1. Abstracts (Plenary talks)

Jae Choon Cha (POSTECH)

Slicing iterated Bing doubles

Abstract: We introduce new techniques to detect non-slice iterated Bing doubles and results obtained by applying them. Parts of the results are joint with Charles Livingston, Daniel Ruberman, and Taehee Kim.

Boju Jiang (Peking University)

Computing the Nielsen number on a graph — a survey

Abstract: Let $f : X \to X$ be a selfmap on a compact connected polyhedron X. The Nielsen number $N(f)$ is a homotopy invariant which is a lower bound for the number of fixed points in the homotopy class of f. This lower bound is realizable when X is a manifold of dimension at least 3.

In contrast to its theoretical beauty, the Nielsen number is notoriously difficult to compute, even if X is a graph (= a 1-dimensional complex)! We'll survey the advances in the past decade towards algorithmic computation of $N(f)$ on graphs.

Gyo Taek Jin (KAIST)

Prime knots with arc index up to 11 and an upper bound of arc index for non-alternating knots

Abstract: This is a joint work with Wang Keun Park. Every knot can be embedded in the union of finitely many half planes with a common boundary line in such a way that the portion of the knot in each half plane is a properly embedded arc. The minimal number of such half planes is called the arc index of the knot. We have identified all prime knots with arc index up to 11. We also proved that the crossing number is an upperbound of arc index for non-alternating knots. As a result the arc index is determined for prime knots up to twelve crossings

In Dae Jong (Osaka City Univ.)

On the Alexander polynomials of alternating knots of genus two

Abstract : We give linear inequalities for the Alexander polynomials of alternating knots of genus two. Our linear inequalities are complete in the sense that any other linear inequality for all alternating knots of genus two is a consequence of our inequalities. In particular, as consequences of our inequalities, we can obtain the affirmative answer for Fox's trapezoidal conjecture and Ozsváth-Szabó's condition for alternating knots of genus two. As an application of our result, we determine the alternating knots which possess the Alexander polynomials $\Delta(t) = \sum_{i=0}^{4} a_i t^i$ with $|a_0| \leq 3$.

Ki Hyoung Ko (KAIST)

Graph braid groups and right angled Artin groups

Abstract: We first survey the theory of graph braid groups that was introduced by Ghrist and Abrams in 1999. Even though most of graph braid groups are right-angled Artin groups, some counterexamples have been discovered and then one of main goals has been to determine when a graph braid group is a right-angled Artin group. We try to answer this question except for small braid index.

Takashi Matsuoka (Naruto University of Teacher Education)

Applications of braid group representations to dynamical systems

Abstract : The generalized Lefschetz number for a continuous map is a refinement of the classical one defined by the action of the map on the fundamental group. Recently, B. Jiang and H. Zheng proved that, in the case of homeomorphisms on punctured disks, it coincides with the trace of some representation of braid groups. They also defined other representations of the braid group which extend the generalized Lefschetz number to periodic points. We compute some of these representations. The results are applied to study periodic points of homeomorphisms on punctured disks.

Takayuki Morifuji (Tokyo Univ. Agri. & Tech.)

On the signature cocycle and related invariants of 3-manifolds

Abstract: The signature cocycle was introduced by W. Meyer in the early '70s. It is a group 2-cocycle of the Siegel modular group and related to some invariants of 3-manifolds. In this talk, we discuss relations between them from the viewpoint of the mapping class group of a surface.

Andrei Pajitnov (Université de Nantes)

T.B.A.

Yo'av Rieck (The University of Arkansas)

On the Heegaard genus of knot exteriors (joint with Tsuyoshi Kobayashi)

Abstract : We will survey some of the authors' results about the behavior of Heegaard genus of knot exteriors under connected sum operation. As our main result we will prove that given integers $g_i > 1$ $(i = 1, \ldots, n)$, there exist knots K_i in S^3 so that:

1) $g(E(K_i)) = g_i$, and;

2) $g(E(K_1 \sharp \cdots \sharp K_n)) = g(E(K_1)) + \cdots + g(E(K_n))$.

This proves the existence of counterexamples to Morimoto's Conjecture.

Toshifumi Tanaka (Osaka City Univ.)

An infinite family of exotic 4-manifolds and Rasmussen invariants of knots

Abstract : One of the biggest break-throughs in 4-dimensional topology was Freedman's proof that every Casson handles is homeomorphic to the standard open 2-handle since it was used in a proof of Poincaré conjecture in dimension 4. On the other hand, R. Gompf showed that there exist infinitely many diffeomorphism types of Casson handles by using gauge theory, and Ž. Bižaca gave an explicit example of a Casson handle which is not diffeomorphic to the standard open 2-handle. Such a Casson handle is called exotic. Many Casson handles are exotic, however, it is still not known if all of them are. In this talk, by using Rasmussen's invariant derived from Khovanov theory, we give a gauge-theory free proof for the existence of countably many exotic Casson handles in a family of Casson handles. On the other hand, by using Bohr's inequality about the kinkiness of knots, derived via gauge theory, we distinguish between any two Casson handles in the family. Finally, we discuss some problems about smooth structures of Casson handles and other non-compact smooth 4-manifolds.

Jiangang Yao (UC Berkeley)

On embedding all n-manifolds into a single $(n+1)$-manifold

Abstract: Let e_n be the smallest integer such that any n-dimensional connected, closed manifold can be embedded into a single connected, closed manifold of dimension $n + e_n$. Whitney Embedding Theorem gives that e_n is at most n, while we show that e_n is at least 2 for most n. On the other hand, all simply-connected closed indefinite 4-manifolds and compact 4-manifolds with boundary can be embedded into a single closed 5-manifold. This is a joint work with F. Ding and S.C. Wang in Peking University.

2. **Abstracts (Parallel Sessions)**

Fan Ding (Peking University)

A unique decomposition theorem for tight contact 3-manifolds

Abstract: It has been shown by V. Colin that every tight contact 3-manifold can be written as a connected sum of prime manifolds. Here we prove that the summands in this decomposition are unique up to order and contactomorphism. This is a joint work with H.Geiges.

Toru Ikeda (Kochi University)

Boundaries of incompressible surfaces in graph link exteriors

Abstract : We will study boundaries of incompressible surfaces properly embedded in graph knot exteriors. We will first show that any bounded two-sided surface is meridional or longitudinal. In particular, iterated torus knot exteriors contain no bounded two-sided essential surface which is meridional or preferred longitudinal but Seifert surfaces. Even if the surface is possibly one-sided, the boundary is not of type $(2p, 2q + 1)$ for any integers p and q.

Teruhisa Kadokami (Dalian University of Technology)

Lens surgeries along the Whitehead link (a joint work with Noriko Maruyama (Musashino Art University) and Masafumi Shimozawa (Tokyo Woman's Christian University))

Abstract: Let $W = K_1 \cup K_2$ be the Whitehead link. We denote p_i/q_i-surgery along $K_i (i = 1, 2)$ by $M = (W; p_1/q_1, p_2/q_2)$. We assume that $p_1 \geq p_2 \geq 0$, $\gcd(p_i, q_i) = 1$ and $q_1 q_2 \neq 0$. Then our main result is the following:
Theorem. M is a lens space if and only if (1) $p_2/q_2 = 1$ and $|p_1 - 6q_1| = 1$, or (2) $(p_1/q_1, p_2/q_2) = (3, 2)$ or $(5, 2)$ or $(4, 3)$.

For the mirror image of W, the similar result holds by multiplying -1 to each surgery coefficient in the theorem. To prove the theorem, we used the Reidemeister torsion and the Casson-Walker invariant and the Rolfsen moves.

Tamas Kalman (The University of Tokyo)

The Homfly polynomial of braids with a full twist

Abstract: Let β be any braid on n strands, with exponent sum w. Let Δ be the Garside half-twist braid on n strands. We prove that the coefficient of v^{w-n+1} in the Homfly polynomial of the closure of β agrees with $(-1)^{n-1}$ times the coefficient of v^{w+n^2-1} in the Homfly polynomial of the closure of $\beta\Delta^2$. This implies that the lower Morton–Franks-Williams estimate for the v–degree of the Homfly polynomial of the closure of β is sharp if and only if the upper MFW estimate is sharp for the v–degree of the Homfly polynomial of the closure of $\beta\Delta^2$.

Seiichi Kamada (Hiroshima University)

On bridge presentation of virtual knots

Abstract : A proposal for bridge presentation of virtual knots is given and we discuss it. Some examples are introduced. This is a joint work with Mikami Hirasawa and Naoko Kamada.

Hun Kim (Institute for Gifted Students, KAIST)

Lattice Edge Number of Figure-8 knot

Abstract: Lattice edge number is the minimal number of unit length edges required to construct a polygonal representation of the knot K in $\mathbb{Z}^3$. In this talk, we will introduce the result of our work finding the lattice edge number of figure-8 knot.

Se Goo Kim (Kyoung Hee University)

Polynomial splittings of metabelian von Neumann rho-invariants of knots

Abstract: This is a joint work with Taehee Kim. We show that if the connected sum of two algebraically slice knots with coprime Alexander polynomials has vanishing von Neumann rho-invariants associated with certain metabelian representations then so do both knots. As an application, we give a new example of an infinite family of knots which are linearly independent in the knot concordance group.

Eiko Kin (Tokyo Institute of Technology)

An asymptotic behavior of the dilatation for a family of pseudo-Anosov braids (joint with Mitsuhiko Takasawa)

Abstract : The dilatation of a pseudo-Anosov braid is a conjugacy invariant. We study the dilatation of a special family of pseudo-Anosov braids. We prove an inductive formula to compute their dilatation, a monotonicity and an asymptotic behavior of the dilatation for this family of braids. We also give an example of a family of pseudo-Anosov braids with arbitrarily small dilatation such that the mapping torus obtained from such braid has 2 cusps and has an arbitrarily large volume.

Teruaki Kitano (Soka University) and **Masaaki Suzuki** (Akita University)

On the number of $SL(2;\mathbb{Z}/p\mathbb{Z})$-representations of knot groups

Abstract : The number of representations of a knot group is an invariant of knots. In this talk, we calculate these numbers associated to $SL(2;\mathbb{Z}/p\mathbb{Z})$-representations for all the knots in the Rolfsen's knot table. Moreover, we show some properties of these numbers.

Takahito Kuriya (Kyushu University)

$O(2N)$ and $Sp(N)$-version of the LMO invariant as a matrix model

Abstract : It is conjectured that G evaluation of LMO invariant is captured to the trival connection contribution to the quantum G invariant of rational homology 3-sphere. Actually, it is true for Seifert homology spheres and the contribution can be expressed as a matrix integral. In the case of $G = U(N)$, Garoufalidis and Marino showed that $U(N)$ evaluation of the LMO invariant of arbitrary rational homology 3-sphere can be always expressed as a matrix integral. In this talk, we will have the same result for $G = O(2N), Sp(N)$.

Jung Hoon Lee (Korea Institute of Advanced Study)

An upper bound for tunnel number of a knot using free genus

Abstract: The tunnel number of a knot, $t(K)$ is bounded above by $2g_f(K)$, where $g_f(K)$ is the free genus of K. One can take the tunnels on the free Seifert surface. In this talk we give a sufficient condition that $t(K) \leq 2g_f(K) - 1$ with the tunnels on the surface also.

Sang Yop Lee (Seoul National University)

Lens spaces and toroidal Dehn fillings

Abstract: We show that if M is a hyperbolic 3-manifold with ∂M a torus such that $M(r_1)$ is a lens space and $M(r_2)$ is toroidal, then $\Delta(r_1, r_2) \leq 4$.

Sang Youl Lee (Pusan National University)

New surface link invariants via ch-diagrams

Abstract: By a *surface link* (or *knotted surface*) of n components we mean a locally flat closed (possibly disconnected) surface $\mathcal{L} = F_1 \cup F_2 \cup \cdots \cup F_n$ imbedded in the oriented Euclidean space $\mathbb{R}^4$, where each component F_i is homeomorphic to a connected closed surface. Two surface links $\mathcal{L}$ and $\mathcal{L}'$ in $\mathbb{R}^4$ are said to be *equivalent* if there exists an orientation preserving homeomorphism $\Phi : \mathbb{R}^4 \to \mathbb{R}^4$ such that $\Phi(\mathcal{L}) = \mathcal{L}'$. In this talk, I'd like to introduce new invariants of equivalent surface links via a state-sum model associated with ch-diagrams of the surface links and show some features of the invariants.

Fengchun Lei (Dalian University of Technology)

On Maximal Collections of Essential Annuli in a Handlebody

Abstract: Let H_n be an orientable handlebody of genus n. Let $\mathcal{A}$ be a collection of pairwise disjoint non-parallel essential annuli in H_n. $\mathcal{A}$ is *maximal* if A is an essential annulus in H_n with $A \cap \mathcal{A} = \emptyset$ then A is parallel to a component of $\mathcal{A}$ in H_n. It is known that a maximal collection of essential annuli in H_2 of genus 2 could contain exactly 1, or 2, or at most 3 annuli. In the talk we will show that a maximal collection of essential annuli in H_n with $n \geq 3$ can contain at most $4n-5$ annuli and at least two annuli, and the bounds are best possible. Furthermore, we show that, for each m, $2 \leq m \leq 4n-5$, there exists a maximal collection of essential annuli in H_n which contains exactly m annuli. This is a joint work with Xunbo Yin and Jingyan Tang.

Zhi Lu (Fudan University)

Topological types of 3-dimensional small covers

Abstract: In this paper we study the (equivariant) topological types of a class of 3-dimensional closed manifolds (i.e., 3-dimensional small covers), each of which admits a Z_2^3-action such that its orbit space is a simple convex 3-polytope. We introduce six equivariant operations on such 3-dimensional closed manifolds. These six operations are interesting because of their combinatorial natures. Then we show that each such 3-dimensional closed manifold can be obtained from S^3, RP^3 and $S^1 \times RP^2$ with certain Z_2^3-actions under these six operations. As an application, we classify all such 3-manifolds up to equivariant unoriented cobordism.

Jiming Ma (Fudan University)

Distance and the Heegaard genera of annular 3-manifolds

Abstract: Let M be a compact orientable 3-manifold, and A be an essential annulus which cuts M into two 3-manifolds M_1 and M_2. It is well known that $g(M) \leq g(M_1) + g(M_2)$. In this talk, we will give a sufficient condition that $g(M) = g(M_1) + g(M_2)$. This is a joint work with R. Qiu, K. Du and M. X. Zhang.

Kanji Morimoto (Konan University)

Essential surfaces and torus knots with twists

Abstract : Let p, q be coprime integers and T(p,q) the torus knot of type (p, q). Suppose $p > 2$, and let r be an integer with $1 < r < p$. Take r-strands in the parallel p-strings of $T(p, q)$, and perform s-times full twists on the r-strands for some integer s. Then we denote the knot obtained by adding the full twists to $T(p, q)$ by $K(p, q; r, s)$. In the present talk, in the case of $r = 2$, we show that $K(p, q; 2, s)$ contains no closed essential surfaces in the exteriors for any p, q and s. On the other hand, for any composite number $r = km$ with $k > 1$ and $m > 1$, by putting $p = kn + 1$ and $q = k$ with $n \geq m$, we show that $K(p, q; r, s)$ contains an essential torus in the exterior, i.e. $K(kn+1, k; km, s)$ is a satellite knot whose companion is the torus knot $T(m, ms+1)$ and the pattern is the torus knot $T(k, k(n + m^2 s) + 1)$.

Daniel Moskovich (RIMS)

Surgery presentations of the dihedral covering link

Abstract : For any compact oriented 3-manifold M, we give two translations from a representation of M as a branched dihedral covering to a representation of M via surgery. Information about covering-linkage invariants is preserved by both methods. This is joint work with Andrew Kricker (Nanyang Technological University).

Jun Murakami (Waseda University)

On logarithmic knot invariant

Abstract : A new knot invariant is introduced from the radical of the restricted quantum group. This invariant is related to the logarithmic conformal field theory. I would like to expose the construction of it, and its relation to the colored Alexander invariant and the Hennings-Kauffman-Radford invariant.

Takuji Nakamura (Osaka Electro Communication university)

Delta unknotting numbers for positive knots

Abstract : A Delta unknotting number for a knot is the minimal number of "Delta moves" needed to create the unknot. A knot is said to be positive if it has a diagram whose all crossings are positive. In this talk, we consider Delta unknotting numbers for positive knots and for some larger classes of knots.

Ryo Nikkuni (Kanazawa University)

On spatial graph diagrams with at most three crossings (joint work with Youngsik Huh (Hanyang University))

Abstract : In this talk, we show the followings.

(1) Let G be a planar graph. A regular projection $\varphi : G \to \mathbb{S}^2$ is said to be *knotted* if any spatial embedding of G obtained by lifting φ with respect to the natural projection $\mathbb{S}^3 \to \mathbb{S}^2$ is not trivial. We show that if φ is knotted then φ must have at least three double points and any of the double points is produced by two disjoint edges.

(2) Let G be a graph (does not need to be planar) and f a spatial embedding of G which have a regular diagram with at most three crossings. Then we show that if $f(G)$ does not contain a Hopf link or a trefoil knot then f is *totally free*, namely $\pi_1(\mathbb{S}^3 - f(H))$ is a free group for any subgraph H of G.

We will also mention some corollaries implied by the results above.

Hyo Won Park (KAIST)

Injectivity of homologies of graph braid groups

Abstract: We will show that the first and second homologies of the braid group on the graph Γ' embeds in to those on the graph Γ when Γ contains Γ' in a certain way. Using holonomy Lie algebras of graph braid groups together with this injectivity, we show that the graph contains no "tumor" graphs if and only if its graph braid group is a right-angled Artin group when the braid index is ≥ 5 .

Seo Jung Park (KAIST)

Quadrisecant approximation of hexagonal trefoil knots

Abstract : We investigate whether the quadrisecant approximation of a hexagonal trefoil knot has more quadrisecants than those inherited from the trefoil.

Shin Satoh (Kobe University)

On tricolorable 2-knots of triple point number four

Abstract : We have shown that if a 2-knot has a non-trivial quandle cocycle invariant associated with tricolorings, then the triple point number is greater than or equal to four. In particular, the 2-twist-spun trefoil has the triple point number four. Hence, it is important to determine the family of 2-knots of triple point number four. Under the condition that the tricoloring invariant is non-trivial, we prove that a 2-knot has the triple point number four if and only if it is ribbon-concordant to the 2-twist-spun trefoil.

Akiko Shima (Tokai University)

On charts with two crossings (This is a joint work with Teruo Nagase)

Abstract : We show that if a chart contains at most two crossings, and if its closure is a disjoint union of 2-spheres, then its closure is a ribbon surface.

We introduce 'tangles' in charts. We study tangles in a disk which does not contain any crossings and whose boundary intersects three consecutive labels.

Reiko Shinjo (OCAMI)

Spatial graph diagrams realizing prescribed subdiagrams partitions

Abstract : Suppose $D_1, D_2, \ldots, D_n$ are spatial graph diagrams. If a spatial graph G is partitioned into edge disjoint spatial graphs $H_1, H_2, \ldots, H_n$ admitting the diagrams $D_1, D_2, \ldots, D_n$, respectively, then there is a diagram of G whose restrictions to $H_1, H_2, \ldots, H_n$ are equivalent to $D_1, D_2, \ldots, D_n$, respectively.

This is a natural extension of the result given by J. H. Lee and G. T. Jin.

Alexander Stoimenow (OCAMI)

Determinants of knots and Diophantine equations

Abstract : The Kauffman bracket approach to evaluate the determinant of a knot and a theorem on the signature of unit determinant knots is used to show the non-solvability, or derive conditions on solutions of certain Diophantine equations. The simplest such equations involve the second highest elementary symmetric polynomial. One can also obtain a criterion on knot adjacency. If time permits, I'll briefly mention other applications of the methods used.

Hongbin Sun (Peking University)

Commensurability of Surface Automorphisms

Abstract: In this talk, we study the relation between surface automorphisms: commensurability and rational commensurability. We use the theory of hyperbolic geometry and covering space to give some necessary conditions of (rational) commensurability for pseudo D-type automorphisms. Then, we use the consequence to give examples of 3-dimensional manifold which has different structures of surface bundle over circle up to rational commensurability.

Mitsuhiko Takasawa (Tokyo Institute of Technology)

Entropy of pseudo-Anosov braids and fiber surfaces of hyperbolic 3-manifolds (joint with Eiko Kin)

Abstract : There are two primitive invariants for hyperbolic surface bundles over the circle. One is the entropy of the monodromy and the other is the hyperbolic volume. If we fix the fiber surface, the entropy is linearly bounded from below by the hyperbolic volume for any monodromy. Some hyperbolic manifolds have many fiber structures. We compute the entropy of many fiber structures for the 3-chain link complement.

Kokoro Tanaka (Gakushuin University)

A categorification of the one-variable Kamada-Miyazawa polynomial (joint work with Atsushi Ishii (RIMS, Kyoto University))

Abstract : Khovanov homology is a homology theory for classical links whose graded Euler characteristic is the Jones polynomial. If we want to extend Khovanov homology to virtual links, Khovanov's construction does not immediately work and the main difficulty arising is the existence of Möbius cobordisms (bifurcations of type $1 \to 1$).

In this talk, we construct an extension of Khovanov homology to virtual links by taking suitable grading shifts and assigning one of two non-zero maps to each of the Möbius cobordisms. Our homology theory is a categorification of a one-variable specialization of the Kamada-Miyazawa polynomial.

Saki Umeda (Nara Women's University)

A design for pseudo-Anosov braids using hypotrochoid curves

Abstract : Topological nature of stirring fluid by using finitely many rods is closely related to Nielsen-Thurston theory and braid theory. It is natural to expect that stirrings corresponding to pseudo-Anosov braids can mix up fluid efficiently. Making use of this idea, various mixing devices are proposed by several authors, and their efficiencies are confirmed by using computer simulations and experiments. In this talk, we introduce other mixing devices with simple structures each consisting of few gears, where the movements of rods are given by hypotrochoid curves. We show that the braids corresponding the movements are pseudo-Anosov type by using linking numbers of the closures of them. We believe that our device has an advantage of for practical use from the viewpoint of the efficiency of the mixings.

Shida Wang (Peking University)

Strict achirality of links up to 11-crossing

Abstract: Achirality is an important property of objects in the 3-space and there are different abstractions or definitions of achirality in mathematics. Various methods have been developed to detect achiralities of knots and links and we shall use them to determine the strictly achiral links. It will be showed that there are exactly four strictly achiral non-trivial prime links up to 11 crossings.

Jianchun Wu (Peking University)

The degrees of self maps of orientable torus bundles and semi-torus bundles

Abstract: Given a geometric 3-manifold M and an interger d, there is a basic question whether there exists a proper map $f : M \to M$ of degree d. We calculate all degrees of self maps of M when M is orientable and is covered by a torus bundle over the circle.

Yoshikazu Yamaguchi (The University of Tokyo)

On the geometry of certain slices of character varieties of knots (joint work with Fumikazu Nagasato)

Abstract : We can define regular functions on character varieties of knot groups by meridians. The level sets of the regular function give subvarieties in a character variety, in particular, the level set at zero is used in the definition of the Casson-Lin invariant. In this talk, we construct algebraically a map from the level set at zero to the character variety of the two–fold branched cover along a knot and investigate the structure of the level set through this map. If we have time, we would like to talk about a relation with the equivalent Casson invariant.

Zhiqing Yang (Dalian University of Technology)

Wirtinger presentations and link diagrams

Abstract: In this talk, I shall discuss when a Wirtinger presentation determines a unique link diagram, or link type.

Tsukasa Yashiro (Sultan Qaboos University)

On lower bounds of triple point numbers for 5-colorable 2-knots

Abstract : An oriented connected closed surface embedded in 4-space is called a surface-knot. A 2-knot means a surface-knot with genus zero. The minimal number of triple points in all possible surface diagrams is a surface-knot invariant called the triple point number. In this talk we discuss about lower bounds of triple point numbers for 2-knots colored with the dihedral quandle of order 5. This is a joint work with Abdul Mohamad.

Akira Yasuhara (Tokyo Gakugei University)

Self delta-equivalence for links whose Milnor's isotopy invariants vanish

Abstract : For an n-component link L, the Milnor's isotopy invariant is defined for each multi-index $I = i_1 i_2 ... i_m$ ($i_j \in \{1, ..., n\}$). Here m is called the length. Let $r(I)$ denote the maximum number of times that any index appears. It is known that Milnor invariants with $r = 1$ are link-homotopy invariant. N. Habegger and X. S. Lin showed that two string links are a link-homotopic if and only if their Milnor invariants with $r = 1$ coincide. This gives us that a link in S^3 is link-homotopic to a trivial link if and only if the all Milnor invariants of the link with $r = 1$ vanish. Although Milnor invariants with $r = 2$ are not link-homotopy invariants, T. Fleming and the speaker showed that Milnor invariants with $r \leq 2$ are self Δ-equivalence invariants. In this talk, we give a self Δ-equivalence classification of the set of n-component links in S^3 whose Milnor invariants with length $\leq 2n - 1$ and $r \leq 2$ vanish. As a corollary, we have that a link is self Δ-equivalent to a trivial link if and only if the all Milnor invariants of the link with $r \leq 2$ vanish.

Ki-Heon Yun (Seoul National University)

Fibered knot and Lefschetz fibrations of Fintushel-Stern knot surgered 4-manifold

Abstract: Let $E(n)$ be the simply connected elliptic surface without multiple fiber and which has holomorphic Euler characteristic n and $K \subset S^3$ be a fibered knot. Then the Fintushel-Stern knot surgered 4-manifold $E(n)_K$ has a symplectic structure. In the talk, we will explain how to consider a knot surgered 4-manifold $E(n)_K$ as a Lefschetz fibration. We also give some applications of this construction to the smooth classification problem of simply connected 4-manifolds.

Mingxing Zhang (Dalian University of Technology)

Labeled graph method in handle addition

Abstract: Gordon, Litherland and Luecke developed label graph method in studying Dehn filling. We will introduce an extension of this method to handle addition. As an application, we will prove that the distance between two separating reducing handle additions is at most two. This is a joint work with R. Qiu.

Qiang Zhang (Peking University)

Boundary slopes of immersed surfaces in Haken manifolds

Abstract: In this paper, we give a bound for the number of boundary slopes of orientable immersed proper 1-injective surfaces of given genus g in an orientable Haken 3-manifold M with a torus boundary, where the bound is independent of M, and a function of g and m, the number of the Jaco-Shalen-Johannson decomposition tori of M.

Xuezhi Zhao (Capital Normal University)

Homotopy minimal periods for maps on the 3-nilmanifolds

Abstract : One of the natural problems in dynamical systems is the study of the existence of periodic points of least period exactly n. Homotopically, a new concept, namely homotopy minimal periods was introduced by Alsedà, Baldwin, Llibre, Swanson and Szlenk in 1995. Since the homotopy minimal period is preserved under a small perturbation of a self-map f on a manifold X, the set of homotopy minimal periods of f describes the rigid part of dynamics of f.

In this talk, we illustrate a complete description of the homotopy minimal periods for all maps on the 3-dimensional nilmanifolds

Hao Zheng (Sun Yat-sen University)

High order skein relations in colored HOMFLY polynomial

Abstract: In this talk I will show that the skein relations in HOMFLY polynomial still hold in a subtle way in its generalizations. I will also show how to use these relations to give a partial proof to the LMOV conjecture, which predicts a highly nontrivial structure in the colored HOMFLY polynomial of knots and links.

3. **Abstracts (Poster Session)**

Arnaud Deruelle (Tokyo Institute of Technology)

Network of Seifert surgeries
(joint works with Mario EUDAVE-MUNOZ, Katura MIYAZAKI, Kimihiko MOTEGI)

Abstract : In a preliminary work with K. Miyazaki and K. Motegi, we introduced a Network of Seifert surgeries in order to find a global explanation to the production of Seifert fiber spaces by Dehn surgeries on knots, called Seifert surgeries for short; for instance, Seifert surgeries on Torus knots are well-understood as their exterior (in S^3) is "already" Seifert fibered. This Network is usefull to understand Seifert surgeries on Hyperbolic knots as "descendants" of Seifert surgeries on Torus knots. We studied many known examples as Berge or Dean Seifert surgeries, and recently, worked on the case of the Covering knots that are obtained by the Montesinos trick; in particular, the examples introduced by M. Eudave-Munoz.

Tetsuya Ito (The University of Tokyo)

Braid ordering, Nielsen-Thurston classification and geometry of knot complement

Abstract : According to Thurston, braids are classified into three types by their dynamics; periodic, reducible, and pseudo-anosov. On the other hand, Thurston also shows knots are classified into three types by the geometry of their complements; torus knot, satellite knot, and hyperbolic knot.Since every link is represented as a closed braid, it is natural to study relationship between these two classifications. We prove that if Dehornoy floor of braids, which is an integer determined by the ordering of braid groups, are larger than three, these classifications are in one-to-one correspondence.

Masahide Iwakiri (OCAMI)

A G-family of quandles and cocycle invariants for handlebody-links (joint work with Atsushi Ishii (RIMS, Kyoto University))

Abstract : A handlebody-link is a disjoint union of circles and a finite trivalent graph embedded in the 3-sphere. We consider it up to isotopies and IH-moves. A G-family of quandles is a family of quandles whose binary operations are parameterized by the elements of G. A symmetric quandle is defined by using the G-family. We define a coloring of handlebody-links associated with such a symmetric quandle. We

show how a quandle cocycle invariant for handlebody-links is obtained when G is a finite group generated by one element.

Yeonhee Jang (Osaka University)

Genus 2 Heegaard splittings of 3-manifolds and 3-bridge presentations of links

Abstract : We give a positive answer to a question by Morimoto about how to distinguish Heegaard splittings up to isotopy or up to homeomorphism. We can generalize the result to other non-simple manifolds and, by considering double branched coverings, we obtained a family of 3-bridge links each of which admits infinitely many 3-bridge presentations.

Yasto Kimura (The University of Tokyo)

Third rack homology class of knot quandle obtained from shadow coloured diagram

Abstract : For a non-trivial knot K, it is known that a diagram D of K determines a 2nd rack homology class of the knot quandle $Q(K)$. We show that the diagram D also determines a 3rd rack homology class of $Q(K)$. This homology class is also shown to concern with the shadow cocycle invariants of knots.

Takahiro Kitayama (The University of Tokyo)

Isometries on SU(2)-representation spaces of knot groups and twisted Alexander functions

Abstract : We study two sorts of actions on the space of conjugacy classes of irreducible SU(2)-representations of a knot group. One of them is an involution which comes from the algebraic structure of SU(2). The other is the action by the outer automorphism group of the knot group. In particular, we consider them on a 1-dimensional smooth part $\mathrm{Reg}(K)$ of the space, which is canonically metrized via a Reidemeister torsion volume form. This investigation enables us to detect the distribution of the classes of metabelian representations in $\mathrm{Reg}(K)$. Using the number of these classes, we can also obtain a sufficient condition for $\mathrm{Reg}(K)$ to have an arc component and a necessary condition for a knot to be amphicheiral. As a further

application, we show that the twisted Alexander function on the SU(2)-representation space has a symmetry about the metrization on $\mathrm{Reg}(K)$.

Shojiro Nagata (InterVision Institute)

Knot related patterns in folk arts

Abstract : Folk patterns include a kind of actual knots e.g Asian Knots, or a kind of string patterns e.g Celtic knot design, Kolam painting in South India, Sona sand painting in Central Africa or Nitus sand painting in Vanuatu, South Pacific Oceania etc. These latter patterns are very similar in graphical structures and we can analyze and synthesize them as knot patterns. These string and knot patterns have some unsolved problems, different from the Eulerian Cycle, which are now addressed as topics in knot/link theory in mathematics.

Keiichi Sakai (The University of Tokyo)

Configuration space integral and Poisson structure on the homology of the space of framed long knots

Abstract : It is known that a little disks operad acts on the space K of framed long knots, and hence its homology is a Poisson algebra. But in the case of codimension greater than two, the Poisson structure has not been well understood. In this talk we show that, in higher codimensional case, the Poisson bracket gives the first example of non-zero homology class of K which does not correspond to any trivalent graphs. We prove the non-triviality of the class by evaluating it on the dual cocycle arising from a non-trivalent graph cocycle via configuration space integral.