The 21st "Kagoshima Algebra-Analysis-Geometry Seminar"

February 16th 13:30 - 19th 17:00, 2026
Room 104, Bldg. 1, Faculty of Science, Kagoshima University

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PROGRAM

February 16 (Monday)

13:30-14:20 : Takehiko Yasuda (Osaka University)
Counting wild abelian torsors over a function field

14:40-15:30 : Yusaku Tiba (Ochanomizu University)
C^ℓ-estimates for the $\overline{\partial}$-equation on high tensor powers of positive line bundles

15:50-16:40 : Kenro Furutani (Osaka Metropolitan University)
Lagrangian submanifold on the Cayley projective plane satisfying Maslov's quantization condition

February 17 (Tuesday)

10:00-10:50 : Yusuke Nakamura (Nagoya University)
Ehrhart theory on periodic graphs

11:00-11:50 : Eiji Inoue (Kyoto University)
Perelman entropy and algebraic geometry

11:50-13:30 : Lunch break

13:30-14:20 : Joonyeong Won (Ewha Womans University)
Polar cylinders on weighted Fano varieties

14:40-15:30 : Koji Hasegawa (Tohoku University)
Quantization of discretized monodromy preserving deformation and its application

15:50-16:40 : Katsuhiko Kuribayashi (Shinshu University)
On Riemannian diffeological spaces

February 18 (Wednesday)

10:00-10:50 : Tetsushi Ito (Kyoto University)
Recent developments on the arithmetic of hyper-Kaehler varieties

11:00-11:50 : Takeo Uramoto (Kagoshima University)
On a deformation of the absolute Galois groups of number fields

11:50-13:30 : Lunch break

13:30-14:20 : Shin-ichiro Seki (Nagahama Institute of Bio-Science and Technology)
Drop 1

14:40-15:30 : Kento Fujita (Osaka University)
Toward criteria for K-stability of Fano varieties

15:50-16:40 : Yasuyuki Kawahigashi (University of Tokyo)
Tensor categories in mathematical physics and operator algebras

18:15- Conference Dinner

February 19 (Thursday)

10:00-10:50 : Hiroyuki Fuji (Kobe University)
Topological Recursion from a Hamiltonian Formalism

11:00-11:50 : Mikiya Masuda (Osaka Metropolitan University)
Torus orbit closures in the flag variety

11:50-13:30 : Lunch break

13:30-17:00 : Free Discussion

ABSTRACTS

Takehiko Yasuda: Counting wild abelian torsors over a function field

Malle's conjecture predicts an asymptotic formula for the number of Galois extensions of a number field with a prescribed Galois group and bounded invariants. A similar formula is expected for extensions of function fields as well, provided that the order of the group is coprime to the characteristic of the base field. In this talk, I will present a formulation of a similar conjecture that removes the coprimality condition and discuss its verification for abelian groups under certain assumptions. This is joint work with Ratko Darda.

Yusaku Tiba: C^ℓ-estimates for the $\overline{\partial}$-equation on high tensor powers of positive line bundles

Let M be a compact complex manifold, L be a positive holomorphic line bundle over M, and E be a holomorphic vector bundle over M. It is known that the cohomology groups $H^i(M, L^k \otimes E)$ vanish for $i > 0$ when k is sufficiently large. This vanishing theorem is typically proved by solving the $\overline{\partial}$-equation using Hörmander's L^2-estimates in the complex geometry. In this talk, we solve the $\overline{\partial}$-equation not by Hörmander's method, but by means of weighted integral formulas. In particular, we apply the weighted integral formula of Andersson–Berndtsson (1982) in a semi-classical setting and obtain C^ℓ-norm estimates for solutions of the $\overline{\partial}$-equation.

Kenro Furutani: Lagrangian submanifold on the Cayley projective plane satisfying Maslov's quantization condition

In this talk I will explain so called Maslov's quantization condition and related examples.

Historically, starting from Bohr's hydrogen model, a classical but famous condition, Maslov's quantization condition was an interesting subject, which guarantees the existence of a certain sequence of eivenvalues of the Laplacian.

So, after some introduction I explain an operator theoretical meaning of the role of Lagrangian submanifolds in the *condition*. The existence theorem is named as "Eigenvalue Theorem". Particularly, I will explain its meaning from the Fourier integral operator theory, or Lagrangian distribution theory.

It is not clear whether there is such a Lagrangian submanifold on any closed Riemannian manifold.

The main content of this talk is to show such a Lagrangian submanifold on a particular manifold, Cayley projective plane. The construction is explicit based on the realization of the punctured cotangent bundle of the Cayley projective plane in the complex space $\mathbb{C}^{27}\backslash\{0\}$ as a quadrics.

If I have a time, I will explain a behavior of Lagrangian submanifolds under Riemannian submersion and a related example.

Yusuke Nakamura: Ehrhart theory on periodic graphs

A periodic graph is defined as a graph on which the lattice Z^N acts freely, such that its quotient graph is a finite graph. Periodic graphs are objects of study in mathematical crystallography, and they also appear naturally in geometric group theory as Cayley graphs of virtually abelian groups. The growth sequence $b(n)$ of a graph is defined as the number of vertices within a graph distance of n or less from a starting vertex. In this talk, we will first introduce the result (Nakamura-Sakamoto-Mase-Nakagawa) that the growth sequence of a periodic graph is of quasi-polynomial type (i.e., it is a quasi polynomial for sufficiently large n). In the remaining time, we would also like to discuss phenomena analogous to Ehrhart theory.

Eiji Inoue: Perelman entropy and algebraic geometry

Perelman entropy has a special feature in Kähler geometry: it has a reflection in "non-archimedean mirror". I will explain how one can use this mirror to find 'duality' between cscK metric and K-semistability, and 'duality' between Kahler-Ricci flow and MMP.

Joonyeong Won: Polar cylinders on weighted Fano varieties

Fano varieties form a distinguished subclass of Mori fiber spaces and have attracted significant interest in recent years. Their relevance is closely tied to concepts such as K-stability and the existence of cylinders. When mild singularities are permitted, weighted Fano varieties arise naturally and become an important object of study. We survey recent progress on the cylindricity phenomena in the setting of weighted Fano varieties.

Koji Hasegawa: Quantization of discretized monodromy preserving deformation and its application

Painlevé Vi equation (PVI) is known to be the monodromy preserving deformation equation for the rank two connection on P^1 with four poles. It is a non-autonomous Hamiltonian system with so-called Bäcklund transformations that transform solutions to solutions. Symmetry preserving discretization qPVI of PVI is known by Jimbo and Sakai, and we can think of the quantization of qPVI. In this talk I will explain two approaches to this problem, one is to quantize the Bäcklund transformations, and the other is to use the quantum group representations. Two approaches give the identical system $\widehat{qPVI}$ and we can generalize the latter construction for the higher

rank versions. Moreover, our recent joint work with Awata, Kanno, Ohkawa, Shakilov, Shiraishi and Yamada [arxiv/2211.16772, 2309.15364] shows that the resulting system appear as the equation for the K-theoretic Nekrasov partition function of the supersymmetric gauge theory.

Katsuhiko Kuribayashi: On Riemannian diffeological spaces

Diffeology provides a natural generalization of differential topology and geometry. The de Rham theory, sheaf theory, infinite dimensional geometry for partial differential equations and (abstract) homotopy theory have also been developed in the diffeological setting. Moreover, categorical comparisons of diffeology with other smooth and topological structures are made in several papers. However, it is hard to say that the development of Riemannian notions of diffeological spaces is sufficient.

In this talk, a framework for Riemannian diffeology is introduced with the tangent functor in the sense of Blohmann and one of the options of a metric on a diffeological space in the sense of Iglesias-Zemmour. As a consequence, the category RiemDiff consisting of weak Riemannian diffeological spaces and isometries is established. We observe that the category of Riemaniann manifolds (possibly infinite dimensional) embeds in RiemDiff. In the second half of the talk, an adjunction space of manifolds and a space of smooth maps are considered as examples of weak Riemannian diffeological spaces. This talk is based on the joint work doi.org/10.1017/prm.2025.10114 with Sakai and Shiobara.

Tetsushi Ito: Recent developments on the arithmetic of hyper-Kaehler varieties

Smooth projective varieties are called "hyper-Kaehler" (or IHS = Irreducible Holomorphic Symplectic) if they admit everywhere non-degenerate holomorphic symplectic 2-forms. Such varieties are generalizations of $K3$ surfaces, and play an important role in several branches of mathematics. Thanks to the recent developments of the theory of Shimura varieties, we can obtain arithmetic results by combining techniques from number theory and complex geometry. In this talk, we explain some recent results on the arithmetic of $K3$ surfaces and hyper-Kaehler varieties, including Tate's conjecture, Grothendieck's standard conjecture, arithmetic analogues of Nagai's conjecture on monodromy, and the l-independence of Hasse-Weil L-polynomials. This talk is based on a joint work with Kazuhiro Ito (Tohoku), Teruhisa Koshikawa (RIMS), Teppei Takamatsu (Saitama), and Haitao Zou (Bielefeld).

Takeo Uramoto: On a deformation of the absolute Galois groups of number fields

In this talk, I will describe a non-abelian variant of the construction of the Deligne-Ribet monoid DR_K of a number field K, a certain commutative profinite monoid constructed from the monoid of non-zero integral ideals of K. DR_K has an intrinsic relationship with classical class field theory, and is especially related to my recent work, where I showed that the field structure of the number field K can be reconstructed from the semigroup structure of DR_K. In particular, one of my methods developed there naturally admits a non-abelian extension of DR_K, so that the unit group is isomorphic to the absolute Galois group G_K (while the unit group of DR_K is isomorphic to the maximal abelian Galois group G_K^{ab}). The basic ideas for this are (1) that Hoshi's previous reconstruction from G_K of the integer ring $O_{\mathfrak{p}}$ (minus zero) of the local field $K_{\mathfrak{p}}$ naturally extends to a submonoid of the so-called Weil group of the local field $K_{\mathfrak{p}}$, where I will replace the unit group $O_{\mathfrak{p}}^{\times}$ with the inertia subgroup $I_{\mathfrak{p}}$ of the absolute Galois group of $K_{\mathfrak{p}}$; and (2) that, in order to obtain a better description of the structure of this non-abelian variant of DR_K, I can use the non-abelian local class field theory, developed by Laubie in particular, where the absolute Galois groups of the local fields $K_{\mathfrak{p}}$ have a description in terms of formal power series over finite fields (or field of norms). In this talk, I will outline these observations as far as time allows.

Shin-ichiro Seki: Drop 1

In this talk, I will introduce a new family of relations among multiple zeta values, called the drop 1 relation. I will explain its place within the existing theory of multiple zeta values and explain multiple zeta diamond values, which play a key role in the proof. If time allows, I will also present some recent progress on the drop 1 operator. This is a joint work with Minoru Hirose, Takumi Maesaka, Taiki Watanabe.

Kento Fujita: Toward criteria for K-stability of Fano varieties

The Calabi problem for Fano manifolds asks the existence of "good" metrics, so called Kähler–Einstein metrics. Around 10 years ago, the above differential geometric problem is shown to be equivalent to an algebraic stability condition called "K-stability". In this talk, I will present a simplification of the above stability condition using the notion of volume functions, obtained independently by Chi Li. Moreover, I would like to survey recent progresses for K-stability of Fano varieties.

Yasuyuki Kawahigashi: Tensor categories in mathematical physics and operator algebras

Tensor categories have emerged as new types of symmetries generalizing the classical notion of a group in quantum field theory and condensed matter physics recently. The Jones theory of subfactors in operator algebras was the first mathematical theory to deal with such symmetries. I will present recent advances in this approach based on operator algebras.

Hiroyuki Fuji: Topological Recursion from a Hamiltonian Formalism

In this talk, we discuss a Hamiltonian formulation of the topological recursion introduced by Chekhov-Eynard-Orantin. Topological recursion is a recursive structure satisfied by certain integrals over moduli spaces of bordered Riemann surfaces, including intersection numbers and WeilPetersson volumes. Originally discovered as a method for computing asymptotic expansions of matrix integrals in theoretical physics, it has since found broad mathematical applications and motivated extensions of its underlying algebraic framework, revealing an increasingly rich structure.

In joint works with Masahide Manabe (Tottori University) and Yoshiyuki Watahiki (Institute of Science Tokyo), we re-examine topological recursion from a physics perspective and establish a realization in terms of a string-field-theoretic Hamiltonian formalism developed in the study of two-dimensional quantum gravity in the 1990s. In particular, by reconstructing the Hamiltonian from the spectral-curve data of topological recursion, we obtain a Hamiltonian description not only for two-dimensional gravity, but also for topological recursion arising in a wide range of mathematical models, including Seiberg-Witten theory in four-dimensional gauge theory.

This talk is based on the following works:
[1] H. Fuji, M. Manabe, Y. Watabiki, "Dynamical Triangulations for 2D Pure Gravity and Topological Recursion," arXiv:2509.18916[hep-th].
[2] H. Fuji, M. Manabe, Y. Watabiki, "Multicritical Dynamical Triangulations and Topological Recursion," arXiv:2512.10519 [hep-th].
[3] H. Fuji, M. Manabe, Y. Watabiki, "A Hamiltonian Formalism for Topological Recursion," arXiv:2512.14059 [math-ph].

Mikiya Masuda: Torus orbit closures in the flag variety

The study of torus orbit closures in the flag variety was initiated by Klyachko and Gelfand–Serganova in the mid-1980s. However, not much work has been done since then. In this talk, I overview some of the work by Klyachko and Gelfand–Serganova and my recent work with Eunjeong Lee

and Seonjeong Park on the topology, geometry, and combinatorics of torus orbit closures in the flag variety.