The 13th KOOK-TAPU Joint Seminar on Knots and Related Topics and The 15th Graduate Student Workshop on Mathematics

Program of The 13th KOOK-TAPU Joint Seminar on Knots and Related Topics

July 26 (Tue)

9:20–9:30 Opening remarks

(Chair: Wataru Yuasa)
9:30–10:00 **Sam Nelson** (Claremont McKenna College)
Biquandle Bracket Quivers

10:10–10:40 **Jieon Kim** (Pusan National University)
Symmetric biquandle cocycle invariants for unoriented links and surface-links

(Chair: Sam Nelson)
10:50–11:20 **Wataru Yuasa** (OCAMI/RIMS)
State-clasp correspondence for skein algebras

11:30–12:00 **Seongjeong Kim** (Jilin University)
On parity-like invariant for knots in $S_g \times S^1$

July 27 (Wed)

(Chair: Yeonhee Jang)
9:30–10:00 **Seung Yeop Yang** (Kyungpook National University)
Homology theories of distributive structures: computations

10:10–10:40 **Erika Kuno** (Osaka University)
Gromov hyperbolicity of nonseparating curve graphs for nonorientable surfaces

(Chair: Seung Yeop Yang)
10:50–11:20 **Byeorhi Kim** (POSTECH)
On research related to 4-dimensional light bulb theorem

11:30–12:00 **Yeonhee Jang** (Nara Women's University)
On keen bridge splittings

July 28 (Thu)

(Chair: Sang Youl Lee)
9:30–10:00 **Tetsuya Abe** (Ritsumeikan University)
Ribbon concordance and the minimality of tight fibered knots

10:10–10:40 **Seonmi Choi** (Kyungpook National University)
On marked graph mosaics

(Chair: Tetsuya Abe)
10:50–11:20 **Hirotaka Akiyoshi** (Osaka Metropolitan University)
An extension of Ford domain

11:30–12:00 **Sang Youl Lee** (Pusan National University)
Dibiquandles and invariants for oriented dichromatic links

12:30–12:40 Closing remarks

Program of The 15th Graduate Student Workshop on Mathematics

July 26 (Tue)

13:20–13:30 Opening remarks

13:30–14:30 (Chair: Hirotaka Akiyoshi)

Ryo Takenaka (Osaka Metropolitan University)
Fermionic form of character formulas for affine Lie algebras

Suhyeon Jeong (Pusan National University)
Invariants for pseudo-links derived from Goeritz matrices

Sadaf Habibi (Osaka City University)
Applications of p-harmonic transplantation for functional inequalities

Jinseok Oh (Kyungpook National University)
On set-theoretic Yang-Baxter cohomology of a certain family of Alexander biquandles

14:45–15:45 (Chair: Seongjeong Kim)

Minju Seo (Pusan National University)
A polynomial invariant for pseudo-links

Katsunori Arai (Osaka University)
Groupoid racks and spatial surfaces

Hongdae Yun (Kyungpook National University)
A geometric realization of the extreme Khovanov homology of a pretzel link

Hajime Kubota (Kyoto University)
The knot concordance invariant Υ using grid homology

16:00–17:00 (Chair: Byeorhi Kim)

Hyobeen Kim (Kyungpook National University)
The complexity dichotomy for matroid-homomorphism

Kanako Oie (Nara Women's University)
Uniqueness of prime decomposition of 3-manifolds

Sanghoon Park (Pusan National University)
On the Gordon-Litherland pairing for links in thickened surfaces

Jumpei Yasuda (Osaka University)
A note on the plat index for surface-links

July 27 (Wed)

13:30–14:30 (Chair: Jieon Kim)

Jihyeon Lee (Pusan National University)
Rigidity theorems of λ-translating solitons

Unhou Kin (Nagoya City University)
pseudo Goeritz matrix of twisted knot

Hyungtae Baek (Kyungpook National University)
Some properties of S-strong Mori modules

Haruki Yoshimura (Osaka City University)
On a deformation of a cubical complex

14:45–15:45 (Chair: Erika Kuno)

Moemi Hiraki (Nagoya City University)
A virtualized skein relation for a multivariable polynomial under some conditions

Da Bin Park (Kyungpook National University)
Recovering of the initial values from light cone trace of solutions of the fractional wave equation

Fumika Mizoguchi (Osaka City University)
Nilpotent Lie algebras obtained by quivers and Ricci solitons

Youjin Lee (Pusan National University)
Data analysis and prediction of testing process in medical laboratory via machine learning

16:00–17:00 (Chair: Seonmi Choi)

Youn Jeong Oh (Kyungpook National University)
Graph Convolutional Neural Networks with modules that enable graph analysis more globally

Minami Matsumura (Nagoya City University)
An n-writhe for twisted knots

Jia Lijiao (Pusan National University)
Dynamic complexity of a three-dimensional host-parasitoids model with Logistic growth function

Yuta Taniguchi (Osaka University)
Surface knot invariants obtained from a quandle 2-cocycle

July 28 (Thu)

12:10–12:30 Awards Ceremony

12:30–12:40 Closing remarks

Abstracts of The 13th KOOK-TAPU Joint Seminar on Knots and Related Topics

---

Tetsuya Abe (Ritsumeikan University)
Ribbon concordance and the minimality of tight fibered knots

Agol proved that ribbon concordance forms a partial ordering on the set of knots in the 3-sphere. In this talk, we prove that a tight fibered knot, such as a torus knot, is minimal in the partially ordered set. This result gives a supporting evidence for a generalization of the slice-ribbon conjecture. This is joint work with Keiji Tagami.

Hirotaka Akiyoshi (Osaka Metropolitan University)
An extension of Ford domain

The canonical decomposition of a noncompact hyperbolic manifold of finite volume with a single cusp is defined by Epstein and Penner. For 3-dimensional manifolds, it is used by the computer software SnapPea due to Weeks, and known to be very much effective to understand the properties of manifolds. The construction is applied to infinite volume manifolds and the resulting decomposition is called the EPH-decomposition. It is known that the canonical decomposition (reps. a subcomplex of the EPH-decomposition) for a finite (resp. infinite) volume manifold is dual to the Ford domain, which is another canonical fundamental domain. In this talk the definition of Ford domain is extended to produce a convex set dual to the EPH-decomposition.

Seonmi Choi (Kyungpook National University)
On marked graph mosaics

In 2008, Lomonaco and Kauffman introduced a knot mosaic system to define a quantum knot system. In 2014, Kuriya and Shehab proved Lomonaco-Kauffman conjecture which means that knot mosaic type is a complete invariant of tame knots. The mosaic number of a knot K is the smallest integer n for which K can be represented on an $n \times n$ mosaic board. In this talk, we define a mosaic system for surface-links using marked graph diagrams and study the mosaic number of surface-links. This talk is based on a joint work with Sam Nelson.

Yeonhee Jang (Nara Women's University)
On keen bridge splittings

In this talk, we extend the concept of (strong) keenness for Heegaard splittings to bridge splittings, and show that, for any integers $n \geq 1$, $g \geq 0$ and $b \geq 1$ except for $(g, b) = (0, 1)$, and $(g, b, n) = (0, 3, 1)$, there exists a strongly keen (g, b)-splitting of a link with distance n. We also show that any $(0, 3)$-splitting of a link with distance 1 cannot be keen.

Byeorhi Kim (POSTECH)
On research related to 4-dimensional light bulb theorem

The classical light bulb trick states that a knot smoothly embedded in $S^2 \times S^1$ that intersects a $S^2 \times \{y\}$ transversally exactly one point is isotopic to the standard vertical curve. In 2020, David Gabai generalized the classical light bulb trick to 4-dimensions. In this talk, we will give an overview Gabai ' s 4-dimenstional light bulb theorem and other results introduced after Gabai. We also discuss our result progress on isotopy of immersed 2-sphere.

Jieon Kim (Pusan National University)
Symmetric biquandle cocycle invariants for unoriented links and surface-links

A quandle is a non-empty set with a binary operation with conditions derived from Reidemeister moves. A quandle can be generalized to a biquandle, which is a non-empty set with two binary operations. When we define invariants of (surface-)links by using quandles or biquandles, we use orientations of (surface-)links. In this reason, it is difficult to define invariants for non-orientable surface-links by using (bi)quandles. In 2009, Kamada and Oshiro constructed symmetric quandles, a quandle with a map called a good involution, which give cocycle invariants for unoriented (surface-)links.

In this talk, we define symmetric biquandles analogously to the symmetric quandles and introduce symmetric biquandle (co)homology and symmetric biquandle cocycle invariants for unoriented links and surface-links. This is a joint work with Sang Youl Lee.

Seongjeong Kim (Jilin University)
On parity-like invariant for knots in $S_g \times S^1$

Because of the definition of fibered links, one can obtain a knot K in $\Sigma_L \times S^1$ from a classical link $K \cup L$, where L is a fibered link and Σ_L is a Seifert surface of L. K in $\Sigma_L \times S^1$ has a geometric property coming not only from the underlying surface Σ_L but also S^1. In this talk, we will discuss about knots in $S_g \times S^1$ where S_g is an oriented surface with genus g. We introduce basic notions for knots in $S_g \times S^1$, for example, diagrams, moves for diagrams and so on. For knots in $S_g \times S^1$ technically we lose over/under information. But we will have information how many times the half of the knot at a crossing rotates along S^1. We introduce the parity-like invariant induced from the number of rotation of a half at a crossing and discuss about universal object for the parity-like invariant.

Erika Kuno (Osaka University)
Gromov hyperbolicity of nonseparating curve graphs for nonorientable surfaces

Curve graphs are often used to study mapping class groups of surfaces. A full subgraph of a curve graph that consists of all vertices represented by the nonseparating curves is called the nonseparating curve graph. After Masur–Minsky in 1999 proved that the curve graphs of orientable surfaces are Gromov hyperbolic, various studies about the Gromov hyperbolicity for curve graphs have progressed. In 2020, Rasmussen proved that the nonseparating curve graphs of orientable surfaces are Gromov hyperbolic with a hyperbolicity constant which is independent of the topological types of orientable surfaces. In this talk, we generalize the result by Rasmussen to nonorientable surfaces, and in particular we would like to discuss about differences from the case of orientable surfaces.

Sang Youl Lee (Pusan National University)
Dibiquandles and invariants for oriented dichromatic links

A *knot* is a smooth simple closed curve in three-dimensional space and the disjoint union of n knots is called an *n-component link*. A link with different colors (labels) for each component is called a *dichromatic link*. Usually, the two colors (labels) are represented by "1" and "2". A special class of dichromatic links is a class of links in the solid torus $S^1 \times D^2$. So far, many invariants for classical links have been generalized to those of dichromatic links. In this talk, we introduce an algebraic structure called a *dibiquandle* which is a set equipped with four quandle operations satisfying certain conditions. We discuss various examples and some properties of dibiquandles and also show that a dibiquandle enables us to distinguish oriented dichromatic links by showing that the number of their all possible colorings are different when their arcs are colored by elements of the dibiquandle. This is a joint work of J. Kim and M. I. Sheikh.

Sam Nelson (Claremont McKenna College)
Biquandle Bracket Quivers

Biquandle brackets are skein invariants for biquandle-colored oriented knots and links. Examples include the classical skein invariants as well as the biuqandle and quandle 2-cocycle invariants. Biquandle coloring quivers are directed graph-valued invariants of oriented knots and links associated to sets of endomorphisms of a finite biquandle. Biquandle bracket quivers unite these two ideas to obtain an infinite family of categorifications of biquandle bracket invariants, including new categorifications of the Jones polynomial quite different from Khovanov homology. This is joint work with Pia Cosma Falkenburg.

Seung Yeop Yang (Kyungpook National University)
Homology theories of distributive structures: computations

Since C. S. Peirce emphasized the importance of self-distributivity in algebraic structures in 1880, these structures have been actively studied by a number of scholars, including Mayer, Toyoda, Bruck, Galkin, etc. While homology theories of associative structures, such as groups and rings, have been extensively studied, starting with the work of Eileenberg and Hochschild, it has not been long since the study of homology theories of non-associative distributed structures began to be active. In this talk, we discuss what we are currently studying about homology theories of non-associative distributed structures.

Wataru Yuasa (OCAMI/RIMS)
State-clasp correspondence for skein algebras

For an oriented surface Σ with marked points $\mathbb{M} \subset \partial\Sigma$ and boundary intervals $\mathbb{B}$, we introduce the stated $\mathfrak{g}$-skein algebra $\mathscr{S}_{\mathfrak{g}}(\Sigma, \mathbb{B})$ and the clasped $\mathfrak{g}$-skein algebra $\mathscr{S}_{\mathfrak{g}}(\Sigma, \mathbb{M})$ for $\mathfrak{g} = \mathfrak{sp}_4$. Moreover, we show that the reduced version of the stated $\mathfrak{g}$-skein algebra $\mathscr{S}^{\mathrm{rd}}_{\mathfrak{g}}(\Sigma, \mathbb{B})$ is isomorphic to the boundary-localization of the clasped $\mathfrak{g}$-skein algebra $\mathscr{S}_{\mathfrak{g}}(\Sigma, \mathbb{M})[\partial^{-1}]$ for a Lie algebra $\mathfrak{g} = \mathfrak{sl}_2$, $\mathfrak{sl}_3$ or $\mathfrak{sp}_4$. This isomorphism is a quantum counterpart of the two descriptions of the cluster algebra associated with the pair $(\mathfrak{g}, \Sigma)$ in terms of the matrix coefficients of Wilson lines and cluster variables, respectively. This talk is based on a joint work with Tsukasa Ishibashi (Tohoku Univ.).

Katsunori Arai (Osaka University)

Groupoid racks and spatial surfaces

A rack is a set with a binary operation satisfying two conditions corresponding to two of the Reidemeister moves in knot theory. We introduce the notion of a groupoid rack. It is used for coloring a spatial surface, which is a compact oriented surface with boundary embedded in S^3. We show that a multiple group rack and a rack with a partially product defined by Saito-Zappala are examples of groupoid racks.

Hyungtae Baek (Kyungpook National University)

Some properties of S-strong Mori modules

Let D be an integral domain, S a multiplicative subset of D and M a D-module. In 2014, Kim, Kim and Lim defined S-strong Mori modules; that is, every D-submodule of M is S-w-finite, equivalently, if N is a D-submodule of M, then there exist $s \in S$ and a finitely generated D-submodule L of N such that $Ns \subseteq L_w$.

In this talk, we investigate some properties of S-strong Mori modules. To do this, we study the definition of the star-operation; and w-operation which is one of examples of star-operations. The main goal of this talk is Hilbert basis theorem for S-strong Mori modules. The detailed statement is as follows.

Theorem (Hilbert basis theorem for S-strong Mori modules)
Let D be an integral domain, S an anti-Archimedean multiplicative subset of D and M a torsion-free w-module over D. Then the following assertions are equivalent.

(1) *M is an S-strong Mori D-module.*

(2) *$M[X]$ is an S-strong Mori $D[X]$-module.*

(3) *$M[X]_{N_v}$ is an S-strong Mori $D[X]_{N_v}$-module.*

(4) *$M[X]_{N_v}$ is an S-Noetherian $D[X]_{N_v}$-module.*

Sadaf Habibi (Osaka City University)

Applications of p-harmonic transplantation for functional inequalities involving a Finsler norm

In this talk, we prove several inequalities such as Sobolev, Poincaré, logarithmic Sobolev, which involve a general norm with accurate information of extremals, and are valid for some symmetric functions. We use Ioku's transformation, which is a special case of p-harmonic transplantation, between symmetric functions.

Moemi Hiraki (Nagoya City University)

A virtualized skein relation for a multivariable polynomial under some conditions

The virtualized skein relation for the Jones polynomial of virtual link diagrams was studied by N. Kamada, S. Nakabo, and S. Satoh if one of diagrams in a virtual skein triple is checkerboard colorable. Also different virtualized skein relations for the Jones polynomial were studied by N. Kamada. On the other hand, H. A. Dye, L. H. Kauffman, and Y. Miyazawa intruoduced a multivariable polynomial invariant of virtual links, which is a refinement of Jones polynomial. In this talk, we discuss virtual skein relations for the multivariable polynomial invariant.

Suhyeon Jeong (Pusan National University)
Invariants for pseudo-links derived from Goeritz matrices

In 2010, Hanaki introduced the notion of a *pseudo-diagram*,which is a knot or link diagram where we ignore over/under information at some crossings of the diagram. Henrich, Hoberg, Jablan, Johnson, Minten, and Radvić extended this idea to a *pseudo-knot* (or *pseudo-link*), which is an equivalence class of pseudo-diagrams modulo pseudo Reidemdister moves.

In this talk, we would like to introduce the *Goeritz matrix* for a pseudo-link, which is an extension of the Goeritz matrix for a classical link. Using this, we show that the determinant of a modified Goeritz matrix gives a Laurent polynomial invariant for pseudo-links in one variable u with integer coefficients. Also, we introduce the notions of the signature, determinant, and nullity of pseudo-links. This is a joint work with Jieon Kim and Sang Youl Lee.

Hyobeen Kim (Kyungpook National University)
The complexity dichotomy for matroid-homomorphism

We introduce the difference between graph-homomorphisms and matroid-homomorphisms. With this we prove a complexity dichotomy for the problem $\mathrm{Hom}_{\mathbb{M}}(\mathrm{N})$ of deciding if there is a matroid-homomorphism to N. The problem is polynomial time solvable if N has a loop or has no circuits of odd length, and is otherwise NP-complete. This is joint work with Mark Siggers at Kyungpook National University and Cheolwon Heo at Sungkyunkwan University.

Unhou Kin (Nagoya City University)
pseudo Goeritz matrix of twisted knot

Twisted knot theory is an extension of virtual knot theory. Pseudo Goeritz matrices are defined for virtual knot diagrams. Torsion invariants of pseudo Goeritz matrices are invariants for virtual knots. In this talk we discuss pseudo Goeritz matrices of twisted knots and their applications.

Hajime Kubota (Kyoto University)
The knot concordance invariant Υ using grid homology

Grid homology is an invariant for knots in S^3. Grid homology eneble us to calculate some geometric invariants for knots combinatorially. Two knots $K_1, K_2 \in S^3$ are called *concordant* if there is a smooth embedding of $S^1 \times [0,1]$ into $S^3 \times [0,1]$ having boundary the knots K_1 and $-K_2$ in $S^3 \times \{0\}$ and $S^3 \times \{1\}$, respectively. The Υ invariant is a knot concordance invariant in knot Floer homology. In this talk, we give a combinatorial restruction of the Υ invariant using grid homology and prove that the combinatorial Υ invariant is a concordance invariant.

Jihyeon Lee (Pusan National University)
Rigidity theorems of λ-translating solitons

In this talk, we are going to deal with λ-translating solitons in the Euclidean and Minkowski space. A λ-translating soliton is a natural generalization of translating soliton, which is the equation of the limit flow by a proper blow-up procedure near type II singular points of the mean curvature flow. Thus, it is important to study (λ-)translating solitons for understanding the mean curvature flow. After some basic definitions and preliminaries of the λ-translating solitons in both spaces, in terms of the critical point of some area functional, we give the main results for classifications of λ-translating solitons.

Youjin Lee (Pusan National University) **Data analysis and prediction of testing process in medical laboratory via machine learning**

In the talk, I present our recent research on data analysis and prediction of testing process in medical laboratory via machine learning to improve medical quality. Firstly, we addressed the importance of laboratory results in medical fields and presented the current situation of work efficiency in the laboratory. Next, we identified the causes that reduce the efficiency of test work. Finally, we proposed an advanced integrated laboratory management system to solve the limitation of current system. It supports machine learning-based test end time prediction, real-time TAT monitoring, and urgent test request so that medical technologists can focus on their chemistry test working. Here, we employed XGBoost, LightGBM, Random Forest, CatBoost regressions and their ensemble to predict the test end time. As a result of the use in laboratories and outpatient clinics, the number of failures to comply with the guided time and abnormal samples decreased.

Jia Lijiao (Pusan National University)
Dynamic complexity of a three-dimensional host-parasitoids model with Logistic growth function

Host-parasitoid interactions have been studied for a long time, constructing host-parasitoid model and exploring its stability have significant meaning for biological control, which prefer the interaction between pest and its parasitoid remain sufficiently stable in order to prevent the host from re-emerging as a pest. Under the natural environment, it is very common to find an insect species being attacked by two or more specific insect parasites. The problem we investigate in this study is mainly about a three-dimensional host-parasitoid-parasitoid model with Logistic growth function on the host population. We demonstrate the existence of boundary and positive equilibrium points of the three-dimensional system. Under certain conditions, the positive equilibrium remains locally asymptotically stable. Moreover, it is demonstrated that the system undergoes Neimark-Sacker bifurcation by using bifurcation theory. In order to stabilize the unstable steady state, the pole-placement feedback control strategy is introduced. Complexity and chaotic behaviour are confirmed through the plots of bifurcation diagrams, maximum Lyapunov exponents and phase portraits in numerical simulations.

Minami Matsumura (Nagoya City University)
An n-writhe for twisted knots

A double covering diagram from a twisted link diagram was introduced N. Kamada and S. Kamada. S. Satoh and K. Taniguchi introduced the n-writhe, a virtual knot invariant for each non-zero integer n. In this talk, We discuss n-writhes for double covering diagram from a twisted link diagram.

Fumika Mizoguchi (Osaka City University)
Nilpotent Lie algebras obtained by quivers and Ricci solitons

A quiver is a directed graph where loops and multiple arrows between two vertices are allowed. In this talk, we introduce a new method for obtaining nilpotent Lie algebras from quivers. We consider Lie algebras obtained by quivers without cycles, and prove that the corresponding simply connected Lie groups always admit left-invariant Ricci solitons.

Jinseok Oh (Kyungpook National University)
On set-theoretic Yang-Baxter cohomology of a certain family of Alexander biquandles

A homology theory of set-theoretic Yang-Baxter operators was established by Carter, Elhamdadi, and Saito. Biquandles, a generalization of quandles, are special solutions of the set-theoretic Yang-Baxter equation. The free parts of quandle homology groups were completely determined, but only little is known about biquandles. In this talk, we first review the definition of set-theoretic Yang-Baxter (co)homology and determine the Betti numbers of some finite Alexander biquandles. This is joint work with Seung Yeop Yang and Hongdae Yun.

Youn Jeong Oh (Kyungpook National University)
Graph Convolutional Neural Networks with modules that enable graph analysis more globally

Graphs have flexible data structures that can be generalized to a variety of data structures. Accordingly, there is an advantage in that the problem can be viewed from a new perspective when expressing data in a graph structure. We introduce Graph Convolutional Neural Networks, which applies the convolution neural networks model to graph data, one of the methods for analyzing graphs. In particular, in order to create a GCN model that can analyze the graph structure globally as well as locally, I studied with interest how to add a module that can explicitly know graph information so that it can be analyzed in much more detail.

Kanako Oie (Nara Women's University)
Uniqueness of prime decomposition of 3-manifolds

It is known that every orientable closed 3-manifold can be decomposed into a finite number of prime orientable closed 3-manifolds by connected sum, and such decomposition is unique. In fact, the existence of such decomposition is proved by H. Kneser, and the uniqueness is proved by J. Milnor. In this talk, I introduce an outline of the proof of the uniqueness presented in the textbook of K. Morimoto.

Da Bin Park (Kyungpook National University)
Recovering of the initial values from light cone trace of solutions of the fractional wave equation

We reconstruct the initial functions from the trace of solution of an initial value problem for the wave equation on the light cone. When the spatial dimension is odd, Rakesh and Yuan have already provide the inverting the operator trace the solution on the light cone from the initial function [1]. We generalize their work to the fractional wave equation and all dimensions. That is, we present how to reconstruct the initial functions from the solution of the fractional wave equation on the light cone.

Sanghoon Park (Pusan National University) **On the Gordon-Litherland pairing for links in thickened surfaces**

In 1978, Gordon and Litherland defined a symmetric, bilinear form which is called Gordon-Litherland pairing for links in S^3 together with a choice of unoriented spanning surface. Boden and Karimi extended the pairing to links in thickened surfaces. Using it, they defined some invariants - signature, determinant, and nullity invariants for links in thichened surfaces. In this talk, based on their paper, I review the Gordon-Litherland pairing for links in thickened surfaces.

Minju Seo (Pusan National University)
A polynomial invariant for pseudo-links

A pseudo-diagram is a knot diagram that may be missing some crossing information. At these crossings, it is undetermined which strand passes over. Pseudo-link is an equivalence class of pseudo-diagrams upto local moves of pseudo-diagrams, called pseudo-Reidemeister moves. Pseudo-diagrams were first introduced by Ryo Hanaki in 2010. In this talk, we introduce a modification of the Jones polynomial for pseudo-links. By using this modification, we define a polynomial for pseudo-diagrams and discuss that the polynomial is invariant under pseudo-Reidemeister moves.

Ryo Takenaka (Osaka Metropolitan University)
Fermionic form of character formulas for affine Lie algebras

Let $\mathfrak{g}$ be a simple Lie algebra with an automorphism ν. The corresponding affine Lie algebra is denoted by $\tilde{\mathfrak{g}}$. In this talk, we write character fomulas for an affine Lie algebra in terms of q series. For some character formula, these fermionic character formulas are rewriting of Weyl-Kac character formula written by formal exponentials. As a consequence, we are able to find some connection to Rogers-Ramanujan identities.

Yuta Taniguchi (Osaka University)
Surface knot invariants obtained from a quandle 2-cocycle

J. S. Carter, M. Saito and S. Satoh defined an invariant of oriented surface knots using a quandle 2-cocycle θ. In this talk, we relate the surface knot invariant using a quandle 2-cocycle θ to an f-twisted Alexander matrix, which was introduced by A. Ishii and K. Oshiro, using the Alexander pair associated with the quandle 2-cocycle θ. As an application, we determined the second quandle homology group of the knot quandle of 2-knots.

Jumpei Yasuda (Osaka University)
A note on the plat index for surface-links

A plat form for links is a presentation of a classical link using a braid. We can apply this presentation to surface-links, using a braided surface instead of a braid, and prove that every surface-link has a plat form presentation. The plat index is a surface-link invariant defined by using a plat form and is an analogy of the bridge index for classical links. In this talk, we compute the plat index of a 2-twist-spun trefoil. Also, for any positive integer m, we give infinitely many surface-knots with the plat index m.

Haruki Yoshimura (Osaka City University)
On a deformation of a cubical complex

It is known that the complement of a reduced alternating link admits a non-positively curved cubing. I will talk about an attempt to obtain the hyperbolic structure as a deformation of the non-positively curved structure. In particular, we focus on the two examples, the Borromean rings and the figure-eight knot.

Hongdae Yun (Kyungpook National University)
A geometric realization of the extreme Khovanov homology of a pretzel link

The Khovanov (co)homology was introduced by Mikhail Khovanov in 2000, and Viro explained it in terms of enhanced states of a link diagram. J. González-Meneses, P.M.G. Manchón, M. Silvero showed the (potential) extreme Khovanov homology of a link is isomorphic to the independence simplicial complex of a Lando graph from the link. In this talk, we investigate the extreme part of Khovanov homology of certain pretzel links and their geometric realizations. This is joint work with Jinseok Oh and Seung Yeop Yang.
