Talk Schedule

Time	14 January MONDAY		
	Lecture Hall		
8:55–9:00	Opening Remarks		
9:00–10:00	Dale Rolfsen		
10:10–11:10	Kazuo Habiro		
11:20–12:20	Se-Goo Kim		
12:20–14:00	Lunch		
	Room 1	Room 2	Room 3
14:00–14:30	Gyo Taek Jin	Takayuki Morifuji	Kokoro Tanaka
14:40–15:10	Teruhisa Kadokami	Jinseok Cho	Shin'ya Okazaki
15:20–15:50	Masaaki Suzuki	HyoWon Park	Ayako Ido
15:50–16:20	Tea Time		
16:20–16:50	Hwa Jeong Lee	Toshifumi Tanaka	Hyoungjun Kim
17:00–17:30	Ayaka Shimizu	Yoshikazu Yamaguchi	Keiji Tagami

Time	15 January TUESDAY		
	Lecture Hall		
9:00–10:00	Jae Choon Cha		
10:10–11:10	Jesse Johnson		
11:20–12:20	Kazuo Habiro		
12:20–14:00	Lunch		
	Room 1	Room 2	Room 3
14:00–14:30	Masakazu Teragaito	Sang-Jin Lee	Mikami Hirasawa
14:40–15:10	Sangyop Lee	Tetsuya Ito	Hye Jin Jang
15:20–15:50	Kazuhiro Ichihara	Byung hee An	Min Hoon Kim
15:50–16:20	Tea Time		
16:20–16:50	Jungsoo Kim	In Dae Jong	Hideo Takioka
17:00–17:30	Motoo Tange	Tetsuya Abe	Hyuntae Kim
18:00–20:00	Banquet		

Room 1 = Lecture Hall, Room 2 = Room 056, Room 3 = Room 052

Time	16 January WEDNESDAY		
	Lecture Hall		
9:00–10:00	Kazuo Habiro		
10:10–11:10	Roger Fenn		
11:20–12:20	Seiichi Kamada		
12:20–14:00	Lunch		
	Room 1	Room 2	Room 3
14:00–14:30	Mike Sullivan	Naoko Kamada	Sosuke Ashihara
14:40–15:10	Shin Satoh	Youngsik Huh	Kyungpyo Hong
15:20–15:50	Hee Jung Kim	Atsushi Ishii	Wataru Yuasa
15:50–16:20	Tea Time		
16:20–16:50	Masahide Iwakiri	Dongseok Kim	Kiyohito Kuwahara
17:00–17:30	Kanako Oshiro	Takuji Nakamura	Jun Ueki
17:40–18:10	Inasa Nakamura	Seojung Park	Megumi Hashizume

Time	17 January THURSDAY
	Lecture Hall
9:00–10:00	Koya Shimokawa
10:10–11:10	Akio Kawauchi & Ikuo Tayama
11:20–12:20	Jung Hoon Lee
12:20–12:25	Closing Remarks
12:25–14:00	Lunch
14:00–19:00	Excursion
19:00–	Dinner

Room 1 = Lecture Hall, Room 2 = Room 056, Room 3 = Room 052

Program

14 January MONDAY

LECTURE HALL

08:55–09:00 Opening remarks: Toshitake Kohno

09:00–10:00 **Dale Rolfsen** (University of British Columbia)
Ordering knot groups

10:10–11:10 **Kazuo Habiro** (RIMS, Kyoto University)
Quantum fundamental groups of 3-manifolds (I)

11:20–12:20 **Se-Goo Kim** (Kyumg Hee University)
Non primary splittability of the rational homology cobordism group of 3-manifolds

ROOM 1

14:00–14:30 **Gyo Taek Jin** (KAIST)
Prime knots which have arc index 12

14:40–15:10 **Teruhisa Kadokami** (East China Normal University)
Switching scheme and switching complex

15:20–15:50 **Masaaki Suzuki** (Akita University)
An integral region choice problem on knot projection

16:20–16:50 **Hwa Jeong Lee** (KAIST)
Arc index of some montesinos links

17:00–17:30 **Ayaka Shimizu** (Hiroshima University)
Measuring how reduced a spherical curve is

ROOM 2

14:00–14:30 **Takayuki Morifuji** (Keio University)
The hyperbolic torsion polynomial of twist knots

14:40–15:10 **Jinseok Cho** (KIAS)
Optimistic limits of hyperbolic links

15:20–15:50 **HyoWon Park** (KAIST)
Planarity of finite regular CW-complexes

16:20–16:50 **Toshifumi Tanaka** (Gifu University)
On the Jones polynomial of knots with symmetric union presentations

17:00–17:30 **Yoshikazu Yamaguchi** (Tokyo Institute of Technology)

On the asymptotics of higher Reidemeister torsion for Seifert manifolds

ROOM 3

14:00–14:30 **Kokoro Tanaka** (Tokyo Gakugei University)
Independence of Roseman moves including triple points

14:40–15:10 **Shin'ya Okazaki** (OCAMI, Osaka City University)
Bridge genus and braid genus of lens space

15:20–15:50 **Ayako Ido** (Nara Women's University)
Heegaard splitting with distance exactly n (joint work with Yeonhee Jang and Tsuyoshi Kobayashi)

16:20–16:50 **Hyoungjun Kim** (Korea University)
Intrinsically knotted graph with 22 edges

17:00–17:30 **Keiji Tagami** (Tokyo Institute of Technology)
HQFT and Khovanov homology for link diagrams on surfaces

15 January TUESDAY

LECTURE HALL

09:00–10:00 **Jae Choon Cha** (POSTECH)
Covering link calculus and the bipolar filtration of links

10:10–11:10 **Jesse Johnson** (Oklahoma State University)
Common stabilizations of Heegaard splittings and bridge surfaces

11:20–12:20 **Kazuo Habiro** (RIMS, Kyoto University)
Quantum fundamental groups of 3-manifolds (II)

ROOM 1

14:00–14:30 **Masakazu Teragaito** (Hiroshima University)
Left-orderable fundamental group and Dehn surgery on twist knots

14:40–15:10 **Sangyop Lee** (Chung-Ang University)
Toroidal Dehn fillings with infinitely many cores

15:20–15:50 **Kazuhiro Ichihara** (Nihon University)
Exceptional surgeries on alternating knots

16:20–16:50 **Jungsoo Kim** (Seoul National University)
On critical Heegaard splittings of tunnel number two composite knot exteriors

17:00–17:30 **Motoo Tange** (University of Tsukuba)
Lens space surgery and a classification

ROOM 2

14:00–14:30 **Sang-Jin Lee** (Konkuk University)
Geometric braid interpretation of the braid group of type (de, e, r)

14:40–15:10 **Tetsuya Ito** (University of British Columbia)
Fractional Dehn twist coefficients of closed braids
(joint with Keiko Kawamuro (Univ. Iowa))

15:20–15:50 **Byung hee An** (KIAS)
Automorphisms of braid groups on orientable surfaces

16:20–16:50 **In Dae Jong** (Osaka Prefecture University)
Annulus twist and diffeomorphic 4-manifolds

17:00–17:30 **Tetsuya Abe** (RIMS, Kyoto University)
A construction of slice knots via annulus twists

ROOM 3

14:00–14:30 **Mikami Hirasawa** (Nagoya Institute of Technology)
Sphere eversion, a new method

14:40–15:10 **Hye Jin Jang** (POSTECH)
New 2-torsion in the knot concordance group

15:20–15:50 **Min Hoon Kim** (POSTECH)
Torsion elements in rational knot concordance group

16:20–16:50 **Hideo Takioka** (OCAMI, Osaka City University)
The cable version of the zeroth coefficient HOMFLYPT polynomial of a mutant knot

17:00–17:30 **Hyuntae Kim** (KAIST)
Links with Ramsey number equal to 8

18:00–20:00 **Banquet, Komaba Faculty House**

16 January WEDNESDAY

LECTURE HALL

09:00–10:00 **Kazuo Habiro** (RIMS, Kyoto University)
Quantum fundamental groups of 3-manifolds (III)

10:10–11:10 **Roger Fenn** (University of Sussex)
New directions in combinatorial knot theory

11:20–12:20 **Seiichi Kamada** (Hiroshima University)
Two and three dimensional braids

ROOM 1

14:00–14:30 **Mike Sullivan** (Southern Illinois University)
Nonsingular Smale flows on 3-manifolds

14:40–15:10 **Shin Satoh** (Kobe University)
A lower bound of the number of colors for knots

15:20–15:50 **Hee Jung Kim** (POSTECH)
Non-sliceness of some non-ribbon fibered knots

16:20–16:50 **Masahide Iwakiri** (Saga University)
The numbers of crossings in charts and quandle cocycle invariants

17:00–17:30 **Kanako Oshiro** (Japan Women's University)
On rack colorings for surface-knot diagrams without branch points

17:40–18:10 **Inasa Nakamura** (Gakushuin University)
Satellites of an oriented surface link and their local moves

ROOM 2

14:00–14:30 **Naoko Kamada** (Nagoya City University)
The surface state for the Miyazawa polynomial

14:40–15:10 **Youngsik Huh** (Hanyang University)
Linear embedding of graphs with free exterior

15:20–15:50 **Atsushi Ishii** (University of Tsukuba)
A handlebody-knot is a spatial trivalent graph without bridges up to IH-moves

16:20–16:50 **Dongseok Kim** (Kyonggi University)
The boundaries of graphs

17:00–17:30 **Takuji Nakamura** (Osaka Electro-Communication University)
State numbers for plane curves, knots and virtual knots

17:40–18:10 **Seojung Park** (KAIST)
Quadrisecants of linear embeddings of K_6

ROOM 3

14:00–14:30 **Sosuke Ashihara** (Hiroshima University)
On the fundamental biquandle of a ribbon torus-knot

14:40–15:10 **Kyungpyo Hong** (Korea University)
Lattice stick number of links

15:20–15:50 **Wataru Yuasa** (Tokyo Institute of Technology)
Hyperelliptic Goldman Lie algebra and its abelianization

16:20–16:50 **Kiyohito Kuwahara** (Soka University)
Computation of special values of colored Jones polynomials and a partial order on the set of prime knots

17:00–17:30 **Jun Ueki** (Kyushu University)
Kida's formula on Iwasawa λ-invariants for links

17:40–18:10 **Megumi Hashizume** (Nara Women's University)
On the homomorphism induced by region crossing changes on link diagram

17 January THURSDAY

LECTURE HALL

09:00–10:00 **Koya Shimokawa** (Saitama University)
Application of knot theory to molecular biology:
Band surgery and site-specific recombination of DNA

10:10–11:10 **Akio Kawauchi** (OCAMI, Osaka City University)
Ikuo Tayama (OCAMI, Osaka City University)
Tabulation of 3-manifolds of lengths up to 10

11:20–12:20 **Jung Hoon Lee** (Chonbuk National University)
On topologically minimal surfaces of high genus

12:20–12:25 Closing remarks: Toshitake Kohno

14:00–19:00 **Excursion**

19:00– **Dinner**

Abstracts (Mini course)

Kazuo Habiro (RIMS, Kyoto University)

Quantum fundamental groups of 3-manifolds

Abstract: The quantum fundamental group $P(M)$ of a 3-manifold M (with boundary) is a refinement of the fundamental group, which involves isotopy classes of tangles, i.e., properly embedded arcs based at a disc in the boundary of M, instead of homotopy class of loops based at a point. More precisely, $P(M)$ consists of the sets $P(M)(n)$ of the isotopy classes of n-component "bottom tangles" (which are tangles consisting of framed arc components with certain properties), and a family of operations of the form $f : P(M)(m) \to P(M)(n)$, which may be considered as refinements of algebraic operations. The set $P(M)(n)$ is a refinement of the nth power of the set $\pi_1(M)$. Another way to formulate the quantum fundamental group is to define $P(M)(n)$ to be the set of isotopy classes of embeddings of genus n handlebody H_n into M, where a prescribed discs in the boundary of H_n is mapped into a prescribed disc in the boundary of M. We call such a 3-manifold with a prescribed disc in the boundary a disc-based 3-manifold. Then $P(M)$ can be defined as a contravariant functor from the category of disc-based handlebodies and isotopy classes of embeddings to the category of sets.

In this minicourse, I plan to introduce the notion of quantum fundamental groups of 3-manifolds, and explains several 3-manifold invariants derived from the quantum fundamental groups, such as quantum representation varieties associated to co-ribbon Hopf algebras and quantum classifying spaces.

Abstracts (Plenary talks)

Jae Choon Cha (POSTECH)

Covering link calculus and the bipolar filtration of links

Abstract: The bipolar filtration introduced by Cochran, Harvey, and Horn is a new framework of the study of smooth concordance of topologically slice knots and links. It is known that there are topologically slice 1-bipolar knots which are not 2-bipolar, and this is the deepest level at which the filtration is known to be nontrivial. For the link case, we prove the nontriviality at all level: for any n, there are topologically slice links which are n-bipolar but not $(n+1)$-bipolar. In the proof we describe a geometric construction which raises the bipolar height of certain links exactly by one, using covering link calculus. This work is joint with Mark Powell.

Roger Fenn (University of Sussex)

New directions in combinatorial knot theory

Abstract: **Combinatorial Knot Theory**: *The study of knots by the use of diagrams.* Diagrams, since the time of Gauss, have always been used to represent knots. This is because a diagram of a knot on a 2 dimensional plane gives an immediate and physical feel for the knot in 3 dimensional space. Many topological invariants of knots such as the fundamental group, the Alexander polynomial, the Jones' polynomial etc can be investigated from a diagram of the knot in question. Other invariants, such as the unknotting number, the crookedness, the energy, etc struggle to be defined, if at all, from the diagram.

Recently, diagrams have evolved to represent objects other than classical knots. Indeed some diagrams are objects in their own right and represent no physical object.

These evolved diagrams have spawned a huge interest in previously undefined algebras of a combinatorial nature.

I shall be talking about these diagrams and their associated algebras. In particular I shall look at the fundamental birack and biquandle which appear to be purely combinatorial and without topological interpretation.

Jesse Johnson (Oklahoma State University)

Common stabilizations of Heegaard splittings and bridge surfaces

Abstract: A Heegaard splitting is a decomposition of a three-dimensional manifold into two simple pieces (called handlebodies) that meet along a Heegaard surface. A bridge surface for a knot defines a similar decomposition into two rational tangles. There is a strong analogy between these two decompositions, both in their properties and the tools used to study them. Every three-manifold admits many different Heegaard splittings, but any two Heegaard splittings are related by repeatedly applying a construction called stabilization. Similarly, the many different bridge surfaces for a given knot are related by a construction called perturbation. I will discuss the problem of understanding how many times one must apply stabilization or perturbation to get between different Heegaard splittings or different bridge surfaces. This includes both finding upper bounds on the number in general and constructing examples in which a large number of stabilizations or perturbations are needed.

Seiichi Kamada (Hiroshima University)

Two and three dimensional braids

Abstract: The first part is an introductory talk on two-dimensional braids and their chart description. As classical braids play an important role in study of knots and links, so do two-dimensional braids in study of surface knots and links. Then we generalize these notions to the three-dimensional case. We introduce three-dimensional braids and three-dimensional version of the chart description, called curtains. This is a joint work with J. Scott Carter.

Akio Kawauchi (OCAMI, Osaka City University)
Ikuo Tayama (OCAMI, Osaka City University)

Tabulation of 3-manifolds of lengths up to 10

Abstract: This talk is a survey talk on the complete list of 3-manifolds of lengths up to 10. A well-order introduced on the set of links by the first speaker naturally induces a well-order on the set of prime links, the set of the groups of prime links, and eventually the set of closed connected orientable 3-manifolds. Then it is explained how the set of prime links of lengths up to 10, the set of groups of prime links of lengths up to 10, and the set of 3-manifolds of lengths up to 10 are tabulated.

Se-Goo Kim (Kyumg Hee University)

Non primary splittability of the rational homology cobordism group of 3-manifolds

Abstract: This is joint work with Charles Livingston. Given a 3-manifold M with $H_1(M) = \mathbf{Z}_p \oplus \mathbf{Z}_q$, p and q distinct prime, one can ask a question whether M can be rationally homology cobordant to a connected sum of 3-manifolds M_p and M_q, where $H_1(M_p)$ is p-torsion and $H_1(M_q)$ is q-torsion. We answer this negatively in smooth category, using d-invariants of knot Floer homology theory. We also present examples of 3-manifolds which split in such a way topologically but not smoothly.

Jung Hoon Lee (Chonbuk National University)

On topologically minimal surfaces of high genus

Abstract: Topologically minimal surfaces are defined by Bachman as topological analogues of minimal surfaces. We show that a 3-manifold containing an incompressible surface has topologically minimal surfaces of arbitrary high genus.

Dale Rolfsen (University of British Columbia)

Ordering knot groups

Abstract: The group of a knot K in 3-space is the fundamental group of its complement. I will discuss the surprising result that all knot groups can be given a left-invariant ordering, meaning that $g < h$ implies $fg < fh$ for all f, g, h in the group. Some, but not all, knot groups have orderings which are two-sided invariant. I will discuss these results, why it is interesting, and some connections with Heegaard-Floer homology.

Koya Shimokawa (Saitama University)

Application of knot theory to molecular biology: Band surgery and site-specific recombination of DNA

Abstract: In this talk we apply knot theory to solve problems of molecular biology. We give characterizations of band surgeries between some classes of knots and links. Using these results we characterize mechanisms of DNA unlinking by site-specific recombination system Xer-dif-FtsK.

Abstracts (Parallel Session)

Tetsuya Abe (RIMS, Kyoto University)

A construction of slice knots via annulus twists

Abstract: We introduce a method to obtain slice knots which are not obviously ribbon via annulus twists. We study whether these slice knots are ribbon or not. This is joint work with M. Tange.

Byung hee An (KIAS)

Automorphisms of braid groups on orientable surfaces

Abstract: We compute the automorphism groups $Aut(P_n(\Sigma))$ and $Aut(B_n(\Sigma))$ of braid groups $P_n(\Sigma)$ and $B_n(\Sigma)$ on any orientable surface Σ, which are isomorphic to group extensions of the extended mapping class group $M_n^{\pm}(\Sigma)$ by the transvection subgroup except for a few cases.

Sosuke Ashihara (Hiroshima University)

On the fundamental biquandle of a ribbon torus-knot

Abstract: The fundamental quandle and the fundamental biquandle are invariants of a surface knot. It is known that the fundamental quandle is not a complete invariant of a surface knot. It is unknown whether two surface knots with isomorphic fundamental quandles have isomorphic fundamental biquandles. In this talk, I would like to show that if two ribbon torus-knots have isomorphic fundamental quandles, then they have isomorphic fundamental biquandles.

Jinseok Cho (KIAS)

Optimistic limits of hyperbolic links

Abstract: Yokota suggested an optimistic limit method of the Kashaev invariants of hyperbolic knots and showed it determines the complex volumes. His method is very effective and gives almost combinatorial method of calculating the complex volumes of hyperbolic knots. However, to describe the triangulation of the knot complement, he restricted his method to hyperbolic knot diagrams with certain conditions. Although these restrictions are general enough for any hyperbolic knots, they make his method hard to apply to some cases. In this talk, we suggest more general way to decide the complex volumes of hyperbolic links using a modified optimistic limit method. This is a joint-work with Hyuk Kim and Seonhwa Kim of Seoul National University.

Megumi Hashizume (Nara Women's University)

On the homomorphism induced by region crossing changes on link diagram

Abstract: Cheng and Gao defined an incidence matrix $M(D)$ of a link diagram D to describe the region crossing change of D, which was introduced by A. Shimizu et al. The matrix $M(D)$ can be regarded as a representative of the homomorphism from $(\mathbb{Z}_2)^{R(D)}$ to $(\mathbb{Z}_2)^{c(D)}$ where $R(D)$ is the set of regions of D, and $c(D)$ is the set of crossing of D. In this talk, I will give a basis of the kernel of this homomorphism, which has neat geometric representatives.

Mikami Hirasawa (Nagoya Institute of Technology)

Sphere eversion, a new method

Abstract: Eversing a sphere means to turn a sphere in the 3-space inside out. It is allowed that a surface passed though itself, but punching and pinching are forbidden. S. Smale first proved in 1958 that it is possible to evert a sphere. Since then several visualizations are given. In this talk, we describe a new way of eversion where the behavior of apparent counter is quite simple. We also visualize how the curves of self-intersection are deformed. This is a joint work with Minoru Yamamoto (Hirosaki University)

Kyungpyo Hong (Korea University)

Lattice stick number of links

Abstract: Lattice stick number of link is defined to be the minimal number of sticks required to construct a polygonal representation of the link in the cubic lattice. In this talk, I will classify links whose lattice stick number is less than 15.

Youngsik Huh (Hanyang University)

Linear embedding of graphs with free exterior

Abstract: An embedding of a graph into the Euclidean 3-space is said to be linear, if any edge of the graph is sent to a line segment. This talk will focus on graphs such that for any linear embedding its exterior is of free fundamental group.

Kazuhiro Ichihara (Nihon University)

Exceptional surgeries on alternating knots

Abstract: I will report on a recent project toward the complete classification of the exceptional surgeries on hyperbolic alternating knots. This is a joint work with Hidetoshi Masai (Tokyo Institute of Technology).

Ayako Ido (Nara Women's University)

Heegaard splitting with distance exactly n (joint work with Yeonhee Jang and Tsuyoshi Kobayashi)

Abstract: Hempel introduced the concept of distance of Heegaard splitting by using curve complex, and showed that there exist Heegaard splittings of closed orientable 3-manifolds with distance $> n$ for any integer n. In this talk, we construct pairs of curves with distance exactly n for any integer n. Then we apply the result to show that there exist Heegaard splittings (of 3-manifolds with two boundary components) with distance exactly n.

Atsushi Ishii (University of Tsukuba)

A handlebody-knot is a spatial trivalent graph without bridges up to IH-moves

Abstract: A handlebody-knot is a handlebody embedded in the 3-sphere, and a handlebody-link is a disjoint union of handlebodies embedded in the 3-sphere. Two handlebody-links are equivalent if one can be transformed into the other by an isotopy of the 3-sphere. When a handlebody-link H is a regular neighborhood of a spatial graph K, we say that K represents H, or H is represented by K. Then two spatial trivalent graphs represent an equivalent handlebody-link if and only if they are related by a finite sequence of IH-moves. That is, a handlebody-knot is a spatial trivalent graph up to IH-moves. In this talk, we see that a handlebody-knot is a spatial trivalent graph without bridges up to IH-moves.

Tetsuya Ito (University of British Columbia)

Fractional Dehn twist coefficients of closed braids (joint with Keiko Kawamuro (Univ. Iowa))

Abstract: The fractional Dehn twist coefficients (FDTC), introduced by Honda-Kazez-Matić, allows us to read various properties of 3-manifolds and contact structures from the monodromy of their open decompositions.

We introduce a fractional Dehn twist coefficients of closed braids in open books, and give several applications including geometric structures, contact structures, and topology to illustrate the usefulness of FDTC in 3-dimensional (contact) topology.

Our arguments are based on open book foliation techniques.

Masahide Iwakiri (Saga University)

The numbers of crossings in charts and quandle cocycle invariants

Abstract: T. Nagase and A. Shima showed that any chart with at most one crossing represents a ribbon surface, and that there is no a chart with just two crossings representing a non-ribbon 2-link. In this talk, we show that any 4-chart representing a surface-link whose dihedral quandle cocycle invariant of order 3 is non-trivial has at least three crossings, and there is a 5-chart with just two crossings representing a surface-link whose dihedral quandle cocycle invariant of order 3 is non-trivial.

Hye Jin Jang (POSTECH)

New 2-torsion in the knot concordance group

Abstract: Cochran, Orr, and Teichner defined a filtration on the knot concordance group whose structure is not completely investigated yet. Up do date, it is known that a quotient of each associated graded group has a primary decomposition structure, and that in each primary part, there are subgroups isomorphic to $\mathbb{Z}^\infty$ and $\mathbb{Z}_2$, respectively. By combining techniques developed by Cochran, Harvey, Leidy, and Cha, we show that there are more 2-torsions.

Gyo Taek Jin (KAIST)

Prime knots which have arc index 12

Abstract: We give the list of prime knots with arc index 12 together with their minimal grid diagrams.

In Dae Jong (Osaka Prefecture University)

Annulus twist and diffeomorphic 4-manifolds

Abstract: We give a method for obtaining infinitely many framed knots which represent a diffeomorphic 4-manifold. Our key tools are an annulus twist introduced by Osoinach and carving technique introduced by Akbulut. This is a joint work with Tetsuya Abe, Yuka Omae, and Masanori Takeuchi.

Teruhisa Kadokami (East China Normal University)

Switching scheme and switching complex

Abstract: In 2010, A. Shimizu defined a region crossing change for a classical link diagram, and she showed that it is an unknotting operation for every knot diagram. In 2012, Z. Cheng showed that for a link diagram, a region crossing change is an unknotting operation if and only if the link is proper. Note that the results above do not depend on representing diagrams of a link. We define two kinds of region crossing changes for a virtual link diagram, and obtained necessary and sufficient conditions for being unknotting operations. The two region crossing changes coincide with the original one for a classical link diagram. One depends on representing diagrams, and the other does not. Moreover we define a switching scheme and its switching complex as a generalized notion.

Naoko Kamada (Nagoya City University)

The surface state for the Miyazawa polynomial

Abstract: Miyazawa defined a multivariable polynomial invariant for virtual knots, that is equivalent to Kauffman's arrow polynomial. And I generalized it to an invariant for twisted knots.

On the other hand, using the f-polynomial (the Jones polynomial), Dye and Kauffman defined a surface bracket polynomial for virtual knots. They found a relationship between curves of the surface state of a virtual knot diagram and its genus.

In this talk, we apply the idea of the surface state and surface bracket polynomial to the Miyazawa polynomial for virtual knots and the invariant I defined for twisted knots. Then we have surface bracket polynomials for virtual knots and twisted knots. We also show a relationship between curves of the surface state and the variables $d_1, d_2, \ldots$ of the polynomial invariants.

Dongseok Kim (Kyonggi University)

The boundaries of graphs

Abstract: Graphs are one of main tool to solve problems in many different area. A voltage assignment on a graph was used to enumerate all possible 2-cell embeddings of a graph onto surfaces. The boundary of the surface which is obtained from 0 voltage on every edges of a very special diagram of a complete bipartite graph $K_{m,n}$ is surprisingly the (m, n) torus link. In the present talk, we prove that every link is the boundary of a complete bipartite multi-graph $K_{m,n}$ for which voltage assignments are either -1 or 1 and that every link is the boundary of a complete bipartite graph $K_{2,n}$ for which voltage assignments are either $-1, 0$ or 1 where edges in the diagram of graphs may be linked but not knotted. Furthermore, we enumerate the number of components of the boundary of a complete bipartite graph $K_{2,n}$. We also demonstrate the relation between our result with the genus distribution of dipoles and banded surfaces.

Hee Jung Kim (POSTECH)

Non-sliceness of some non-ribbon fibered knots

Abstract: We investigate the concordance classification of a family genus 2 fibered knots K_n described by F. Bonahon. Using the theorem of Casson and Gordon which provides a necessary condition for a fibred knot to be ribbon in terms of a cobordism property of monodromy, Bonahon showed that for distinct m and n, $K_m \sharp -K_n$ is non-ribbon. We investigate whether this family of knots is slice, and show that $K_m \sharp - K_0$ is not slice when m is nonzero. This is a joint work with Daniel Ruberman.

Hyoungjun Kim (Korea University)

Intrinsically knotted graph with 22 edges

Abstract: We proved that only 14 graphs are intrinsically knotted graphs with 21 edges. Furthermore, we will show the process of the finding intrinsically knotted graphs with 22 edges.

Hyuntae Kim (KAIST)

Links with Ramsey number equal to 8

Abstract: The Ramsey number of a link L is the smallest positive integer n such that any linear embedding of the complete graph K_n contains a set of disjoint cycles equivalent to L. In this talk we present some results that the $(2,4)$-torus link has Ramsey number greater than 8, and so do any other links with stick number 8. We also talk about an approach to the case of $(2,4)$-torus link via the method of oriented matroids, if time allows.

Jungsoo Kim (Seoul National University)

On critical Heegaard splittings of tunnel number two composite knot exteriors

Abstract: In this talk, we prove that a tunnel number two knot induces a critical Heegaard splitting in its exterior if there are two weak reducing pairs such that each weak reducing pair contains the cocore disk of each tunnel. Moreover, we prove that a connected sum of two 2-bridge knots or more generally that of two $(1,1)$-knots can induce a critical Heegaard splitting in its exterior as the examples of the main theorem. Finally, we give an equivalent condition for a weak reducing pair to be determined by a compressing disk uniquely when the manifold is closed, irreducible and the Heegaard splitting is of genus three and unstabilized.

Min Hoon Kim (POSTECH)

Torsion elements in rational knot concordance group

Abstract: For the knots in rational homology 3-sphere, the $\mathbb{Q}/\mathbb{Z}$-valued torsion linking form of ambient rational homology 3-sphere becomes the obstruction to have Seifert surfaces. In this talk, we discuss several candidates of torsion elements in the rational knot concordance group related to this obstruction. Their ambient rational homology 3-spheres have non-trivial $\mathbb{Q}/\mathbb{Z}$-valued torsion linking form.

Kiyohito Kuwahara (Soka University)

Computation of special values of colored Jones polynomials and a partial order on the set of prime knots

Abstract: We consider a prime knot K in the 3-dimensional sphere S^3. By substituting a value $\xi_N = exp(\frac{2\pi\sqrt{-1}}{N})$ to the variable q of colored Jones polynomials $J_{K,N}(q)$, we get a special value $\frac{\log|J_{K,N}(\xi_N)|}{N}$ and a progress of $\{\frac{\log|J_{K,N}(\xi_N)|}{N}\}(N = 2, 3, 4, \dots)$. It is conjectured that the progress $\{\frac{\log|J_{K,N}(\xi_N)|}{N}\}$ will converge to the volume of the complement of a knot (volume conjecture). From this conjecture, we considered an another problem whether it holds $\frac{\log|J_{k,N}(\xi_N)|}{N} \geq \frac{\log|J_{K',N}(\xi_N)|}{N}$ for sufficiently large natural number N if an epimorphism exists between the two fundamental group of $S^3 \setminus K$, $S^3 \setminus K'$. We computed the special values of colored Jones polynomials of twist knots of twist number $p = -3, -2, -1, 2, 3, 4$ and two-bridge knots $S(3, 1), S(5, 2), S(9, 1), S(41, 17)$ up to $n = 1000$ by using computer.
In this talk, I explain observation and studying about the behavior of special values.

Hwa Jeong Lee (KAIST)

Arc index of some montesinos links

Abstract: Arc index of a knot or link L is defined as the minimum number of pages of a book needed to present L so that each page intersects L in a single arc. In this talk, we compute the arc index of some montesinos links and study more cases when the arc index is strictly less than its minimal crossing number.

Sang-Jin Lee (Konkuk University)

Geometric braid interpretation of the braid group of type (de, e, r)

Abstract: We describe a Garside structure for the braid group of type (de, e, r). This gives an interpretation of the group as a subgroup of the Artin braid group. Combining with known results about Artin braid groups, we can prove the uniqueness of roots up to conjugacy and classify periodic elements. This is a joint work with Ruth Corran and Eon-Kyung Lee.

Sangyop Lee (Chung-Ang University)

Toroidal Dehn fillings with infinitely many cores

Abstract: We show that there are infinitely many cores for hyperbolic 3-manifolds admitting two toroidal Dehn fillings of distance 2 or 3 apart.

Takayuki Morifuji (Keio University)

The hyperbolic torsion polynomial of twist knots

Abstract: The hyperbolic torsion polynomial $\mathcal{T}_K$ was introduced by Dunfield, Friedl and Jackson for a hyperbolic knot K. It is conjectured that $\mathcal{T}_K$ determines the knot genus and fibering of K. In this talk we show that the conjecture is true for twist knots.

Inasa Nakamura (Gakushuin University)

Satellites of an oriented surface link and their local moves

Abstract: For an oriented surface link F in $\mathbb{R}^4$, we introduce a new satellite construction of a surface link, called an F-covering link, which is in the form of a covering over F. We introduce the notion of a chart on a surface diagram $\pi(F) \subset \mathbb{R}^3$ of F, which is a finite graph on $\pi(F)$ satisfying certain conditions and is a generalized notion of a chart on a 2-disk presenting a surface braid. An F-covering link is presented by a chart on $\pi(F)$. It is known that two surface links are equivalent if and only if their surface diagrams are related by a finite sequence of ambient isotopies of $\mathbb{R}^3$ and local moves called Roseman moves. We show that Roseman moves for surface diagrams with charts can be well-defined.

Takuji Nakamura (Osaka Electro-Communication University)

State numbers for plane curves, knots and virtual knots

Abstract: We introduce the notion of state numbers for plane curves. A state of a plane curve C is a collection of simple closed curves obtained from C by splicing all double points on C. Then n-state number of C is defined as the number of states of C consisting of n simple closed curves. In this talk we will discuss several properties of state numbers for plane curves. We also consider state numbers for (virtual) knot diagrams and define the "minimal state number" for a (virtual) knot. We will also discuss them. This is a joint work with Y. Nakanishi, S. Satoh, and Y. Tomiyama.

Shin'ya Okazaki (OCAMI, Osaka City University)

Bridge genus and braid genus of lens space

Abstract: The bridge genus and the braid genus are invariants of a closed connected orientable 3-manifold which are introduced by Kawauchi. In this talk, we calculate the bridge genus and braid genus for some lens spaces.

Kanako Oshiro (Japan Women's University)

On rack colorings for surface-knot diagrams without branch points

Abstract: A rack is a non-empty set equipped with a binary operation satisfying two axioms that are obtained from Reidemeister moves of type II and type III. In general, racks do not give us invariants for oriented surface-knots. In this talk, we show some properties about rack colorings for surface-knot diagrams without branch points. In particular, rack colorings for 2-knot diagrams without branch points are interpreted by associated quandle colorings, which means rack colorings give us invariants for 2-knots. This is a joint work with Kokoro Tanaka (Tokyo Gakugei University).

Seojung Park (KAIST)

Quadrisecants of linear embeddings of K_6

Abstract: The complete graph K_n is a graph with n vertices such that any two vertices are joined by one edge. We call an embedding of a graph G into $\mathbb{R}^3$ a spatial embedding of G and the image of the embedding a spatial graph. A linear embedding of G is a spatial embedding such that the image of each edge is a line segment. In this talk, I'd like to explain some results about quadrisecants of linear embeddings of K_6.

HyoWon Park (KAIST)

Planarity of finite regular CW-complexes

Abstract: We prove that a finite regular CW-complex can be embedded into the plane if and only if the first homology of 2-braid group on the complex is torsion free.

Shin Satoh (Kobe University)

A lower bound of the number of colors for knots

Abstract: We consider the number of distinct colors appeared in a knot diagram with a non-trivial Fox p-coloring. We prove that the number of such colors is always greater than or equal to $\lfloor \log_2 p \rfloor$. Furthermore, this lower bound is best possible in the sense that there is a p-colorable virtual knot which attains the bound. This is a joint work with T. Nakamura and Y. Nakanishi.

Ayaka Shimizu (Hiroshima University)

Measuring how reduced a spherical curve is

Abstract: We measure how reduced a spherical curve (or a knot projection on the sphere) is by considering the number of the inverse-half-twisted splice needed to obtain a reducible curve from the curve. We call the number reducivity. In this talk we show that every spherical curve has the reducivity three or less by considering the unavoidable sets of tangles for reduced spherical curves.

Mike Sullivan (Southern Illinois University)

Nonsingular Smale flows on 3-manifolds

Abstract: We review some recent work by Bin Yu and Elizabeth Haynes concerning which manifolds support certain classes of nonsingular Smale flows.

Masaaki Suzuki (Akita University)

An integral region choice problem on knot projection

Abstract: In this talk we consider a region choice problem for a knot projection. This problem is an integral extension of Shimizu's region crossing change unknotting operation. We show that there exists a solution of the region choice problem for all knot projections. This is a joint work with Kazushi Ahara.

Keiji Tagami (Tokyo Institute of Technology)

HQFT and Khovanov homology for link diagrams on surfaces

Abstract: Two link diagrams on compact surfaces are strongly equivalent if they are related by Reidemeister moves and orientation preserving homeomorphisms on surfaces. They are stable equivalent if they are related by Reidemeister moves, orientation preserving homeomorphisms and adding or removing handles. Turaev and Turner constructed a link homology for each stable equivalent class by applying an unoriented TQFT to a geometric complex. In this talk, we construct a link homology for each strongly equivalent class by using an unoriented HQFT which is an extension of a TQFT.

Hideo Takioka (OCAMI, Osaka City University)

The cable version of the zeroth coefficient HOMFLYPT polynomial of a mutant knot

Abstract: It is known that the 3-cable version of the HOMFLYPT polynomial distinguishes some mutant pairs. One of our interests is whether the cable version of the zeroth coefficient HOMFLYPT polynomial can distinguish a mutant pair. In this talk, we will give several observations on this question.

Kokoro Tanaka (Tokyo Gakugei University)

Independence of Roseman moves including triple points

Abstract: Roseman moves are seven types of local moves of a surface-link diagram. It is known that given two diagrams represent ambient isotopic surface-links if and only if they can be transformed into each other by a finite sequence of Roseman moves and isotopies of the 3-space. Yashiro proved that a particular move can be described by the other six moves. (More precisely, two of the other six moves are enough to describe it.) Then it is natural to ask whether the six Roseman moves are independent or not. In this talk, we focus on Roseman moves including triple points and discuss their independence. This is a joint work with Kengo Kawamura (Tokyo Gakugei University) and Kanako Oshiro (Japan Women's University).

Toshifumi Tanaka (Gifu University)

On the Jones polynomial of knots with symmetric union presentations

Abstract: For a knot with a symmetric union presentation, we give formulas for the first and second derivatives of the Jones polynomial at -1. We also introduce an invariant for such a knot called the minimal twisting number and calculate it for some ribbon knots with low crossing number.

Motoo Tange (University of Tsukuba)

Lens space surgery and a classification

Abstract: We give a criterion for a lens space to be an integral Dehn surgery of a knot in 3-sphere. We discuss how to classify any lens surgery parameters into a lens surgery list.

Masakazu Teragaito (Hiroshima University)

Left-orderable fundamental group and Dehn surgery on twist knots

Abstract: It is a natural question which fundamental groups of 3-manifolds are left-orderable. We prove that if the slope lies in an interval $[0, 4]$ then the surgery on a hyperbolic twist knot yields a 3-manifold whose fundamental group is left-orderable. This is a generalization of a similar result for the figure-eight knot by Boyer, Gordon and Watson.

Jun Ueki (Kyushu University)

Kida's formula on Iwasawa λ-invariants for links

Abstract: ⟪Arithmetic topology⟫ studies the analogy between number theory and low dimensional topology. For example, number fields extension ℓ/k ramified over a prime $\mathfrak{p}$ corresponds to cover of 3-manifold $h : N \to M$ branched over a knot K, in the "dictionary". In the mid 1960's, the analogy between Alexander-Fox theory and Iwasawa theory was first pointed out by B. Mazur, and in the 2000's, the analogue of Iwasawa class number formula of $\mathbb{Z}_p$-field for p-adic tower of rational homology spheres was established by M. Morishita, Y. Mizusawa, T. Kadokami, and others. In this talk, we present the "translation" of Kida's formula on λ invariants of $\mathbb{Z}_p$-fields extension L/K, into the context of 3-dimensional topology.

Yoshikazu Yamaguchi (Tokyo Institute of Technology)

On the asymptotics of higher Reidemeister torsion for Seifert manifolds

Abstract: We discuss the asymptotic behaviors of higher dimensional Reidemeister torsion for Seifert manifolds. The asymptotics shows that the leading coefficient converges to the Euler characteristic of the base orbifold of a Seifert manifold. In this talk, we focus on Brieskorn manifolds which are obtained by surgeries along torus knots. We will observe the asymptotic behavior of higher dimensional Reidemeister torsion for a Brieskorn manifold using a cut and paste method.

Wataru Yuasa (Tokyo Institute of Technology)

Hyperelliptic Goldman Lie algebra and its abelianization

Abstract: The covering transformation group of a Galois covering of a surface acts on the Goldman Lie algebra of the total space. We show the invariant part of this Lie algebra can be embedded into the Goldman Lie algebra of the base space. As an application, we define the hyperelliptic Goldman Lie algebra of a surface equipped with a hyperelliptic involution and give a lower bound for the dimension of the abelianization.