Low dimensional topology and number theory XI

March 11 - 14, 2019
Conference Room E404, Science Building. E, Toyonaka Campus,
Osaka University, JAPAN

Program

March 11 (Monday)
10:00 ∼ 11:00
Ken Ono (Emory University)
Polya's Program for the Riemann Hypothesis and Related Problems

11:20 ∼ 12:20
Tomoyoshi Ibukiyama (Osaka University)
Graded rings of modular forms of rational weight

14:00 ∼15:00
Toshiki Matsusaka (Kyushu University)
A Kronecker limit type formula for hyperbolic Eisenstein series

15:20∼16:20
Anastasiia Tsvietkova (OIST)
Representations of knot groups

March 12 (Tuesday)
10:00 ∼ 11:00
Akira Sarashina (RIMS, Kyoto University)
Reconstruction of one-punctured elliptic curves in positive characteristic by their geometric fundamental groups

11:20 ∼ 12:20
Wataru Yuasa (Kyoto University)
Andrews-Gordon type identities for A_2 with one-row Young diagrams

14:00 ∼ 15:00
Masanobu Kaneko (Kyushu University)
On a variant of multiple zeta values of level two

15:20 ∼ 16:20
Madeline Dawsey (Emory University)
Higher Width Moonshine

17:15 ∼ Banquet

March 13 (Wednesay)
10:00 ∼ 11:00
Ian Wagner (Emory University)
Harmonic Hecke eigenlines and Mazur's problem

11:20 ∼ 12:20
Hikaru Hirano (Kyushu University)
On arithmetic Chern-Simons-Kim invariants for any number rings

14:00 ∼15:00
Hidekazu Furusho (Nagoya University)
Betti side of the double shuffle theory

15:20 ∼ 16:20
Jae Choon Cha (Postech)
Homotopical properties and freely slicing good boundary links

March 14 (Thursday)
10:00 ∼ 11:00
Jun Ueki (Tokyo Denki University)
Chebotarev link is stably generic

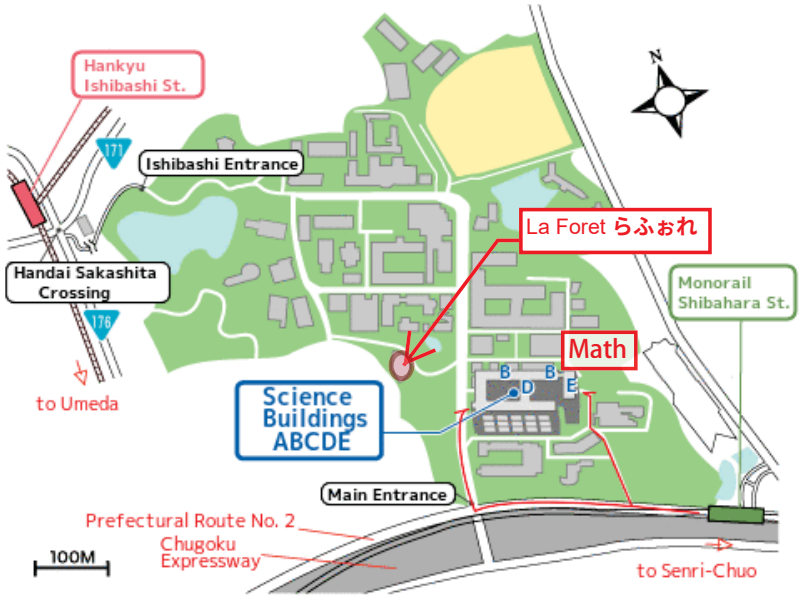
11:20 ∼ 12:20
Densuke Shiraishi (Osaka University)
Galois actions on fundamental groups of $\mathbb{P}^1\backslash\{0,1,\infty\}$ and triple ℓ-th power residue symbols

Banquet

March 12(Tue) 17:15—19:30 +α
Cafeteria, La Foret らふぉれ in Toyonaka Campus

Entrance fee ¥3000

If you wish to participate, please fill the check-box following your name at the registration sheet by 14:00 of Monday (today).



Low dimensional topology and number theory XI
March 11 (Mon) - 14 (Thur), 2019

Abstract

Jae Choon Cha (Pohang University of Science and Technology)
Homotopical properties and freely slicing good boundary links
A question of fundamental importance in 4-dimensional topology is whether surgery works for arbitrary fundamental groups. It is known to be equivalent to the free slicing problem for certain class of links which are called good boundary links. We show that good boundary links satisfying a homotopically trivial plus property are freely slice. This generalizes all previously known methods for freely slicing good boundary links with two or more components, and presents new freely slice good boundary links.

Madeline Locus Dawsey (Emory University)
Higher Width Moonshine
Weak moonshine for a finite group G is the phenomenon where an infinite dimensional graded G-module

$$V_G = \bigoplus_{n \gg -\infty} V_G(n)$$

has the property that its trace functions, known as McKay-Thompson series, are modular functions. Recent work of Dehority, Gonzalez, Vafa, and Van Peski established that weak moonshine holds for every finite group. Since weak moonshine only relies on character tables, which are not isomorphism class invariants, non-isomorphic groups can have the same McKay-Thompson series. We address this problem by extending weak moonshine to arbitrary width $s \in \mathbb{Z}^+$. Namely, for each $1 \leq r \leq s$ and each irreducible character χ_i, we employ Frobenius' r-character extension $\chi_i^{(r)} : G^{(r)} \to \mathbb{C}$ to define McKay-Thompson series of $V_G^{(r)} := V_G \times \cdots \times V_G$ (r copies) for each r-tuple in $G^{(r)} := G \times \cdots \times G$ (r copies). These series are modular functions. We find that *complete* width 3 weak moonshine always determines a group up to isomorphism. Furthermore, we establish orthogonality relations for the Frobenius r-characters, which dictate the compatibility of the extension of weak moonshine for V_G to width s weak moonshine.

Hidekazu Furusho (Nagoya University)
Betti side of the double shuffle theory
This is on my joint work with Benjamin Enriquez. The double shuffle relation is one of the most important algebraic relations among multiple zeta values. In 2002, Racinet gave its nice description by using certain

Hopf algebras constructed from the de Rham fundamental group of the projective line minus three points. My talk is on its Betti counterpart of his work. I will introduce a new coproduct on a Hopf algebra constructed from the Betti fundamental group and by using this I will explain how the double shuffle relation follows from the associator relation. The proof relies on an interpretation of the harmonic coproduct in terms of infinitesimal braid Lie algebras, which is implicit in the unpublished work of Deligne and Terasoma from 2005.

Hikaru Hirano (Kyushu University)
On arithmetic Chern-Simons-Kim invariants for any number rings
Recently, Minhyong Kim introduced the notion of arithmetic Chern- Simons invariants for totally imaginary number fields, which is based on analogies with Dijkgraaf-Witten theory for 3-manifolds. In this lecture, I will extend Kim's invariants for any number fields, using modified étale cohomology which takes real places into account, and then calculate abelian Chern-Simons-Kim invariants concretely for certain real quadratic number fileds.

Tomoyoshi Ibukiyama (Osaka University)
Graded rings of modular forms of rational weight
We construct a system of modular forms of one variable of rational weight belonging to $\Gamma(N)$ and write the automorphy factor explicitly. Then we consider the graded rings of modular forms of integral multiples of that weight and ask if the forms we constructed give generators of the ring. We show that the answer is yes for small N by using Mumford criterion of normal generation, and give fundamental relations of the generators for such N.

Masanobu Kaneko (Kyushu University)
On a variant of multiple zeta values of level two
We introduce and discuss a variant of multiple zeta values of level 2, which forms a subspace of the space of alternating multiple zeta values. This variant exhibits nice properties such as duality, shuffle product, parity results like ordinary multiple zeta values. We give some conjectures on relations between our values and ordinary multiple zeta values.

Toshiki Matsusaka (Kyushu University)
A Kronecker limit type formula for hyperbolic Eisenstein series
In 1979, Kudla and Millson introduced a form-valued hyperbolic Eisenstein series associated to any closed geodesic on the Riemann surface $\Gamma\backslash\mathfrak{H}$. More recently, Jorgenson, Kramer, and Pippich in 2010 defined a scalar-valued analog of the hyperbolic Eisenstein series, and established the meromorphic continuation to the whole s-plane. As in the classical parabolic case, they studied the Laurent expansion at the special point $s = 0$. In the particular case of $\Gamma = \mathrm{SL}_2(\mathbb{Z})$, this Eisenstein series has double zero at $s = 0$. In this talk, we give the second order coefficient explicitly.

Ken Ono (Emory University)
Polya's Program for the Riemann Hypothesis and Related Problems
In 1927 Polya proved that the Riemann Hypothesis is equivalent to the hyperbolicity of Jensen polynomials for Riemann's Xi-function. This hyperbolicity has only been proved for degrees d=1, 2, 3. For each d we prove the hyperbolicity of all but (perhaps) finitely many Jensen polynomials. We obtain a general theorem which models such polynomials by Hermite polynomials. This theorem also allows us to prove a conjecture of Chen, Jia, and Wang on the partition function. This result can be thought of as a proof of GUE for the Riemann zeta function in derivative aspect. This is joint work with Michael Griffin, Larry Rolen, and Don Zagier.

Akira Sarashina (RIMS, Kyoto University)
Reconstruction of one-punctured elliptic curves in positive characteristic by their geometric fundamental groups
The principal theme for anabelian geometry is the reconstruction of the geometry of algebraic varieties by their étale fundamental groups. By G.A.G.A. theorems, the isomorphism class of the étale fundamental group of a curve over an algebraically closed field of characteristic 0 is determined by the genus and the cardinality of cusps. But that of a curve over an algebraically closed field of positive characteristic is not determined by easy invariants. In other words, it has much information. Tamagawa proved that the isomorphism class as a scheme of curves over $\overline{\mathbb{F}}_p$ can be reconstructed by their étale fundamental groups when the genus is 0. In this talk, we will discuss the genus 1 case, and prove a similar result when the genus is 1, the cardinality of cusps is 1 and the characteristic is not equal to 2.

Densuke Shiraishi (Osaka University)
Galois actions on fundamental groups of $\mathbb{P}^1\backslash\{0, 1, \infty\}$ and triple ℓ-th

power residue symbols
In this talk, we discuss relationships between ℓ-adic Galois polylogarithms and triple ℓ-th power residue symbols in some special cases studied by a recent work of Hirano-Morishita. We show that a functional equation of ℓ-adic Galois polylogarithm by Nakamura-Wojtkowiak implies a reciprocity law of triple ℓ-th power residue symbol.

Anastasiia Tsvietkova (Okinawa Institute of Science and Technology)
Representations of knot groups
We describe a new method of producing equations for the representation variety of a knot group into (P)SL(2,C). Unlike known methods, this does not involve any polyhedral decomposition or triangulation of the link complement, and uses only a link diagram satisfying a few mild restrictions. This results in a simple algorithm that can often be performed by hand, and in many cases, for an infinite family of knots at once. This is a joint work with Kathleen Peterson, based on an earlier joint work with Morwen Thislethwaite. The discrete faithful representation gives rise to the invariant trace field, which is a topological and commensurability invariant. We will also show how these ideas allow to compute the field exactly and from a link diagram. This is an earlier joint work with Walter Neumann.

Jun Ueki (Tokyo Denki University)
Chebotarev link is stably generic
When we study the analogy between knots and prime numbers in "arithmetic topology", it is a fundamental question to ask "what is the analogue of the set of all prime ideals of a number field in a 3-manifold?" In [NiiboUeki2018], the speaker constructed a "very admissible link" as a candidate in a 3-manifold, and described the idelic class field theory by summing up local theories to describe the global theory. Afterwards, Mihara gave a cohomological interpretation on it, and proposed a "stably generic link" refining our link so that we can study analogues of ray class fields in [Mihara2018]. On the other hand, McMullen proved in [McMullen2013] that the closed orbits of a pseudo-Anosov flow on a 3-manifold obeys the Chebotarev law in the sense of B. Mazur [Mazur2012], if ordered by length. For instance, the planetary link of the figure eight knot (or the Whitehead link or the Borromean rings) obeys the Chebotarev law, by Thurston's classification theorem. In addition, this infinite link contains all isotopy classes of links, due to the theory of universal template [Ghrist1993]. In this talk, we compare

these infinite links and prove that Chebotarev link is stably generic. In addition, as an example of Chebotarev phenomena, we study the decomposition types of knots in an analogue of a quintic field.

Ian Wagner (Emory University)
Harmonic Hecke eigenlines and Mazur's problem

We construct two families of harmonic Maass Hecke eigenforms. Using these families, we construct p-adic harmonic Maass forms in the sense of Serre. The p-adic properties of these forms answer a question of Mazur about the existence of an " eigencurve-type " object in the world of harmonic Maass forms.

Wataru Yuasa (Kyoto Univeristy)
Andrews-Gordon type identities for A_2 with one-row Young diagrams
In this talk, we derive Andrews-Gordon type identities for the $\mathfrak{sl}_3$ (false) theta functions via knot theory. The $\mathfrak{sl}_3$ tail of a link L is a limit of the $\mathfrak{sl}_3$ colored Jones polynomials $\{J_\lambda^{\mathfrak{sl}_3}(L)\}_{\lambda\in\Lambda}$ for Λ is a certain subset of two-row Young diagrams. For one-row Young diagrams $\Lambda = \{(n,0)\}$, we calculate two types of explicit formulae of $J_\lambda^{\mathfrak{sl}_3}(T(2,m))$ where $T(2,m)$ is a $(2,m)$-torus link and obtain two explicit formulae of its tail. They give the Andrews-Gordon type identities for Ramanujan (false) theta functions.