KOOK-TAPU Workshop of Knots in Tsushima Island

Conference Place: Tsushima City Koryu Center (TIARA)

Abstract

September 6, 2016

9:30-10:00 Fumikazu Nagasato (Meijo University) *Ghost characters, character varieties and abelian knot contact homology*

We will show a mechanism relating the character varieties of the 2-fold branched covering $\Sigma_2 K$ of 3-sphere branched along a knot K with the abelian knot contact homology, through meridionally trace-free characters and ghost characters of a knot. Then using Shinnosuke Suzuki's calculations for the SL(2,C) - representations of the fundamental group of $\Sigma_2 K$, we will discuss Ng's conjecture concerned with the abelian knot contact homology.

10:05-10:25 Shinnosuke Suzuki (Meijo University) *On the SL(2,C) -representations of the fundamental group of the 2-fold branched covering of 3-sphere branched along a knot*

We will calculate concretely the fundamental group of the 2-fold branched covering of 3-sphere branched along a certain knot. Then we will discuss a relationship of its SL(2,C) -representations and ghost characters.

10:30-11:00 Sang Youl Lee (Pusan National University) *Ideal coset invariants for surface-links via Kauffman bracket polynomial*

A surface-link is a closed 2-manifold smoothly embedded in four space. A marked graph diagram is a link diagram possibly with some marked 4-valent vertices. It is known that a surface-link can be described by a marked graph diagram modulo Yoshikawa moves. In this talk, I would like to discuss the Kauffman bracket ideal coset invariant for surface-links and oriented surface-links.

11:05-11:25 Kodai Wada (Waseda University) *Milnor's link-homotopy invariants*

Milnor defined two kinds of link-homotopy invariants $\overline{\mu}$ and μ^*. By definition it would seem that the μ^*-invariant is weaker than the $\overline{\mu}$-invariant. In this paper we show that this is indeed the case by giving an example of length greater than 4 where $\overline{\mu} = 1$ and $\mu^* = 0$. For non-repeated sequences of length not greater than 4, Milnor has shown that $\overline{\mu} = \mu^*$.

11:30-12:00 Ayumu Inoue (Aichi University of Education) *A subspecies of region crossing change, region freeze crossing change*

Region crossing change is a local move on a link diagram. In this talk, we introduce a variety of region crossing change, named region freeze crossing change. We study similarity and difference between region crossing change and region freeze crossing change. This is a joint work with Ryo Shimizu.

13:30-14:00 Yasutaka Nakanishi (Kobe University) *Differences of Alexander polynomials for knots caused by a single crossing change, II*

In the previous work with Okada, we gave a characterization of Alexander polynomials for knots which are transformed into the 10_132 knot (and the 5_1 knot) by a single crossing change. In this talk, we will give a characterization of Alexander polynomials for knots which are transformed into the 8_{20} knot by a single crossing change. Then, we will show the Gordian distance between the two knots 4_1 and 8_{20} is two.

14:05-14:25 Geunyoung Kim (Pusan National University) *On construction of Dunwoody 3-manifolds*

Let F_n be the free group on free generators $x_0, x_1, \ldots, x_{n-1}$. Let $\theta : F_n \to F_n$ be the automorphism for which $\theta(x_i) = x_{i+1}, i = 0, 1, \ldots, n-2; \theta(x_{n-1}) = x_0$. For a given word $w \in F_n$, define $G_n(w) = F_n/R$, where R is the normal closure in F_n of the set $\{w, \theta(w), \theta^2(w), \ldots, \theta^{n-1}(w)\}$. A group G is said to have a *cyclic presentation* if G is isomorphic to $G_n(w)$ for some $n \geq 1$ and $w \in F_n$. In 1995, M. J. Dunwoody introduced a method of constructing closed 3-manifolds admitting cyclic presentations for their fundamental groups. In this talk, I would like to discuss the Dunwoody's construction and some remarks.

14:30-15:00 Reiko Shinjo (Kokushikan University) *On coherent and incoherent regions of an oriented knot diagram*

A face of an oriented knot diagram on the two sphere is called a coherent (resp. an incoherent) region if the orientation of its boundary is coherent (resp. incoherent). In this talk, we investigate the number of the coherent (resp. incoherent) regions of a spacial diagram, and give some relation with the braid index (resp. canonical genus) of a knot. We also characterize the knots having a special diagram with less than five coherent regions. This is a joint work with Kokoro Tanaka (Tokyo Gakugei University).

15:25-15:45 Sera Kim (Pusan National University) *Applications of the Index values for Knotoids*

In 2012, V. Turaev introduced a *knotoid diagram* which is an open diagram with two endpoints. A *knotoid* is then defined as the equivalence class of knotoid diagrams under the Reidemeister moves. In 2010, A. Henrich defined a polynomial invariant of virtual knots by vanishing classical crossings, which is now called the *index polynomial*. In this talk, I'd like to discuss how to construct Gauss code diagrams for knotoid diagrams and define the index values for classical crossings of knotoid diagrams by using their Gauss diagrams. Also, I'd like to give new definition for virtual knots from virtual knotoids and consider the relationship between the height of a knotoid and its index value. This is a joint work with Y. H. Im.

15:50-16:10 **Suhyeon Jeong** (Pusan National University) *Jones-type invariants for knots and links from the six vertex model*

At the beginning of the 1980s, V. F. R. Jones discovered a polynomial invariant for classical knots and links which is called the Jones polynomial. It was shown that the Jones polynomial is closely related to the partition functions of exactly solvable models of statistical mechanics. In this talk, I would like to discuss how to recover the Jones polynomial from the partition function of exactly solvable six vertex model and its generalization to a series of Jones-type invariants for knots and links. We also discuss unitary solutions to the Yang-Baxter equation in dimension four given by H. A. Dye.

16:15-16:35 **Hun Lee** (Kyungpook National University) *On colorability of Sums of n-Tangles*

An n-tangle diagram in knot or link projection is a region in the projection plane surrounded by a circle such that there is the disjoint union of n arcs into the circle. In this talk, we will define colorability of an n-tangle diagram and introducethe sums of n-tangles. Also, we will study how colorability of T_1 and T_2 effects on colorability of their sums.

16:40-17:10 **Teruhisa Kadokami** (Kanazawa University) *Three amphicheiralities of a virtual link*

We define three amphicheiralities for a virtual link by using its geometric realization.

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9:30-10:00 **Kazuhiro Ichihara** (Nihon University) *Minimal coloring number for $\mathbb{Z}$-colorable links*

For a link with zero determinant, a $\mathbb{Z}$-coloring is defined as a generalization of the well-known Fox coloring. In this talk, I will consider the minimal number of colors appearing in non-trivial $\mathbb{Z}$-colorings. In fact, several sufficient conditions for non-splittable $\mathbb{Z}$-colorable links to have the least minimal coloring number will be given. This talk is based on a joint work with Eri Matsudo (Nihon University).

10:05-10:25 **Shun Yoshiike** (Nihon University) *Unknotting twist knots by forbidden moves*

It is known that any knots and virtual knots can be deformed to the trivial knot by Reidemeister moves, virtual Ridemeister moves and forbidden moves. The number of forbidden moves needed to deform a knot to the trivial knotis called the forbidden number of the knot. I will report a result which improves known upper bounds on the forbidden number of twist knots. In particular, the forbidden number of the trefoil knot is shown be at most three.

10:30-11:00 Jieon Kim (Osaka City University, JSPS) *Marked graph diagrams of immersed surface-links*

An immersed surface-link is the image of the disjoint union of oriented surfaces in the 4-space $\mathbb{R}^4$ by a smooth immersion. By using normal forms of cobordisms introduce by A. Kawauchi, T. Shibuya, and S. Suzuki, we introduced normal forms of immersed surface-links. In this talk, we introduce marked graph diagrams of immersed surface-links, and moves for the marked graph diagrams. This is a joint work with S. Kamada and A. Kawauchi.

11:05-11:25 Megumi Hashizume (Nara Women's University) *Link version of Inoue-Shimizu's result on region crossing change*

Recently, a new local transformation on link diagram called region freeze crossing change is proposed as a mutant of region crossing change. It is known that any change of crossings on any knot diagram can be realized as a region crossing change. Inoue-Shimizu showed there is a knot diagram such that some change of crossings can NOT be realized by region freeze crossing change. They showed necessary and sufficient condition for the exchangeability of any given crossing of the knot diagram via region freeze crossing change. In this talk, we discuss about a generalization of this result for links.

11:30-12:00 Kokoro Tanaka (Tokyo Gakugei University) *The canonical genus of Whitehead doubles of non-prime alternating knots*

The canonicai genus of a Whitehead double of a knot is less than or equal to its crossing number. Tripp observed that the equality holds for 2-braid knots and conjectured that the equality holds for all knots. However, Jang and Lee found counterexamples for this conjecture. In this talk, we discuss this conjecture for non-prime alternating knots.

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9:30-10:00 Shin Satoh (Kobe University) *A construction of stable classes of ribbon surface-knots from non-ribbon surface-knots*

Two orientable surface-knots and -links are stably equivalent if they are ambient isotopic in 4-space up to adding or deleting trivial 1-handles. We denote by S and Σ the set of surface-knots/-links and that of stable equivalence classes of ribbon surface-knots/-links, respectively. In this talk, we construct a map $\omega : S \to \Sigma$ and study its several properties. In particular, we prove that $\omega(K) = [K]$ if K is ribbon, K and $\omega(K)$ has the same knot quandle, and $\omega(K\#K') = \omega(K)\#\omega(K')$. We also demonstrate that $\omega(K)$ for the 2-twist-spun trefoil knot K is represented by a certain ribbon T^2-knot.

10:05-10:25 Takato Minamino (Kobe University) *Local moves and odd writhes for virtual knots*

It is known that the crossing change is a non-unknotting operation for virtual knots. Therefore any local move realized by the crossing change is a non-unknotting operation for virtual knots. In this talk, we introduce the “doubled” forbidden move which is not realized by the crossing change. We prove that it is a non-unknotting operation for virtual knots. To prove this theorem, we give a relationship between the local move and the odd writhe.

10:30-10:50 Seonmi Choi (Kyungpook National University) *A decomposition of finite quandles and their rack homology groups*

A quandle is a set equipped with a binary operation satisfying three quandle axioms and it also can be expressed as a sequence of permutations of the underlying set satisfying two conditions. A decomposition of finite quandles was studied by Nelson, Wong, Ehrman, Gurpinar, Thibault and Yetter. For two finite quandles Q and Q', one can defince a new operation $*$ on $Q \cup Q'$ whose restrictions on Q and Q' are the original quandle operations on Q and Q', respectively. In this talk, we will study a rack homology group of $(Q \cup Q', *)$.

11:00-11:30 Hirotaka Akiyoshi (Osaka City University) *Ford and Dirichlet domains for the torus with a single cone point*

A cone hyperbolic structure σ on the torus with a single cone point T is canonically extended to a cone hyperbolic structure $\hat{\sigma}$ on $T \times I$. We discuss the relation between the Dirichlet domain for σ and the Ford domain for $\hat{\sigma}$.

13:30-14:00 Takuji Nakamura (Osaka Electro-Communication University) *On the minimum number of colors on Fox colorings for knots*

The n-colorability of knots introduced by Fox is one of the elementary notion in knot theory. For an n-colorable knot K, $\mathrm{C}_n(K)$ stands for the minimum number of distinct colors used over all nontrivial n-colorings of K. Since three colors are always required for any nontrivial 3-colorings, we see that $\mathrm{C}_3(K) = 3$ for any 3-colorable knot K. In this talk, we review several studies of $\mathrm{C}_n(K)$, and give a recent result for $\mathrm{C}_n(K)$ of n-colorable torus knots. This talk based on joint works with Yasutaka Nakanishi and Shin Satoh (Kobe University).

14:05-14:25 Jihee Kim (Pusan National University) *A description of the index polynomial and the odd writhe invariants for virtual knots using Gauss diagrams*

L. H. Kauffman introduced a fundamental invariant for a virtual knot which is called the odd writhe. There are several generalizations of the odd writhe, such as the index polynomial and the odd writhe polynomial. S. Satoh defined the n-writhe for each non-zero integer n, which unifies these invariants, and study various properties of the n-writhe. In this talk, I would like to introduce a description of the index polynomial and the n-writhe invariants for virtual knots using Gauss diagrams.

14:30-15:00 **Inasa Nakamura** (University of Tokyo) *Unbraiding 2-dimensional braids by an addition of 1-handles with chart loops*

A 2-dimensional braid over an oriented surface-knot F is a surface in the form of a simple branched covering over F. A 2-dimensional braid is presented by a certain graph called a chart on a surface diagram of F. We consider 2-dimensional braids obtained by an addition of 1-handles equipped with chart loops. We show that an addition of 1-handles with chart loops is an unbraiding operation.

15:25-15:45 **Byeorhi Kim** (Kyungpook National University) *An intrinsic topology on a quandle*

Let Q be a quandle and A a subset of Q. Let $c(A)$ denote the smallest connected subqundle of Q containing A. Then c satisfies Kuratowski closure axioms and hence induces a topology $\mathfrak{T}$ for Q. In this talk, we will study properties of the topological space $(Q, \mathfrak{T})$.

15:50-16:10 **Yongjae Park** (Kyungpook National University) *On the invertibility of (n, n)-tangles*

An (n, n)-tangle is an embedding of n arcs into a 3-ball without circle components. For given (n, n)-tangles T and T', we will define the product $T \bullet T'$ which is also an (n, n)-tangle. In this talk, we will study conditions of T in which there exists an (n, n)-tangle T' such that the closure of $T \bullet T'$ is the trivial link.

16:15-16:35 **Hyeran Cho** (Pusan National University) *On* $(1, 1)$ *decomposition of knots*

In 1995, M. J. Dunwoody introduced a class of closed 3-manifolds, depending on six integer parameters, admitting cyclic presentations for their fundamental groups. It has been shown that all these 3-manifolds turn out to be strongly-cyclic branched coverings of $(1, 1)$-knots in lens spaces, possibly the 3-sphere S^3. In this talk, I would like to discuss this relationship between Dunwoody 3-manifolds and $(1, 1)$-knots and also give some remarks on recent study on $(1, 1)$ decomposition of knots.

16:40-17:10 **Akio Kawauchi** (Osaka City University) *On Hosokawa polynomial of a link, dedicated to the memory of Professor Fujitsugu Hosokawa*

The torsion Hosokawa polynomial of a link is a generalization of the original Hosokawa polynomial of a link, which is modified to be a non-zero one-variable Laurent polynomial. After a characterization of the Hosokawa polynomial and the torsion Hosokawa polynomial, it is shown how the torsion Hosokawa polynomial is used for a link cobordism and an immersed link cobordism.