Low dimensional topology and number theory IX

March 15 - 18, 2017
AiRIMaQ Seminar Room, Innovation Plaza, Momochihama, Fukuoka, JAPAN

Program

March 15 (Wednesday)
9:30 ∼ 10:30
Toshie Takata (Kyushu University)
The slope conjecture and periodic construction

10:50 ∼ 11:50
Shunsuke Tsuji (The University of Tokyo)
Construction of an invariant for integral homology spheres

14:00∼ 15:00
Shinya Harada (The University of Tokyo)
Deformation varieties of hyperbolic two-bridge link complements and their zeta functions

15:20 ∼ 16:20
Megumi Takata (Kyushu University)
The infinite base change lifting associated to an APF extension of a mixed characteristic local field

March 16 (Thursday)
9:30 ∼ 10:30
Sakie Suzuki (Kyoto University, RIMS)
The universal quantum invariant and colored ideal triangulation

10:50 ∼ 11:50
Seidai Yasuda (Osaka University)
Ihara bracket for group schemes

14:00 ∼ 15:00
Nariya Kawazumi (The University of Tokyo)
The Kashiwara-Vergne problem and the Goldman-Turaev Lie bialgebra in genus zero

15:20 ∼ 16:20
Jinsung Park (Korea Institute for Advanced Study)
Reidemeister torsion, complex volume, and Zograf infinite product

March 17 (Friday)
9:30 ∼ 10:30
Yasushi Mizusawa (Nagoya Institute of Technology)
On pro-p link groups of number fields

10:50 ∼ 11:50
Jun Ueki (The University of Tokyo)
p-adic Mahler measure, entropy, and $\widehat{\mathbb{Z}}$-covers

14:00 ∼15:00
Eiko Kin (Osaka University)
Small asymptotic translation lengths of pseudo-Anosov maps on the curve complex

15:20 ∼ 15:40
Junhyeung Kim (Kyushu University)
On the foliation cohomology groups and dynamical zeta functions for surface bundles over S^1

15:50 ∼ 16:40
Masanori Morishita (Kyushu University)
Local symbols and the reciprocity law on foliated 3-manifolds

March 18 (Saturday)
9:30 ∼ 10:30
Takefumi Nosaka (Kyushu University)
Massey products of free groups and Milnor-Orr link invariants.

10:50 ∼ 11:50
Kazuo Habiro (Kyoto University, RIMS)
The Kontsevich integral for bottom tangles in handlebodies

14:00 ∼ 15:00
Tetsuya Ito (Osaka University)
On a structure of Dehn surgery along knots and LMO invariant

Abstract

Kazuo Habiro (Kyoto University, RIMS)
The Kontsevich integral for bottom tangles in handlebodies
Using the Kontsevich integral, we define a functor from the category $\mathcal{B}$ of bottom tangles in handlebodies to a category $\mathbf{A}$ of chord diagrams. This functor can be thought of as a (partial) refinement of the LMO functor on Lagrangian cobordisms. I also plan to explain the algebraic structure of the category $\mathbf{A}$. This is joint work with Gwenael Massuyeau.

Shinya Harada (The University of Tokyo)
Deformation varieties of hyperbolic two-bridge link complements and their zeta functions
After a brief survey on SL_2-character varieties and their zeta functions of hyperbolic 3-manifolds, I will talk on a work in progress about the deformation varieties attached to the canonical decompositions of certain hyperbolic two-bridge link complements and their zeta functions.

Tetsuya Ito (Osaka University)
On a structure of Dehn surgery along knots and LMO invariant
In this talk we use the LMO invariant to study a structure of Dehn surgery along a knot in S^3. Through a computation of the LMO invariant, we give various constraints for a knot to admit cosmetic surgery (Dehn surgery along the same knot with different slopes, yielding the same 3-manifold), or the Lens space surgeries.

Nariya Kawazumi (The University of Tokyo)
The Kashiwara-Vergne problem and the Goldman-Turaev Lie bialgebra in genus zero
In view of results of Goldman and Turaev, the free vector space over the free loops on an (connected) oriented surface has a natural Lie bialgebra structure. The Goldman bracket has a formal description by using a special (or symplectic) expansion of the fundamental group of the surface. It is natural to ask for a formal description of the Turaev cobracket. This Lie bialgebra is closely related to the mapping class group of the surface. In this talk we will show how to obtain a formal description of the Goldman-Turaev Lie bialgebra for genus 0 using a solution of the Kashiwara-Vergne problem. A similar result was recently obtained by Massuyeau using the Kontsevich integral. If time permits, I would like to discuss positive genus analogues of the result. This talk is based on

a joint work by A. Alekseev, N. Kawazumi, Y. Kuno and F. Naef.

Junhyeung Kim (Kyushu University)
On the foliation cohomology groups and dynamical zeta functions for surface bundles over S^1
C. Deninger initiated the cohomological study of the dynamical zeta function for a manifold which is equipped with a 1-codimensional foliation and the transversal flow. In this talk, we give concrete descriptions of the foliation cohomology and the dynamical zeta function for the simplest example, namely, a surface bundle over S^1. We also discuss some future problems.

Eiko Kin (Osaka University)
Small asymptotic translation lengths of pseudo-Anosov maps on the curve complex
We consider the mapping class groups on the closed surface S_g of genus g. We are interested in two invariants of pseudo-Anosov mapping classes. The one is the entropy (the logarithm of the stretch factor of the pseudo-Anosov map). The other is the asymptotic translation distance on the complex of curves. It is known that fixing the genus g, both invariants have minima. Furthermore the minimal entropies for S_g behaves like $1/g$ as g goes to infinity. On the other hand, the minimal asymptotic translation distance on the complex of curves for S_g behaves like $1/g^2$ as g goes to infinity. We describe a source of generating a sequence of pseudo-Anosov maps on S_g whose both invariants are small, i.e, the two invariants of the sequence behave like $1/g$ and $1/g^2$ respectively. This is a joint work with Hyunshik Shin (KAIST).

Yasushi Mizusawa (Nagoya Institute of Technology)
On pro-p link groups of number fields
As an analogue of a link group, we consider the Galois group of the maximal pro-p-extension of a number field with restricted ramification which is cyclotomically ramified at p, i.e, tamely ramified over the intermediate cyclotomic $\mathbb{Z}_p$-extension of the number field. In some basic cases, such a pro-p Galois group also has a Koch type presentation described by linking numbers and mod 2 Milnor numbers (Rédei symbols) of primes. Then the pro-2 Fox derivative yields a calculation of Iwasawa polynomials analogous to Alexander polynomials.

Masanori Morishita (Kyushu University)

Local symbols and the reciprocity law on foliated 3-manifolds
The theory of local symbols (Hilbert symbols, tame symbols) is a beautiful subject in number theory and algebraic geometry, and plays an important role in class field theory. In this talk, we introduce a local symbol on a foliated 3-manifold and show the reciprocity law. Our idea is to extend Deligne's interpretation of a tame symbol on a Riemann surface, by using Gomi-Terashima's higher dimensional holonomy of a smooth Deligne cocycle. Joint with Junhyeung Kim and Yuji Terashima.

Takefumi Nosaka (Kyushu University)
Massey products of free groups and Milnor-Orr link invariants.
TBA

Jinsung Park (KIAS)
Reidemeister torsion, complex volume, and Zograf infinite product
In this talk, I will explain a formula which expresses the Reidemeister torsion in terms of complex volume and Zograf infinite product for closed hyperbolic 3-manifold. This can be understood as an analogue of the corresponding formula of Zograf and McIntyre-Takhtajan for the regularized determinant of the hyperbolic Laplacian of compact Riemann surface.

Sakie Suzuki (Kyoto University, RIMS)
The universal quantum invariant and colored ideal triangulation
The Drinfeld double of a finite dimensional Hopf algebra is a quasi-triangular Hopf algebra with the canonical element as the universal R-matrix, and one can obtain a ribbon Hopf algebra by adding the ribbon element. The universal quantum invariant of framed links is constructed using a ribbon Hopf algebra. In that construction, a copy of the universal R-matrix is attached to each crossing, and invariance under the Reidemeister III move is shown by he quantum Yang-Baxter equation of the universal R-matrix. On the other hand, R. Kashaev showed that the Heisenberg double of a finite dimensional Hopf algebra has the canonical element (the S-tensor) satisfying the pentagon relation. In this talk we reconstruct the universal quantum invariant using the Heisenberg double, and extend it to an invariant for colored singular triangulations of topological spaces, especially for colored ideal triangulations of tangle complements. In this construction, a copy of the S-tensor is attached to each tetrahedron, and invariance under the colored Pachner (2; 3) moves is shown by the pentagon relation of the

S-tensor.

Megumi Takata (Kyushu University)
The infinite base change lifting associated to an APF extension of a mixed characteristic local field
Langlands conjectured that there is a nice correspondence between automorphic forms/representations and Galois representations of number fields. In the Langlands conjecture, the base change lifting is the counterpart on the automorphic side of the restriction functor on the Galois side. For a finite cyclic extension of a number field or a mixed characteristic local field, the lifting was constructed by Langlands for GL(2) and by Arthur-Clozel for GL(n). In this talk, we give such a lifting for a totally ramified $\mathbb{Z}_p$-extension of a mixed characteristic local field. By Kazhdan's theory of close fields, we can interpret this as an operation which maps an automorphic representation of GL(n) over a local field of mixed characteristic to that of positive characteristic.

Toshie Takata (Kyushu University)
The slope conjecture and periodic construction
The slope conjecture proposed by Garoufalidis asserts that the Jones slopes given by the sequence of degrees of the colored Jones polynomials are boundary slopes. We verify the slope conjecture for some non-adequate, periodic knots. This is a joint work with Kimihiko Motegi.

Shunsuke Tsuji (The University of Tokyo)
Construction of an invariant for integral homology spheres via Kauffman bracket skein algebras
Using an explicit formula for the action of the Dehn twist along a simple closed curve on the completed Kauffman bracket skein modules of the surface, we introduce an embedding of the Torelli group into the completed skein algebra. This embedding and a Heegaard splitting enable us to construct an invariant for an integral homology sphere which is an element of $\mathbb{Q}[[A+1]]$. This invariant induces a finite type invariant of order $n+1$ which is an element of $\mathbb{Q}[[A+1]]/((A+1)^n)$.

Jun Ueki (The University of Tokyo)
p-adic Mahler measure, entropy, and $\widehat{\mathbb{Z}}$-covers
My talk consists of two parts related to homology growth in $\mathbb{Z}$-covers of 3-manifolds. Let p be a fixed prime number.
(1) p-adic Mahler measure and $\mathbb{Z}$-covers of links.

An asymptotic formula of homology torsion growth with use of Mahler measure is well-known, and its p-adic refinement called the Iwasawa type formula is studied by Morishita and others. We introduce a p-adic analogue of Mahler measure imitating the Shnirel'man integral, and prove a p-adic analogue of the asymptotic formula. In addition, we give a balance formula among p-adic Mahler measure, Iwasawa mu-invariant, and Bowen's p-adic entropy.
(2) Profinite completions of knot groups determine Alexander polynomials.
It is interesting to ask what topological properties of knots are determined by the profinite completions of their knot groups; in other words, what the systems of finite quotients of knot groups know. By results of Hempel and Perelman, knot groups inject into their profinite completion. Grothendieck conjectured that such finitely generated groups would be determined by their profinite completions. However, counter examples were given by Bridson–Grunewald. We generalize results of Boileau–Friedl and Bridson–Reid by proving that the profinite completions of knot groups determine their Alexander polynomials. In the course of proof, we use Fried's theorem on cyclic resultant related to the Artin–Mazur zeta function of dynamical systems, and study modules over the completed group ring $\hat{\mathbb{Z}}[[t^{\hat{\mathbb{Z}}}]]$. Our method is suggested by a viewpoint of Arithmetic Topology.

Seidai Yasuda (Osaka University)
Ihara bracket for group schemes
TBA.