Low dimensional topology and number theory X

March 26 - 29, 2018
AiRIMaQ Seminar Rm, Innovation Plaza, Momochihama, Fukuoka, JAPAN

Program

March 26 (Monday)
9:30 ∼ 10:30
Takahiro Kitayama (The University of Tokyo)
Torsion polynomial functions and essential surfaces

10:50 ∼ 11:50
Thang Le (Georgia Institute of Technology)
The skein algebra of surfaces and hyperbolic TQFT

13:40∼ 14:40
Makoto Sakuma (Hiroshima University)
End invariants of $\mathrm{SL}(2;\mathbb{C})$ characters of the once punctured torus

15:00 ∼ 16:00
Masanobu Kaneko (Kyushu University)
Genus character L-functions of quadratic orders and class numbers

17:00 ∼ Buffet (casual, Italian)

March 27 (Tuesday)
9:30 ∼ 10:30
Hwajong Yoo (IBS, Center for Geometry and Physics, Postech)
Examples in arithmetic Chern-Simons theory

10:50 ∼ 11:50
Romyar Sharifi (University of California, Los Angeles)
Modular symbols and arithmetic

13:40 ∼ 14:40
Tomoki Mihara (Tokyo Institute of Technology)
Homotopy Theory for Metric Spaces

15:00 ∼ 16:00
Pavel Zalesskii (Universidade Brasilia)

The profinite colmpetion of 3-manifold groups

17:15 ∼ Banquet (Japanese)

March 28 (Wednesay)
9:30 ∼ 10:30
Tsukasa Ishibashi (The University of Tokyo)
Cluster Dehn twists in cluster modular groups

10:50 ∼ 11:50
Jun Murakami (Waseda University)
On a q-deformation of PSL(2) representations of knot groups

13:40 ∼14:40
Yoshitaka Hachimori (Tokyo University of Science)
Functional equations and positively ramified extensions

15:00 ∼ 16:00
Zdzislaw Wojtkowiak (Universié de Nice)
A weak analogue of the Euler formula for l-adic Galois double zeta values

March 29 (Thursday)
9:30 ∼ 10:30
Koichiro Sawada (RIMS, Kyoto University)
Finiteness of isomorphism classes of hyperbolic polycurves with prescribed fundamental groups

10:50 ∼ 11:50
Benjamin Collas (Universitat Bayreuth)
Arithmetics of Moduli Spaces of Curves and Topological Approaches

13:40 ∼ 14:40
Katsumi Ishikawa (RIMS, Kyoto University)
A link-homotopy invariant for surface links

15:00 ∼ 16:00
Kent Orr (Indiana University)
Transfinite 3-manifold invariants and a problem of John Milnor

Abstract

Benjamin Collas (Universitat Bayreuth)
Arithmetics of Moduli Spaces of Curves and Topological Approaches
The moduli stack of curves are endowed with two stratifications, a divisorial one induced by the Knudsen morphisms in the stable compactification, and a stack one induced by the automorphism of curves. They both encapture some remarkable arithmetical and combinatorial properties, which are the core of Grothendieck-Teichmüller theory, i.e. the study of the absolute Galois group of rational in terms of topology. The goal of this talk is to present how Grothendieck-Teichmüller theory – combined with group properties of the mapping class groups, and with homotopy properties of operads – leads to a better understanding of these arithmetics, as well as some promising research lines.

Yoshitaka Hachimori (Tokyo University of Science)
Functional equations and positively ramified extensions
We discuss functional equations of some elements in Iwasawa algebras, arising from the theory of positively ramified extensions which was developed by Alexander Schmidt.

Tsukasa Ishibashi (The University of Tokyo)
Cluster Dehn twists in cluster modular groups
A cluster modular group, which is introduced by Fock-Goncharov, is an automorphism group of a cluster algebra. The cluster modular group acts on a pair (A, X) of contractible manifolds called a cluster ensemble. These objects are associated with a combinatorial data called a seed. For the seed associated with an ideal triangulation of a punctured surface, it is known that cluster modular group=the (tagged) mapping class group, A = the decorated Teichmuller space, X = the enhanced Teichmuller space. Taking a suitable seed, we can also describe various objects: double Bruhat cells of algebraic groups, canonical bases of quantum groups, higher Teichmuller spaces, and so on. In this talk, we introduce the concept of "cluster Dehn twists" for a general cluster modular group, which is a generalization of Dehn twists and half-twists in the mapping class group of a surface. We show that orbits of the action of a cluster Dehn twist on the A-space have the similar asymptotic behavior as those of (half) Dehn twists. Moreover, for several seeds of finite mutation type, we show that the corresponding cluster modular group is generated by cluster Dehn twists. It is a generalization of the classical fact that the mapping class group of a surface is generated by

Dehn twists and half-twists.

Katsumi Ishikawa (RIMS, Kyoto University)
A link-homotopy invariant for surface links
A surface link is an oriented closed (not necessarily connected) surface smoothly embedded in the 4-sphere. Any 2-link, i.e. a surface link with all components being 2-spheres, is known to admit a link homotopy which pulls the 2-spheres apart, but we know only a little about homotopy classification of other surface links: for example, we have only a few link-homotopy invariants for them. In this talk, we introduce a link-homotopy invariant for surface links as a refinement of the asymmetric linking number. This is a surface-link version of Milnor's link-homotopy invariant for 1-links, and the triple linking number is calculated from it. This invariant works well for homotopy classification and the speaker expects it to detect the null-homotopy surface links.

Masanobu Kaneko (Kyushu University)
Genus character L-functions of quadratic orders and class numbers
For general quadratic orders, the genus character L-functions are explicitly computed. As an application, we generalize a formula due to Hirzebruch and Zagier which expresses the class number of imaginary quadratic fields in terms of continued fraction expansion. This is a joint work with Yoshinori Mizuno.

Takahiro Kitayama (The University of Tokyo)
Torsion polynomial functions and essential surfaces
We will discuss an application of torsion invariants to an extension of the Culler-Shalen construction of essential surfaces in a 3-manifold. The coefficients of twisted Alexander polynomials of a 3-manifold induce functions on its SL_n-character variety. We will describe how the homology class of an essential surface given by an ideal point is restricted by regularity of the function of the highest degree.

Thang Le (Georgia Institute of Technology)
The skein algebra of surfaces and hyperbolic TQFT
The skein algebra of surface has close relations to the character variety and the quantum Teichmüller space; it serves as a bridge between quantum topology and classical topology. We will discuss representations of the skein algebra and show how they can be used to potentially construct a hyperbolic TQFT.

Tomoki Mihara (Tokyo Institute of Technology)
Homotopy Theory for Metric Spaces
This is a joint work with Frederic Paugum. By a technique by Nikolai Durov, metric spaces are regarded as normed infinity groupoids. Using the identification, I formulate homotopy theory for metric spaces in terms of normed infinity category theory.

Jun Murakami (Waseda University)
On a q-deformation of PSL(2) representations of knot groups
In this talk, I would like to explain an idea to construct a q-deformation of PSL(2) representations of knot groups. The main tool is the braided quantum group BSL(2) constructed by S. Majid. The knot group is given by Wirtinger presentation, which is interpreted as a conjugate quandle. Here we construct a braided version of the conjugate quandle, and then associate the braided quantum group to the dual of the braided conjugate quandle., and then explain how the braided conjugate quandle relate to a knot diagram. This is joint with Roland van der Veen.

Kent Orr (Indiana University)
Transfinite 3-manifold invariants and a problem of John Milnor
In the mid-1950s, Milnor introduced his link invariants, a vast and profound extension of the classical the linking number. His examples, results, and a seminal list of problems have driven decades of research. One of Milnor's original questions remains unresolved. How can one extract a version of Milnor's invariants from the transfinite lower central series. We present a solution to this problem for 3-manifolds, developing transfinite invariants and realizing non-trival values.

Makoto Sakuma (Hiroshima University)
End invariants of $\mathrm{SL}(2;\mathbb{C})$ characters of the once punctured torus
By extending the concept of a geometrically infinite end of a Kleinian group, Bowditch introduced the notion of the end invariants of a type-preserving $\mathrm{SL}(2;\mathbb{C})$ character of the once punctured torus. Tan, Wong and Zhang extended this notion (with slight modification) to an arbitrary $\mathrm{SL}(2;\mathbb{C})$-character of the once punctured torus. In this talk, I will give an explicit description of the set of end invariants of the $\mathrm{SL}(2;\mathbb{C})$ characters of the once punctured torus corresponding to the holonomy representations of hyperbolic 2-bridge links. I will also explain a natu-

ral variation of the ending lamination conjecture, and present a possible approach to the conjecture for those characters corresponding to hyperbolic 2-bridge links. This talk is based on my joint work with Donghi Lee.

Koichiro Sawada (RIMS, Kyoto University)
Finiteness of isomorphism classes of hyperbolic polycurves with prescribed fundamental groups
A hyperbolic polycurve is a successive extension of families of hyperbolic curves, which have been regarded as a typical example of "an anabelian variety". In other words, roughly speaking, a hyperbolic polycurve over a certain type of a field may be completely determined by its arithmetic fundamental group. In this talk, we show that a hyperbolic polycurve is determined by its arithmetic fundamental group up to finitely many possibilities.

Romyar Sharifi (University of California, Los Angeles)
Modular symbols and arithmetic
In this talk, I will explain a conjectural connection between modular symbols modulo an Eisenstein ideal and values of Steinberg symbols of cyclotomic units. I will then discuss recent developments in a program which has arisen from this.

Zdzislaw Wojtkowiak (Universié de Nice)
A weak analogue of the Euler formula for l-adic Galois double zeta values
The fact that the double zeta values $\zeta(n,m)$ can be written as a sum of products of two zeta values $\zeta(a)\zeta(a)$ and of $\zeta(n+m)$, whenever $n+m$ is odd, is due to Euler. We shall show the weak version of this result for the l-adic Galois realization.

Hwajong Yoo (Universie de Nice)
Examples in arithmetic Chern-Simons theory
We introduce a basic idea behind of arithmetic Chern-Simons theory. Then, we compute the arithmetic Chern-Simons invariants in some cases using decomposition formula. As an application, we give a short proof of non-existence of certain quaternion extensions of the rational number field.

Pavel Zalesskii (Universidade Brasilia)

The profinite colmpetion of 3-manifold groups
We shall present structural results of the profinite completion $\widehat{G}$ of a 3-manifold group G and its interrelation with the structure of G. Residual properties of G also will be discussed.