV

9:30–11:50

- 10 Takuya Hosokawa (Ibaraki Univ.)^{*} Differences of weighted composition operators from H^∞ to the Bloch space 10
Shūichi Ohno (Nippon Inst. of Tech.)

Summary: We consider the boundedness and compactness of the differences of two weighted composition operators acting from the Banach space of bounded analytic functions on the open unit disk to the Bloch space.

- 11 Kouhei Izuchi (Yamaguchi Univ.)[#] Operator inner functions for Rudin type invariant subspaces over the bidisk 15

Summary: Let \mathcal{M} be a Rudin type invariant subspace of the Hardy space over the bidisk. In this talk, an operator inner function for \mathcal{M} is given. This is a generalization of Q in and Yang's work.

- 12 Takeshi Miura (Niigata Univ.)[#] On surjective isometries between function algebras 15

Summary: Let S be a surjective isometry between function algebras on locally compact Hausdorff spaces. We prove that such an isometry induces a homeomorphism between Choquet boundaries, and give a representation of it by a weighted composition operators.

- 13 Koichi Shimada (Univ. of Tokyo) A classification of flows on AFD factors with faithful Connes–Takesaki modules 15

Summary: We classify flows on AFD factors with faithful Connes–Takesaki modules. This generalizes the classification of trace-scaling flows on the AFD II_∞ factor, which is closely related to the uniqueness of the AFD III_1 factor. In order to do the classification, we show that flows on AFD factors with faithful Connes–Takesaki modules has the Rohlin property. This also gives a partial answer to a classification problem of the Rohlin property for flows.

- 14 Yusuke Isono (Univ. of Tokyo)[#] Strong solidity of II_1 factors of free quantum groups 15

Summary: We generalize Ozawa's bi-exactness to discrete quantum groups and give a new sufficient condition for strong solidity, which implies the absence of Cartan subalgebras. As a corollary, we prove that II_1 factors of free quantum groups are strongly solid. We also consider similar conditions on non-Kac type quantum groups, namely, non finite von Neumann algebras.

- 15 Satoshi Goto (Sophia Univ.)[#] On equivalence classes of irreducible generalized intermediate subfactors of ADE subfactors 10

Summary: By combining Ocneanu's classification of all biunitary connections between ADE Dynkin diagrams with Kawahigashi's quantum Galois correspondence for subfactors and previously obtained subequivalence among ADE paragroups, we show that all irreducible generalized intermediate subfactors of ADE subfactors are classified into (sub)equivalence classes.

- 16 Satoshi Goto (Sophia Univ.)[#] On intermediate subfactors of Goodman–de la Harpe–Jones subfactors 10

Summary: All intermediate subfactors of GHJ subfactors and those lattice structures were obtained by Xu. We show that Xu's result is also obtained by using Ocneanu's classification of all biunitary connections between ADE Dynkin diagrams.

- 17 Toshihiko Masuda (Kyushu Univ.)[#] A sufficient condition for vanishing of an obstruction in orbifold construction 15

Summary: We present a simple sufficient condition for vanishing of an obstruction in orbifold construction for subfactors. For example, our result can be applied to show the existence of subfactors with principal graph D_{2n} .

September 26th (Thu) Conference Room IV

9:30–12:00

- 18 Narutaka Ozawa (Kyoto Univ.)[#] Quantum correlations and Tsirelson's problem 15

Summary: The EPR paradox tells us quantum theory is incompatible with classic realistic theory. Indeed, Bell has shown that quantum correlations of independent bipartite systems have more possibility than the classical correlations. To study what the possibilities are, Tsirelson has introduced the set of quantum correlation matrices, but depending on the interpretation of independence, there are two plausible definitions of it. Tsirelson's problem asks whether these definitions are equivalent. It turned out that this problem in quantum information theory is in fact equivalent to Connes's embedding conjecture, one of the most important open problems in theory of operator algebras. I will talk some recent progress on Tsirelson's problem.

- 19 Takuya Takeishi (Univ. of Tokyo) On nuclearity of C^* -algebras of Fell bundles over étale groupoids 15

Summary: In my master's thesis, I showed that if E is a Fell bundle over an amenable étale locally compact Hausdorff groupoid such that every fiber on the unit space is nuclear, then $C_r^*(E)$ is also nuclear. In order to show this, we introduce (minimal) tensor products of Fell bundles with fixed C^* -algebras.

- 20 Hiroyuki Osaka (Ritsumeikan Univ.)[#] LP property for C^* -algebras 15
 Dinh Trung Hoa (Duy Tan Univ.)
 Ho Minh Toan
 (Vietnam Acad. Sci. Tech.)

Summary: A C^* -algebra is said to have the LP property if the linear span of projections is dense in a given algebra. It is well known that the LP property of a C^* -algebra A is inherited to the matrix tensor product $M_n(A)$ and the quotient $\pi(A)$ for any $*$ -homomorphism π . But it is not stable under the hereditary subalgebras, fixed point algebras A^G by finite groups G , and crossed products $A \rtimes_\alpha G$. We present that given a simple unital C^* -algebra A with the LP property if an action α of a finite group G to $\text{Aut}(A)$ has the Rokhlin property then A^G and $A \rtimes_\alpha G$ has the LP property.

- 21 Rui Okayasu (Osaka Kyoiku Univ.)[#] Some properties for free group C^* -algebras associated with ℓ_p 15

Summary: I discuss some properties for free group C^* -algebras associated with ℓ_p .

- 22 Norio Nawata (Chiba Univ.)[#] A Rohlin type theorem for trace scaling automorphisms of certain stably projectionless C^* -algebras 15

Summary: We shall introduce the Rohlin property for automorphisms of σ -unital stably projectionless C^* -algebras. Let \mathcal{W}_2 be the Razak–Jacelon algebra (which is a certain simple nuclear stably projectionless C^* -algebra having trivial K -groups and a unique tracial state). We shall show that every trace scaling automorphism of $\mathcal{W}_2 \otimes \mathbb{K}$ has the Rohlin property.

- 23 Yasuhiko Sato (Kyoto Univ.)[#] Approximately unitarily equivalent automorphisms of UHF absorbing C*-algebras 15

Summary: M. Rørdam showed that two automorphisms in a Kirchberg algebra are approximately unitarily equivalent, if they have the same invariants in the KL-group. In that same period, E. Kirchberg obtained an abstract proof of this result based on Connes–Higson’s E-theory. On the other hand, for stably finite cases H. Lin showed analogous results of Rørdam’s theorem by using his condition of tracial rank zero. In the present work, we show an alternative proof of H. Lin’s theorem in a similar way of Kirchberg’s strategy.

- 24 Yuhei Suzuki (Univ. of Tokyo)[#] Haagerup property for C*-algebras and rigidity of C*-algebras with property (T) 15

Summary: In this talk, I will talk about the Haagerup property and property (T) for C*-algebras, both of which have been recently introduced to the theory of C*-algebras. I studied on *-homomorphisms from a C*-algebra with property (T) to a C*-algebra with the Haagerup property. An application of Popa’s theorem shows images of such *-homomorphisms must be residually finite dimensional. I also want to talk about the studies of such property for relative property (T) cases. I studied on the reduced group C*-algebras of the concrete examples of discrete groups with relative property (T).

- 25 Kengo Matsumoto (Joetsu Univ. of Edu.)^{*} Topological full groups of C*-algebras arising from β -expansions 15
Hiroki Matui (Chiba Univ.)

Summary: We introduce a family $\Gamma_\beta, 1 < \beta \in \mathbb{R}$ of infinite non-amenable discrete groups as an interpolation of the Higman–Thompson groups $V_n, 1 < n \in \mathbb{N}$ by using the topological full groups of the groupoids defined by β -expansions of real numbers. They are regarded as full groups of certain interpolated Cuntz algebras $\mathcal{O}_\beta, 1 < \beta \in \mathbb{R}$. The groups $\Gamma_\beta, 1 < \beta \in \mathbb{R}$ are realized as groups of piecewise linear functions on $[0, 1]$ if the β -expansion of 1 is finite or ultimately periodic. We classify the groups $\Gamma_\beta, 1 < \beta \in \mathbb{R}$ by the number theoretical property of β .

14:15–15:45

- 26 Tsuyoshi Kajiwara (Okayama Univ.)[#] Discrete traces on the cores of C*-algebras associated with rational functions 15
Yasuo Watatani (Kyushu Univ.)

Summary: The cores of the C*-algebras associated from complex dynamical systems and self-similar maps have much information of the original dynamical system. In the previous talks, we have classified traces and ideals of the C*-algebras associated with self similar maps under some condition. In the present talk, we report the classification of discrete extreme trace of the core of the C*-algebras associated with the dynamical system given by rational functions on the Riemannian sphere. In the present situation, the analysis is more difficult because rational functions do not have global inverse branch in general, and branched points can appear in the backward orbits of branched points.

- 27 Yasuo Watatani (Kyushu Univ.)^{*} Transitive Hilbert representations of quivers 15
Masatoshi Enomoto (Koshien Univ.)

Summary: We study transitive Hilbert representations of quivers. We show that the existence of infinite-dimensional transitive Hilbert representations of a quiver depends on the quiver’s orientation.

- 28 Reiji Tomatsu (Hokkaido Univ.)[#] Product type actions of a compact quantum group G_q 15

Summary: I will explain recent progress of study of product type actions of a compact quantum group G_q .

- 29 Ryo Tabata (Hiroshima Univ.)[#] On possible values of generalized matrix functions on the determinant-permanent number line 15

Summary: Schur's Theorem (1917) and Lieb's Permanent Dominance Conjecture (1966) state that the determinant is the minimum and the permanent is the maximum among the normalized generalized matrix functions. In this research, we try to sharpen the Lieb's conjecture to determine the possible values of the generalized matrix functions in the determinant-permanent number line. In particular for the case of immanants, we conjecture that the maximum values are attained at Y_n (for most immanants) and $Y_3 \oplus I_{n-3}$ (for the character $(n-1, 1)$). On the other hand, the matrices at which the generalized matrix functions attain the maximum for most of non-immanant case seems to be a chaos. When the subgroup is trivial, Pierce's conjecture (1987) implies that the maximum value is attained at Y_n .

- 30 Katsuhiko Kikuchi (Kyoto Univ.)[#] Spherical representations for certain Gelfand pairs 15

Summary: Let G be a Lie group, K a compact subgroup of G . We say that (G, K) is a Gelfand pair if the Banach $*$ -algebra $L^1(K \backslash G / K)$ of all K -biinvariant integrable functions on G are commutative. In this talk, we give a parametrization of all spherical representations of certain Gelfand pairs (G, K) neither of reductive nor of Heisenberg type. The group G is the semidirect product $G = L \ltimes N$ of a nilpotent Lie group and a compact Lie group L which includes K as a proper closed subgroup.

16:00–17:00 Talk invited by Functional Analysis Section

- Toshihiko Matsuki (Ryukoku Univ.)[#] Finite-type orbit decompositions of multiple flag varieties for orthogonal groups

Summary: Let G be the split special orthogonal group of odd degree over an arbitrary field of characteristic not 2. Let P_1, \dots, P_k be parabolic subgroups of G . Then we can consider the multiple flag variety

$$\mathcal{M} = (G/P_1) \times \dots \times (G/P_k)$$

with the diagonal G -action. In this talk, I will give a necessary condition for finiteness of the orbit decomposition. I hope the condition will be also sufficient for finiteness.

September 27th (Fri) Conference Room IV

9:30–12:00

- 31 Junichi Fujii (Osaka Kyoiku Univ.)[#] On hyperkähler structure for the 2 by 2 positive-definite matrices 10

Summary: The manifold of the positive operators whose geodesic is an operator mean has been discussed. Recently Pálfi showed that the operator means corresponding to the Riemannian metrics are only 3 ones; the arithmetic, harmonic and geometric ones, except the cases that the dimension of the space is not less than 3. In this talk, we discuss the 2 dimensional case that has a hyperkähler structure.

- 32 Noboru Nakamura [#] Proofs of operator monotonicity of some functions 15
 (Toyama Nat. Coll. of Tech.)
 Saich Izumino

Summary: A real-valued function f on $(0, \infty)$ is *operator monotone*, if $f(A) \leq f(B)$ for operators A and B such that $0 \leq A \leq B$. As a typical example, $t \mapsto t^p$ ($0 \leq p \leq 1$) is an operator monotone function, which is well-known as Löwner–Heinz theorem.

Besenyi and Petz showed the following two functions, parameterized with p , $f_p(x) = \left(\frac{x^p-1}{p(x-1)}\right)^{\frac{1}{p-1}}$ for $-2 \leq p \leq 2$ and $g_p(x) = \left(\frac{1+x^p}{2}\right)^{\frac{1}{p}}$ for $-1 \leq p \leq 1$ are operator monotone in x , respectively. By the representation of $f_p(x)$ using the integral, $f_p(x) = \left(\int_0^1 (1-t+tx)^{p-1} dt\right)^{\frac{1}{p-1}}$, we give another way of showing operator monotonicity of $f_p(x)$. Operator monotonicity of $g_p(x)$ is simply induced from the use of a binomial expansion. Moreover, related to them, we give a simple proof of operator monotonicity of Petz–Hasegawa’s function.

- 33 Kenjiro Yanagi (Yamaguchi Univ.) [#] Uncertainty relation of generalized skew information 15
 Shigeru Furuichi (Nihon Univ.)
 Ken Kuriyama (Bukkyo Univ.)

Summary: We consider $f(x, y) = ((1+x^y)/2)^{1/y}$ as a function of y for $x > 0$. We prove that $f(x, y)$ is concave in $1/2 < y < 1$. By using the concavity of $f(x, y)$, we give uncertainty relation with generalized skew information.

- 34 Eizaburo Kamei ^{*} An extension of Tsallis relative operator entropy 15
 Hiroshi Isa (Maebashi Inst. of Tech.)
 Masatoshi Ito (Maebashi Inst. of Tech.)
 Hiroaki Tohyama
 (Maebashi Inst. of Tech.)
 Msayuki Watanabe
 (Maebashi Inst. of Tech.)

Summary: We see the relations among relative operator entropy $S(A|B)$ and Tsallis relative operator entropy $T_r(A|B)$ and $S_r(A|B)$ which is a generalization of $S(A|B)$. We give an extension of Tsallis relative operator entropy $T_{t,r}(A|B)$ and an expanded relative operator entropy $S_{t,r}(A|B)$. Then we show relations between $T_{t,r}(A|B)$ and $S_{t,r}(A|B)$ which are similar to the relations between $T_r(A|B)$ and $S_r(A|B)$.

- 35 Masatoshi Ito (Maebashi Inst. of Tech.) [#] Generalizations of operator Shannon inequality based on Tsallis and
 Hiroshi Isa (Maebashi Inst. of Tech.) Rényi relative entropies 15
 Eizaburo Kamei
 Hiroaki Tohyama
 (Maebashi Inst. of Tech.)
 Masayuki Watanabe
 (Maebashi Inst. of Tech.)

Summary: Recently, we obtained inequalities among relative operator entropies of sequences, which is an extension of operator version of Shannon inequality (briefly, operator Shannon inequality) discussed by Furuta and Yanagi–Kuriyama–Furuichi. In this talk, we shall obtain two generalizations of these inequalities by considering generalizations of relative operator entropies of sequences.

- 36 Masatoshi Ito (Maebashi Inst. of Tech.)[#] Matrix inequalities including grand Furuta inequality via Karcher mean 15

Summary: Recently, we have shown a generalization of Furuta inequality via weighted Karcher mean (weighted Riemannian mean) of n -matrices. In this talk, we shall obtain a generalization of grand Furuta inequality as an extension of our previous result.

- 37 Mitsuru Uchiyama (Shimane Univ.)[#] A converse of Loewner–Heinz inequality 15

Summary: Let $f(t)$ be a non-constant operator monotone function in a neighborhood of $t = a$. Then $A \leq B$ if and only if there is a sequence $\{t_n\}_{n=1}^\infty$ so that $t_n \downarrow 0$ and $f(a + t_n A) \leq f(a + t_n B)$.

- 38 Masaru Nagisa (Chiba Univ.)[#] The reverse order of operator mean 15
Mitsuru Uchiyama (Shimane Univ.)

Summary: We denote by $A\sigma B$ a operator mean of positive operators A and B . It is known that an operator mean associated with some operator monotone function f on $(0, \infty)$. Let X and Y be positive invertible operators. We show that the condition $(tA + X)\sigma Y \leq (tB + X)\sigma Y$ holds for a sufficiently small $t > 0$ is equivalent to $A \leq B$ if and only if X is a scalar multiple of Y or the operator monotone function f has the form

$$f(t) = \frac{at + b}{ct + d}, \quad a, b, c, d \in \mathbb{R}, \quad ad - bc > 0.$$

- 39 Takeaki Yamazaki (Toyo Univ.)[#] Operator inequality and operator mean 10
Mitsuru Uchiyama (Shimane Univ.)

Summary: Let $f(t)$ be an operator monotone function. Then $A \leq B$ implies $f(A) \leq f(B)$, but the converse implication is not true. Let $A\sharp B$ be the geometric mean of $A, B \geq 0$. If $A \leq B$, then $B^{-1}\sharp A \leq I$; the converse implication is not true either. We will introduce that if $f(\lambda B + I)^{-1}\sharp f(\lambda A + I) \leq I$ for all sufficiently small $\lambda > 0$, then $f(\lambda A + I) \leq f(\lambda B + I)$ and $A \leq B$. Moreover, we extend it to multi-variable matrices means.

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

- Yuki Seo (Osaka Kyoiku Univ.)[#] Developments of operator geometric means from the viewpoint of Kantorovich inequality

Summary: In this talk, from the viewpoint of so-called “reverse inequalities”, we shall consider non-commutative structure of three n variable operator geometric means, that is, the chaotic geometric mean, the Karcher geometric mean and the Ando–Li–Mathias geometric mean. Firstly, we outline the history of the Kantorovich inequality, and describes how the Kantorovich inequality has developed in the field of operator inequalities. Next, we compare three geometric means from the viewpoint of the Ando–Hiai type inequality, and consider norm inequalities and its reverse for three geometric means. Moreover, we investigate the reverse of the arithmetic-geometric mean inequality for three operator geometric means.

Statistics and Probability

September 24th (Tue) Conference Room VIII

9:30–12:00

- 1 Kiyotaka Suzaki (Osaka Univ.)[#] Construction of leafwise non-degenerate diffusion processes on foliated spaces via SDE approach and its application 15

Summary: We construct leafwise non-degenerate diffusion processes on foliated spaces via SDE approach. As an application we state a central limit theorem for a class of additive functionals of the leafwise diffusion process starting at almost every point with respect to any harmonic measure.

- 2 Takafumi Amaba (Ritsumeikan Univ.)[#] On the monotonicity of \mathcal{L}_0 -cost along backward heat flow 15
Kazumasa Kuwada (Ochanomizu Univ.)

Summary: On a manifold having (forward) Ricci flow background, we discuss the existence of a coupled Brownian motion such that their \mathcal{L}_0 -distance is a supermartingale. As a consequence, another proof of the monotonicity of \mathcal{L}_0 -cost along backward heat flow than Lott (2009) is obtained. This is a joint work with Kazumasa Kuwada (Ochanomizu University).

- 3 Jirô Akahori (Ritsumeikan Univ.)[#] A discrete-time Clark–Ocone formula and its application to an error analysis 15
Takafumi Amaba (Ritsumeikan Univ.)
Kaori Okuma (Ritsumeikan Univ.)

Summary: In this talk, we will establish a discrete-time version of Clark(–Ocone–Haussmann) formula, which can be seen as an asymptotic expansion in a weak sense. The formula is applied to the estimation of the error caused by the martingale representation. This is a joint work with Jirô Akahori (Ritsumeikan Univ.) and Kaori Okuma (Ritsumeikan Univ.).

- 4 Masafumi Hayashi[#] Hölder continuity property of the densities of SDEs with singular drift
(Univ. of Ryukyus/JST CREST) coefficients 10
Arturo Kohatsu Higa
(Ritsumeikan Univ./JST CREST)
Go Yuki
(Ritsumeikan Univ./JST CREST)

Summary: We prove that the solution of stochastic differential equations with deterministic diffusion coefficient admits a Hölder continuous density if the Fourier transform of the drift coefficient exists and it has a polynomial decay property. In this result, the order of the decay is an important factor to determine the order of Hölder continuity of the density.

- 5 Hideki Tanemura (Chiba Univ.)[#] Complex Brownian motion representations of non-colliding diffusion
Makoto Katori (Chuo Univ.) processes 10

Summary: Dyson’s Brownian motion model with the parameter $\beta = 2$, is realized as an h -transform of the absorbing Brownian motion in a Weyl chamber of type A. In this talk we give another representation of the model by means of complex Brownian motions with entire functions. We also give some generalization of the result.

- 6 Hideki Tanemura (Chiba Univ.)[#] Strong Markov property of determinantal processes 10

Summary: In this talk we discuss the strong Markov property of the determinantal processes with an infinite number of particles obtained by the appropriate scaling limit of non-colliding diffusion processes. For some interesting models, the strong Markov property is proved.

- 7 Nobuaki Naganuma (Tohoku Univ.)[#] Asymptotic error distributions of the Crank–Nicholson scheme for SDEs driven by fractional Brownian motion 15

Summary: We investigate the error between the solution to a stochastic differential equation driven by a fractional Brownian motion and the approximation by the Crank–Nicholson scheme associated to the equation. In this talk, we consider the error as stochastic processes and determine the convergence rate of the error and the limit distribution in the Skorohod topology. The limit distribution is expressed by the term of the solution to the equation and the Itô integral with respect to a standard Brownian motion independent of the driving process of the equation. The key ingredients in our proof are asymptotic behavior of weighted Hermite variations as stochastic processes.

- 8 Shigeyoshi Ogawa (Ritsumeikan Univ.)^{*} Identification of a noncausal Itô process from the stochastic Fourier coefficients 15
Hideaki Uemura (Aichi Univ. of Edu.)

Summary: Let X_t be a noncausal Itô process of Skorokhod type, that is: a stochastic process of the form $dX_t = b(t, \omega)dt + a(t, \omega)dW_t$ where W_t is the Brownian motion and the term $a(\cdot)dW_t$ is understood as Skorokhod integral. For such an Itô process X_t we consider the Fourier coefficient $\mathcal{F}_n(dX)$ of the differential dX_t by $\mathcal{F}_n(dX) = \int_0^1 \overline{e_n(t)}dX_t, e_n(t) = \exp(2\pi n\sqrt{-1}t)$ ($n \in \mathbf{Z}$) and we are concerned with the elementary question; whether we can identify the original process X_t by the complete set of the stochastic Fourier coefficients $\{\mathcal{F}_n(dX), n \in \mathbf{Z}\}$. We study this problem in a framework of noncausal calculus, as we did in the previous articles, and we give an affirmative answer with a concrete scheme for the reconstruction.

- 9 Naoyuki Ichihara (Hiroshima Univ.)^{*} The generalized principal eigenvalue for ergodic type HJB equations 15

Summary: We are concerned with the generalized principal eigenvalue for HJB equations arising in a class of stochastic ergodic control problems. We give a necessary and sufficient conditions so that the generalized principal eigenvalue of an HJB equation coincides with the optimal value of the corresponding optimal control problem.

14:15–14:45

- 10 Naoki Kubota (Nihon Univ.)[#] Rates of convergence in first passage percolation with a weaker condition than exponential tail assumptions 15

Summary: We consider the first passage percolation with i.i.d. weights on edges of a cubic lattice. Under the assumptions that a weight is equal to zero with probability smaller than the critical probability of bond percolation in a cubic lattice, and has the α -th moment for some $\alpha > 1$, we investigate rates of convergence in first passage time.

- 11 Yuji Hibino (Saga Univ.)[#] Asymptotic spectral distributions of distance- k graphs of direct product graphs 15

Summary: We will show that the distance- k graph of the N -th direct power of any fixed graph approximate the k -th Hermite polynomial of a standard normal variable as $N \rightarrow \infty$.

15:00–16:00 Talk invited by Statistics and Probability Section

Makoto Nakashima (Univ. of Tsukuba)[#] Branching random walks in random environment

Summary: We consider branching random walks in time-space random environment. Branching random walks are often regarded as the random measure process on \mathbb{Z}^d or \mathbb{R}^d . When environment is constant, a lot of properties as random measure process are already studied. We will discuss the properties as random measure process for random environment case.

16:15–17:15 Talk invited by Statistics and Probability Section

Katusi Fukuyama (Kobe Univ.)[#] Uniform distribution theory for geometric progressions

Summary: Metric discrepancy results for various sequences will be presented. One of the main target is the investigation of the class consisting of geometric progressions and its variations.

September 25th (Wed) Conference Room VIII

9:15–11:50

- 12 Hiroki Takahashi (Keio Univ.)^{*} Prevalence of non-uniform hyperbolicity at the first bifurcation of the Hénon family 20

Summary: We consider strongly dissipative Hénon-like maps in the plane, around the first bifurcation parameter a^* at which the uniform hyperbolicity is destroyed by the formation of homoclinic or heteroclinic tangencies inside the limit set. In [Takahashi H.: Commun. Math. Phys. **312** 37–85 (2012)] it was proved that a^* is a full Lebesgue density point of the set of parameters for which the non wandering set of the corresponding map is transitive, and Lebesgue almost every initial point diverges to infinity under forward iteration. For these parameters, we show that all Lyapunov exponents of all invariant ergodic Borel probability measures are uniformly bounded away from zero, uniformly over all the parameters.

- 13 Takuya Ikeda (Osaka Univ.)^{*} Central limit theorem for a class of nonsingular transformations with Takehiko Morita (Osaka Univ.) quasi-compact Perron–Frobenius operator 15

Summary: We consider a class of nonsingular transformations T on a probability space (X, \mathcal{B}, m) satisfying the following two conditions. First, there exists a Banach algebra V with $1 \in V$ embedded continuously in $L^\infty(m)$ and dense in $L^1(m)$. Secondly, the so called Perron–Frobenius operator $\mathcal{L}_{T,m}$ of T restricted to V is quasi-compact and its iterations $\mathcal{L}_{T,m}^n$ are uniformly bounded on V . Then given a real valued element f in V we can show a central limit theorem of mixed type with nice convergence rate for the sum $\sum_{k=0}^{n-1} f \circ T^k$ as $n \rightarrow \infty$ provided that the limiting variance is nondegenerate.

- 14 Makoto Mori (Nihon Univ.)[#] On the essential spectrum of Perron–Frobenius operator 20

Summary: We consider piecewise linear and Markov transformations F with same slope β ($\beta > 1$) on an interval I . As is well-known, when we restrict the Perron–Frobenius operator P associated with F to the set of functions with bounded variation, the spectrum radius of P equals 1 and the essential spectrum radius equals β^{-1} . On the other hand, if F is Markov, the dynamical zeta function $\zeta(z)$ is a rational function. Thus, when we consider a suitable domain of P , there exists possibility that the essential spectrum radius become smaller. In this talk, we will study the cases when we restrict its domain to the set of piecewise continuous functions.

- 15 Naotaka Kajino (Kobe Univ.)[#] (Non-)periodic asymptotic behavior of the heat kernel on Sierpiński carpets 20

Summary: Let $p_t(x, y)$ be the heat kernel associated with the canonical self-similar Dirichlet form on a generalized Sierpiński carpet and let d_s denote the spectral dimension of the Dirichlet space, so that $t^{d_s/2}p_t(x, x)$ is uniformly bounded from above and below by positive constants for $t \in (0, 1]$. This talk presents two recent results of the author on asymptotic behavior of $p_t(x, x)$ as $t \downarrow 0$. The former result asserts that for a “generic” (in particular, almost every) point x of the fractal, $t^{d_s/2}p_t(x, x)$ *neither* varies regularly at 0 *nor* is asymptotically log-periodic, whereas the latter states a short time asymptotic expansion of the trace of the heat semigroup involving ONLY finitely many log-periodic functions and an exponentially decaying remainder.

- 16 Yukio Kasahara (Hokkaido Univ.)[#] Matrix-valued rigid functions, kernels of Toeplitz operators and CND
Akihiko Inoue (Hiroshima Univ.) processes 15
Mohsen Pourahmadi
(Texas A&M Univ.)

Summary: We define matrix-valued rigid functions, and extend some known results in the 1-dimensional case, connecting kernels of Toeplitz operators and completely nondeterministic (CND) stationary processes, to the multi-dimensional case.

- 17 Shunsuke Ihara (Nagoya Univ.*)[#] Asymptotic behavior of error probabilities in information transmission over white Gaussian channel with feedback 15

Summary: In information transmission over Gaussian channels, it is well known that the error probability can be substantially reduced by using feedback, namely, under the average power constraint, the error probability decreases more rapidly than the exponential of any order. We consider continuous-time white Gaussian channels with feedback. The aim is to prove a stronger result on the multiple-exponential decay of the error probability. More precisely, for any positive constant c , there exists a feedback coding scheme such that the error probability $P_e(T)$ at time T decreases more rapidly than the exponential of order cT as T tends to infinity.

- 18 Takaaki Shimura (Inst. of Stat. Math.)[#] A numerical characteristic of extreme values 15

Summary: A numerical characteristic of large random numbers is studied. Let F be a distribution on the real numbers with infinite endpoint. X denotes a random variable with distribution F . Consider the transformation for a decimal number $d_1d_2d_3\dots d_n.d_{n+1}\dots$ in $[10^{n-1}, 10^n)$ to $0.d_2d_3\dots$ in $[0, 1)$. We are interested in the distribution of transformed X for large X , which implies the behavior of the large random number except the first figure. It is shown that the distribution of transformed X converges as X becomes large for most distributions and the limit distribution depends on the tail behavior of F .

- 19 Satoshi Suzuki (Shimane Univ.)[#] Surrogate duality for quasiconvex programming with data uncertainty
Daishi Kuroiwa (Shimane Univ.) 15

Summary: Robust optimization problems, which have uncertain data, are considered. We investigate surrogate duality theorem for robust quasiconvex optimization problems. We give necessary and sufficient constraint qualifications for surrogate duality, and show some examples at which such duality results are used effectively.

September 26th (Thu) Conference Room VIII

9:00–12:00

- 20 Takayuki Fujii (Shiga Univ.)[#] Nonparametric estimation for jump Markov processes 15

Summary: We consider nonparametric estimation problems for a class of jump Markov processes. First we introduce the local time related to the level crossings and construct the local time estimator for the stationary density, which is unbiased and uniformly consistent. Furthermore, we also investigate other estimation problems for the jump intensity and the conditional jump size distribution.

- 21 Koji Tsukuda [#] Z-process methods in ℓ^∞ - and L_2 -spaces for change point problems
(Grad. Univ. for Adv. Stud.) 20
Yoichi Nishiyama
(Inst. of Stat. Math./Grad. Univ. for Adv. Stud.)

Summary: We propose some new test statistics for some parametric change point problems. For testing goodness-of-fit, there are three well-known tests, namely, Kolmogorov–Smirnov test, Crámer–von Mises test and Anderson–Darling test. We are interested in Anderson–Darling test because its power is known to be good. To treat Anderson–Darling type statistics, choosing L_2 -space as the framework of weak convergence is natural. We apply this method to change point problems. In this talk, we will present a modification of the test statistic by Horváth and Parzen (1994) to Anderson–Darling type, derive its asymptotic distribution under null hypothesis and prove consistency of test under alternative hypothesis.

- 22 Teppei Ogihara (Osaka Univ.)[#] Local asymptotic mixed normality property for nonsynchronously observed diffusion processes 20

Summary: We prove the local asymptotic mixed normality (LAMN) property for statistical models of nonsynchronously observed diffusion processes when the length of observation intervals go to 0. The problem of nonsynchronous observations appears when we estimate the covariance of security returns using high-frequency financial data. When the statistical model has the LAMN property, we obtain a lower bound of the asymptotic variance of estimation error for any estimator of the parameter. We also see that the quasi-maximum likelihood estimator and the Bayes type estimator proposed by Ogihara and Yoshida (2012) attain this bound and hence are asymptotically efficient.

- 23 Ayaka Yagi (Tokyo Univ. of Sci.)[#] Tests for mean vector and simultaneous confidence intervals with three-
Takashi Seo (Tokyo Univ. of Sci.) step monotone missing data 15

Summary: We consider the problem of testing for mean vector and simultaneous confidence intervals when the data have monotone pattern missing observation. The maximum likelihood estimators of the mean vector and the covariance matrix for the case of three-step monotone missing data are given based on the result of Jinadasa and Tracy (1992). Further the covariance matrix of the maximum likelihood estimator of mean vector are obtained and approximate upper percentiles of the Hotelling's T^2 type statistic are proposed. These upper percentiles are then used to obtain simultaneous confidence intervals for the equality of mean components and linear contrasts. Finally the accuracy of the approximation is investigated by Monte Carlo simulation.

- 24 Masashi Hyodo (Tokyo Univ. of Sci.)[#] On the new test statistic based on linear combination of Dempster
Takahiro Nishiyama (Senshu Univ.) statistics and T^2 statistics 15
Takashi Seo (Tokyo Univ. of Sci.)

Summary: We deal with a one-sample location test in high-dimensional data. For high dimensional data, Hotelling's T^2 -statistics is not always well conditioned in the viewpoint of power of a test. Consequently, due to loss of the power, some nonexact approaches are proposed, e.g., Dempster's test, Bai-Saranadasa's test, and so on. In this talk, we focus on the power of Hotelling's T^2 test and Dempster's test. We propose the asymptotically optimal linear combination test statistics of T^2 -statistics with the Dempster's test statistics when their asymptotic power is equal. Optimality is meant with respect to maximization of the asymptotic power function. Our numerical results show that the new test have higher power than the both Dempster's test and Hotelling's test in most cases.

- 25 Hiroki Watanabe (Tokyo Univ. of Sci.)[#] A determination of cut-off point for Euclidean distance discriminant
Hyodo Masashi (Tokyo Univ. of Sci.) rule in high-dimensional data 15
Seo Takashi (Tokyo Univ. of Sci.)

Summary: We provide the cut-off point for high-dimensional discriminant rule based on conditional error rate and expected error rate. In high-dimensional data, we can not use Wald-Anderson's plug-in criterion. For this reason, we use the Euclidean distance discriminant rule (EDDR) provided by Saranadasa (1993). To determine the cut-off point, we derive the asymptotic distribution for the conditional error rate and the second order unbiased estimator of expected error rate under the high-dimensional settings.

- 26 Aki Ishii (Univ. of Tsukuba)[#] On the distribution of the largest eigenvalue via geometric representa-
Kazuyoshi Yata (Univ. of Tsukuba) tion in high-dimension, low sample size context 15
Makoto Aoshima (Univ. of Tsukuba)

Summary: A common feature of high-dimensional data is that the data dimension is high, however, the sample size is relatively low. We call such a data HDLSS data. We consider a geometric representation of a Gaussian-type HDLSS data. We find a surprising geometric characteristic in the dual space of the HDLSS data when the mean is not zero. We give an estimator of the eigenvalue by using the noise-reduction methodology created by Yata and Aoshima (2012). We show that the estimator enjoys the consistency in a mild condition when the dimension is high. In addition, we provide an asymptotic distribution of the estimator for the largest eigenvalue. Finally, we apply the findings to constructing a confidence interval of the largest eigenvalue.

- 27 Kazuyoshi Yata (Univ. of Tsukuba)[#] Asymptotic normality for inference on high-dimensional mean vectors
Makoto Aoshima (Univ. of Tsukuba) under mild conditions 15

Summary: In this talk, we consider the asymptotic normality for inference on high-dimensional mean vectors. We relax the conditions to verify the asymptotic normality of concerned statistic for high-dimensional settings. We verify the asymptotic normality under some mild conditions. With the help of the asymptotic normality, we show that concerned statistics can ensure consistency for inferences on multi-sample and high-dimensional mean vectors.

- 28 Fumiya Akashi (Waseda Univ.)[‡] An empirical likelihood approach toward discriminant analysis for non-Gaussian vector stationary processes 15

Summary: In this talk, we apply an empirical likelihood approach to the problem of classifying a multivariate (not necessarily Gaussian) stationary process into one of two categories described by two hypotheses Π_1 and Π_2 , which specify that $\{\mathbf{X}(t); t \in \mathbb{Z}\}$ has “pivotal quantities” $\boldsymbol{\eta}_1$ and $\boldsymbol{\eta}_2$ under Π_1 and Π_2 , respectively. It is shown that the misclassification probabilities by the empirical likelihood classification criterion converge to 0 as sample size tends to infinity. We also discuss non-Gaussian robustness, and show that for scalar processes, the empirical likelihood statistic is always non-Gaussian robust. To confirm the theoretical results, simulation studies are given.

- 29 Yan Liu (Waseda Univ.)[‡] A new way to estimate tail index 15

Summary: In this talk, we introduce a new way to estimate the tail index. It is known that there is an asymptotic distribution for any self-normalized sum made from an independent and identically distributed distribution function which belongs to a domain of attraction of a stable law. We give a general and explicit formula for the moments of the asymptotic distribution of symmetric self-normalized sums. The result shows that the finite order moments are polynomials of the tail index of the distribution function and then always finite. As an application, tail index can be estimated through our result by using moment estimators. The numerical results compared with Hill’s estimator will also be presented.

14:30–15:30 Talk invited by Statistics and Probability Section

- Yoichi Nishiyama[‡] A stochastic maximal inequality, weak convergence of infinite-dimensional martingales, and semiparametric statistics
(Inst. of Stat. Math./Grad. Univ. for Adv. Stud.)

Summary: As an alternative to maximal inequalities based on the usual methods of “chaining” that have been developed in the study of random fields, a new stochastic maximal inequality is prepared for some purposes stated below by using the formula for integration by parts. The main aim of this work is to obtain some central limit theorems (CLTs) in the space of bounded functions equipped with the uniform metric for three kinds of sequences of separable random fields of locally square-integrable martingales. As special cases, some new results for i.i.d. random sequences, including a new Donsker class and a maximal inequality for empirical processes indexed by a class of functions, are presented. This kind of results have been known to be useful for semiparametric statistical inference as well as statistical machine learning. The talk will be finished with some other topics of independent interest including an infinite-dimensional version of the classical CLT, a sufficient condition for the existence of bounded continuous version of separable, centered Gaussian random fields, a sufficient condition for the VC-dimension of given countable class of sets to be finite, and asymptotic representation of semiparametric Z -estimators that are adaptive in many cases and useful for deriving semiparametric AIC.

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

Kouji Yamamoto (Osaka Univ.)[#] Modelling for square contingency tables and its application

Summary: For the analysis of square contingency tables with the same row and column classifications, many observations concentrate on (or near) the main diagonal cells of the table. Therefore, the independence between the row and column classifications rarely holds. So, for analyzing such tables, we are interested in symmetry or asymmetry between the row and column classifications, instead of the independence between them.

Many statisticians have proposed models on symmetry or asymmetry. In this talk, I focus on models for analyzing square contingency tables with ordered categories, based on the cumulative probabilities. Also I talk about model that may be appropriate, if it is reasonable to assume an underlying a specified distribution.

As an application, some examples are shown using models described above, including real data analysis and numerical simulations.

September 27th (Fri) Conference Room VIII

9:15–12:00

30 Kentaro Tanaka (Tokyo Tech)[#] Algebraic methods for conditional independence inference 15

Summary: Conditional independence is a fundamental concept in statistics and applied in a variety of fields. In this talk, we deal with the implication problem of conditional independence statements, that is, testing whether a conditional independence statement is derived from a set of other conditional independence statements. In order to solve this problem, we propose a new algebraic methods. The method is based on an idea that the implication problem can be transformed into an easier problem by adding extra conditional independence statements to a given set of conditional independence statements.

31 Yoshihide Kakizawa (Hokkaido Univ.)[#] Third-order average local powers of Bartlett-type adjusted tests: Ordinary versus adjusted profile likelihood 15

Summary: Bartlett-type adjustment is a higher-order asymptotic method for improving the chi-squared approximation to the null distributions of various test statistics, which ensures that the resulting test has size alpha up to the third-order. In this talk, we continue our recent works on the third-order average local power properties of several Bartlett-type adjusted tests. Our results are applicable in wide generality since they allow both the interest and nuisance parameters to be multi-dimensional, for which there is no assumption regarding the global parameter orthogonality. We discuss Stern’s (1997) adjusted profile likelihood inference for handling nuisance parameters.

32 Yoshihiko Maesono (Kyushu Univ.)[#] Smoothing of the Wilcoxon’s signed rank test 10

Summary: In this talk we discuss theoretical properties of a smoothed Wilcoxon’s signed rank test, which is based on a kernel smooting. We show that the smoothed Wilcoxon’s signed rank test is equivalent to the Wilcoxon’s signed rank test in the sense of Pitman efficiency, and its main term of the variance does not depend on the distribution of the population, under the null hypothesis. Though the smoothed Wilcoxon’s signed rank test is not distribution-free, we can obtain an Edgeworth expansion which does not depend on the distribution of the population.

- 33 Yusuke Saigusa (Tokyo Univ. of Sci.)[#] Decomposition of symmetry using extended palindromic symmetry
 Kouji Tahata (Tokyo Univ. of Sci.) models for square contingency tables 10
 Sadao Tomizawa (Tokyo Univ. of Sci.)

Summary: For the square contingency tables with ordered categories, Saigusa et al. (2013) have proposed an extended palindromic symmetry model. We give the decomposition of symmetry using extended palindromic symmetry model.

- 34 Masanori Sawa (Nagoya Univ.)[#] A lemma on the eigenvalues of Hermitian matrices and its application
 2 —Proof of Fisher's inequality 15

Summary: In this talk we discuss a lemma in linear algebra on the eigenvalues of a Hermitian matrix and present a new proof of Fisher's inequality on the number of blocks of a balanced incomplete block design.

- 35 Masatake Hirao[#] Constructions of optimal rotatable designs on the n -ball 15
 (Tokyo Woman's Christian Univ.)
 Masanori Sawa (Nagoya Univ.)
 Masakazu Jimbo (Nagoya Univ.)

Summary: We propose two explicit constructions for Φ_p -optimal rotatable designs of degree 3 on the unit ball. The first one is a group-theoretic construction, which provides a systematic treatment of some related approaches that have been traditionally used in design of experiments. The second one is a combinatorial construction, which was originally studied by Victoir (2004) in the context of a certain numerical integration formula called a cubature formula. This construction is easy but very powerful, as well as will act as an intermediary between an optimal design and various combinatorial objects such as block designs and orthogonal arrays.

- 36 Sanpei Kageyama^{*} An affine α -resolvable symmetric triangular design does not exist for
 (Hiroshima Inst. of Tech.) any α 10

Summary: The existence of an affine alpha-resolvable triangular design has been investigated by Kageyama (2007, 2008), who showed its non-existence for any alpha less than or equal to 10. In this talk, for a symmetric design the existence will be disproved completely.

- 37 Sanpei Kageyama Some existence of additive cyclic BIB designs 15
 (Hiroshima Inst. of Tech.)
 Kazuki Matsubara (Hiroshima Univ.)

Summary: Some class of ℓ PAB(v, k, λ) have been constructed by direct and recursive methods in Matsubara et.al (2006, 2007, 2013). In particular, for ℓ PAB($v, 2, 1$), it has been shown that there are 3 PAB($v, 2, 1$) for any $v \geq 6$. However, the existence of ℓ PAB($12, 2, 1$) with $\ell \in \{4, 5, 6\}$ is not known in literature. The purpose of this talk is devoted to provide some construction of ℓ PACB($v, 2, 1$) and show some nonexistence of ℓ PACB($v, 2, 1$).

- 38 Takeshi Torii (Osaka Pref. Univ.)* A nested row-column design with split units constructed by a regular
 Shinji Kuriki (Osaka Pref. Univ.) generalized Youden design 10

Summary: We consider a nested row-column design with split units for a two-factor experiment. The whole plot treatments occur in a regular generalized Youden design and the subplot treatments occur in a proper block design. We consider a mixed linear model for the observations with a four-step randomization, i.e., the randomization of blocks, the randomization of the rows (or columns) within each block, the randomization of the columns (or rows) within each block and the randomization of the subplots within each whole plot. We give the stratum efficiency factors for such a nested row-column design with split units, which has the general balance property.

- 39 Hiromu Yumiba (Int. Inst. for Nat. Sci.)# Existence conditions for balanced fractional factorial designs of resolu-
 Yoshifumi Hyodo tion V derived from three-symbol simple arrays (III) 15
 (Okayama Univ. of Sci./Int. Inst. for Nat. Sci.)
 Masahide Kuwada
 (Int. Inst. for Nat. Sci.)

Summary: We consider a fractional 3^m factorial design derived from a simple array (SA), which is a balanced array of full strength, where $m \geq 4$. In this situation, we give a necessary and sufficient condition for an SA to be a balanced fractional 3^m factorial design of resolution V. Such a design is characterized by the suffixes of the index of an SA.

- 40 Yiling Lin (Nagoya Univ.)# Optimal equi-difference conflict-avoiding codes of odd length and weight
 Miwako Mishima (Gifu Univ.) three 18
 Junya Satoh (Nagoya Univ.)
 Masakazu Jimbo (Nagoya Univ.)

Summary: A conflict-avoiding code (CAC) of length m and weight w is defined as a collection C of w -subsets (called codewords) of $\mathbb{Z}_m = \{0, 1, \dots, m - 1\}$, the ring of residues modulo m , such that $\Delta(x) \cap \Delta(y) = \emptyset$ for any $x, y \in C$, where $\Delta(x) = \{j - i \pmod{m} : i, j \in x, i \neq j\}$. The class of all the CACs of length m and weight w is denoted by $\text{CAC}(m, w)$. A code $C \in \text{CAC}(m, w)$ is called an equi-difference code if every codeword $x \in C$ has the form $\{0, i, 2i, \dots, (w - 1)i\}$. In this talk, we will present several explicit series of odd m for equi-difference codes which have maximum code size in $\text{CAC}(m, 3)$ by revisiting several properties of multiplicative order of a unit in $\mathbb{Z}_m \setminus \{0\}$ and cyclotomic polynomials.

Applied Mathematics

September 24th (Tue) Conference Room VII

9:45–12:00

- 1 Chihiro Matsuoka (Ehime Univ.)[#] Entropy estimation of the Hénon attractor 15
Koichi Hiraide (Ehime Univ.)

Summary: The topological entropy of the Hénon attractor is estimated using a function that describes the stable and unstable manifolds of the Hénon map. This function provides an accurate estimate of the length of curves in the attractor. The estimation method presented here can be applied to cases in which the invariant set is not hyperbolic. From the result of the length calculation, we have estimated the topological entropy h as $h \sim 0.49703$ for the original parameters $a = 1.4$ and $b = 0.3$ adopted by Hénon.

- 2 Kenta Noguchi (Keio Univ.)[#] Congruence classes of the monodromy of even triangulations on surfaces 15

Summary: An even triangulation on a closed surface is an embedded graph where every face is a triangle and the degree of every vertex is even. It is known that there is an invariant of even triangulations, called “monodromy”. In this talk, we count the number of congruence classes of the monodromy of even triangulations.

- 3 Valentin Borozan[#] Partitioning a graph into highly connected subgraphs 10
(Univ. Paris 11/Hungarian Acad. of Sci.)
Shinya Fujita (Maebashi Inst. of Tech.)
Michitaka Furuya (Tokyo Univ. of Sci.)
Yannis Manoussakis (Univ. Paris 11)
Narayanan N (Indian Inst. Tech.)

Summary: We discuss partitioning a graph into highly connected subgraphs. Let G be a graph of order n . We prove that if the minimum degree of G is at least $\lceil \sqrt{n} \rceil$, then $V(G)$ can be partitioned into several parts H_1, \dots, H_l such that each H_i induces a 2-connected graph.

- 4 Iwao Sato (Oyama Nat. Coll. of Tech.)[#] The vertex weighted complexity of a graph 15
Hongfeng Wu (Peking Univ.)
Rongquan Feng (Peking Univ.)

Summary: We treat the vertex weighted complexity of a graph, and give a generalization of Northshield’s theorem for the vertex weighted complexity of a graph. Furthermore, we present an explicit formula for the vertex weighted complexity of a regular covering graph of G in terms of that of G .

- 5 Yutaka Sueyoshi (Nagasaki Univ.)[#] On the maximal value of break intervals of equitable round-robin tour-
Ryuichi Harasawa (Nagasaki Univ.) naments with home-away assignments (II) 15
Aichi Kudo (Nagasaki Univ.*)

Summary: We continue the study of the maximal value of break intervals for equitable round-robin tournaments with home-away assignments. By using the m -team conditions, we prove the uniqueness of the break interval sequence with maximal break interval $k + 1$ for 2^{k+1} teams. Further, we show that the maximal value of break intervals for equitable round-robin tournaments with $2n$ ($2^k < n < 2^{k+1}$) teams is equal to or less than $k + 1$.

- 6 Akane Kawaharada (Hiroshima Univ.)[#] Inverse ultradiscretization of a two-dimensional nonlinear cellular automaton 15

Summary: We study the application of the inverse ultradiscretization, a method for deriving partial differential equations from a given cellular automaton, to a two-dimensional nonlinear cellular automaton. It is shown that the obtained partial differential equation preserves self-organizing patterns of the cellular automaton.

- 7 Kousuke Suzuki (Univ. of Tokyo)[#] An explicit construction of point sets with large minimum Dick weight 15

Summary: Walsh figure of merit $WAFOM(P)$ is a quality measure of point sets P for quasi-Monte Carlo integration constructed by a digital net method. $WAFOM(P)$ is bounded by the minimum Dick weight of P^\perp , where the Dick weight is a generalization of Hamming weight. In this talk, we give an explicit construction of point sets with large minimum Dick weight using Niederreiter–Xing sequences and Dick’s interleaving construction. These point sets are also examples of low-WAFOM point sets.

- 8 Kenta Ozeki (Nat. Inst. of Information/JST ERATO)[#] Condition on the core to be Class 1 10

Summary: By the theorem of Vizing, it is known that every graph G has an edge-coloring with exactly $\Delta(G)$ or $\Delta(G)+1$ colors, where $\Delta(G)$ is the maximum degree of G . If G has an edge-coloring with $\Delta(G)$ colors, then G is called **Class 1**. For a graph G , the **core** of G is the subgraph of G induced by the vertices of degree $\Delta(G)$. The conjecture by Hilton and Zhao asserts that every graph G of even order is Class 1 if the core of G has maximum degree at most 2. In this talk, we show that it is true if G is a claw-free graph.

14:15–16:30

- 9 Michitaka Furuya (Tokyo Univ. of Sci.)[#] On monochromatic homeomorphically irreducible trees in 2-edge-colored complete graphs 15
 Shoichi Tsuchiya (Tokyo Univ. of Sci.)
- 10 Shin Harase (Tokyo Tech)[#] A construction of low-WAFOM point sets based on the digital construction scheme 15
 Ryuichi Ohori (Univ. of Tokyo)

Summary: Multi-dimensional numerical integration is an essential problem in numerical analysis, and the Monte Carlo method is a first choice in high dimensional cases. However, its convergence rate is significantly slow, so that we often replace random numbers with quasi-random numbers, such as Sobol’ and Niederreiter–Xing sequences, for acceleration. Recently, Matsumoto, Saito, and Matoba proposed the Walsh figure of merit (WAFOM), which is a fast computable criterion for quasi-Monte Carlo point sets. They also constructed low-WAFOM point sets based on M-sequences by using random search, but such point sets have a disadvantage that the sample sizes are not extensible. In this talk, we introduce a construction of low-WAFOM point sets with extensibility in terms of the digital construction scheme.

- 11 Masataka Nakamura (Univ. of Tokyo)[#] Supersolvable antimatroid lattices and rooted circuit graphs 15
 Kenji Kashiwabara (Univ. of Tokyo)

Summary: We shall show that an antimatroid is supersolvable as a lattice if and only if the associated rooted circuit graph is acyclic. An antimatroid lattice has a natural edge labelling. It is proved that the natural edge labelling of an antimatroid is an S_n EL labelling if and only if the rooted circuit graph is acyclic. The existence of an S_n EL labelling for a finite graded lattice is known to be equivalent to the supersolvability of the lattice, from which our main result follows. We note that the family of the complements of the elements of an antimatroid is called a convex geometry, and it is particularly a closure system. A closure system gives rise to a closure operator, from which rooted circuits are determined.

- 12 Masataka Nakamura (Univ. of Tokyo)[#] The idempotence, the exchange property, and the anti-exchange property of monotone extensive operators 15
 Kenji Kashiwabara (Univ. of Tokyo)

Summary: In the class of monotone extensive operators on a non-empty finite set, we present the characterizations of idempotence, the exchange property, and the anti-exchange property in terms of rooted circuits and rooted cocircuits. For instance, a monotone extensive operator is a closure operator if it is idempotent. Hence the combination of the idempotence and the exchange property implies that it is a matroid, which leads to a new set of axioms of matroid. The situation is the same for a convex geometry as a convex geometry comes from the pair of the idempotence and the anti-exchange property. Thus new and old sets of axioms of convex geometry arise from our results.

- 13 Yasuko Matsui (Tokai Univ.)[#] An enumeration algorithm for the optimal cost vertex colorings for trees
 Kento Kizaka (Tokai Univ.) 15

Summary: In this talk, we propose an algorithm for enumerating all the optimal cost vertex colorings of given trees without repetitions if the optimal cost vertex coloring is not unique. Moreover, we characterize trees which use an arbitrary number of colors for optimal cost vertex coloring.

- 14 Kazuhiko Ushio (Kinki Univ.)[#] Balanced (C_9, C_{14}) -foil designs and related designs 15

Summary: In graph theory, the decomposition problem of graphs is a very important topic. Various type of decompositions of many graphs can be seen in the literature of graph theory. This paper gives balanced (C_9, C_{14}) -foil designs and related designs.

- 15 Masanori Sawa (Nagoya Univ.)[#] A lemma on the eigenvalues of Hermitian matrices and its application
 1 —Eigenvalues of adjacency matrices and graph decomposition 15

Summary: In this talk we discuss a lemma in linear algebra on the eigenvalues of a Hermitian matrix and its application to the theory of graph decomposition and isometric embeddings of graphs.

- 16 Mariko Hagita (Ochanomizu Univ.)[#] Dispersive coloring polynomials of some graphs 15

Summary: For a coloring c of a graph G , we shall define the Chromatic distance as $cd(c) := \min\{d(x, y) | c(x) = c(y), x \neq y\}$. And for a graph G , and an integer r , we shall define the chromatic distance of G with r colours as $cd(G, r) := \max\{cd(c) | c \text{ is a } r \text{ colouring of } G\}$. If c is a colouring of graph G with $cd(c) > d$, we say c is a $(d-)$ dispersive $(r-)$ colouring (of G). We shall consider the dispersive coloring polynomials of some graphs.

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

Masaaki Harada (Yamagata Univ.)[#] Self-dual codes and related topics

Summary: Self-dual codes, which are an important class of codes for both theoretical and practical reasons, are studied from several viewpoints. For example, many relationships between self-dual codes and unimodular lattices are known. It is a fundamental problem to classify self-dual codes of modest lengths and determine the largest minimum weight among self-dual codes of that length. In my talk, the current state of knowledge about the fundamental problem is presented, including my recent progress. Some observations about relationships between self-dual codes and unimodular lattices are also given.

September 25th (Wed) Conference Room VII

9:45–12:00

- 17 Masahiro Hachimori[#] Simplicial complexes whose restrictions are all shellable, and extend-
 (Univ. of Tsukuba) ability of shellings 15
 Kenji Kashiwabara (Univ. of Tokyo)

Summary: In this talk, we consider simplicial complexes whose restrictions are all shellable. Such simplicial complexes consist a generalized class of matroid complexes. One more property we discuss in this talk is extendable shellability, where, a simplicial complex is extendably shellable if every partial shelling can be extended to a full shelling. Formerly, Bjorner and Eriksson showed that rank 3 (= 2-dimensional) matroid complexes are extendably shellable. In this talk, we show that the 2-dimensional pure skeleton of a 2-dimensional simplicial complex whose restrictions are all shellable is extendably shellable. This is a generalization of the result of Bjorner and Eriksson.

- 18 Kiyoshi Ando (Univ. of Electro-Comm.)[#] Contractible subgraphs in 5-connected graphs 15

Summary: Let G be a 5-connected graph. A subgraph H of G is said to be contractible if the graph G/H obtained from G by contracting H is still 5-connected. We show that if a 5-connected graph G with $|V()| \geq 13$ has a fragment A such that (1) $|A| = 2$ and (2) either A has a vertex of degree 6 or A has no edge, then G has a contractible subgraph H with $|E(H)| \leq 2$.

- 19 Atsuhiko Nakamoto[#] Balanced partitions on permutations and their application to a geomet-
 (Yokohama Nat. Univ.) ric problem 15
 Yoshiaki Oda (Keio Univ.)
 Tomoki Yamashita (Kinki Univ.)
 Mamoru Watanabe
 (Kurashiki Univ. of Sci. and Arts)

Summary: For a permutation of a set $1, 2, \dots, n$, we consider some balanced partition of it. We also consider an application of the result on geometry.

- 20 Minoru Fujimoto (Seika Science Lab.)[#] An algorithm for the pair of primes of difference $2d$ and Hardy-
 Kunihiko Uehara (Tezukayama Univ.) Littlewood conjecture 15

Summary: Polignac’s conjecture states that for every positive even natural number $2d$, there are infinitely many consecutive prime pairs p and p' such that $p' - p = 2d$. In the case of $d = 1$, we handle the twin primes. We will give a new and simple algorithm which is similar to the Eratosthenes’ sieve to be born the the pair of primes of difference $2d$. We will discuss the Hardy–Littlewood conjecture and give an evaluation for the density of these primes.

- 21 Minoru Fujimoto (Seika Science Lab.)[#] An algorithm for the Sophie Germain primes and the twin primes ···· 15
Kunihiko Uehara (Tezukayama Univ.)

Summary: A prime number p is a Sophie Germain prime if $2p + 1$ is also prime. It is conjectured that there are infinitely many Sophie Germain primes, but this has not been proven. We give a new and simple algorithm which is similar to the Eratosthenes' sieve to get the Sophie Germain primes. Using this algorithm, we discuss the conjecture above and give an evaluation for the density of these primes.

- 22 Naoki Matsumoto[#] The order of snarks can be embedded in surfaces ·········· 15
(Yokohama Nat. Univ.)
Michal Kotrbčik (Comenius Univ.)

Summary: In this talk, we only deal with finite, undirected and simple graphs. A *snark* is a 3-regular, cyclically 4-edge-connected, the girth is at least 5 and has no 3-edge-coloring. There are many results and open problems for snarks. For example, there is a famous conjecture of snarks on orientable surfaces, called Grünbaum conjecture, which is very recently disproved by Kochol. For proving the conjecture, many researchers found many kinds of snarks. In this talk, we consider the order of snarks which can be embedded in fixed surfaces.

- 23 Ronald J. Gould (Emory Univ.)[#] Vertex-disjoint doubly chorded cycles in a graph ·········· 10
Paul Horn (Harvard Univ.)
Kazuhide Hirohata
(Ibaraki Nat. Coll. of Tech.)

Summary: We say an edge that joins two vertices of a cycle is a chord of the cycle if the edge is not an edge of the cycle. A cycle is doubly chorded cycle if there are at least two such chords. We show a sharp degree sum condition on the existence of k vertex-disjoint doubly chorded cycles in a graph of order at least $6k$.

- 24 Atsuhiko Nakamoto Grünbaum coloring of Eulerian triangulations on surfaces ·········· 15
(Yokohama Nat. Univ.)

Summary: Let G be a triangulation a surface, and an edge-coloring of G is called a Grünbaum coloring if each face of G receive three distinct colors on the boundary edges. A triangulation G is said to be Eulerian if each vertex has even degree. We prove that several types of Eulerian triangulations have Grünbaum coloring.

13:00–14:00 Talk invited by Applied Mathematics Section

- Kanako Suzuki (Ibaraki Univ.)[#] Dynamics of some reaction-diffusion-ODE systems

Summary: We consider mathematical models of a pattern formation arising in processes described by a system a single reaction-diffusion equation coupled with an ordinary differential equation. This type of models exhibits the diffusion-driven instability, and it is expected that non-constant stationary solutions exist and some spatially inhomogeneous solutions converge toward them. We shall discuss the stability of inhomogeneous stationary solutions and a possible large time behaviour of solutions.

September 26th (Thu) Conference Room VII

9:30–10:20

- 25 Kazuki Sano (Nihon Univ.)[#] Precoloring extension involving pairs of vertices of small distance 15
 Chihoko Ojima (Nihon Univ.)
 Akira Saito (Nihon Univ.)

Summary: In this talk, we consider coloring of graphs under the assumption that some vertices are already colored. Let G be an r -colorable graph and let $P \subset V(G)$. Albertson (1998) proved that if every pair of vertices in P have distance at least four, then every $(r + 1)$ -coloring of $G[P]$ can be extended to an $(r + 1)$ -coloring of G , where $G[P]$ is the subgraph of G induced by P . In this talk, we allow P to have pairs of vertices of distance at most three, and investigate how the number of such pairs affects the number of colors we need to extend the coloring of $G[P]$.

- 26 Katsuhiro Ota (Keio Univ.)[#] Vertex-disjoint chorded cycles of the same length 15
 Guantao Chen (Georgia State Univ.)
 Ronald J. Gould (Emory Univ.)
 Kazuhide Hirohata
 (Ibaraki Nat. Coll. of Tech.)
 Songling Shan (Georgia State Univ.)

Summary: An edge joining two nonconsecutive vertices of a cycle is called a *chord*, and a cycle with a chord is called a *chorded cycle*. One can easily see that any graph with minimum degree at least 3 contains a chorded cycle. Corresponding to Corrádi and Hajnal’s result, Finkel (2008) showed that any graph with at least $4k$ vertices and minimum degree at least $3k$ contains k vertex-disjoint chorded cycles. This minimum degree condition is sharp, because the complete bipartite graph $K_{3k-1, n-3k+1}$ does not contain k vertex-disjoint chorded cycles. In this talk, we consider vertex-disjoint chorded cycles of the same length, and give a minimum degree condition for a large graph to contain such chorded cycles.

- 27 Shunzi Horiguchi[#] Continued fraction presentations of the powers of square root and cubic root by the Tsuchikura–Horiguchi’s method (the first extension recurrence formula of Murase Yoshimasu–Newton’s type) 15
 (Niigata Sangyo Univ.)

Summary: Yoshimasu Murase introduced the 2 dimensions recurrence formula of x^*x in 1673. In 2009, we discovered Tsuchikura–Horiguchi method which is an expansion of the Newton method by way of Yoshimasu Murase. We give continued fraction presentations of the powers of square root and cubic root by Tsuchikura–Horiguchi method (the first extension recurrence formula of Murase Yoshimasu–Newton’s type).

10:30–12:00 Special Session “Japanese chess and puzzle”

- Masato Shinoda (Nara Women’s Univ.)[#] How to design strong computer Shogi programs 40

Summary: We give an overview of the construction of strong computer Shogi programs, especially focusing on the design of the evaluation function of the game board.

Hideki Tsuiki (Kyoto Univ.) [#]	Imaginary cube puzzles	40
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Summary: Imaginary cubes are three dimensional objects which have square projections in three orthogonal ways just as a cube has. In this talk, we study imaginary cubes and present puzzles based on them. We show that there are 16 equivalence classes of minimal convex imaginary cubes, among whose representatives are a hexagonal bipyramid imaginary cube and a triangular antiprism imaginary cube. Our main puzzle is based on remarkable properties of these objects, in particular, the possibility of tiling 3D Euclidean space. We show how these objects are related to fractals, and present sculptures and coloring problems of them.

14:15–17:45

28 Takashi Okuda Sakamoto (Meiji Univ.) [#]	Bogdanov–Takens bifurcation in a three component reaction-diffusion system in the presence of 0:1:2 resonance	15
Toshiyuki Ogawa (Meiji Univ.)		

Summary: Bogdanov–Takens bifurcation (BT bifurcation) is observed in a shadow system of three component reaction-diffusion system around the triple degenerate point of 0:1:2 modes. We state that the normal form around the triple degenerate point of the RD system can be re-normalized into the normal form for BT bifurcation. The result is obtained by applying center manifold reduction and normal form transformation.

29 Hirofumi Izuhara (Meiji Univ.) [#]	Spatio-temporal oscillation in the Keller–Segel system with growth	15
Shin-Ichiro Ei (Kyushu Univ.)		
Masayasu Mimura (Meiji Univ.)		

Summary: In this talk, we deal with the Keller–Segel system with the logistic growth. This system exhibits two types of spatio-temporal oscillations in the distinct parameter regimes. We discuss why the two oscillations are observed in the Keller–Segel system with the logistic growth.

30 Shingo Iwami (Kyushu Univ.) [#]	An existence of conserved quantity in virus infection experiment	15
Yusuke Kakizoe (Kyushu Univ.)		
Satoru Morita (Shizuoka Univ.)		

Summary: An ordinary differential equation describing virus infection predicts a conserved quantity. We validated the quantity based on time-course of experimental data in virus infection.

31 Hiromi Seno (Tohoku Univ.) [#]	A simple mathematical model for the annual variation of epidemic outbreak with prevention level affected by past incidence sizes	15
Ayaka Terada (Hiroshima Univ.)		
Mika Inoue (Hiroshima Univ.)		

Summary: Annual or seasonal fluctuation of the incidence size has been observed for a variety of infectious diseases, for example, influenza, measles, rubella, mumps, chickenpox etc. In case when incidence sizes in past epidemic seasons were large, the people in the community would tend to increase the prevention level against the infectious disease. To consider the essential effect of such social factor on the potentiality of incidence size fluctuation, we construct and analyze a simple mathematical model of discrete dynamical system, which is derived from the final-size equation of Kermack–McKendrick SIR model. We show that such social factor could potentially or partially contribute to the driving force causing the annual or seasonal fluctuation of incidence size for some infectious diseases.

- 32 Tetsuya Ishiwata (Shibaura Inst. of Tech.)[#] Spiral-shaped solutions to crystalline curvature flow with a moving tip 15

Summary: We consider crystalline curvature flow with a driving force. This equation is a simple model of spiral crystal growth. We mainly discuss the motion of spiral-shaped curve with a moving tip and show global existence of the solutions.

- 33 Takeshi Ohtsuka (Gunma Univ.)[#] Crystal growth by a co-rotating pair of screw dislocations 15
 Yoshikazu Giga (Univ. of Tokyo)
 Yen-Hsi Richard Tsai (Univ. of Texas at Austin)

Summary: Consider a co-rotating pair of spiral steps provided by a pair of screw dislocations. Burton, Cabrera and Frank proposed the critical distance of a co-rotating screw dislocations which we can regard the pair as a single screw dislocation with two spiral steps. In this talk we present some numerical results to see that there is the gap between their critical distance and numerical results. Then, we give a new definition and more precise value of the critical distance with making a formula of the growth rate of a crystal surface by a co-rotating pair.

- 34 Takaaki Aoki (Kyoto Univ.)[#] Some mathematical properties of the dynamically inconsistent Bellman equation: A note on the two-sided altruism dynamics 15

Summary: This article describes some dynamic aspects on dynastic utility incorporating two-sided altruism with an OLG setting. We analyzed the special case where the weights of two-sided altruism are dynamically inconsistent. The Bellman equation for two-sided altruism proves to be reduced to one-sided dynamic problem, but the effective discount factor is different only in the current generation. We show that a contraction mapping result of value function cannot be achieved in general, and that there can locally exist an infinite number of self-consistent policy functions with distinct steady states (indeterminacy of self-consistent policy functions).

- 35 Naoto Nakano (Tohoku Univ.)[#] Statistical coefficients formulae and orbit predictability in a data analysis method in the framework of stochastic differential equations 15
 Yoshitaka Saiki (Hitotsubashi Univ.)
 Masaru Inatsu (Hokkaido Univ.)
 Seiichiro Kusuoka (Tohoku Univ.)

Summary: For a dataset whose orbit is distributed densely in the phase space, a data analysis method in the framework of stochastic differential equations (SDEs) is considered. Using the relation between the solution and the coefficients of SDE, we attempt to evaluate the coefficients by the data in order to extract its dynamics. Here, we introduce the improved formula to estimate the SDE coefficients and the quantitative index of predictability of the orbit of the data, and finally we show the result obtained by the presented method.

- 36 Masaji Watanabe (Okayama Univ.)[#] Modeling and simulation for microbial depolymerization processes of xenobiotic polymers with time factor of degradation rate 15
 Fusako Kawai (Kyoto Inst. Tech.)

Summary: The microbial population is considered as a time factor of a degradation rate in a microbial depolymerization process. An inverse problem is solved to construct a molecular factor of a degradation rate. An initial value problem is solved to simulate the transition of the weight distribution and the microbial population.

- 37 Kei Nishi (Hokkaido Univ.)[#] Behavior of a front-back pulse arising in a bistable reaction-diffusion system with jump-type heterogeneity 15
 Yasumasa Nishiura (Tohoku Univ.)
 Takashi Teramoto (Asahikawa Medical Univ.)

Summary: We consider the dynamics of a pulse solution (front-back pulse) arising in a bistable reaction-diffusion system in one space dimension. It is numerically found that the front-back pulse exhibits five kinds of behavior when it encounters a jump-type heterogeneity. Among them, we focus on a sliding motion of an oscillatory standing pulse solution. To analytically clarify its mechanism, the original PDE system is first reduced to a mixed ODE-PDE system and then center manifold reduction is applied to the reduced system.

- 38 Nobuyuki Higashimori[#] An inverse problem of determining coefficients in a one-dimensional radiative transport equation 15
 (Hitotsubashi Univ.)

Summary: We consider an inverse problem of determining unknown coefficients for a time-dependent radiative transport equation on a one-dimensional spatial interval. The main result shows that the absorption coefficient and the effective scattering coefficient are uniquely determined by giving pulse-like inputs at the endpoints of the interval and observing the outputs. The inverse problem is analyzed by considering the structure of the solution to the direct problem with pulse-like inputs.

- 39 Masato Kimura (Kanazawa Univ.)[#] A discrete phase field model of fracture on a spring-block system 15
 Hirofumi Notsu (Waseda Univ.)

Summary: We propose a crack propagation model on a spring-block system using an idea of phase field model for the damage of springs. We consider a discrete model of elastic body using a scalar or tensor-valued spring-block system, and study its properties in detail. Our fracture model is constructed on the spring-block system. It is described in a mathematically clear way and the unique existence and regularity of a solution are proved.

September 27th (Fri) Conference Room VII

9:00–12:00

- 40 Yusuke Imoto (Kyushu Univ.)[#] Truncation error analysis of approximated operators on SPH and MPS
 Daisuke Tagami (Kyushu Univ.) method 15

Summary: Particle methods have been developed as computation method for compressible or incompressible flow, and particularly used to understand massive phenomenon such as Tsunami. On the other hand, mathematical analysis such as truncation error and stability is not enough. We have investigated the truncation error, which is first step of mathematical justification, of approximated operators of SPH and MPS method that are main methods of particle methods.

- 41 Hirofumi Notsu (Waseda Univ.)[#] Error estimates and computation of a pressure-stabilized characteristics
 Masahisa Tabata (Waseda Univ.) finite element scheme for the Navier–Stokes equations 15

Summary: A pressure-stabilized characteristics finite element scheme for the Navier–Stokes equations is presented and its error estimates for the velocity and the pressure are proved. The scheme can deal with convection-dominated problems and leads to the symmetric coefficient matrix of the system of linear equations. A cheap P1/P1 finite element is employed and degrees of freedom are smaller than that of other elements. Therefore, the scheme is useful especially for three dimensional problems. Two and three dimensional numerical results are shown to recognize the theoretical convergence orders.

- 42 Yoshihiro Saito[#] Numerical asymptotic stability of the simplified order 2.0 weak Taylor
 (Gifu Shotoku Gakuen Univ.) scheme 15

Summary: The numerical asymptotic stability of the simplified order 2.0 weak Taylor scheme for stochastic differential equations is discussed. We study asymptotic stability of the simplified order 2.0 weak Taylor scheme with a random variable that matches the first five moments of the normal random variable. In this talk three types of the random variable will be treated.

- 43 George Miyake[#] An analysis of nonlinear symmetrical differential equations with dihedral
 (Ube Nat. Coll. of Tech.) group and odd function 15
 Yuji Katsuta (Ube Nat. Coll. of Tech.)

Summary: Through investigating conditions of nonlinear symmetrical differential equations with dihedral group and odd function, specifications for bifurcations are studied, namely one of these bifurcations is identified as a transcritical bifurcation.

- 44 Naoharu Ito (Nara Univ. of Edu.)[#] Boundedness of the solutions of higher order systems of linear difference
 equations 15

Summary: In this note we study higher order systems of linear difference equations where the associated characteristic matrix polynomial is self-inversive. We consider classes of equations with bounded solutions.

- 45 Shuichi Jimbo (Hokkaido Univ.)^{*} Eigenvalues of Laplacian in a domain with a thin tubular hole 15

Summary: I deal with the eigenvalue problem of Laplacian in a singularly perturbed domain. This domain is given by removing a thin tubular neighborhood of a submanifold M , from the original fixed domain. I consider the asymptotic behavior of each eigenvalue of Laplacian (Dirichlet or other boundary condition), when the thinness (small) parameter goes to zero.

- 46 Harunori Monobe (Meiji Univ.)[#] Multiple existence of traveling waves of a free boundary problem 15
 Hirokazu Ninomiya (Meiji Univ.)

Summary: In this talk, we consider multiple existence of traveling waves of a free boundary problem

- 47 Mi-Ho Giga (Univ. of Tokyo)[#] On behavior of signs for the heat equation and a diffusion method for
 Yoshikazu Giga (Univ. of Tokyo) data separation 15
 Takeshi Ohtsuka (Gunma Univ.)
 Noriaki Umeda (Meiji Univ.)

Summary: Consider the solution $u(x, t)$ of the heat equation with initial data u_0 . The diffusive sign $S_D[u_0](x)$ is defined by the limit of sign of $u(x, t)$ as $t \rightarrow 0$. A sufficient condition for $x \in \mathbf{R}^d$ and u_0 such that $S_D[u_0](x)$ is well-defined is given. A few examples of u_0 violating and fulfilling this condition are given. It turns out that this diffusive sign is also related to variational problem whose energy is the Dirichlet energy with a fidelity term. If initial data is a difference of characteristic function of two disjoint sets, it turns out that the boundary of the set $S_D[u_0](x) = 1$ (or -1) is roughly an equi-distance hypersurface from A and B and this gives a separation of two data sets.

- 48 Hideki Murakawa (Kyushu Univ.)[#] Error estimates for discrete-time approximations of nonlinear cross-
 diffusion systems 15

Summary: This talk is concerned with nonlinear and linear discrete-time algorithms for cross-diffusion systems. The nonlinear scheme corresponds to backward differences in time. The linear algorithm is a very easy to implement scheme we proposed. The main purpose of this paper is to derive convergence rates of the discrete-time schemes. We obtain the same orders for both the nonlinear and the linear schemes. Moreover, these orders are optimal. We also establish uniqueness and regularity results of weak solutions of the cross-diffusion systems.

- 49 Kousuke Abe (Nihon Univ.)^{*} A remark on the Courant–Friedrichs–Lewy condition in finite difference
 Nobuyuki Higashimori approach 15
 (Hitotsubashi Univ.)
 Masayoshi Kubo (Kyoto Univ.)
 Hiroshi Fujiwara (Kyoto Univ.)
 Yuusuke Iso (Kyoto Univ.)

Summary: The Courant–Friedrichs–Lewy condition (CFL condition) is one of the most well-known concepts in the analysis of finite difference schemes, and it is sometimes misunderstood as the criterion for stability of numerical solutions. In this study, we recall the original meaning of the CFL condition as a necessary condition for convergence. We show some numerical experiments to illustrate unstable numerical solutions under the CFL condition.

- 50 Masataka Kuwamura (Kobe Univ.)[#] Turing patterns in prey-predator systems with dormancy of predators
 15

Summary: In this talk, we study Turing patterns in prey-predator reaction-diffusion systems with dormancy of predators. In simple terms, the results show that dormancy of predators is not a generator but an enhancer of spatio-temporal patterns in prey-predator systems.

14:15–16:45

- 51 Koya Sakakibara (Meiji Univ.)[#] An extension of Amano’s method for numerical conformal mappings to
 Masashi Katsurada (Meiji Univ.) non-starlike domains and the method based on the dipole simulation
 method 15

Summary: In this talk, we extend the numerical method for conformal mappings proposed by Amano based on the charge simulation method to non-starlike domains. Moreover we propose two numerical methods for conformal mappings. One is that we compute approximate values of h at the collocation points $\{z_j\}_{j=1}^N$ and approximate h by the charge simulation method, or approximate the conformal mapping f by the complex dipole simulation method. The other is to compute numerical conformal mappings based on the dipole simulation method which is one branch of the charge simulation method. In addition, we show results for our numerical experiments and exemplify the effectiveness of our proposing numerical methods.

- 52 Takahito Kashiwabara (Univ. of Tokyo)[#] On the convergence of Robin boundary condition to Dirichlet or Neu-
 mann ones 15

Summary: The Robin boundary condition $\partial u/\partial n + \alpha u = 0$ for the Poisson equation formally agrees with the Dirichlet and Neumann conditions when $\alpha = +\infty$ and $\alpha = 0$ respectively. We prove that the solution subject to the Robin condition indeed converges to the one satisfying the Dirichlet and Neumann conditions in the arbitrary Sobolev space $H^m(\Omega)$, with the rates of convergence $O(1/\alpha)$ and $O(\alpha)$, when $\alpha \rightarrow +\infty$ and $\alpha \rightarrow 0$ respectively.

- 53 Takuya Tsuchiya (Waseda Univ.)[#] A new numerical scheme for Einstein equations with discrete variational
 derivative method 15

Summary: We propose a new set of the discretized equations of the Einstein equations with the discrete variational derivative (DVD) method. Because of the complexity of the Einstein equations, it is difficult to compare the discretized equations by the DVD method with the one by the Crank–Nicolson scheme. Therefore we derive a set of the discretized Maxwell equations with the DVD method, and compare it with the set of the discretized equations by the Crank–Nicolson scheme.

- 54 Akitoshi Takayasu (Waseda Univ.)[#] The constructive implicit function theorem and its applications to con-
 Shin’ichi Oishi tinuation method 15
 (Waseda Univ./JST CREST)

Summary: In this talk, the implicit function theorem is considered. The classical implicit function theorem yields the existence and local uniqueness of solutions for parameterized nonlinear operator equations in Banach spaces. Nevertheless, the explicit range of solution existence is difficult to obtain directly. The constructive implicit function theorem assures the explicit bound by computer assistance. Furthermore, it applies to numerical continuation method.

- 55 Yoshitaka Watanabe (Kyushu Univ.)[#] A numerical verification method for nonlinear functional equations
 Mitsuhiro T. Nakao based on infinite-dimensional Newton-like iteration 15
 (Sasebo Nat. Coll. of Tech.)

Summary: We will describe a numerical verification of solutions for infinite-dimensional functional equations based on residual form and Newton-like iteration. The method is based upon the existing verification method originally developed by the authors. Several computer-assisted proofs for differential equations, including nonlinear partial differential equations will be shown.

- 56 Guanyu Zhou (Univ. of Tokyo)[#] Fictitious domain method with the L^2 -penalty and application to the
 Norikazu Saito (Univ. of Tokyo) finite element and finite volume methods 15

Summary: The fictitious domain approach is useful to compute numerical solutions of PDEs defined in complex domains and time-dependent moving domains. In this paper, we study a simple fictitious domain method with L^2 -penalty for elliptic and parabolic problems. A priori estimates and the error estimates for penalization problems are carefully investigated. Our methods can be applied not only to Finite Element Method (FEM) but to Finite Volume Method (FVM). For FEM, the $P1$ -element approximation is considered and the error estimates are derived. Introducing an admissible mesh to the fictitious domain, we provide the approximating scheme for FVM and obtain its error estimates. Numerical experiments are performed to confirm the theoretical results.

- 57 Takiko Sasaki (Univ. of Tokyo)[#] A second-order scheme for a system of nonlinear Schrödinger equations
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Summary: We propose a new time discretization scheme for a system of nonlinear Schrödinger equations which is a model of the interaction of a non-relativistic particles with different masses. Our scheme is composed of two (complex-valued) linear systems at each time step, and the solution is shown to converge at a second order rate. We report numerical example to confirm the theoretical results. Our idea can be applied to a large class of nonlinear PDEs.

- 58 Issei Oikawa (Waseda Univ.)[#] Hybridized discontinuous Galerkin method with the $P_1 - P_0$ 15

Summary: We propose a hybridized discontinuous Galerkin method with the $P_1 - P_0$ element. A weaker penalty term allows us to use the $P_1 - P_0$ element. Several numerical results are presented to verify the validity of our method.

- 59 Daisuke Koyama[#] Korn's inequality for a hybridized discontinuous Galerkin FEM with
 (Univ. of Electro-Comm.) lifting operator 15
 Fumio Kikuchi (Hitotsubashi Univ.)

Summary: We present a formulation of hybridized Discontinuous Galerkin Finite Element Method (DGFEM) with lifting operator for the plane stress problem. To validate the formulation, we establish Korn's inequality associated with the DGFEM.

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

- Takaharu Yaguchi (Kobe Univ.)[#] Energy-preserving numerical methods based on the finite element exterior calculus for wave-type differential equations

Summary: In this talk, we consider energy-preserving numerical methods for the following wave-type equations

$$u_{tt} - (d\delta + \delta d)u = f$$

where u is a k -form and the operator $d\delta + \delta d$ is the Hodge Laplacian. Recently numerical methods that approximate differential forms have received much attention. Among them, the finite element exterior calculus (FEEC) is the most reliable framework, which is based on the finite element method. On the other hand, the above equation is a Hamiltonian system, and hence this equation has the remarkable properties such as the energy conservation law and the symplecticity. We show that the finite element exterior calculus and the energy-preserving integrators by the discrete gradient method can be combined to discretize the above equation.

Topology

September 24th (Tue) Conference Room V

9:00–12:00

- 1 Jun Yagi (Kochi Univ.)[#] The classification of configuration spaces of 5-membered ringed chains 15

Summary: An n -membered ringed chain is defined by a closed n -chain whose bond lengths are 1 and bond angles are constant except for two successive bond angles without the restriction. So far it has been proven that the configuration space of 5-membered ringed chains with the standard bond angle is a circle. In this talk, we determine the configuration space of 5-membered ringed chains for any bond angle.

- 2 Hirotaka Akiyoshi (Osaka City Univ.)[#] Cone hyperbolic structures on the torus with a single cone point 10

Summary: A fundamental polygon for a cone hyperbolic structure on the torus with a single cone point is constructed. The construction is a variation of Jorgensen’s theory on the Ford domains of once-punctured torus groups.

- 3 Akiko Shima (Tokai Univ.)[#] 4-charts with four crossings 15
 Teruo Nagase (Tokai Univ.)^{*}

Summary: We show that there does not exist any 4-minimal 4-chart with four crossings which represents a disjoint union of spheres. That is if a 4-chart with four crossings represents a disjoint union of spheres, then we can reduce the number of white vertices by C-moves.

- 4 Tetsuya Ito (Kyoto Univ.)[#] On surface links whose link groups are abelian 10
 Inasa Nakamura (Gakushuin Univ.)

Summary: It is known that the link group of a classical link L is abelian if and only if L is an unknot or a Hopf link, and the link type is determined from the linking number. In this talk, we show that the analog of this fact does not hold for surface links. We study surface links whose link groups are free abelian, and we construct various examples of such surface links with the same link group but with various double linking numbers and triple linking numbers. Here the double and triple linking numbers are link-homotopy invariants of surface links, defined as natural generalizations of the classical linking numbers.

- 5 Inasa Nakamura (Gakushuin Univ.)[#] Satellites of an oriented surface link and their local moves 10

Summary: For an oriented surface link F in \mathbb{R}^4 , we consider a satellite construction of a surface link, called a 2-dimensional braid over F , which is in the form of a covering over F . We introduce the notion of an m -chart on a surface diagram $\pi(F) \subset \mathbb{R}^3$ of F , which is a finite graph on $\pi(F)$ satisfying certain conditions and is an extended notion of an m -chart on a 2-disk presenting a surface braid. A 2-dimensional braid over F is presented by an m -chart on $\pi(F)$. It is known that two surface links are equivalent if and only if their surface diagrams are related by a finite sequence of ambient isotopies of \mathbb{R}^3 and local moves called Roseman moves. We show that Roseman moves for surface diagrams with m -charts can be well-defined.

- 6 Reiko Shinjo (Kokushikan Univ.)[#] Universal sequences of spatial graphs 10

Summary: An increasing sequence of integers is said to be universal for links if every link has a projection to the sphere such that the number of edges of each complementary face of the projection comes from the given sequence. In this talk, we define universal sequences for spatial graphs and prove that the sequence (1,2,3,4,5) is universal for spatial graphs without vertices of odd degree.

- 7 Ayaka Shimizu (Gunma Nat. Coll. of Tech.)[#] Region crossing change on spatial graphs 10
 Kenta Hayano (Osaka Univ.)
 Reiko Shinjo (Kokushikan Univ.)

Summary: We discuss the region crossing change on spatial-graph diagrams.

- 8 Megumi Hashizume (Nara Women's Univ.)[#] Coset decomposition by images of homomorphisms induced by region crossing change on 3-component link diagrams 15

Summary: Let D be a link diagram. In 2010, A. Shimizu [Shi] et al. introduced a local move on D called region crossing change. Let \mathcal{R} (\mathcal{C} resp.) be the set of the regions (crossings resp.) of D . In [Ha], I introduced \mathbf{Z}_2 -linear structures on $2^{\mathcal{R}}$ and $2^{\mathcal{C}}$, and showed that region crossing change on D induces a linear map $\varphi: 2^{\mathcal{R}} \rightarrow 2^{\mathcal{C}}$. In this talk, I will describe the coset decomposition of $2^{\mathcal{C}}$ by $\text{Im}\varphi$ for the case that D is a 3-component link diagram.

[Shi] A. Shimizu. *Region crossing change is an unknotting operation*, to appear in Journal of the Mathematical Society of Japan.

[Ha] M. Hashizume. *On the homomorphism induced by region crossing change*, to appear in JP Journal of Geometry and Topology.

- 9 Yusuke Takimura (Waseda Univ.)[#] Regular projections of 6_2 knot 15

Summary: For each knot of five or less crossings, the set of all regular projections of it is determined by Taniyama. Here a regular projection has no over/under crossing information. In this talk we determine the set of all regular projections of 6_2 knot.

- 10 Taizo Kanenobu (Osaka City Univ.)[#] Coherent band-Gordian distances between knots with up to seven crossings 10
 Hiromasa Moriuchi (Osaka City Univ.)

Summary: A coherent band surgery is a local move on an oriented link, which is equivalent to a smoothing a crossing. The coherent band-Gordian distance between two links is the least number of coherent band surgeries needed to transform one into the other. We explain how we tabulate the coherent band-Gordian distances between two knots with up to seven crossings.

- 11 Keiji Tagami (Tokyo Tech)[#] Rasmussen invariants of almost positive knots 10

Summary: An oriented knot is almost positive if it is not positive and has a knot diagram with exactly one negative crossing. In this talk, we show that the Rasmussen invariant, 4-genus and 3-genus of an almost positive knot are equal. Moreover, we determine the Rasmussen invariant of an almost positive knot in terms of its almost positive diagram. As corollaries, we prove that there is no homogeneous and almost positive knot, and there is no almost positive knot of 4-genus one.

- 12 Masakazu Teragaito (Hiroshima Univ.)[#] Cyclic branched covers of 2-bridge knots and L -spaces 10

Summary: Any genus one two-bridge knot has a form of $C[2m, -2n]$ in Conway's notation. We examine when a cyclic branched cover over the knot is an L -space. When $mn < 0$, all cyclic branched covers are known to be L -spaces. When $mn > 0$, it is known that the d -fold cyclic branched cover is an L -space only for $d = 2, 3$. In this talk, we verify it for $d = 4$, and also discuss the left-orderability of its fundamental group.

- 13 Motoo Tange (Univ. of Tsukuba)* A graph made from a slice disk and its deformation 15
Tetsuya Abe (Tokyo Tech)

Summary: In this talk we will explain how to get a planar graph from a slice disk. The graph presents a singular set in a handle diagram of 4-ball. We will discuss a sufficient condition for the graph to come from a ribbon disk.

14:15–16:00

- 14 Toshio Saito (Joetsu Univ. of Edu.)[#] Meridional destabilizing number of knots 10

Summary: We define the meridional destabilizing number of a knot. This together with Heegaard genus (or tunnel number) gives a binary complexity of knots. We study its behavior under connected sum of tunnel number one knots.

- 15 Kazuhiro Ichihara (Nihon Univ.)[#] Knots with arbitrarily high distance bridge decompositions 10
Toshio Saito (Joetsu Univ. of Edu.)

Summary: We show that for any given closed orientable 3-manifold M with a Heegaard surface of genus g , any positive integers b and n , there exists a knot K in M which admits a (g, b) -bridge splitting of distance greater than n with respect to the Heegaard surface except for $(g, b) = (0, 1), (0, 2)$.

- 16 Shinya Okazaki (Osaka City Univ.)[#] Bridge genus and braid genus of lens space 10

Summary: The bridge genus and the braid genus are invariants of a closed connected orientable 3-manifold M which are introduced by A. Kawauchi. The bridge genus (resp. the braid genus) of M is the minimal number of $\text{bridge}(L)$ (resp. $\text{braid}(L)$) for any L such that M is obtained by the 0-surgery of the three sphere along a link L . In this talk, we calculate the bridge genus and braid genus for some lens spaces.

- 17 Kenta Okazaki (Kyoto Univ.)[#] On the E_6 state sum invariant of lens spaces 10

Summary: The state sum invariants, first introduced by Turaev and Viro, and generalized by Ocneanu, are the invariants of closed oriented 3-manifolds associated with their simplicial decompositions. The E_6 state sum invariant is the state sum invariant derived from the E_6 subfactor.

In this talk, we briefly review the definition of the state sum invariants, and calculate many of the E_6 state sum invariant of the lens spaces $L(p, q)$, which were originally calculated for $q = 1, 2, 3$ by Suzuki and Wakui.

- 18 Yoshikazu Yamaguchi (Akita Univ.)[#] The asymptotic behavior of the higher dimensional Reidemeister torsion for Seifert manifolds 15

Summary: For hyperbolic 3-manifolds of finite volume, we can derive the hyperbolic volumes from the asymptotic behavior of the higher dimensional Reidemeister torsion for the holonomy representations. For Seifert manifolds, we can also derive the Euler characteristics of the base orbifolds in the Seifert fibrations from the asymptotic behavior of the higher dimensional Reidemeister torsion. In this talk, we will see the asymptotic behavior of the higher dimensional Reidemeister torsion for Seifert manifolds via a surgery formula for asymptotics. We will also discuss the difference between the asymptotic behaviors for hyperbolic 3-manifolds and Seifert manifolds.

- 19 Tatsuro Shimizu (Univ. of Tokyo)[#] Morse homotopy invariant and the Kontsevich–Kuperberg–Thurston invariant of homology 3-spheres 10

Summary: We prove the degree one part of the Kontsevich–Kuperberg–Thurston invariant coincides with the degree one part of Morse homotopy invariant. (These two invariants are topological invariants for oriented rational homology 3-spheres.)

- 20 Motoo Tange (Univ. of Tsukuba)^{*} Homology spheres bounded by 4-manifolds with intersection form $-E_8$ 10

Summary: We construct simply-connected, $-E_8$ -manifolds whose boundaries are $\Sigma(2, 3, 12n + 5)$, where $-E_8$ -manifold is a 4-manifold with intersection form $-E_8$. These 4-manifolds can be embedded in $E(1)$ and the complements are the Gompf’s nuclei. The embedding gives a sphere class with square -29 .

- 21 Yoshifumi Matsuda (Kyoto Univ.)^{*} Rotation number and actions of the modular group on the circle 15

Summary: We characterize the standard action of the modular group on the circle, which corresponds to a hyperbolization of the modular surface, among actions of the modular group on the circle in terms of rotation number.

16:20–17:20 Talk invited by Topology Section

- Tadayuki Watanabe (Shimane Univ.)[#] Morse theory and graph-valued 3-manifold invariant

Summary: In his article published in 1996, K. Fukaya constructed a 3-manifold invariant by using Morse homotopy theory. Roughly, his invariant is defined by considering several Morse functions on a 3-manifold and counting with weights the ways that the theta-graph can be immersed such that edges follow gradient lines. We generalize his construction to 3-valent graphs with arbitrary number of loops for integral homology 3-spheres. I will also discuss extension of our method to 3-manifolds with positive first Betti numbers.

September 25th (Wed) Edu. Bldg.2, Large Lect. Room

10:50–11:50 Award Lecture for 2013 Geometry Prize

Katsutoshi Yamanoi (Tokyo Tech)[#] Value distribution of derivatives of meromorphic functions

Summary: We discuss about the following two problems in value distribution of derivatives of meromorphic functions in the plane:

Conjecture of Gol'dberg, middle 1980-s: For every transcendental meromorphic function in the plane, the frequency of distinct poles is governed by the frequency of zeros of the second derivative.

Conjecture of Mues, 1971: For every non-constant meromorphic function in the plane which has primitive, the summation of the defects $\delta(a)$ over all complex numbers a is not greater than 1.

Our discussion is based on two developments in Nevanlinna theory, which are interesting for their own sake. The first one is a generalization of the second main theorem (SMT) for small moving targets, which gives a complete answer to Nevanlinna's old question dating back to 1920s. The other is a solution to reversion problem of SMT.

We shall also discuss about the background of the theory and related topics.

13:15–14:15 Award Lecture for 2013 Geometry Prize

Toshitake Kohno (Univ. of Tokyo)[#] Braids, quantum symmetry and hypergeometric integrals

Summary: The idea of constructing representations of fundamental groups by the monodromy of logarithmic connections goes back to Poincaré and Lappo-Danilevsky. In 1970's a relationship between nilpotent completions of fundamental groups and iterated integrals was established by K. T. Chen. Subsequently, Aomoto described the unipotent monodromy of the fundamental group of the complement of a complex hypersurface by iterated integrals of logarithmic forms.

After reviewing these historical aspects, I will apply such technique to representations of braid groups. For braid groups there is an important flat connection called KZ connection. On the other hand, there is a topological way to construct representations of braid groups, namely homological representations. These representations of braid groups are defined as the action of the mapping class group of a punctured disk on the homology of an abelian covering of its configuration space. They were extensively studied by Krammer and Bigelow.

We show that specializations of the homological representations of braid groups are equivalent to the monodromy of the KZ equation with values in the space of null vectors in the tensor product of Verma modules when the parameters are generic. Here the representations of the solutions of the KZ equation by hypergeometric integrals due to Schechtman, Varchenko and others play an important role. By this construction we recover quantum symmetry of the monodromy of KZ connection due to Drinfel'd and myself by means of the action of the quantum groups on twisted cycles. In the case of special parameters corresponding to conformal field theory, we show that KZ connection can be regarded as Gauss–Manin connection.

We also discuss the representations of mapping class groups appearing in the monodromy of conformal field theory for Riemann surfaces. We explain a joint work with Funar concerning a description of the image and the kernel of the monodromy of conformal field theory and give some applications.

September 26th (Thu) Conference Room V

9:00–12:00

- 22 Katsuhisa Koshino (Univ. of Tsukuba)* Topological types of pairs of convex sets in Fréchet spaces 15

Summary: In this talk, we consider topological types of pairs of σ -locally compact convex sets and the closures in Fréchet spaces. Let $\ell_2^f(\tau)$ be the linear span of the canonical orthonormal basis of the Hilbert space $\ell_2(\tau)$ of weight an infinite cardinal τ . We show that for every σ -locally compact convex set C in a Fréchet space such that the closure \overline{C} is not locally compact, the pair (\overline{C}, C) is homeomorphic to $(\ell_2(\tau), \ell_2^f(\tau))$ if C is strongly countable-dimensional, and (\overline{C}, C) is homeomorphic to $(\ell_2(\tau) \times [0, 1]^{\aleph_0}, \ell_2^f(\tau) \times [0, 1]^{\aleph_0})$ if C contains an infinite-dimensional locally compact convex set. This result is a generalization of the separable version due to D. Curtis, T. Dobrowolski and J. Mogilski.

- 23 Takashi Shimomura[‡] Approximation by conjugacies and graph coverings 15
(Nagoya Univ. of Econ.)

Summary: A 0-dimensional system is constructed from a sequence of graph coverings. Mutual approximation of Cantor systems by topological conjugacies are determined by the construction from sequences of graph coverings. Approximation by conjugacies from a Cantor system to a chain transitive Cantor system is determined by their periodic properties. A sequence of coverings with the lifting property determines G_δ conjugacy class. The universal homeomorphism of the topological transitive Cantor system can be shown in this way. The space of chain recurrent Cantor systems also has the universal conjugacy class of homeomorphisms.

- 24 Yusuke Tokunaga (Osaka Univ.)[‡] Measures with maximum total exponent of C^1 diffeomorphisms with basic sets 15

Summary: We show that for a generic element in sufficiently small C^1 -neighborhood of a C^1 -diffeomorphism with basic set, the measure with maximum total exponent on the continuation of the basic set is unique, of zero entropy and fully supported on the continuation. To the contrary, if $r \geq 2$ then for a generic element in sufficiently small C^r -neighborhood of a C^r -diffeomorphism with basic set, any measure with maximum total exponent on the continuation of the basic set is not fully supported on the continuation. Moreover, we give some applications of these results.

- 25 Tatsuhiko Yagasaki (Kyoto Inst. Tech.)[‡] Groups of uniform homeomorphisms with the uniform topology 15

Summary: We study local and global deformation properties of spaces of uniform embeddings and groups of uniform homeomorphisms in metric manifolds endowed with the uniform topology. From the Edwards–Kirby local deformation theorem for embeddings of compact spaces and the Arzela–Ascoli theorem, we deduce a local deformation theorem in any metric covering spaces over compact manifolds and any metric manifolds with geometric group actions. We also obtain a global deformation theorem in any metric manifold with finitely many bi-Lipschitz Euclidean ends.

- 26 Noriyuki Hamada (Kyushu Univ.)[‡] Non-holomorphic Lefschetz fibrations with (-1) -section 15

Summary: Non-holomorphic Lefschetz fibrations have been discovered in several ways, however, all of such Lefschetz fibrations have been constructed as the fiber sum of two or more non-trivial Lefschetz fibrations. In this talk, we give new non-holomorphic Lefschetz fibrations, which cannot be decomposed as a non-trivial fiber sum.

- 27 Noriyuki Hamada (Kyushu Univ.)[#] Decompositions of positive relations in the mapping class group 15

Summary: Motivated by Luo’s presentation for the mapping class group of a compact oriented surface, we introduce a notion of decomposition of relations in the mapping class group. Moreover, we give explicit decompositions of the typical positive relations such as the hyperelliptic relation, the chain relation with general length and the Cadavid–Korkmaz relation.

- 28 Ryoma Kobayashi (Tokyo Univ. of Sci.)[#] On the genus of a Lefschetz fibration and a finitely presented group 10

Summary: It is known that every finitely presented group is the fundamental group of the total space of a Lefschetz fibration. Amorós–Bogomolov–Katzarkov–Pantev and Korkmaz constructed Lefschetz fibrations whose fundamental group is a given finitely presented group. In addition, Korkmaz defined the *genus* $g(\Gamma)$ of a finitely presented group Γ to be the minimal genus of a Lefschetz fibration whose fundamental group is isomorphic to Γ . In this talk, I evaluate upper bounds for genera of some finitely presented groups.

- 29 Takuya Sakasai (Univ. of Tokyo)[#] Johnson homomorphisms up to degree 6 15
Masaaki Suzuki (Meiji Univ.)
Shigeyuki Morita
(Univ. of Tokyo*/Tokyo Tech*)

Summary: Johnson homomorphisms are important tools for understanding the structure of the mapping class group. We will discuss how to determine the rational image of Johnson homomorphisms up to degree 6 and report our explicit computational results.

- 30 Yusuke Kuno (Tsuda Coll.)[#] An infinitesimal Dehn–Nielsen theorem and an embedding of the largest
Nariya Kawazumi (Univ. of Tokyo) Torelli group 15

Summary: We prove that a completion of the Goldman–Turaev Lie bialgebra of any compact connected oriented surface S is canonically isomorphic to the Lie algebra of continuous derivations of a completion of the ‘groupoid ring’ of (a restriction of) the fundamental groupoid of the surface S annihilating the boundary loops. This isomorphism induces a geometric construction of the Johnson homomorphisms (of all degree) for any compact connected oriented surface S .

- 31 Ryo Kato (Nagoya Univ.)[#] The non-existence of a special $E(n)$ -invertible spectra 10
Yuna Kawamoto (Kochi Univ.)
Katsumi Shimomura (Kochi Univ.)

Summary: In this talk we define the notion of “special” invertible spectra in the Picard group of $E(n)$ -local spectra, and we will prove that there is no special invertible spectra under some condition.

- 32 Tomoki Kashiwagi (Kochi Univ.)[#] The 2-primary chromatic $H^1M_{n-1}^1$ 10
Ryo Kato (Nagoya Univ.)
Katsumi Shimomura (Kochi Univ.)

Summary: The Adams–Novikov spectral sequence is one of good instrument for investigating the stable homotopy groups of spheres. Then we want to know the E_2 -terms of the spectral sequence, and the chromatic method by Miller–Ravenel–Wilson is a useful tool for it. The chromatic spectral sequence is a powerful tool in chromatic method, and we determined the structure of some chromatic E_1 -terms at the prime 2.

14:15–16:00

- 33 Ryo Kato (Nagoya Univ.)[#] Generalized Bousfield lattices and generalized retract conjecture 10
 Katsumi Shimomura (Kochi Univ.)
 Yutaro Tatehara (Kochi Univ.)

Summary: We redefine the notion of Bousfield lattice, and we determined the structure of typical examples of them. Also we showed that the generalized retract conjecture holds on our Bousfield lattices under some condition.

- 34 Ryo Kato (Nagoya Univ.)[#] On the products of β -elements 10
 Katsumi Shimomura (Kochi Univ.)

Summary: In the stable homotopy groups of spheres, the Greek letter elements are important things for v_n -periodicity. In this talk we notice the second Greek letter family, called beta elements, and we will give the triviality and non-triviality of two beta elements.

- 35 Ryo Kato (Nagoya Univ.)[#] The stable homotopy groups of the classifying space of a finite cyclic group and its applications to algebraic K -theory 10

Summary: We will consider the stable homotopy groups of integers module a power of two, and the TR-groups of the sphere spectrum.

- 36 Shumi Kinjo (Shinshu Univ.)[#] A construction of immersions of 3-sphere into 4-space associated with Dynkin diagrams and the Smale invariant 15

Summary: In this talk, we construct immersions of 3-sphere into 4-space associated with Dynkin diagram type A . We also compute the Smale invariants of the immersions.

- 37 Takahito Naito (Shinshu Univ.)[#] String topology and a Frobenius algebra structure of the Yoneda algebra 10

Summary: The homology of the based loop space of a simply connected Gorenstein space has a structure of Frobenius algebras as with the string operations. On the other hand, Smith has proved that the Yoneda algebra of a Gorenstein algebra with finite global dimension is Frobenius. In this talk, we show that the correspondence of the two Frobenius algebra structures via the Eilenberg–Moore isomorphism.

- 38 Kentaro Matsuo (Shinshu Univ.)[#] The equivariant rational cohomology of the loop spaces 10

Summary: We show that the equivariant rational cohomology of loop spaces is isomorphic to the torsion product. Moreover, we compute explicitly the one dimensional sphere equivariant rational cohomology of the space of the loops on the complex projective space.

- 39 Tatsuya Horiguchi (Osaka City Univ.)[#] The equivariant cohomology ring of $(n - k, k)$ Springer variety 10
 Yukiko Fukukawa (Osaka City Univ.)

Summary: Given a nilpotent operator $N: \mathbb{C}^n \rightarrow \mathbb{C}^n$, the Springer variety \mathcal{S}_N is defined the subvariety of a flag variety $Flags(\mathbb{C}^n)$. When N is a nilpotent matrix in a Jordan canonical form with weakly decreasing sizes $(\lambda_1, \dots, \lambda_q)$ of Jordan blocks, \mathcal{S}_N is called the $(\lambda_1, \dots, \lambda_q)$ Springer variety. It admits an S^1 -action induced from the natural T^n -action on $Flags(\mathbb{C}^n)$, where the S^1 -subgroup of T^n is given by $\{(g^n, g^{n-1}, \dots, g) \mid g \in \mathbb{C}, |g| = 1\}$. We give an explicit description of the equivariant cohomology ring of $(n - k, k)$ Springer variety under some assumption.

- 40 Miho Hatanaka (Osaka City Univ.)[#] Cohomological rigidity problem for real toric manifolds 10

Summary: A toric manifold is a closed smooth algebraic variety with an effective algebraic action of complex torus having an open dense orbit. It is not known whether or not the cohomological rigidity problem with integer coefficient for toric manifolds is affirmative. But that problem with mod 2 coefficient for real toric manifolds, the set of real points in toric manifolds, is not affirmative, and a counterexample is known. On the other hand, there are several partial affirmative results. One of them is that cohomological rigidity problem with mod 2 coefficient for real Bott manifolds is affirmative. All real Bott manifolds are real toric manifolds. The main theorem in this talk is that the cohomological rigidity problem for the product of real toric manifolds of dimension less than or equal to two is affirmative.

- 41 Kenshi Ishiguro (Fukuoka Univ.)[#] Pairings for the classifying spaces of compact Lie groups 10
Fumihisa Yayama (Fukuoka Univ.)

Summary: We consider the maps between classifying spaces of compact Lie groups of certain forms. If the restriction map on a classifying space is a weak epimorphism, then the restriction on the other is known to factor through the classifying spaces of the center of the compact Lie group. Suppose a group is a semi-simple subgroup of a given connected compact Lie group with same rank. Replacing the weak epimorphism by the inclusion, analogous results are obtained. We will show, however, that if the subgroup is not semi-simple, the corresponding result does not hold.

16:20–17:20 Talk invited by Topology Section

- Tetsuya Itoh (Kyoto Univ.)[#] Open book foliation

Summary: In this talk we will give an overview of an open book foliation theory, which studies (contact) 3-manifolds in a topological and combinatorial way via the open book decomposition. This method can be regarded as a generalization of Birman–Menasco’s braid foliation theory which treats the case S^3 , and is also seen as a refinement of convex surface techniques. We will explain basic ideas, and show several applications. In particular, we will demonstrate how a simple invariant of mapping class group, called the fractional Dehn twist coefficient, is related to the topology and contact structure of 3-manifolds. This is a joint work with Keiko Kawamuro (Univ. Iowa)

Infinite Analysis

September 24th (Tue) Conference Room IX

9:30–12:00

- 1 Masataka Kanki (Univ. of Tokyo)[#] Constructing the integrable systems over finite fields using the field of
 Tetsuji Tokihiro (Univ. of Tokyo) p -adic numbers 15
 Jun Mada (Nihon Univ.)

Summary: We discuss how to define the discrete integrable equations over the finite field. We define the integrable equations over the field of p -adic numbers and then project the obtained time evolution onto the finite field. A property which resembles the good reduction in the theory of arithmetic dynamical systems is shown to be an integrability detector. This property is shown to be an arithmetic analog of the singularity confinement method in the case of discrete Painlevé equations. We briefly explain how to apply our methods to the soliton systems.

- 2 Shuhei Kamioka (Kyoto Univ.)[#] A combinatorial expression of the solution to an initial value problem
 of the Toda molecule 15

Summary: A combinatorial expression is given to the solution to an initial value problem of the Toda molecule. The tau function of the discrete Toda molecule that solves the corresponding initial value problem is described by means of combinatorial objects including Schur polynomials and non-intersecting paths. Taking continuum limit of the tau function, we obtain an expression in terms of non-intersecting paths of the tau function of the Toda molecule that solves the initial value problem.

- 3 Atsushi Nobe (Chiba Univ.)[#] A geometric realization of the periodic box-ball system 15

Summary: An explicit formula concerning tropical curve intersections equivalent to the time evolution of the periodic box-ball system (pBBS) is presented. First, the time evolution of the periodic discrete Toda lattice (pdTL) is realized as a point addition on a hyperelliptic curve, then the point addition is translated into curve intersections. Next, it is shown that the curves which appear in the curve intersections are explicitly given by using the conserved quantities of the pdTL. Finally, the formulation is lifted to the framework of tropical geometry, and a tropical geometric realization of the pBBS is constructed via tropical curve intersections.

- 4 Mami Okiyoshi (Hiroshima Univ.)[#] Generating functions of box and ball system 15

Summary: Generating functions of BBS is defined and studied. When the number of balls is finite, we show that the generating function is a rational function. When there are infinitely many balls, we conjecture that the generating function is rational if and only if the BBS is semi-periodic. We prove the conjecture in some special case. We also study the generating function of the BBS with a limited cart, including semi-periodic cases.

- 5 Kouichi Takemura (Chuo Univ.)[#] Ultradiscrete Painlevé VI with parity variables 15
Terumitsu Tsutsui

Summary: We introduce a ultradiscretization with parity variables of the q -difference Painlevé VI equations. We show that ultradiscrete limit of Riccati-type solutions of q -Painlevé VI satisfies the ultradiscrete Painlevé VI equations with the parity variables, which is valid by using the parity variables. We study some solutions of the ultradiscrete Riccati-type equations and those of ultradiscrete Painlevé VI equations.

- 6 Takao Suzuki (Kinki Univ.)[#] A particular solution of the Schlesinger system $\mathcal{H}_{3,2}$ in terms of a rigid system 15

Summary: The Schlesinger system $\mathcal{H}_{3,2}$ is proposed by Tsuda. It is given as the monodromy preserving deformation of a Fuchsian system with a spectral type $21, 21, 21, 111, 111$. It is known that $\mathcal{H}_{3,2}$ admits a particular solution in terms of a hypergeometric function which is a generalization of ${}_{n+1}F_n$. In this talk, we present another particular solution of $\mathcal{H}_{3,2}$, which is given by a rigid system.

- 7 Yousuke Ohyaama (Osaka Univ.)[#] A connection problem for linear q -difference equations related to the q -Painlevé equation 15

Summary: For the continuous Painlevé equations, character varieties, which are cubic surfaces satisfied by monodromy invariants, play an important role to study nonlinear connection problems. We show a q -analogue of a character variety for the q -Painlevé VI equation found by Jimbo and Sakai. We show a weak Riemann-Hilbert correspondence for q -linear equations, in the sense of G. D. Birkoff.

- 8 Kazuo Kaneko (Yokkaichi Univ.)^{*} Symmetric solutions to the degenerate four dimensional Painlevé type equations NY^{A_4} , IV^{Mat} and II^{Mat} 20

Summary: The four dimensional degenerate Painlevé type equations $NY^{A_4}((11))((11))$, $31, IV^{Mat}((2))((2))$, 211 and $II^{Mat}(((2)))(((11)))$ are derived by H. Kawakami, A. Nakamura and H. Sakai as extensions of the fourth and the second Painlevé equations. In this talk, we show that we classified the symmetric solutions to these equations by using their invariance under the symmetric transformations with the weight of radical of unity and the symmetric solutions to NY^{A_4} are transformed each other by the Bäcklund transformations. We also show the calculation results of the linear monodromy $\{M_\infty, C, S_1, S_2, S_3, S_4, e^{2\pi iT_0}\}$ for the one of these solutions.

14:15–16:20

- 9 Koji Hasegawa (Tohoku Univ.)[#] Lax formalism for quantum discrete Garnier system 15
Yousuke Semba (Asakura Publ.)

Summary: We show that the Lax form of affine Toda system [Kashaev–Reshetikhin(1997)] can be obtained as the image of universal R matrix of $U_q(\widehat{\mathfrak{sl}}_N)$ and generalize the construction in a non-autonomous way. After periodic reduction it can be recognized as a quantization of the isomonodromy deformation equation of Garnier type.

- 10 Yas-Hiro Quano [#] Spontaneous polarization of spin-1 analogue of the eight-vertex model
(Suzuka Univ. of Med. Sci.) 20

Summary: The spin-1 analogue of the eight vertex model is considered on the basis of free field representations of vertex operators in the 2×2 -fold fused SOS model and vertex-face transformation. The spontaneous polarization of the model is obtained in terms of one-fold integral formula. The result is compared with that of trigonometric model obtained by Idzumi.

- 11 Tomoki Nakanishi (Nagoya Univ.) [#] Diagrammatic description of c -vectors and d -vectors of cluster algebras
Salvatore Stella (Northeastern Univ.) of finite type 15

Summary: We provide an explicit Dynkin diagrammatic description of the c -vectors and the d -vectors (the denominator vectors) of any cluster algebra of finite type with principal coefficients and any initial exchange matrix. We use the surface realization of cluster algebras for types A_n and D_n , then we apply the folding method to D_{n+1} and A_{2n-1} to obtain types B_n and C_n . Exceptional types are done by direct inspection with the help of a computer algebra software.

- 12 Tomoki Nakanishi (Nagoya Univ.) [#] Wonder of sine-Gordon Y -systems 15
Salvatore Stella (Northeastern Univ.)

Summary: The sine-Gordon Y -systems and the reduced sine-Gordon Y -systems were introduced by Tateo in the 90's in the study of the integrable deformation of conformal field theory by the thermodynamic Bethe ansatz method. The periodicity property and the dilogarithm identities concerning these Y -systems were conjectured by Tateo, and only a part of them have been proved so far. We formulate these Y -systems by the polygon realization of cluster algebras of types A and D , and prove the conjectured periodicity and dilogarithm identities in full generality. As it turns out, there is a wonderful interplay among continued fractions, triangulations of polygons, cluster algebras, and Y -systems.

- 13 Masato Okado (Osaka City Univ.) [#] PBW bases of U_q^+ and quantized algebra of functions 20
Atsuo Kuniba (Univ. of Tokyo)
Yasuhiko Yamada (Kobe Univ.)

Summary: For a finite-dimensional simple Lie algebra \mathfrak{g} , let $U_q^+(\mathfrak{g})$ be the positive part of the quantized universal enveloping algebra, and $A_q(\mathfrak{g})$ be the quantized algebra of functions. We show that the transition matrix of the PBW bases of $U_q^+(\mathfrak{g})$ coincides with the intertwiner between the irreducible $A_q(\mathfrak{g})$ -modules labeled by two different reduced expressions of the longest element of the Weyl group of \mathfrak{g} . This generalizes the earlier result by Sergeev on A_2 related to the tetrahedron equation and endows a new representation theoretical interpretation with the recent solution to the 3D reflection equation for C_2 .

- 14 Motohiro Ishii (Univ. of Tsukuba) [#] Path model for crystal bases of level-zero extremal weight modules over
Satoshi Naito (Tokyo Tech) quantum affine algebras 15
Daisuke Sagaki (Univ. of Tsukuba)

Summary: We introduce a new path crystal over a quantum affine algebra by using the semi-infinite (or generic) Bruhat order on the affine Weyl group (or equivalently the quantum Bruhat graph associated to the finite Weyl group). Our crystal is a slight modification of a Littelmann's Lakshmibai–Seshadri path crystal; in fact, these two crystals are “locally” isomorphic as crystals. We show that the new path crystal provides a combinatorial realization of the crystal bases of level-zero extremal weight modules over quantum affine algebras.

16:30–17:30 Talk invited by Infinite Analysis Special Session

Katsuyuki Naoi (Univ. of Tokyo)[#] An approach to the $X = M$ conjecture using modules over a current algebra

Summary: A one-dimensional sum is defined by a weighted sum on the highest weight elements of a tensor product of KR crystals. The $X = M$ conjecture asserts that each one-dimensional sum has an explicit formula called the fermionic formula. In this talk, after overviewing the previous works we give a proof to this conjecture in non-twisted and classical types (in type BC we need additional assumptions), using the representation theory of the current algebra $\mathfrak{g} \otimes \mathbb{C}[t]$ where \mathfrak{g} is the simple Lie algebra of a given type. The key idea of the proof is to consider two graded $\mathfrak{g} \otimes \mathbb{C}[t]$ -modules whose graded multiplicities coincide with a one-dimensional sum and a fermionic formula respectively. Then we obtain the result by showing that these modules are isomorphic.

September 25th (Wed) Conference Room IX

9:30–12:00

15 Takeshi Morita (Osaka Univ.)[#] A connection formula of a divergent bilateral basic hypergeometric function 15

Summary: We show a connection formula of a divergent bilateral basic hypergeometric function. We introduce the q -Borel–Laplace transformations to obtain our connection formula. These transformations are powerful tools for the study of divergent basic hypergeometric series (i.e., unilateral series). But the application of these resummation method to bilateral series has not known well. In this talk, we apply these transformations to a bilateral series and give an example of the new connection formula.

16 Masahiko Ito (Tokyo Denki Univ.)[#] The q -Dixon–Anderson integral —a multi-dimensional Ramanujan ${}_1\psi_1$ sum— 20

Summary: I will talk about a multi-dimensional extension of Ramanujan’s ${}_1\psi_1$ summation formula. This formula is motivated from the Dixon–Anderson integral, which is an iterated integral generalized from the beta function. I will explain how this formula is related with Milne–Gustafson’s $U(n)$ type ${}_1\psi_1$ summation formula.

17 Masahiko Ito (Tokyo Denki Univ.)[#] A bilateral extension of the q -Selberg integral and its product expression — q -difference equation, shifted symmetric polynomials, connection formula— 20

Summary: I would like to talk about an extension of the q -Selberg integral as a bilateral series. I will explain a subtle difference between the situation under the exponent of the difference product in the integrand of q -Selberg integral being an integer and that under the exponent not being an integer. After that I will show a new product formula for the extended q -Selberg integral under the exponent being an arbitrary complex number. If we restrict this result on the exponent being an integer, then using analytic continuation, we can find that the result contains a formula studied by Askey and Evans in 1980’s and 90’s.

18 Hiroshi Naruse (Okayama Univ.)[#] Dual Grothendieck polynomials and finite sum Cauchy formula 15
Alain Lascoux
(Univ. de Marne-la-Vallée)

Summary: By using new interpretation of dual Grothendieck polynomials, we found various types of determinantal formula such as Giambelli formula. We also proved finite sum Cauchy identity.

- 19 Hiroshi Naruse (Okayama Univ.)[#] Factorial Schur functions and vexillary permutations of types B, C and D 15

Summary: We found a family of Schubert polynomials that can be expressible using a factorial Schur functions. There are corresponding to the vexillary permutations defined by Anerson-Fulton.

- 20 Hiroshi Mizukawa[#] Schur function identities and the basic representation of $A_2^{(2)}$ 15
 (Nat. Defense Acad. of Japan)
 Tatsuhiro Nakajima (Meikai Univ.)
 Hiro-Fumi Yamada (Okayama Univ.)

Summary: A Lie theoretic interpretation is given for some formulas of Schur functions and Schur Q -functions. Two realizations of the basic representation of the Lie algebra $A_2^{(2)}$ are considered. Via the boson-fermion correspondence, simple relations of the vacuum expectation values of fermions turn out to be identities of Schur functions.

- 21 Yosuke Saito (Tohoku Univ.)[#] Commutative families arising from the elliptic Ding–Iohara algebra and the elliptic Feigin–Odesskii algebra 20

Summary: In 2009, Feigin, Hashizume, Hoshino, Shiraishi, and Yanagida constructed two families of commuting operators which contain the Macdonald operator by using the Ding–Iohara algebra and the trigonometric Feigin–Odesskii algebra. In this talk, I will show that by using the elliptic Ding–Iohara algebra and the elliptic Feigin–Odesskii algebra, we can construct commutative families of the elliptic Macdonald operator.

13:00–14:00 Talk invited by Infinite Analysis Special Session

- Akihiro Tsuchiya (Univ. of Tokyo)^{*} Logarithmic conformal field theory and the representation theory of extended W -algebras

Summary: Recently logarithmic CFT are interested by many mathematicians and physicists. Logarithmic CFT contains log type function in the N point functions. In this talk, I will talk about some examples of vertex operator algebras (VOA) which we call extended W -algebras.