First East Asian School of Knots, Links, and Related Topics

February 16 – 20, 2004
Kyoyuk Munhwa Hoekwan, Seoul, Korea

Program and Abstracts

First East Asian School of Knots, Links, and Related Topics

Kyoyuk Munhwa Hoekwan, Seoul, Korea
February 16 – 20, 2004

Hosted by

Department of Mathematics
Korea Advanced Institute of Science and Technology

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Korea Advanced Institute of Science and Technology

Welcome to

The First East Asian School of Knots, Links and Related Topics

Dear Colleagues,

It is our pleasure to welcome you to this historic inaugural meeting of the East Asian School of Knots, Links and Related Topics.

The purpose of the conference is to help promoting the academic exchange and the friendship among researchers of three East Asian neighbors in the area of knots, links and related topics and encouraging graduate students of the three countries to study in this fascinating area of mathematics. A similar exchange program has been held between Korea and Japan for more ten years and the delegates of three countries met at the Xian topology satellite conference of International Congress of Mathematicians 2002 and agreed that the program need to be expanded to include Chinese colleagues and the first annual meeting will be hosted by Korea in 2004, the second by China, and the third and fourth by Japan.

We hope you will enjoy this opportunity to renew old acquaintances and make new friends during the school and we also hope this beautiful tradition continues in the future schools.

Sincerely,

Ki Hyoung Ko
Chair, Local Organizing Committee

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Abstracts

Braids, knots and contact structures on $\mathbb{R}^3$

Joan Birman, *Barnard College of Columbia University*

We will discuss the interrelationships between braid theory, contact structures on 3-manifolds and Legendrian and transverse knots in S^3. At the end of the talk we will discuss the examples discovered by the speaker and William Menasco of distinct transverse knot types with the same topological knot type and Bennequin invariant.

Concordance of knots in rational homology spheres

Jae Choon Cha, *ICU*

In this talk we discuss the structure of the group of rational concordance classes of codimension two knots in odd dimensional rational homology spheres. It is known that there is a homomorphism of the rational knot concordance group into the algebraic rational concordance group, which is defined to be a limit of ordinary concordance groups of Seifert matrices. One of our main result is a full calculation of the structure of this limit. We discover a complete set of invariants of this limit and show that it is isomorphic to the sum of infinitely many copies of Z, Z/2,and Z/4. An analysis of limiting behaviour of Artin reciprocity using the machinery from algebraic number theory plays a crucial role in this calculation. In higher dimensions, We show that the algebraic rational concordance group is isomorphic to a certain geometrically defined summand of the rational knot concordance group which contains concordance classes of all knots in the honest sphere. It follows that the rational concordance group has order 2 and 4 elements. We also show that the kernel (resp. cokernel) of the natural homomorphism of the ordinary concordance group into the rational concordance group is large enough to contain infinitely many independent elements of order 2 (resp. of order 2, 4, and infinite which are nondivisible). This illustrates that the structure of the rational knot concordance group is drastically ifferent from integral knot concordance group. In the classical dimension, we show that the rational concordance class is not determined by its Seifert matrix, even for knots in the three sphere, using von Neumann L2-signature invariants.From this it follows that the first unknown step of the Cochran-Orr-Teichner rational solvability filteration is nontrivial.

Quantum invariants and group action on 3-manifolds

Nafaa Chbili, *Tokyo Institute of Technology*

Let $p \geq 2$ be an integer. A link L in the three-sphere is said to be $p-$freely periodic if and only if there exists an orientation-preserving auto-diffeomorphism of S^3, such that $h(L) = L$, h is of order p and h^i has no fixed points for all $1leqileqp-1$. In a former work, we provided a necessary condition for a knot to be $p-$freely periodic (for p prime), using the first coefficient of the HOMFLY polynomial. In this talk, we explain how to extend this result to the second and the third coefficient of the HOMFLY polynomial. We also explain how to apply this for knots with less than nine crossings.

Braid groups, the topology of configuration spaces, and homotopy groups

Frederick Cohen, *University of Rochester*

This talk explores how Artin's braid groups encode maps from spheres to other natural spaces. One example which is given by elementary "cabling of braids" encodes information about maps from the n-sphere, n ¿ 1, to the 2-sphere. An overview of these structures, as well as connections to Vassiliev invariants of pure braids and associated Lie algebras of Kohno-Drinfel'd will be given. This talk is based on joint work with J.Berrick, Y.-L. Wong, and J. Wu.

Braid Colourings

Patrick Dehornoy, *Université de Caen*

As concentrating on one single unifying aspect,namely braid colorings, we will show how this leads equally naturally to the Artin representation, the Burau representation, or the braid ordering

Positive Quaternionic Kahler manifolds and symmetry rank

Fuquan Fang, *Nankai University*

Let M be a positive quaternionic Kähler manifold of dimension $4m$.If the isometry group $ext\mathrm{Isom}(M)$ has rank at least $\frac{m}{2}+3$, then M is isometric to $BbbHP^m$ or $Gr_2(BbbC^{m+2})$. The lower bound for the rank is optimal if m is even.

Genera and fiberedness of satellite knots of tunnel number one(Joint with K. Murasugi)

Mikami Hirasawa, *Gakushuin University*

In 1991, Morimoto-Sakuma determined satellite knots of tunnel number one, and in 1999, Goda-Teragaito determined which of them have genus one. In this talk, we exhibit an argorithm to span a minimal genus Seifert surface for them and determine which of them are fibered knots. Except for one family of them (with a precise description), the genera and fiberedness are determined by the degree and the monicity of the Alexander polynomials. Our study is reduced to that on their pattern knots, which are obtained from a 2-bridge link by twisting one component by the other.

On diffeomorphisms over surfaces in the complex projective plane

Susumu Hirose, *Saga University*

In this talk, we discuss the extendability of diffeomorphisms on surfaces embedded in the complex projective plane. For trivially embedded surface (boundary of the 3-dimensional handlebodies embedded in the complex projective plane) and surfaces in the complex projective plane defined as non-singular plane curve of degree 3 or 4, any orientation preserving diffemorphisms over these surfaces are extendable to the complex projective plane. On the other hand, for a surfaces defined as non-singular plane curve of odd degree greater than or equal to 5, there are orientation preserving diffemorphisms over these surfaces which are not extendable to the complex projective plane.

The Smale conjecture for lens spaces

Sungbok Hong, *Korea University*

S. Smale proved that for the standard round 2 spehere S^2, tje inclusion of the isometry group $O(3)$ into the diffeomorphism group $\mathrm{Diff}(S^2)$ is a homotopy equivalence. He conjectured that the analogous result holds true for the 3-shere. It was proved by A. Hatcher. A natural extension of the Smale conjecture is that if M is any elliptic 3-manifold then $\mathrm{Isom}(M) \to \mathrm{Diff}(M)$ is a homotopy equivalence. We prove this conjecture confirmatively for lens spaces.

Skein relations of the Links-Gould invariant and their applications

Atsushi Ishii, *Osaka University*

We introduce two skein relations. One is obtained by deforming the known

cubic skein relation. Another one is obtained from the first skein relation by replacing a tangle with similar one. Although it is not easy to evaluate the LG invariant without the aid of a computer because of the size of the R-matrix, these skein relations lead us to recursive calculation of the invariant for Conway's algebraic links. By using these skein relations we obtain a formula for the Links-Gould invariant of the family of knots given by Kanenobu, which include infinitely many knots with the same Jones and HOMFLY polynomials, and show that the invariant is complete for this family.

Dihedral cocycle invariants of twist-spun 2-bridge knots

Masahide Iwakiri, *Hiroshima University*

J. S. Carter, D. Jelsovsky, S. Kamada, L. Langford and M. Saito introduced the quandle cocycle invariants of 2-knots, and calculated the invariants of a 2-twist-spun trefoil knot with a 3-cocycle of the dihedral quandle of order 3. S. Asami and S. Satoh calculated the cocycle invariants of twist-spun torus knots associated with 3-cocycles of some dihedral quandles. They used tangle diagrams of the torus knots. In this talk, we caluculate cocycle invariants of twist-spun 2-bridge knots by a similar method.

Reidemeister torsion of homology lens spaces

Teruhisa Kadokami, *OCAMI*

We investigated the Reidemeister torsion of certain homology lens spaces. The first main result is that we gave a necessary and sufficient condition for the Reidemeister torsion of a homology lens space which is a rational surgery along a torus knot to be that of a lens space. The second result is that if a rational surgery along a knot K in a homology 3-sphere, whose Alexander polynomial $\Delta_K(t)$ is degree 2, is lens space type, then $\Delta_K(t) = t^2 - t + 1$.

Virtual knots and virtual crossings

Naoko Kamada, *OCAMI*

The feature of the Jones polynomials for virtual links is quite different from that for classical links. There are a lot of virtual knots whose Jones polynomials are trivial. It is known that the Jones polynomials of alternating virtual link diagrams behave similarly to classical ones. Kishino studied the Jones polynomials of alternating virtual link diagrams with one virtual crossing. Here we study the Jones polynomials of v-alternating virtual link diagrams. We say that

a virtual link diagram is v-alternating if it becomes an alternating virtual link diagram after changing one virtual crossing into a real crossing. The result is as follows: The span of the Jones polynomial of a v-alternating link diagram is determined by the number of real crossings and the supporting genus. Moreover we see that any v-alternating link diagram is not equivalent to a classical link diagram.

Knot Mutation: 4-Genus of Knots and Algebraic Concordance

Se Goo Kim, *University of California Santa Barbara*

Kearton observed that mutation can change the concordance class of a knot. A close examination of his example reveals that it is of 4-genus 1 and has a mutant of 4-genus 0. The first goal of this talk is to construct examples to show that for any pair of nonnegative integers m and n there is a knot of 4-genus m with a mutant of 4-genus n. A second result of this talk is a crossing change formula for the algebraic concordance class of a knot, which is then applied to prove the invariance of the algebraic concordance class under mutation. The paper concludes with an application of crossing change formulas to give a short new proof of Long's theorem that strongly positive amphicheiral knots are algebraically slice.

Some Topics on quandle cocycle invariants

Yasto Kimura, *Tokyo University*

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For a quandle \(X\) and a quandle 2-co-cycle \(\phi\in
Z_\Qdl^2(X; A)\), there exists an invariant \(\Phi_\phi(L)\)
of a link \(L\), which is called a quandle 2-co-cycle invariant.
In my talk, I construct a co-braided Hopf algebra \(H(X; \phi)\)
with  \(\mathcal{R}\) which gives \(\Phi_\phi(L)\) through its
co-action on \(V=\bigoplus_{i\in X} Ke_i\) and show some
properties of them. There are some generalizations of quandle
co-homology. The twisted quandle co-homology is one of them.
Carter, Elhamdadi, Gra\~na and Saito [CEGS] introduced
a new knot invariant \(\Phi^\Tw_\phi(L)\)
by twisted quandle co-cycle \(\phi\in Z_\Tw^2(X; M)\).
I demonstrate the identification of this invariant
with the eigenvalue of some map from \(\Z[M]\) to \(\Z[M]\).
Through this identification, we also get
a new representation of braid groups \(B_n\).
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Braids, hypergeometric integrals and conformal field theory

Toshitake Kohno, *Tokyo University*

Conformal field theory on the Riemann sphere provides a vector bundle over X_n, the configuration space of ordered distinct n points on the complex plane, equipped with a flat connection called the Knizhinik-Zamolodchikov connection. The purpose of this talk is to give a complete description of the horizontal sections of this vector bundle in terms of hypergeometric integrals in the sense of Aomoto and Gelfan'd.It turns out that the cylcles of the integration can be given by regularizable bounded chambers in the fiber of the projection map $\pi : X_{m+n} \to X_n$ with suitable m. We also describe the monodromy representations of the braid group in relation with Lawrence-Krammer representations.

Cycling orbits, cyclic words and the conjugacy problem on the braid groups

Jang Won Lee, *KAIST*

We discuss few potential improvements of the solution given by Garside, Elifai, and Morton to the conjugacy problem on the braid groups. We show that some of them are effective for braids built by multiplying randomly chosen permutation braids. On the other hand we also show how to generate braids that are candidates for making all of these improvements less useful.

Two tunnels of a tunnel number one link

Jung Hoon Lee, *KAIST*

We give a condition for a non-trivial tunnel number one link with two tunnels which gives a genus three Heegaard splitting of the link complement in S^3 and shows that 2-bridge links satisfy the condition.

Conjugacy classes of reducible braids

Sang Jin Lee, *Konkuk University*

All the known solutions to the problem of recognizing split braids and reducible braids need a whole solution to the conjugacy problem in braid groups.In the talk, we discuss the Garside normal form and the super summit set of reducible braids and propose a new solution that uses only a small part of the conjugacy algorithm.

Reducing and annular Dehn fillings

Sang yop Lee, *KIAS*

If two Dehn fillings on a simple manifold create a reducible manifold and an annular manifold respectively, then the distance between those filling slopes is known to be at most two. Moreover,Eudave-Mu noz and Wu gave infinitely many examples of manifolds admitting reducing and annular Dehn fillings at distance two. In this talk, we complement their examples to establish a complete list of simple manifolds admitting such a pair of Dehn fillings.

Minimal genus problem

Banghe Li, *Chinese Academy of Sciences*

The problem of representing a second homology class of a smooth 4-manifold by embedded surfaces with minimal genus started in the 1950's. Breakthroughs were brought by Rohlin's Signature Theorem, Atiyah-Singer's G-Signature Thoorem, Donaldson's Theory and Seiberg-Witten's Theory. We will talk about some history and recent results on this problem.

4-dimensional surgery on a "pochette"

Yukio Matsumoto, *Tokyo University*

A 4-manifold diffeomorphic to $S^1 \times D^3 \natural D^2 \times S^2$ is called a *pochette* (a bag with a shoulder strap). Embed a pochette P into a 4-manifold M by $f : P \to M$. Remove the interior $\mathrm{Int} f(P)$ and paste it back via a diffeomorphism $h : \partial P \to \partial(M \setminus \mathrm{Int} f(P))$. We call this process a *pochette surgery* on M along $f(P)$. Simple loops l and m on ∂P corresponding to $S^1 \times \{*\}$ and $\partial D^2 \times \{*\}$ are called a *longitude* and a *meridian*, respectively.

Theorem 1. *The diffeomorphism type of the resulting 4-manifold is determined by the embedding f, the homology class $h_*([m]) \in H_1(\partial(M \setminus \mathrm{Int} f(P)); \mathbb{Z}) \cong \mathbb{Z}[m] \oplus \mathbb{Z}[l]$ and a modulo 2 framing around $h(m)$.*

Theorem 2. *A pochette contains a "canonical torus", and by this torus, a pochette surgery along the pochette can be replaced by a Dehn surgery along a torus.*

In his master thesis submitted to the University of Tokyo (1999), O. Kataoka considered the branched covering space of S^4 branched along a 2-knot and studied the effect on the total space caused by the crossing change of the 2-knot. In our viewpoint, Kataoka's result can be restated as follows: *the double*

branched covering space of S^4 branched along a ribbon knot is obtained by a sequence of pochette surgeries starting from S^4.

On the Jones polynomials of ribbon knots of 1-fusion

Yoko Mizuma, *Tokyo Institute of Technology*

In this talk, we give some results for the first derivative at -1 of the Jones polynomial of ribbon knots of 1-fusion.

An enumeration of theta-curves with up to seven crossings

Hiromasa Moriuchi, *Osaka City University*

In 1989, Litherland has made a table of prime theta-curves up to seven crossings. However, it has not been published, and the completeness has been unproven. In this talk, we will give a list of all the theta-curves with up to seven crossings using Conway's method.

A Combinatorial Method for Enumerating Tree-Like Jacobi Diagrams

Daniel Moskovich, *Kyoto University*

It is well-known that the space of tree-like Jacobi Diagrams is isomorphic to a free Lie-Algebra. We outline a combinatorial approach for enumerating elements in this space, and show howit may extend to higher loop-degrees. We also give examples of how this approach may be used to facilitate certain homological calculations in the space of such diagrams.

The minimal relation in the Kauffman bracket skein module of the m-twist knot complement

Fumikazu Nagasato, *Kyushu University*

We will give an underlying relation in the Kauffman bracket skein module of the m-twist knot complement, which is called "the minimal relation" in this talk. We will also give an application of the minimal relation to the character variety of the m-twist knot.

On the crossing number of knot and the canonical genus of its Whitehead double

Takuji Nakamura, *OCAMI*

A Seifert surface of a knot K is said to be *canonical* if it is obtained from a diagram of K by applying Seifert's algorithm. Then the minimal genus among all canonical Seifert surfaces of K is called the it canonical genus for K, denoted by $g_c(K)$. J.J. Tripp showed that the canonical genus of a twisted Whitehead double of a torus knot of type $(2, n)$ is equal to n.Then he has conjectured that it the crossing number of a knot coincides with the canonical genus of its Whitehead double. We show that this conjecture is true for 2-bridge knots.

Delta move and Vassiliev invariants

Yasutaka Nakanishi, *Kobe University*

After their works of Goussarov and Habiro,it is known that a local move called C_n-move is strongly related to Vassiliev invariants of order less than n. Let K be a knot, and K^{C_n} the set of knots obtained from a knot K by a single C_n-moves. Let $\mathcal{V}_m$ be the set of Vassiliev invariants of order less than or equal to m ($m \geq 2$),and $\mathcal{V}_m\mathcal{K}$ the value set $(v, v(K)_{K\in\mathcal{K}})_{v\in\mathcal{V}_m}$ for a set of knots $\mathcal{K}$. Our main result is the following: If m_1, m_2 are sufficiently greater than n, then there exists a pair of knots K_1, K_2 such that $\mathcal{V}_{m_1}K_1 = \mathcal{V}_{m_1}K_2$, and $\mathcal{V}_{m_2}K_1^{C_n} e \mathcal{V}_{m_2}K_2^{C_n}$. In other words, the C_n Gordian complex is not homogeneous with respect to Vassiliev invariants. In this talk, we will study the case $n = 2$. Here, a C_2 move is a Δ unknotting operation.

Sharp edge-homotopy on spatial graphs

Ryo Nikkuni, *Waseda University*

A sharp move is a local move on oriented links which is known as an unknotting operation. We say that two spatial embeddings of a graph are sharp edge-homotopic if they are transformed into each other by sharp moves on a spatial edge and ambient isotopies. It is a generalization of self sharp-equivalence on oriented links. We investigate how is the sharp edge-homotopy strong. Moreover we mention a relationship between sharp edge-homotopy and delta edge (resp. vertex)-homotopy on spatial graphs. We show that there are infinitely many spatial complete graphs on four (resp. five) vertices up to delta edge (resp. vertex)-homotopy which are mutually sharp edge-homotopic.

Dehn fillings and small surfaces

Seung sang Oh, *Korea University*

In this talk we investigate the distances between Dehn fillings on a hyperbolic 3-manifold that yield 3-manifolds containing essential small surfaces including non-orientable surfaces.

Braids and singular braids on surfaces

Luis Paris, *Université de Bourgogne*

Let M be a closed surface and let $\mathcal{P} = \{P_1, \ldots, P_n\}$ be a collection of n distinct punctures in the interior of M. Define a *braid of M on n strings based at $\mathcal{P}$* to be a n-tuple $\beta = (b_1, \ldots, b_n)$ of disjoint smooth paths in $M \times [0,1]$, called the *strings* of β, such that:

- the projection of $b_i(t)$ on the second coordinate is t for all $t \in [0,1]$ and all $i \in \{1, \ldots, n\}$;
- $b_i(0) = (P_i, 0)$ and $b_i(1) = (P_{\xi(i)}, 1)$, where ξ is a permutation of $\{1, \ldots, n\}$, for all $i = 1, \ldots, n$.

The isotopy classes of braids based at $\mathcal{P}$ form a group called *braid group of M on n strings based at $\mathcal{P}$*, denoted by $B_n(M) = B_n(M, \mathcal{P})$. Note that this group does not depend on $\mathcal{P}$, up to isomorphism, but only on the cardinality $n = |\mathcal{P}|$.

In the same way as Artin braid groups have been extended to singular braid monoids, one can extend the braid group $B_n(M)$ to $SB_n(M)$, the *monoid of singular braids of M on n strings*. The strings of a singular braid are now allowed to intersect transversely in finitely many double points called *singular points*. As with braids, isotopy is a deformation through singular braids (which fixes the ends), and multiplication is by concatenation. Note that the isotopy classes of singular braids form a monoid and not a group: the singular braids with one or more singular points being non-invertible.

We focus this talk on some recent developments on braid groups and, more specifically, on singular braid monoids of closed surfaces. Firstly, we shall explain González-Meneses' presentation for $SB_n(M)$ (see [Go]). Afterwards, we shall present the theory Vassiliev invariants for braid on surfaces (see [GP]). Finally, we shall say a few words on the proof of Birman's conjecture for singular braids on surfaces (see [Pa]).

References

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[GP] J. González-Meneses, L. Paris, *Vassiliev invariants for braids on surfaces*, Trans. Amer. Math. Soc., to appear. ArXiv: math.GT/0006014.

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The reducibilities of Heegaard splittings

Ruifeng Qiu, *Dalian University of Technology*

In this talk, we shall use Scharlemann-Thompson's powerful ideas of thin decompositions of Heegaard splittings to give a new version to Casson-Gordon's theorem and Haken's lemma on Heegaard splittings. We shall also introduce some new results on the stabilizations of reducible Heegaard splittings and amalgamations of Heegaard splittings.

Complexity of Heegaard splittings

Toshio Saito, *Osaka University*

For Heegaard splittings of compact orientable 3-manifolds, there are several interesting conditions which are called reduciblity, weak reduciblity, the disjoint curve property and etc. Moreover, for closed orientable 3-manifolds, Hempel determined a complexity of Heegaard splittings, which is called the distance, by using the curve complex of each Heegaard surface. A concept of the distance is regarded as an extension of the above conditions for Heegaard splittings.

I would like to talk about another property for Heegaard splittings of compact orientable 3-manifolds.

A variation of McShane's identity for punctured surface bundles

Makoto Sakuma, *Osaka University*

Let M be an orientable complete hyperbolic 3-manifold of finite volume which fibers over the circle, with the fiber a punctured surface. Then each cusp torus of M has a Euclidean structure.We give a formula which expresses the modulus

of the Euclidean torus in terms of the complex translation lengths of essential simple loops on the fiber. This generalizes Bowditch's result on once-punctured torus bundles, which was obtained as a variation of McShane's formula on the lengths of simple closed geodesics of punctured hyperbolic surfaces.

Minimal positive entropy in B_5

Won Taek Song, *KIAS*

We show that the 5-braid $\sigma_1\sigma_2\sigma_3\sigma_4\sigma_1\sigma_2$ attains the minimum growth rate $\lambda_5 \sim 1.72208$, the largest root of $x^4 - x^3 - x^2 - x + 1 = 0$, among 5-braids with positive entropy.

An approach to weak hyperbolization conjecture via automatic groups

Makoto Tamura, *Osaka Sangyo University*

We discuss the following question posed by Gersten:

Is every (bi)automatic group which does not contain any Z+Z subgroup, hyperbolic?

To study this question, we define the notion of "n-track of length n", which is a structure like Z+Z, and show its existence in the Cayley graph of non-hyperbolic automatic groups with mild conditions. Using this structure, we answer the above question affirmatively for 2-starred automatic groups. In the 3-starred cases, we give a partial answer when the corresponding "MT-graph" is of special type.

(This is a joint work with Y. Nakagawa (Ryukoku University) and Y. Yamashita (Nara Women's University))

Braid indices of surface-knots and colorings by quandles

Kokoro Tanaka, *Tokyo University*

The braid index of a surface-knot F is defined to be the minimum number among the degrees of all simple surface braids whose closures are ambient isotopic to F. In this talk, we give a lower bound of the braid index of a surface-knot using the colorings by a quandle. As an application, we determine the braid indices of S^2-knots for infinitely many examples and give an infinite series of ribbon surface-knots of genus g whose braid indices are $s + 2$ for each pair of integers $ggeq0$ and $sgeq1$.

On the colored Jones polynomial of links

Toshifumi Tanaka, *Tokyo institute of technology*

In this talk, I will explain how to calculate the colored Jones polynomial of links by skein theory and I will give the formula for colored Jones polynomial of doubled knots using skein theory. This formula generalizes that of twist knots due to G. Masbaum. Examples of a non-trivial 2-component links whose Jones polynoimial is equal to that of the 2-component unlink was given by Thistlethwaite. I will also give the formula of the colored Jones polynomial of such a link using the same technique.

Enumerating the prime knots and links by a canonical order

Ikuo Tayama, *Osaka City University*

We talk about classical links.A. Kawauchi defined a well order in the set of the links, which naturally induces a well order in the set of the 3-manifolds.He suggested a method for classifying the 3-manifolds by using this order. In this talk we pay attention to the order in the set of the links and we call it the canonical order. We assign a natural number to each link and the number is called the length of the link. The length is equal to the minimal crossing number of a closed braid deformed from the link. Note that if the length of L is smaller than that of L', then L is smaller than L' in the canonical order. Note that for any natural number n, $\{L|L$ is a prime link and the length of L is equal to $n\}$ is a finite set. We give a way to enumerate the prime links and show a table of the prime links up to length 9.

Toroidal surgery on hyperbolic knots

Masakazu Teragaito, *Hiroshima University*

For a hyperbolic knot K in the 3-sphere, a toroidal surgery on K is integral or half-integral.That is, the slope corresponding to the surgery runs at most twice in the longitudinal direction.Recently, Gordon and Luecke showed that any hyperbolic knot with half-integral toroidal surgery is an Eudave-Munoz knot. Independently of this, we will determine the simplest hyperbolic knots with half-integral toroidal surgery. The case of integral toroidal surgery is not clear. All integers can occur among the toroidal slopes of hyperbolic knots. Hence there is no universal upper bound for toroidal slopes, generally. We will propose an upper bound, which is expected to be best possible, for integral toroidal slopes in terms of genera of knots, and report a partial result in this direction.

Strongly n-trivial 2-bridge knots and links

Ichiro Torisu, *Akita University*

We study strong triviality of 2-bridge knots and links via Dehn surgery techniques. We prove that a 2-bridge knot is strongly n-trivial for n¿0 if and only if it is the trivial knot or the trefoil knot or the figure-eight knot.

On Conway polynomials of strongly n-trivial knots and knots obtained from Brunnian links

Yukihiro Tsutsumi, *Keio University*

Let $L = k_1 cupcdotscupk_m$ be an m-component Brunnian link in S^3. Namely $L - k_i$ is an $(m-1)$-component trivial link in S^3. We denote by K_i the knot obtained from k_i by performing $pm1$-twist along each component of $L - k_i$. Then it follows from the Casson surgery formula that $|a_2(K_i)|$ coincide, where a_2 denotes the second coefficient for the Conway polynomial $abla$.When $m = 2$, there are no other restrictions.When $m = 3$, there are some other restrictions.When $m > 3$, $abla_{K_i}(z) = 1$.As an application, we show some properties of the Alexander polynomial of strongly n-trivial knots/links. We also show that any strongly n-trivial link is a boundary-link and has a closed incompressible surface in the complement.

Covering space of S^3 branched over pretzel knot

Yoshiaki Uchida, *Yamagata University*

In my talk, we will consider the branched covering space of the 3-sphere branched over a knot. And we will consider the following problem "which knot does have the 3-sphere as a branched covering space?". We will consider this problem for the pretzel knot.

Degree one maps and intersection forms of 4-manifolds

Shicheng Wang, *Peking University.*

We first give a report about the set of degrees of maps between two given $n-1$ connected $2n$-dimensional closed manifolds (with many concrete examples of such sets).

Then we prove that there is a degree one map from a 4-manifold M to a simply connected 4-manifold N if and only if the intersection form of N is a direct summand of that of M.

This is joint with Duan, Haobao.

Clasper moves among ribbon 2-knots characterizing their finite type invariants

Tadayuki Watanabe, *Tokyo University*

It is known that the notion of finite type invariants of classical knots is topologically reconstructed by a family of local moves called Habiro's C_k-moves among classical knots. C_k-moves are defined by using claspers. In this paper we define claspers and RC_k-moves among ribbon 2-knots to give such a reconstruction of the notion of Habiro-Kanenobu-Shima's finite type invariants of ribbon 2-knots. In particular, we show that two ribbon 2-knots are not distinguished by any finite type invariants of Habiro-Kanenobu-Shima type k if and only if they are related by a finite sequence of RC_{k+1}-moves. Further, we obtain a similar result for ribbon 1-knots. We also prove Habiro-Shima's conjecture that rational finite Habiro-Kanenobu-Shima type invariant extends uniquely to a rational finite Vassiliev-Goussarov type invariant.

Dehn surgery along A' Campo's divide knots

Yuichi Yamada, *University of Electro-Communications*

A'Campo's divide knot theory, which give links from plane curves, is related to Singularity theory. We study Dehn surgery along such divide knots in case that the plane curves are obtained cut out from the Lattice in the plane. In such cases, the "area of the curve" in the plane is related to finite surgery...

A construction of p-adic group action on Menger compacta

Zhiqing Yang, *Peking University*

A generalized version of the Hilbert 5th problem, called the Hilbert-Smith conjecture, asserts that among all locally compact groups only Lie group can act effectively on manifolds. It follows from the work of Newman and Smith that it is equivalent to the special case when the topological group is the p-adic integers group $\widehat{\mathbb{Z}}_p = \varprojlim \mathbb{Z}/p^n\mathbb{Z}, \phi_n$. Although no effective actions of p-adic group on manifolds has yet been constructed, there do exist p-adic group actions on Menger manifolds. We give a new construction of p-adic group action on Menger compacta.

On triple point numbers of surface-knots

Tsukasa Yashiro, *Osaka City University*

A surface–knot is an embedded oriented connected surface in 4–space. A

surface diagram is a generic projection of a surface–knot into 3–space.The triple point number of a surface-knot is the minimal number of triple points for all surface diagrams of the surface–knot. We have found some upper bounds for triple point numbers of some surface–knots by deforming given surface diagrams. In this talk we will show that a surface diagram containing some special sub–diagrams can be deformed into a simpler diagram by eliminating all triple points in those sub–diagrams.

fixed points of homeomorphisms on 3-dimensional reducible manifolds
Xuezhi Zhao, *Capital Normal University*

In this talk, we consider the fixed points of homeomorphisms of closed oriented reducible 3-manifolds. Up to an isotopy, we compute out the fixed point indices and fixed point coordinates for all isolated fixed point sets of homeomorphisms composed by two slides homeomorphism. An upper bound for the Nielsen numbers of these homeomorphims is obtained. Finally, we shall show by some examples that Nielsen numbers of such kind of homeomorphisms can be arbitrarily large, although their Lefschetz numbers are zero.

Representation of Braid groups
Hao Zheng, *Peking University*

In this talk we define a new presentation $\xi_{r,s}$, indexed by positive integer s, of r-string braid group B_r over free $\mathbb{Z}B_{r+s}$-module. This representation by some means widely generalizes the reduced Burau representation and the Lawrence-Krammer representation. Its application on forcing relations of braids is also touched.

On the irreducibility of the Lawrence-Krammer representations of the braid groups
Chen Zhi, *Tokyo University*

The Lawrence representation is a class of representations of the braid groups with two parameters,of which the Lawrence-Krammer representation is a special case.In this talk we will show that these representations are irreducible for generic parameters.

General Information

- **Breakfast (17th through 20th)**
  - **Guests of Kyoyuk Munwha Hoekwan**
    7:00 – 9:00 Western style morning buffet at Coffee Shop on the 2nd floor. The provided coupon need be presented.
  - **Guests of Core Hotel**
    7:00 – 8:10 Boxed breakfast will be distributed at the hotel lobby
- **Lunch**
  - **17th and 18th** 12:00 – 13:30
    Korean dish(Bi-bim-bab and Seafood Jeon-gol) at Cafeteria on the 1st floor. The provided coupon need be presented.
  - **19th** 12:00 – 12:30 Boxed lunch distributed at the exit of the conference hall
- **Dinner**
  - **16th** 18:30 – 20:30 Korean dish(Mushroom Jeon-gol) at Cafeteria on the 1st floor. The provided coupon need be presented. Those of who stay in Core Hotel will have a dinner with volunteer guides at a local restaurant
  - **17th** Reception
  - **18th** Banquet
  - **19th** At a near-by restaurant of your choice on the way of guided tour
- **Reception** 6:30 – February 17, Buffet style food and beverage, Gayagum Hall
- **Banquet** 7:00 – 9:00 February 18 Korean traditional dishes, Restaurant Gang Gang Sul Rae which can be reached by 20-minute walk from Yangjae station. Please catch the hotel shuttle buses that leave 6:20 or 6:40 pm to go to Yangjae station.
- **Shuttle Service** There is a free shuttle service between Kyoyuk Munhwa Hoekwan and Yangjae station every twenty minutes. Under the normal

circumstance, a shuttle bus leaves Yangje station for Kyoyuk Munhwa Hoekwan at 10, 30, 50 minutes passed every hour and it leaves Kyoyuk Munhwa Hoekwan for Yangje station at every exact hour and 20, 40 minutes passed every hour. Because each trip takes only about 10 minutes, it is possible to ride but with no seat.

- **Guided Tour** Thursday Afternoon February 19. After having a boxed lunch distributed, please start a tour in your assigned group by catching the hotel shuttle leaving at 12:20, 12:40 or 1: 00. Please try not to lose your local guides in your group because they are responsible for all expenses during the tour.
- **Phone Numbers**
  - Kyoyuk Munhwa Hoekwan 571-8100 inside Seoul
  - Core Hotel 3473-6031 inside Seoul
- **Presentation materials:**
  - Speakers are required to submit their transparencies unless they submitted in advance via email. The transparencies will be returned after scanning.
  - Scanned copies will be posted on the conference web page http://knot.kaist.ac.kr/2004/.
  - No xerox copies of presentation materials are available during the conference.
- **Proceedings:**
  - Speakers are required to submit TEXfiles of their manuscripts for the proceedings. The proceedings will be published electronically on the conference web page http://knot.kaist.ac.kr/2004/.
  - Printed copies of the proceedings are available only by requests.
- **All invited participants from China and Japan will be provided with:**
  - access to all sessions of *the school*
  - hotel room stay from the night of 16th, February to the night of 19th, February

  - meals from the dinner of 16th, February to the breakfast of 20th, February
  - the Reception in the evening of 17th, February
  - the Banquet in the evening of 18th, February
  - a coffee break in the afternoons of 17th and 18th
  - guided tour on the afternoon of 19th, February.

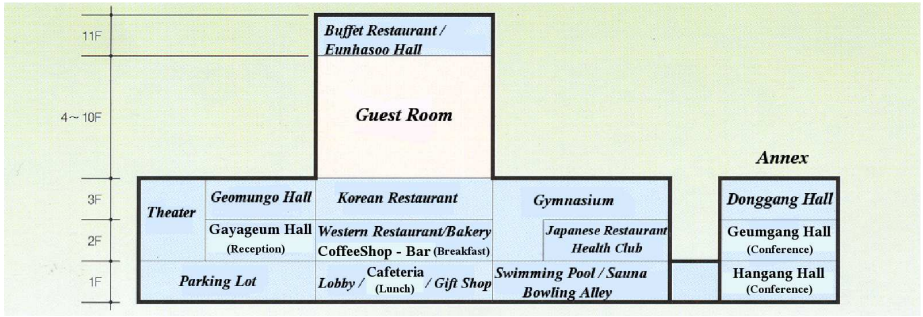
- **The local organizer does not support:**
  - drink and snack stored in the refrigerator
  - phone calls
  - transportation expenses between the airport and the hotel
  - laundry services
  - additional beverages and drinks ordered by participants themselves at the reception and the banquet
  - meals, foods and goods whatever the participants buy from the commercial shops
  - using any additional facilities including sauna (Facilities in Kyoyuk Munhwa Hoekwan in are available at discount prices for guest of the hotel. For example one entry fee of Health Club (indoor swimming pool + exercise room + sauna) is 5,000 Won. Ask at Information Desk for details.)
  - using any additional facilities that are often available at discount prices to hotel guests. For example:
    * One entry to the Health Club (indoor swimming pool + exercise room + sauna) is 5,000 Won.
    * Internet connection in your room is 10,000 Won per day. Ask at Information Desk for details.

Any charge resulted from the above services should be paid in full by participants before checking out the hotel.

Buildings and Floor Plan

- Top View

- Side View



List of Participants

Byung Hee An, *KAIST*
anbyhee@knot.kaist.ac.kr

Soichiro Asami, *Chiba University*
xasami@g.math.s.chiba-u.ac.jp

Zhiqiang Bao, *Peking University*
bzq@math.pku.edu.cn

Joan Birman, *Barnard College of Columbia University*
jb@cpw.math.columbia.edu

Jae Choon Cha, *ICU*
jccha@icu.ac.kr

Jinseok Cho, *Seoul National University*
jindol@math.snu.ac.kr

Nafaa Chbili, *Tokyo Institute of Technology*
chbili@math.titech.ac.jp

Su Hyoung Choi, *Seoul National University*
shchoi@math.snu.ac.kr

Frederick Cohen, *University of Rochester*
cohf@math.rochester.edu

Patrick Dehornoy, *Universite de Caen*
patrick.dehornoy@math.unicaen.fr

Fan Ding, *Peking University*

Fuquan Fang, *Nankai University*
ffang@nankai.edu.cn

Hongzhu Gao, *Beijing Normal University*
hzgao@bnu.edu.cn

Mikami Hirasawa, *Gakushuin University*
hirasawa@math.gakushuin.ac.jp

Susumu Hirose, *Saga University*
hirose@ms.saga-u.ac.jp

Sungbok Hong, *Korea University*
shong@semi.korea.ac.kr

Hong Huang, *Nankai University*

Atsushi Ishii, *Osaka University*
aishii@cr.math.sci.osaka-u.ac.jp

Masahide Iwakiri, *Hiroshima University*
iwakiri@hiroshima-u.ac.jp

Choonbae Jeon, *Tokyo Institute of Technology*
jeon@math.titech.ac.jp

Boju Jiang, *Peking University*
jiangbj@math.pku.edu.cn

Ki Ryong Jung, *Seoul National University*
paulerdos@hotmail.com

Teruhisa Kadokami, *OCAMI*
kadokami@sci.osaka-cu.ac.jp

Seiichi Kamada, *Hiroshima University*
kamada@math.sci.hiroshima-u.ac.jp

Naoko Kamada, *OCAMI*
kamadanjp@ybb.ne.jp

Taizo Kanenobu, *Osaka City University*
kanenobu@sci.osaka-cu.ac.jp

Ensil Kang, *Chosun University*
ekang@chosun.ac.kr

Mitsuyosi Kato, *Kyushu University*
kato@math.kyushu-u.ac.jp

Tomomi Kawamura, *Aoyama Gakuin University*
tomomi@gem.aoyama.ac.jp

Akio Kawauchi, *Osaka City University*
kawauchi@sci.osaka-cu.ac.jp

Heoung Sook Kim, *Korea University*
heoung95@hotmail.com

Jee Hyoun Kim, *KAIST*
jeehyun4@knot.kaist.ac.kr

Jeong Rae Kim, *Seoul National University*
jrkim@math.snu.ac.kr

Ji Young Kim, *Korea University*
duri10000@hanmail.net

Jin Hong Kim, *KAIST*
jinkim@math.kaist.ac.kr

Jung Soo Kim, *Korea University*
pibonazi@hotmail.com

Se Goo Kim, *University of California Santa Barbara*
sekim@math.ucsb.edu

Yasto Kimura, *Tokyo University*
yasto@ms.u-tokyo.ac.jp

Ki Hyoung Ko, *KAIST*
knot@knot.kaist.ac.kr

Toshitake Kohno, *Tokyo University*
kohno@ms.u-tokyo.ac.jp

Sang yop Lee, *KIAS*
slee@kias.re.kr

Sang Jin Lee, *Konkuk University*
sangjin@konkuk.ac.kr

Jang Won Lee, *KAIST*
leejw@knot.kaist.ac.kr

Hwa Jeong Lee, *KAIST*
leehj@knot.kaist.ac.kr

Jung Hoon Lee, *KAIST*
lucy@kaist.ac.kr

Kyung Hwa Lee, *Korea University*
lkh0707@hanmail.net

Sang Youl Lee, *Pusan National University*
sangyoul@pusan.ac.kr

Fengchun Lei, *Harbin Institute of Technology*
fclei@hit.edu.cn

Banghe Li, *Chinese Academy of Sciences*
libh@amss.ac.cn

Qisheng Li, *Henan University*

Zhi Lu, *Osaka City University*
zlu@sci.osaka-cu.ac.jp

Jiming Ma, *Jilin University*

Yoshihiko Marumoto, *Osaka Sangyo University*
marumoto@las.osaka-sandai.ac.jp

Hiroshi Matsuda, *Hiroshima University*
matsuda@math.sci.hiroshima-u.ac.jp

Yukio Matsumoto, *Tokyo University*
yukiomat@ms.u-tokyo.ac.jp

Yoko Mizuma, *Tokyo Institute of Technology*
mizuma@math.titech.ac.jp

Hiromasa Moriuchi, *Osaka City University*
m-hiromas@nifty.com

Daniel Moskovich, *Kyoto University*
danieru@jmail.co.jp

Kunio Murasugi, *Toronto University*
Murasugi@sci.osaka-cu.ac.jp

Fumikazu Nagasato, *Kyushu University*
fukky@math.kyushu-u.ac.jp

Shigekazu Nakabo, *Kurume National College of Technology*
nakabo@kurume-nct.ac.jp

Takuji Nakamura, *OCAMI*
takuji_n2002@yahoo.co.jp

Yasutaka Nakanishi, *Kobe University*
nakanisi@math.kobe-u.ac.jp

Kiyotaka Nakanisi, *Kyushu University*
goingalone3@hotmail.com

Gwanhui Nam, *Seoul National University*
khnam@math.snu.ac.kr

Ryo Nikkuni, *Waseda University*
nick@kurenai.waseda.jp

Seung sang Oh, *Korea University*
soh@math.korea.ac.kr

Takayoshi Okabayashi, *Osaka City University*
okabaya@hotmail.com

Luis Paris, *Universite de Bourgogne*
Luis.Paris@u-bourgogne.fr

Hyo Won Park, *KAIST*
hwowon@hanmail.net

Jiahu Qin, *Harbin Institute of Technology*

Ruifeng Qiu, *Dalian University of Technology*
qiurf@dlut.edu.cn

Toshio Saito, *Osaka University*
saito@gaia.math.wani.osaka-u.ac.jp

Makoto Sakuma, *Osaka University*
sakuma@math.wani.osaka-u.ac.jp

Masafumi Shimozawa, *Osaka City University*
mas23s@hotmail.com

Reiko Shinjo, *Waseda University*
reiko@suou.waseda.jp

Won Taek Song, *KIAS*
cape@kias.re.kr

Makoto Tamura, *Osaka Sangyo University*
mtamura@las.osaka-sandai.ac.jp

Kokoro Tanaka, *Tokyo University*
k-tanaka@ms.u-tokyo.ac.jp

Toshifumi Tanaka, *Tokyo institute of technology*
tanaka@math.titech.ac.jp

Ikuo Tayama, *Osaka City University*
CQX05126@nifty.ne.jp

Masakazu Teragaito, *Hiroshima University*
teragai@hiroshima-u.ac.jp

Ichiro Torisu, *Akita University*
torisu@math.akita-u.ac.jp

Kazunori Tsuji, *Osaka City University*
m03sa019@ex.media.osaka-cu.ac.jp

Keiji Tsujikawa, *Osaka City University*
tjkw-401@beige.plala.or.jp

Yukihiro Tsutsumi, *Keio University*
yukihiro@math.keio.ac.jp

Yoshiaki Uchida, *Yamagata University*
yuchida@sci.kj.yamagata-u.ac.jp

Andrei Vesnin, *Seoul National University*
vesnin@math.snu.ac.kr

Shicheng Wang, *Peking University*
wangsc@math.pku.edu.cn

Tadayuki Watanabe, *Tokyo University*
watanabe@ms.u-tokyo.ac.jp

Yuichi Yamada, *University of Electro-Communications*
yyyamada@e-one.uec.ac.jp

Kyouhei Yamamoto, *Yamagata University*
k_yama@george24.com

Yasushi Yamashita, *Nara Women's University*
yamasita@ics.nara-wu.ac.jp

Zhiqing Yang, *Peking University*
yangzq@math.pku.edu.cn

Tsukasa Yashiro, *Osaka City University*
yashiro@sci.osaka-cu.ac.jp

GengYu Zhang, *Tokyo Institute of Technology*
zhang@math.titech.ac.jp

Xuezhi Zhao, *Capital Normal University*
zhaoxve@mail.cnu.edu.cn

Hao Zheng, *Peking University*
hhmmmmmhh@sina.com

Chen Zhi, *Tokyo University*
zzzchen2002@yahoo.com.cn

Qing Zhou, *East China Normal University*
qzhou@math.ecnu.edu.cn