Abstracts

Plenary talks

1. **Jae Choon Cha** *Pohang University of Science and Technology*

   Title: Von Neumann-Cheeger-Gromov L^2 rho invariants and topology of 3-manifolds

   Abstract: Using deep analytic methods, Cheeger and Gromov showed that for any smooth $(4k-1)$-manifold there exists a universal bound for the von Neumann L^2 rho-invariants. We present a new proof of the existence, which applies to topological manifolds. For 3-manifolds, we establish explicit relationships with triangulations, Heegaard splittings, and surgery descriptions. Applications include new results on the complexity of 3-manifolds. For the proof we develop a geometric construction of efficient 4-dimensional bordisms of 3-manifolds over a group, and develop an algebraic notion of uniformly controlled chain homotopies.

2. **Fuquan Fang** *Capital Normal University*

   Title: Bounding problem of almost flat manifolds

   Abstract: It is an open problem in Yau's list that, every almost flat manifold is the boundary of a smooth manifold. In this talk I will explain a joint work with Jim Davis on this problem.

3. **Boju Jiang** *Peking University*

   Title: On Conway's potential function for colored links

   Abstract: The Conway potential function (CPF) for colored links is a convenient version of the multi-variable Alexander-Conway polynomial. We give a skein characterization of CPF, much simpler than the one by Jun Murakami. In particular, Conway's 'smoothing of crossings' is NOT in the axioms. An interesting by-product is a characterization of the Alexander-Conway polynomial of knots.

4. **Naoko Kamada** *Nagoya City University*

   Title: Virtual knots and twisted knots

   Abstract: A virtual knot is an equivalence class of a virtual knot diagram, that is a knot diagram possibly with some virtual crossings under certain moves. It is interpreted as stable equivalence class of a link in a thickened surface. Some invariants of classical knots, the Jones polynomial, the knot groups, etc. are generalized to those for virtual knots. A twisted knot is an equivalence class of a twisted knot diagram, that is a virtual knot diagram possibly with some bars on its arcs. It is interpreted as stable equivalence class of a link in a thickened surface whose base surface is not necessarily orientable. Virtual knots are an extension of classical knots, and twisted knots are an extension of virtual knots and classical knots. In this talk, we explain these notions and their invariants. We also introduce the notion of abstract knots, that are deeply related to virtual knots and twisted knots.

5. **Se-Goo Kim** *Kyung Hee University*

Title: Topological versus smooth concordance groups

Abstract: The existence of topologically slice knots that are of infinite order in the knot concordance group followed from Freedman's work on topological surgery and Donaldson's gauge theoretic approach to four-manifolds. Here, as an application of Ozsváth and Szabó's Heegaard Floer theory, we show the existence of an infinite subgroup of the smooth concordance group generated by topologically slice knots of concordance order two. In addition, no nontrivial element in this subgroup can be represented by a knot with Alexander polynomial one. This is a joint work with Matt Hedden and Chuck Livingston.

6. **Jiming Ma** *Fudan University*

Title: Geometry of the augmented disk graph

Abstract: For a handlebody H, we define the augmented disk graph $\mathcal{ADG}(H)$ associated to the handlebody, and we show the vertex inclusion gives a quasi-isometric embedding between the augmented disk graph and the curve graph of ∂H. In particular, $\mathcal{ADG}(H)$ is hyperbolic of infinite diameter in the sense of Gromov.

7. **Kimihiko Motegi** *Nihon University*

Title: L-space surgeries and Seifert surgeries on knots

Abstract: An L-space is a rational homology 3-sphere with the simplest possible Heegaard Floer homology. A knot in the 3-sphere is called an L-space knot if it admits a nontrivial L-space surgery. Like torus knots and Berge knots, many known L-space knots admit a Seifert fibered L-space surgery. For L-space knots K with Seifert surgeries we give a sufficient condition on an unknotted circle c such that n-twist along c converts K into an L-space knot K_n for infinitely many integers n. As an application, we show that every torus knot and every hyperbolic Berge knot admits such an unknotted circle, and provide a large number of hyperbolic L-space knots each of which has a Seifert fibered L-space surgery. On the other hand, to the best of our knowledge, there are no explicitly known examples of hyperbolic L-space knots which have no Seifert fibered surgeries, though we expect there should be many. We give also a concrete example of a hyperbolic L-space knot which has no exceptional surgeries, in particular, no Seifert fibered surgeries. The latter part is joint work with Kazushige Tohki.

8. **Takefumi Nosaka** *Kyushu University*

Title: The relative cup products and quandle cocycle invariants of knots

Abstract: I succeeded in describing a formula of computing the relative cup products with every local coefficients of every links in the 3-sphere. The formula can be computed from a link diagram in terms of the quandle 2-cocycle knot-invariant. As a corollary, I propose a canonical construction of bilinear forms on the twisted Alexander modules of links, which I call twisted Blanchfield pairings. I also give applications together with relations to some classical knot-invariants, such as the classical Blanchfield pairing, the twisted Milnor signatures, and works of Kirk-Livingston. In this talk, I give a survey of the results, and demonstrate some advantages of the quandle theory.

9. **Riccardo Piergallini** *University of Camerino*

   Title: Coverings, handles and ribbons

   Abstract: The talk will concern some aspects of the representation of 4-dimensional 2-handlebodies as simple covers of B^4 branched over ribbon surfaces.

10. **Ser Peow Tan** *National University of Singapore*

    Title: Polynomial automorphisms of $\mathbb{C}^n$ preserving the Markoff-Hurwitz polynomial

    Abstract: We will talk about the action of the group of polynomial automorphisms of $\mathbb{C}^n (n \geqslant 3)$ which preserve the Markoff-Hurwitz polynomial

    $$H(x) := x_1^2 + \cdots + x_n^2 - x_1 x_2 \cdots x_n.$$

    We will discuss the determination of the group and its action on $\mathbb{C}^n$, the description of a non-empty open subset of $\mathbb{C}^n$ on which the group acts properly discontinuously, and identities for an orbit of points in the domain of discontinuity. This is joint work with Hengnan Hu and Ying Zhang.

11. **Chao Wang** *University of Science and Technology of China*

    Title: Embedding surfaces into 3-dimensional sphere with maximum symmetry

    Abstract: In the orientable category, we consider those finite group actions on surfaces which extend to the 3-dimensional sphere S^3, and wonder how large these groups can be. For the closed surface with genus $g > 1$, let OE_g be the maximum order of such actions. All the OE_g can be determined, and it can be realized by unknotted embedded surfaces for all g except 21 and 481. The methods and results can be applied to similar questions about general extendable actions on surfaces and handlebodies.

12. **Tian Yang** *Stanford University*

    Title: On type-preserving representations of the four-punctured sphere group

    Abstract: We give counterexamples to a conjecture of Bowditch that if a non-elementary type-preserving representation $\rho : \pi_1(\Sigma_{g,n}) \to \mathrm{PSL}(2;\mathbb{R})$ of a punctured surface group sends every non-peripheral simple closed curve to a hyperbolic element, then ρ must be Fuchsian. The counterexamples come from relative Euler class ± 1 representations of the four-punctured sphere group. As a related result, we show that the mapping class group action on each non-extremal component of the character space of type-preserving representations of the four-punctured sphere group is ergodic. The main tool we use is Penner's lengths coordinates of the decorated character spaces defined by Kashaev.

Contributed talks

1. **Tetsuya Abe** *Tokyo Institute of Technology and Osaka City University Advanced Mathematical Institute*

   Title: Fibered knots with the same 0-surgery and the slice-ribbon conjecture

   Abstract: We prove that if the slice-ribbon conjecture is true, then (modified) Akbulut-Kirby's conjecture on knot concordance is false. We also give a fibered potential counterexample to the slice-ribbon conjecture.

2. **Hirotaka Akiyoshi** *Osaka City University*

   Title: Side parameter for the torus with a single cone point

   Abstract: I will talk about an ongoing project whose goal is to generalize Jorgensen's theory for punctured torus Kleinian groups to the cone hyperbolic structures on the torus with a single cone point. We introduce good fundamental polyhedra as the counterpart to Ford domains for Kleinian groups, and show that the side parameter induced from those polyhedra is a global parameter on the real slice, which corresponds to the space of 2-dimensional cone hyperbolic structures. We also observe how the cone hyperbolic structures collapse when the cone angle increases to 2π.

3. **Byunghee An** *IBS Center for Geometry and Physics*

   Title: Criterion for the Legendrian simplicity of connected sum of knots

   Abstract: A knot K is *Legendrian simple* if Legendrian knots of type K are classified by the Thurston-Bennequin invariant and the rotation number. The Legendrian simplicity is not closed under the connected sum operation in general. In this talk, I will provide the necessary and sufficient conditions for the connected sum of two knots to be Legendrian simple.

4. **Yongju Bae** *Kyungpook National University*

   Title: Descending tangles and unknotting operations of links

   Abstract: Unknotting operations and their Gordian distance is an important tool to study knots or links. In this talk, we will introduce new unknotting operations obtained from the descending tangles. Indeed, we will prove that every descending 3-tangle or descending 4-tangle results in an unknotting operation. Also we will compare the Gordian distances of such unknotting operations. (Jointly with Byeorhi Kim)

5. **Jinseok Cho** *KIAS*

   Title: The optimistic limit of colored Jones polynomial

   Abstract: In this talk, I will define the colored Jones version of the optimistic limit of a boundary-parabolic representation, and show many interesting properties of it. Especially, I will construct the solution of the hyperbolicity equations using the shadow-coloring of the conjugation quandle proposed by Inoue-Kabaya. This talk is based on the articles arXiv:1303.3701 and arXiv:1410.0525.

6. **Youngjin Cho** *KAIST*

Title: Automorphism groups of some Artin groups

Abstract: John Crisp has studied a class of Artin groups that are not rigid, in the sense that the isomorphism class of an Artin group cannot uniquely determine its defining diagram, and he successfully described a finite generating set for the isomorphism groupoid, not the automorphism group, of an Artin group in the class. In this talk, we give a finite presentation of the automorphism group of an Artin group in the class.

7. **Seonmi Choi** *Kyungpook National University*

Title: On knotted real projective planes

Abstract: Let $L \xrightarrow{\mathfrak{B}} L_{\mathfrak{B}}$ be a hyperbolic transformation. Let B be a new band attaching to L such that $L_B \xrightarrow{\mathfrak{B}} L_{\mathfrak{B}\cup\{B\}}$ is also a hyperbolic transformation. In this paper, we will study the relationship between the realizing surfaces $F(L \xrightarrow{\mathfrak{B}} L_{\mathfrak{B}})$ and $F(L_B \xrightarrow{\mathfrak{B}} L_{\mathfrak{B}\cup\{B\}})$. If B is a noncoherent band to L and $L_{\mathfrak{B}}$ such that $\hat{F}(L_B \xrightarrow{\mathfrak{B}} L_{\mathfrak{B}\cup\{B\}})$ is defined, then $\hat{F}(L \xrightarrow{\mathfrak{B}} L_{\mathfrak{B}}) \sharp \Re P^2$ and $\hat{F}(L_B \xrightarrow{\mathfrak{B}} L_{\mathfrak{B}\cup\{B\}}) \sharp \Re P^2$ are ambiently isotopic, where $\Re P^2$ is one of the standard real projective planes. As an application, $\Re P^2$ can untangle a knotted sphere F with suitable conditions, when it is attached to F by the connected sum.(Jointly with Yongju Bae)

8. **Mikio Furokawa** *Hiroshima University*

Title: Commensurability between once-punctured Klein bottle groups and once-punctured torus groups

Abstract: The once-punctured torus and the once-punctured Klein bottle are topologically commensurable, in the sense that both of them are doubly covered by the twice-punctured torus. In this talk, we study the $\mathrm{PSL}(2,\mathbb{C})$-representations of the fundamental group of the twice-punctured torus which extend to $\mathrm{PSL}(2,\mathbb{C})$-representations of the fundamental groups of the once-punctured torus and the once-punctured Klein bottle.

9. **Jun Ge** *Xiamen University*

Title: Equivalence classes of knot colorings and minimum number of colors

Abstract: For any link and for any modulus m we introduce an equivalence relation on the set of nontrivial m-colorings of the link. We will show that for any prime modulus the number of equivalence classes depends on the modulus and on the rank of the coloring matrix with respect to this modulus (joint work with S. Jablan, L. Kauffman and P. Lopes). For primes 11, 13 and 17, we classify all the color sets with small cardinality which are possible to form a non-trivial coloring for some link. For any link L with non-zero determinant and any prime $p \geq 17$, we prove that the minimum number of colors mod p is at least 6. Then a positive answer to a question raised by Nakamura, Nakanishi and Satoh will be given (joint work with X. Jin, L. Kauffman, P. Lopes and L. Zhang). At the end of the talk, we will mention a conjecture related to both determinant of knots and links in knot theory and the number of spanning trees in graph theory.

10. **Qilong Guo** *Peking University*

Title: Connectivity of some simplicial complex associate to handlebody

Abstract: There are many simplicial complexes associate to a surface, such as curve complex, separating complex, pants complex and so on. A remarkable property of them

is that they are connected. The connectivity of some of them is a little hard to prove directly. Putman find a method to prove many complexes are connected easily. In this talk, I will talk about the connectivity of some simplicial complex associate to handlebody using Putman's method.

11. **Kenta Hayano** *Hokkaido University*

Title: Multisections of Lefschetz fibrations and topology of symplectic 4-manifolds

Abstract: A multisection of a Lefschetz fibration is a 2-dimensional submanifold in the total space on which the restriction of the fibration is a simple branched covering. Recently we gave a combinatorial way to understand topology and configuration of multisections via mapping class groups of surfaces. In this talk, we will explain applications of our result to the problems on topology of symplectic 4-manifolds, such as existence of exotic symplectic surfaces, non-isomorphic Lefschetz fibrations, and so on. This is joint work with Refik Inanc Baykur (University of Massachusetts).

12. **Kyungpyo Hong** *Korea University*

Title: Quantum knot mosaics and the enumeration

Abstract: Lomonaco and Kauffman developed a knot mosaic system to introduce a precise and workable definition of a quantum knot system. A knot (m, n)-mosaic is an $mimesn$ matrix of mosaic tiles T_0 through T_{10} representing a knot or a link by adjoining properly that is called suitably connected. $D^{(m,n)}$ is the total number of all knot (m, n)-mosaics. In this talk, we construct an algorithm producing the precise value of $D^{(m,n)}$ of various types of knot mosaics that uses recurrence relations of state matrices which turn out to be remarkably efficient to count knot mosaics.

13. **Mitsunori Hori** *Hiroshima University*

Title: Five-fold cyclic branched covers of genus one two-bridge knots are L-spaces

Abstract: We show that the 5-fold cyclic branched cover of any genus one two-bridge knot is an L-space.

14. **Kazuhiro Ichihara** *Nihon University*

Title: Non left-orderable surgeries and generalized Baumslag-Solitar relators

Abstract: I will talk about recent developments of our research on Dehn surgeries on knots yielding 3-manifolds with non left-orderable fundamental groups. It will be shown that a knot admits a non left-orderable surgery if the knot group has a presentation with a generalized Baumslag-Solitar relator and satisfies certain conditions on a longitude of the knot. As an application, examples of twisted torus knots with non left-orderable surgeries will be given. This talk is based on a joint work with Yuki Temma (Nihon University).

15. **Ayako Ido** *Nara Women's University*

Title: On keen Heegaard splitting

Abstract: The distance of Heegaard splitting introduced by Hempel is a measure of its complexity. In this talk, we define a Heegaard splitting $V_1 \cup_\Sigma V_2$ to be keen, if the set of pairs of meridian disks of V_1 and V_2 realizing the distance $d(\Sigma)$ consists of one element, and we present an outline of a proof of the existence of keen Heegaard splittings with distance $n \geq 2$. (Joint work with Yeonhee Jang and Tsuyoshi Kobayashi.)

16. **Ayumu Inoue** *Aichi University of Education*

Title: The zeros of Alexander polynomials and colorability of knots by rotations

Abstract: The set consisting of all rotations of the Euclidean plane is equipped with a quandle structure. Which knots are colorable by this quandle? In this talk, we first show that the colorability of a knot is completely determined by the zeros of the Alexander polynomial of the knot. We next enumerate all colorings of the torus knot using a PL trochoid. As an application of these results, we geometrically obtain the complete factorization of the Alexander polynomial of the torus knot.

17. **Masahide Iwakiri** *Saga University*

Title: Unknotting numbers for handlebody-knots and Alexander quandle colorings

Abstract: A crossing change of a handlebody-knot is that of a spatial graph representing it. We see that any handlebody-knot can be deformed into trivial one by some crossing changes. So we define the unknotting numbers for handlebody-knots. In the case classical knots, which are considered as genus one handlebody-knots, Clark, Elhamdadi, Saito and Yeatman gave lower bounds of the Nakanishi indices by the numbers of some finite Alexander quandle colorings, and hence they also gave lower bounds of the unknotting numbers. In this talk, we give lower bounds of the unknotting numbers for handlebody-knots with any genus by the numbers of some finite Alexander quandle colorings of type at most 3.

18. **Hye Jin Jang** *POSTECH*

Title: 2-torsion in the Grope filtration of the knot concordance group

Abstract: Cochran, Orr, and Teichner defined two filtrations on the knot concordance group, namely the Grope filtration $\mathcal{G}_h$ and solvable filtration $\mathcal{F}_h$. Cochran, Harvey, and Leidy showed that there are infinitely many 2-torsion in $\mathcal{F}_n/\mathcal{F}_{n.5}$ for every integer $n \geq 2$. We show that there are also infinitely many 2-torsion classes in $\mathcal{G}_n/\mathcal{G}_{n.5}$ for every integer $n \geq 2$. Our knots generate a $\mathbb{Z}_2^\infty$ subgroup in $\mathcal{F}_n/\mathcal{F}_{n.5}$ distinct from the $\mathbb{Z}_2^\infty$ subgroup generated from Cochran-Harvey-Leidy's knots. Our main ingredients are amenable L^2-signatures and an iterated grope construction of Horn and Cha.

19. **Seonggu Jeong** *KAIST*

Title: Geometry of Brady complex

Abstract: The n-strand braid groups were shown to be CAT(0) by Brady and McCammond for $n \leq 5$ and by Haettel, Kielak and Schwer for $n = 6$. In fact they showed that the Brady complexes with orthoscheme metric are CAT(0). In this talk we extend this to the 7-strand braid group via more careful analysis.

20. **Adrian Jimenez Pascual** *The University of Tokyo*

Title: On Lassos and the Jones polynomial of satellite knots

Abstract: The purpose of the talk is to present in the first place a new family of knots in the solid torus called lassos and some of their properties. We will recall the idea of satellite knot and the formula for their Alexander polynomial. I will then investigate the Kauffman bracket and the Jones polynomial of knots in the solid torus, and straightaway give explicit formulae for their calculus for satellite knots. In this respect, by using lassos as patterns of satellite knots I will construct infinitely many knots having the same Alexander polynomial as the one of a chosen knot. In the last part I will prove for certain subfamilies

of these satellite knots that they are actually different from each other by using their Jones polynomial.

21. **Gyo Taek Jin** *KAIST*

Title: Quadrisecant approximation of unknots

Abstract: We consider tame knots in space. Every knot can be deformed to a polygonal knot without changing its knot type. If a set of finitely many points is chosen on a knot, we may straighten each subarc between nearby points of the set to form a polygonal curve. Such a curve is called a polygonal approximation of the given knot. A polygonal approximation of a knot is said to be good if it has the same type as the given knot. A quadrisecant of a knot is a straight line which intersects the knot in four distinct points. Every nontrivial knot can be perturbed to have finitely many quadrisecants. If a knot has finitely many quadrisecants, we may use the secant points to form a polygonal approximation, called the quadrisecant approximation. Quadrisecant approximations are conjectured to be good polygonal approximations. We report on our test of this conjecture on a family of random polygonal unknots and some smooth unknots.

22. **Yewon Joung** *Pusan National University*

Title: Applying Lipson's state models to marked graph diagrams of surface-links

Abstract: A surface-link or a knotted surface of n components ($n \geqslant 1$) is n mutually disjoint connected and closed (possibly orientable or non-orientable) 2-manifolds smoothly (or piecewise linearly and locally flatly) embedded in the oriented 4-space. In 1992, A. S. Lipson constructed two state models yielding the same classical link invariant obtained from the Kauffman polynomial $F(a; z)$. In this talk, we apply Lipson's state models to marked graph diagrams of surface-links, and observe when they induce surface-link invariants. This is a joint work with Seiichi Kamada and Sang Youl Lee.

23. **Seiichi Kamada** *Osaka City University*

Title: Quandle presentation of 1-handles attached to surface-knots

Abstract: We investigate how to present 1-handles attached to surface-knots in terms of quandles. For this purpose, we introduce the notion of the tensor product of quandles. Then 1-handles are naturally understood via the tensor product of knot quandles or knot symmetric quandles. Especially, for a case of surface-links, it works nicer than presentation in terms of groups.

24. **Kengo Kawamura** *Osaka City University*

Title: Ribbon-clasp 2-knots and virtual curves

Abstract: A ribbon-clasp 2-knot is the boundary of an immersed 3-ball in the 4-space whose singular set consists of only ribbon singularities and clasp singularities. In this talk, we will talk about ribbon-clasp 2-knots and their representation by virtual curves. This is a joint work with S. Kamada.

25. **Akio Kawauchi** *Osaka City University*

Title: On ribbon surface-link

Abstract: A ribbon surface-link is represented by a chord daigram unlike a Gauss chord diagram. Two equivalent ribbon surface-links are described in terms of local moves on the cord diagrams. As a consequence, two topologically equivalent ribbon surface-links are equivalent. Combining it with an earlier result with J. Hillman, we conclude that a ribbon surface-knot is smoothly trivial if the fundamental group is an infinite cyclic group.

26. **Hyoungjun Kim** *Korea University*

Title: Minor minimal bipartite intrinsically knotted graphs with 22 edges

Abstract: A graph is called intrinsically knotted if every embedding of the graph contains a knotted cycle. It is already known that intrinsically knotted graphs have at least 21 edges, and K_7 and the 13 graphs obtained from K_7 by delta-Y moves are the only intrinsically knotted graphs with 21 edges. We classify which bipartite graphs with 22 edges are intrinsically knotted. Currently, 168 intrinsically knotted graphs with 22 edges of the $K_{3,3,1,1}$ family and the $E_9 + e$ family are known, and the cousins 89 and 110 of the $E_9 + e$ family are the only bipartite graphs among them. The goal is to show that these two are the only bipartite intrinsically knotted graphs with 22 edges.

27. **Hyuntae Kim** *KAIST*

Title: Knots in cubic lattices

Abstract: We study knots which are contained in the (primitive) cubic lattice, a graph whose vertices are the integer points in $\mathbb{R}^3$. We present lists of knots that appear in small lattices whose width does not exceed 3. Simpler cases among them are completely classified with proof, while the others are computer-generated. In addition, we show that every knot can be embedded as a Hamiltonian cycle of a finite lattice cube, and give an upper bound on the width of such a cube.

28. **Jieon Kim** *Pusan National University*

Title: Quandle 3-cocycle invariants of surface-links in $\mathbb{R}^4$

Abstract: A surface-link is a closed surface smoothly embedded in $\mathbb{R}^4$ (or S^4). Surface-links are represented by broken surface diagrams or marked graph diagrams. In 2003, J. S. Carter, D. Jelsovsky, S. Kamada, L. Langford and M. Saito introduced quandle cocycle invariants of oriented surface-links via broken surface diagrams. In 2007, S. Kamada defined symmetric quandle cocycle invariants of unoriented surface-links using symmetric quandle homology theory. In this talk, I'd like to give a method to compute these quandle cocycle invariants via marked graph diagrams. This is a joint work with S. Kamada and S. Y. Lee.

29. **Min Hoon Kim** *POSTECH*

Title: Cheeger-Gromov rho invariant and complexity of lens spaces

Abstract: Using Cheeger-Gromov rho invariants, Cha has recently found a new lower bound for the (pseudo-simplicial) complexity $c(L(n,1))$ of the lens spaces $L(n,1)$ and proved $c(L(n,1))$ is asymptotically linear. In this talk, we give improved estimates for $c(L(n,1))$.

30. **Taehee Kim** *Konkuk University*

Title: The solvable filtration of the knot concordance group

Abstract: Two knots in the 3-sphere are said to be concordant if they cobound a (locally flat or smooth) properly embedded annulus in the product of the 3-sphere and the unit interval. Cochran, Orr, and Teichner defined a filtration of the knot concordance group, which reflects classical invariants at low levels. In this talk, at each level of the filtration, I will explain how to produce new examples of knots which are linearly independent. This is joint work with Tim Cochran.

31. **Teruaki Kitano** *Soka University*

Title: Reidemeister torsion of a homology 3-sphere obtained by $1/n$-surgeried along a (p, q)-torus knot

Abstract: Reidemeister torsion is a classical invariant for a compact manifold with a linear representation of the fundamental group. In this talk we consider this invariant for a Brieskorn homology 3-sphere and a 2-dimensional unimodular representation. Here Reidemeister torsion is defined as a complex number. Dennis Johnson introduced a torsion polynomial, which is the polynomial whose zero is a half value of Reidemeister torsion. He also gave a recursive formula for the homology 3-sphere obtained by $1/n$-surgery along the trefoils knot. We generalize and give the same type formula for the homology 3-sphere obtained by $1/n$-surgery along a (p, q)-torus knot.

32. **Toshitake Kohno** *The University of Tokyo*

Title: Higher holonomy of braids

Abstract: We describe a generalization of holonomy representations of braid groups to higher categories. The 2-categories consist of objects, morphisms and 2-morphisms for any pair of morphisms. Using a method of formal homology connection due to K.-T. Chen, we construct a 2-functor from the path 2-groupoid of the configuration space, which gives representations of cobordisms between braids.

33. **Ho Lee** *KAIST*

Title: Mutation and arc-index

Abstract: We show that there are infinitely many non-semialternating mutant knots whose arc index unchanged by mutation.

34. **Jung Hoon Lee** *Chonbuk National University*

Title: Bridge spheres for the unknot are topologically minimal

Abstract: We show that an $(n+1)$-bridge sphere for the unknot is a topologically minimal surface of index at most n.

35. **Hwa Jeong Lee** *KAIST*

Title: Crossing number of twisted torus knots of type $(p, q, 2, s)$

Abstract: A twisted torus knot of type $(p, q, 2, s)$ is a (p, q)-torus knot with s-full twists on two adjacent strands and is denoted by $T(p, q, 2, s)$. In this talk, we determine the crossing number for $T(p, q, 2, s)$ with $3 \leq p < q$, $s \geq 1$. As a corollary, it follows that $T(p, q, 2, s)$ is a braid positive knot which has a positive minimal crossing diagram.

36. **Sangyop Lee** *Chung-Ang University*

Title: Twisted torus knots

Abstract: Twisted torus knots are obtained by adding full twists to some parallel strands of torus knots. We will discuss some properties of these knots.

37. **Sang Youl Lee** *Pusan National University*

Title: Canonical genera of Whitehead doubles of alternating 3-braid knots

Abstract: A conjecture proposed by J. Tripp in 2002 (later modified by T. Nakamura) states that the crossing number of any alternating knot coincides with the canonical genus of its whitehead double. In the meantime, it has been established that this conjecture is true for a large class of alternating knots including $(2, n)$ torus knots, 2-bridge knots, algebraic alternating knots, and alternating pretzel knots. In this talk, we announce that the conjecture is not true for any alternating 3-braid knot which is the connected sum of two $(2, n)$-torus knots. This results in the modified conjecture that the crossing number of any prime alternating knot coincides with the canonical genus of its whitehead double. We introduce a large class of prime alternating knots satisfying the conjecture, including all prime alternating 3-braid knots. This is a joint work with H. J. Jang.

38. **Fengling Li** *Dalian University of Technology*

Title: Invariants of 3-manifolds from intersecting kernels of Heegaard splittings

Abstract: We will derive some invariants of 3-manifolds from intersecting kernels of their Heegaard splittings. This is a joint work with Fengchun Lei and Jie Wu.

39. **Zhenkun Li** *Peking University*

Title: Width of satellite knot and its companion

Abstract: In the talk, I will show a proof of an inequality $w(K) \geqslant n^2 w(J)$, where K is satellite knot with companion J and n is winding number. I will use a tool called "connected graph", which is introduced by Scharlemann and Schultens, together with some known results on additivity of knot width to find a suitable description for the critical points of k and j and then prove the inequality. This is joint work with Qilong Guo.

40. **Yukio Matsumoto** *Gakushuin University*

Title: Relatively non-singular hermitian forms in low and higher dimensional knot theory

Abstract: Let R and S be not necessarily commutative rings with 1. We are given a surjective homomorphism $h : R \to S$ whose kernel is generated by a central unit u. A hermitian form is said to be *relatively non-singular* if it is defined over R and becomes non-singular over S. For example, let A be a Seifert matrix of a classical knot. Then $tA - A^*$ gives a relatively non-singular hermitian form defined over $\mathbb{Z}[t, t^{-1}]$ and becomes non-singular over $\mathbb{Z}$. In this talk, we will show that the Witt group of relatively non-singular hermitian forms play the role of the obstruction group for higher dimensional "h-regularity problem" in codimension 2. The result was obtained in 1973, but has never been published.

41. **Satoshi Matsumura** *Osaka City University*

Title: Torsion invariants of knots

Abstract: We give several examples of calculations for torsion invariants of knots. In particular, we focus on symmetric unions of knots.

42. **Fumikazu Nagasato** *Meijo University*

Title: On some families of minimal elements for the partial ordering on prime knots

Abstract: This is a joint work with Anh T. Tran (The University of Texas at Dallas). We show that all twist knots, certain double twist knots and some other 2-bridge knots are minimal elements for the partial ordering on the set of prime knots. The key to these results are presentations of their character varieties using Chebyshev polynomials and a criterion for irreducibility of a polynomial of two variables. These give us an elementary method to discuss the number of irreducible components of the character varieties, which concludes the result essentially.

43. **Sangrok O** *KAIST*

Title: Quasi-isometric invariants of graph 2-braid groups

Abstract: Most graph 2-braid groups have free factors. We will discuss when the graph 2-braid group has a free factor and find the number of ends and the order of divergence of graph 2-braid groups modulo their free factors.

44. **Takahiro Oba** *Tokyo Institute of Technology*

Title: Stein fillings of homology 3-spheres and mapping class groups

Abstract: Classification of Stein fillings of a given contact manifold has been discussed as a crucial problem in contact geometry. In particular, it is important to examine which contact manifold admits a unique Stein filling. Uniqueness of Stein fillings had often been clarified by symplectic geometry before 2010, while it is sometimes proved by using combinatorics in mapping class groups after 2010. In this talk, considering Lefschetz fibrations over the disk and mapping class groups, I will present a condition for a Stein fillable homology 3-sphere to admit a unique Stein filling up to diffeomorphism. Moreover I will mention a result of weak fillings of the same manifold.

45. **Seungsang Oh** *Korea University*

Title: Introduction to the state matrix algorithm for multiple self-avoiding polygon enumerations

Abstract: We present the state matrix algorithm for exact enumerations of confined two-dimensional regular lattice objects. It proceeds with recurrence relations of so-called state matrices. This new and efficient algorithm is illustrated by an application to the enumeration of multiple-component self-avoiding polygons (MSAP) which are entirely contained in a rectangular grid on the square lattice. Eventually this algorithm produces the generating function of MSAPs with respect to the length.

46. **Hyo Won Park** *University of Utah*

Title: A metric on an outer space for 2-dimensional right-angled Artin groups

Abstract: We introduce an outer space for 2-dimensional right-angled Artin groups using Charney, Stambaugh and Vogtmann's the spine, on which the outer automorphism groups of 2-dimensional right-angled Artin groups acts properly and cocompactly. We define a metric on the space as Lipschitz metric.

47. **Chao Qian** *University of Chinese Academy of Sciences*

Title: Isoparametric foliations and related topics

Abstract: In this talk, we discuss recent progress on isoparametric foliations (isoparametric functions) on Riemannian manifolds, including exotic spheres. This talk is based on the joint work with Prof. Zizhou Tang.

48. **Naoki Sakata** *Hiroshima University*

Title: A generalization of the Cannon-Dicks fractal tessellation

Abstract: For each once-punctured torus bundle over the circle with pseudo-Anosov monodromy, Cannon and Dicks constructed a fractal tessellation of the complex plane (Riemann sphere with a parabolic fixed point removed), which nicely reflects the nature of the Cannon-Thurston map associated with the bundle. In this talk, I report a generalization of the fractal tessellation to an arbitrary punctured surface bundle over the circle with pseudo-Anosov monodromy.

49. **Migiwa Sakurai** *National Institute of Technology, Ibaraki College*

Title: An affine index polynomial invariant and the forbidden move of virtual knots

Abstract: Kauffman defines an affine index polynomial invariant for virtual knots. The invariant is induced from a numerical invariant called an n-writhe. In this talk, we provide the difference of the values obtained from the invariant between two virtual knots which can be transformed into each other by a single forbidden move. As a result, we make it possible for many virtual knots to determine the unknotting numbers by forbidden moves.

50. **Kouki Sato** *Tokyo Gakugei University*

Title: Non-orientable genus of a knot in punctured Spin 4-manifolds

Abstract: For a closed 4-manifold M and a knot K in the boundary of punctured M, we define $\gamma^0_M(K)$ to be the smallest first Betti number of non-orientable and null-homologous surfaces in punctured M with boundary K. Note that $\gamma^0_{S^4}$ is equal to the non-orientable 4-ball genus and hence γ^0_M is generalization of the non-orientable 4-ball genus. While it is very likely that for given M, γ^0_M has no upper bound, it is difficult to show it. In fact, even in the case of $\gamma^0_{S^4}$, its non-boundedness was shown for the first time by Batson in 2012. In this talk, we show that for any Spin 4-manifold M, γ^0_M has no upper bound.

51. **Reiko Shinjo** *Kokushikan University*

Title: A construction of a link projection satisfying the equation from Euler characteristic

Abstract: A 4-valent graph on the 2-sphere S^2 divides the sphere into n-gons. The numbers of i-gons must satisfy a certain equation obtained from Euler Characteristic. We remark that the equation does not restrict the number of 4-gons. Conversely, in graph theory, there are various studies of 4-valent graphs on S^2 which realize a given sequence satisfying the equation. Since link projections on S^2 can be regarded as 4-valent graph on S^2, the number of i-gons must satisfy the same equation. Therefore we consider a similar problem about link projections. Concretely, we consider whether any link has a projection realizing the given sequence satisfying the equation. For example, for "eight triangles (and no other polygons except for squares)" an affirmative conclusion can be obtained. This means that any link has a projection whose faces are only 3- and 4-gons. This gives alternative proof of our former result. Moreover we prove that any link has a projection whose faces are only 2-, 4- and n-gons for any $n \geq 5$. This is a joint work with Kokoro Tanaka (Tokyo Gakugei University).

52. **Masaaki Suzuki** *Meiji University*

Title: Non-meridional epimorphisms between knot groups

Abstract: An epimorphism between knot groups is called to be meridional if it takes a meridian to a meridian. In this talk, we show infinitely many examples of non-meridional epimorphisms.

53. **Kota Takahashi** *Osaka City University*

Title: Classification of ribbon 2-knot groups by using twisted Alexander polynomial

Abstract: We consider the classification of knot groups of ribbon 2-knots with one fusion, where we use the twisted Alexander polynomial.

54. **Hideo Takioka** *JSPS, Osaka City University AMI*

Title: A characterization of the Γ-polynomials of knots with the clasp numbers at most two

Abstract: It is known that every knot bounds a singular disk whose singular set consists of only clasp singularities. Such a singular disk is called a clasp disk. The clasp number of a knot is the minimum number of clasp singularities among all clasp disks of the knot. The Γ-polynomial is the common zeroth coefficient polynomial of both the HOMFLYPT and Kauffman polynomials. I will talk about a characterization of the Γ-polynomials of knots with the clasp numbers at most two.

55. **Yasuyoshi Tsutsumi** *Oshima National College of Maritime Technology*

Title: On the third Ohtsuki invariants for the Brieskorn-Hamm manifolds

Abstract: We calculate the third Ohtsuki invariant of every Brieskorn-Hamm manifold which is a rational homology 3-sphere. As an application, we show that the third Ohtsuki invariants of the Brieskorn-Hamm integral homology 3-sphere are negative and the third Ohtsuki invariants of the Brieskorn-Hamm rational homology 3-spheres except the Brieskorn-Hamm integral homology 3-spheres are positive.

56. **Shicheng Wang** *Peking University*

Title: Graphs in 3-sphere with maximum symmetry

Abstract: Consider finite groups G acting on pairs (S^3, Γ), where Γ is a connected graph of genus $g > 1$, embedded in S^3. For each g we give the maximum order m_g of such G acting on (S^3, Γ) for all such $\Gamma \subset S^3$. Indeed we will classify all graphs $\Gamma \subset S^3$ which realize these m_g in different levels: as abstract graphs and as special graphs, as well as their group actions. (This is joint work with Chao Wang, Yimu Zhang and Bruno Zimmermann.)

57. **Peng Cheng Xu** *Oklahoma State University*

Title: P-moves between pants block decompositions of 3-manifolds

Abstract: A pants block decomposition of a compact hyperbolic 3-manifold is a decomposition of the 3-manifold which cuts the manifold into fundamental pieces called pants blocks. This is similar to a triangulation, which cuts the 3-manifold into tetrahedra. In this talk we will discuss how to relate two pants block decompositions of a manifold with a sequence of P-moves, which are similar to Pachner moves between triangulations.

58. **Zhiqing Yang** *Dalian University of Technology*

Title: Marked knot diagrams and their applications

Abstract: We introduce one way to mark knot diagram. Using the marking as parameter, we can get more powerful knot invariants. The marking also provides information of crossing numbers.

59. **Mi Jeong Yeon** *Kyung Hee University*

Title: Rasmussen invariants of an infinite family of general pretzel knots

Abstract: We find an infinite family of general pretzel knots whose Rasmussen invariants are not equal to the signature invariants. We use the long exact sequence in Khovanov homology. This is a joint work with Se-Goo Kim.

60. **Bin Yu** *Tongji University*

Title: A note on homotopy classes of nonsingular vector fields on S^3

Abstract: It is well known that the homotopy class (up to homeomorphism) of nonsingular vector fields on S^3 are in one-to-one correspondence with $\mathbb{N}$ via the homotopy number. In this talk, we aim to represent each homotopy class by some "canonical" nonsingular vector fields: (1) we will try to convince you that nonsingular Morse-Smale vector field is a good choice; (2) we will show how to use Morse-Smale vector fields to represent every homotopy class.

61. **Faze Zhang** *Dalian University of Technology*

Title: The subset of $\mathbb{R}^3$ realizing metrics on curve complex

Abstract: In this talk, we will introduce some metrics on curve complex through points in a subset $\mathcal{V}$ of $\mathbb{R}^3$. And we will show some properties of curve complex under these metrics.

62. **Fuji Zhang** *Xiamen University*

Title: Links produced by some unitary operations of graphs

Abstract: It is well known that a shaded link diagram corresponds to a signed plane multi-graph and alternating link diagrams correspond to plane multi-graphs. In this talk, we discuss the new links produced by some unitary operations on graphs. The operations we considered are line graph and parallel line graph. The relation between a link and the new link produced in this way are also discussed. This is a joint work with Xian'an Jin and Weiling Yang.

63. **Kai Zhang** *Dalian University of Technology*

Title: On $2k$-move

Abstract: In this talk, we prove that for each integer $k \geq 3$ there exist some knots which are not $2k$-move equivalent to the trivial knot using the Jones polynomial.

64. **Qiang Zhang** *Xi'an Jiaotong University*

Title: On the fixed subgroups of homeomorphisms on Seifert manifolds

Abstract: For an automorphism of a group, the fixed subgroup consists of elements which are fixed by the automorphism. The property of the fixed subgroup is very interesting in algebra. In this talk, we consider the fixed subgroups of homeomorphisms of Seifert manifolds and give a bound of the rank of the fixed subgroup using topological and algebraic methods.

65. **Yanqing Zou** *Dalian Nationalities University*

Title: The properties of locally large distance 2 Heegaard splittings

Abstract: In this talk, we will introduce the locally large distance 2 Heegaard splitting and show some properties of it. This is a joint work with Ruifeng Qiu.

ECNU = East China Normal University
KAIST = Korea Advanced Institute of Science and Technology
KIAS = Korea Institute for Advanced Study
OCAMI = Osaka City University Advanced Mathematical Institute
POSTECH = Pohang University of Science and Technology