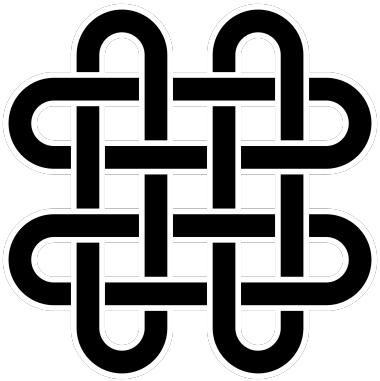
The 8th East Asian School of Knots and Related Topics

January 9–12, 2012

KAIST, Daejeon, Korea



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Welcome to The 8th East Asian School of Knots and Related Topics

Dear Colleagues,

A warm welcome to KAIST and Daejeon. As the fifth largest city in Korea, almost 15 million people live in Daejeon. The city has grown out of a major railroad junction and has little historic heritage but is rather known for education and research. In fact there are 7 major universities and dozens of large research institutions. KAIST is conveniently located just across the Gab-cheon River to the north from the new city center of Daejeon. You would be able to enjoy the lively setting of Daejeon as well as to experience the academic atmosphere of KAIST.

We are happy to host the School three times in Korea including the inaugural meeting in 2004. The three east asian countries have a lot of cultural and traditional background in common but there are also some differences induced by historical and political reasons. We believe that it is constructive and desirable to broaden common understanding via this kind of meeting among people with common interest. Academically this meeting has been giving not only researcher but also graduate students opportunities to present their new results, to share ideas, and to make friends with colleagues from other countries. It is always a great fun for mathematicians to meet with old friends, welcome new people, and all get together for inspirational discussions.

Finally I would like to express my sincere sympathy and consolation to our Japanese colleague suffered by the natural disaster last year.

Thanks for participating. Enjoy the conference!

Sincerely,

Ki Hyoung Ko
Chair, Organizing Committee

Table of Contents

Timetable

	Monday, January 9		
9:00–9:10	Opening remark		
9:10–10:00	*(Ki Hyoung Ko)* Shin Satoh Virtual graph presentations of ribbon surface-knots		
	Break		
10:10–11:00	*(Seiichi Kamada)* Fengchun Lei Link invariants from homotopy groups of the 3-sphere		
	Break		
11:10–12:00	*(Gyo Taek Jin)* Jae Choon Cha Tutorial I: An introduction to L^2-invariants		
	Lunch		
Sessions	E11-101	E11-102	E11-103
13:00–13:40	*(Sang-Jin Lee)* Tashitake Kohno	*(Takayuki Morifuji)* Ximin Liu	*(David Bachman)* Akio Kawauchi
	Break		
13:50–14:30	Toshie Takata	Hee Jung Kim	Naoko Kamada
	Coffee break		
14:50–15:50	*(Taehee Kim)* Kouichi Yasui Zhiqing Yang	*(Susumu Hirose)* Yoshiro Yaguchi Byung Hee An	*(Masaaki Suzuki)* Youlin Li Teruhisa Kadokami
	Break		
16:00–16:40	*(Hee Jung Kim)* Fengling Li Kenta Hayano	*(Akiko Shima)* Hwa Jeong Lee Masayuki Matsuo	*(Ryo Nikkuni)* Hiroka Hashimoto Minjung Lee
	Break		
16:50–17:30	Jianfeng Lin Ayako Ido	Sung Jong No Kyung Pyo Hong	Hidetoshi Masai
18:00–	Reception		

Opening remark and all plenary talks are E11-304 and the names in the parentheses are chairs.

	Tuesday, January 10		
9:00–9:10			
9:10–10:00	*(Yukio Matsumoto)* Shicheng Wang On slope genera of knotted tori in the 4-space		
	Break		
10:10–11:00	*(Ruifeng Qiu)* Ayaka Shimizu Games based on region crossing changes		
	Break		
11:10–12:00	*(Gyo Taek Jin)* Jae Choon Cha Tutorial II: An introduction to L^2-invariants		
	Lunch		
Sessions	E11-101	E11-102	E11-103
13:00–13:40	*(J. Scott Carter)* Seiichi Kamada	*(Youngsik Huh)* Akiko Shima	*(Teruo Nagase)* Teruaki Kitano
	Break		
13:50–14:30	Yongju Bae	Ryo Nikkuni	Masaaki Suzuki
	Coffee break		
14:50–15:50	*(Jung Hoon Lee)* Sungmo Kang Jianchun Wu	*(Shin Satoh)* Kokoro Tanaka Ayumu Inoue	*(Fengchun Lei)* Takuji Nakamura Reiko Shinjo
	Break		
16:00–16:40	*(Toshie Takata)* Inasa Nakamura Minkyoung Song	*(Yasuyuki Miyazawa)* Qiang Zhang Yuka Kotorii	*(Toshio Saito)* Masayuki Niimura Hideo Takioka
	Break		
16:50–17:10	Hye Jin Jang	Takanori Imabeppu	Yukari Funakoshi
18:00–	Dinner		

	Wednesday, January 11		
9:00–9:10			
9:10–10:00	*(Shicheng Wang)* Kazuhiro Ichihara Exceptional surgeries on components of two-bridge links		
	Break		
10:10–11:00	*(Sangyop Lee)* David Bachman Topological, PL, and geometric minimal surfaces		
	Break		
11:10–12:00	*(Ki Hyoung Ko)* Jae Choon Cha Tutorial III: An introduction to L^2-invariants		
	Lunch		
Sessions	E11-101	E11-102	E11-103
13:00–13:40	*(Yuya Koda)* Jae Choon Cha	*(Taizo Kanenobu)* Yasuyuki Miyazawa	*(Kazuhiro Ichihara)* Toshio Saito
	Break		
13:50–14:30	Taehee Kim	Susumu Hirose	Jung Hoon Lee
	Coffee break		
14:50–15:50	*(Yongju Bae)* Atsushi Ishii Hiromasa Moriuchi	*(Ximin Liu)* Jiming Ma Jin Seok Cho	*(Jian-Gang Tang)* Ying Zhang Tetsuya Abe
	Break		
16:00–16:40	*(Eon-Kyung Lee)* Yuanyuan Bao Yanqing Zou	*(Teruaki Kitano)* Hyo Won Park Tomonori Fukunaga	*(Naoko Kamada)* Koushirou Wada Takefumi Nosaka
	Break		
16:50–17:30	Qilong Guo Min Hoon Kim	Tetsuya Ito Kenta Taniguchi	Sosuke Ashihara
18:00–	Banquet		

	Thursday, January 12
9:00–9:10	
9:10–10:00	*(Boju Jiang)* Gyo Taek Jin Quadrisecant approximation of minimal polygonal knots
	Break
10:10–11:00	*(Akio Kawauchi)* Yang Su Free involutions and $\mathbf{Z}/p$-actions .....
	Break
11:10–12:00	*(Toshitake Kohno)* J. Scott Carter n-Dimensional foams and cocycles .....
	Lunch(Bus)
12:10–18:00	Tour Iksan Jewelry Museum and Jeonju Hanok Village
18:00–	Performance and Dinner

Program

9 January

09:10–10:00 *(Ki Hyoung Ko)*

Virtual graph presentations of ribbon surface-knots
by Shin Satoh p.30

10:10–11:00 *(Seiichi Kamada)*

Link invariants from homotopy groups of the 3-sphere
by Fengchun Lei p.25

11:10–12:00 *(Gyo Taek Jin)*

An introduction to L^2-invariants I
by Jae Choon Cha p.18

12:00–13:00 *— Lunch Break —*

13:00–14:30

E11-101 *(Sang-Jin Lee)*

Quantum and homological representations of braid groups
by Toshitake Kohno p.24

An algebraic formula of the Witten-Reshetikhin-Turaev invariant for 3-manifolds
by Toshie Takata p.31

E11-102 *(Takayuki Morifuji)*

Involutions on spin 4-manifolds
by Ximin Liu p.27

Knotting surfaces in four-manifolds
by Hee Jung Kim p.23

E11-103 *(David Bachman)*

Topology of prion proteins
by Akio Kawauchi p.23

Index polynomial invariants of virtual knots and twisted knots.
by Naoko Kamada p.22

14:30–14:50 *— Coffee Break —*

Enclosed by ( ) is the name of the chair-person of each session.

9 January

14:50–15:50

E11-101 *(Taehee Kim)*

Nuclei and exotic 4-manifolds
by Kouichi Yasui p.33

Some new results on new knot invariants
by Zhiqing Yang p.33

E11-102 *(Susumu Hirose)*

Homological invariants of Hurwitz equivalence on tuples of simple braids
by Yoshiro Yaguchi p.33

Geometric automorphisms of braid groups on surfaces
by Byung Hee An p.16

E11-103 *(Masaaki Suzuki)*

The support genus of certain Legendrian knots
by Youlin Li p.26

On amphicheiral links
by Teruhisa Kadokami p.22

15:50–16:00 — *Break* —

Enclosed by ( ) is the name of the chair-person of each session.

9 January

16:00–17:30

E11-101 *(Hee Jung Kim)*

On symmetry-structural links and the loop space of S^3
by Fengling Li p.26

Four-manifolds admitting hyperelliptic broken Lefschetz fibrations
by Kenta Hayano p.20

The fixed subgroup of automorhpism of cofinite volume Klein group
by Jianfeng Lin p.26

On the distance of bridge spheres for knots
by Ayako Ido p.20

E11-102 *(Akiko Shima)*

Arc index of pretzel knots of type $(-p, q, r)$
by Hwa Jeong Lee p.25

Page moves on arc presentations
by Masayuki Matsuo p.27

Upper bound on lattice stick number of knots
by Sung Jong No p.29

Lattice stick number of small knots
by Kyung Pyo Hong p.20

E11-103 *(Ryo Nikkuni)*

On Conway-Gordon type theorems for graphs in the Petersen family
by Hiroka Hashimoto p.19

Exactly 14 intrinsically knotted graphs have 21 edges.
by Minjung Lee p.25

Volume preserving moves on hyperbolic graph and its applications
by Hidetoshi Masai p.27

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10 January

09:10–10:00 *(Yukio Matsumoto)*

On slope genera of knotted tori in the 4-space
by Shicheng Wang p.32

10:10–11:00 *(Ruifeng Qiu)*

Games based on region crossing changes
by Ayaka Shimizu p.30

11:10–12:00 *(Gyo Taek Jin)*

An introduction to L^2-invariants II
by Jae Choon Cha p.18

12:00–13:00 *— Lunch Break —*

13:00–14:30

E11-101 *(J. Scott Carter)*

Twisted biquandles and invariants of twisted links
by Seiichi Kamada p.22

Quandle colorings and Alexander polynomials of links
by Yongju Bae p.17

E11-102 *(Youngsik Huh)*

Linear 4-charts with four crossings (joint work with Teruo Nagase)
by Akiko Shima p.30

On invariants of knots and links in a spatial complete four-partite graph $K_{3,3,1,1}$
by Ryo Nikkuni p.29

E11-103 *(Teruo Nagase)*

On the Alexander polynomial of a knot as an obstruction for SL(2,Z/n)-representations of a knot group
by Teruaki Kitano p.24

Epimorphisms between knot groups and the images of meridians
by Masaaki Suzuki p.31

14:30–14:50 *— Coffee Break —*

Enclosed by ( ) is the name of the chair-person of each session.

10 January

14:50–15:50

E11-101 *(Jung Hoon Lee)*

The primitive/primitive and primitive/Seifert knot in S^3.
by Sungmo Kang p.23

Free degrees of homeomorphisms on compact surfaces
by Jianchun Wu p.33

E11-102 *(Shin Satoh)*

Interpretation of rack coloring knot invariants in terms of quandles
by Kokoro Tanaka p.32

Quandle and link-homotopy
by Ayumu Inoue p.21

E11-103 *(Fengchun Lei)*

Non-identical twin groups of virtual knot
by Takuji Nakamura p.28

Every link has a (3,4)-diagram
by Reiko Shinjo p.31

15:50–16:00 — *Break* —

Enclosed by ( ) is the name of the chair-person of each session.

10 January

16:00–17:10

E11-101 *(Toshie Takata)*

Unknotting numbers of torus-covering knots
by Inasa Nakamura p.28

Milnor's invariants and Hirzebruch-type invariants of homology cylinders
by Minkyoung Song p.31

New filtrations on homology cylinder group
by Hye Jin Jang p.22

E11-102 *(Yasuyuki Miyazawa)*

Bounds for fixed points and fixed subgroups on graph manifolds
by Qiang Zhang p.34

$\bar{\mu}$ invariant of nanophrases
by Yuka Kotorii p.25

A property of normalized arrow polynomials of checkerboard colorable virtual links
by Takanori Imabeppu p.21

E11-103 *(Toshio Saito)*

Epimorphisms between knot groups and special values of colored Jones polynomials
by Masayuki Niimura p.28

The zeroth coefficient polynomial of a $(2,1)$-cable knot
by Hideo Takioka p.32

Pseudo-fiber surface and unknotting operation for fibered links.
by Yukari Funakoshi p.19

Enclosed by ( ) is the name of the chair-person of each session.

11 January

09:10–10:00 *(Shicheng Wang)*

Exceptional surgeries on components of two-bridge links
by Kazuhiro Ichihara p.20

10:10–11:00 *(Sangyop Lee)*

Topological, PL, and geometric minimal surfaces
by David Bachman p.16

11:10–12:00 *(Ki Hyoung Ko)*

An introduction to L^2-invariants III
by Jae Choon Cha p.18

12:00–13:00 — *Lunch Break* —

13:00–14:50

E11-101 *(Yuya Koda)*

Hidden torsion in 3-manifold groups and homology cobordism
by Jae Choon Cha p.17

Concordance class of the Hopf link
by Taehee Kim p.24

E11-102 *(Taizo Kanenobu)*

The HOMFLY polynomial and admissible values
by Yasuyuki Miyazawa p.28

On diffeomorphisms over non-orientable surfaces standardly embedded in the 4-sphere
by Susumu Hirose p.20

E11-103 *(Kazuhiro Ichihara)*

Meridional destabilizing number and connected sums of knots
by Toshio Saito p.30

Critical Heegaard surfaces obtained by amalgamation
by Jung Hoon Lee p.25

14:30–14:50 — *Coffee Break* —

Enclosed by ( ) is the name of the chair-person of each session.

11 January

14:50–15:50

E11-101 *(Yongju Bae)*

Invariants for handlebody-knots derived from Yetter–Drinfeld modules
by Atsushi Ishii p.21

On connected sum of generalized Kinoshita's theta-curves
by Hiromasa Moriuchi p.28

E11-102 *(Ximin Liu)*

Delaunay inversive distance circle packings and hyperideal Fuchsian polyhedra with particles
by Jiming Ma p.27

The optimistic limit of colored Jones polynomial
by Jin Seok Cho p.19

E11-103 *(Jian-Gang Tang)*

Finiteness of integral points in relative moduli spaces of the one-holed torus
by Ying Zhang p.34

On the r-shake genes of a knot
by Tetsuya Abe p.16

15:50–16:00 — *Break* —

Enclosed by ( ) is the name of the chair-person of each session.

11 January

16:00–17:30

E11-101 *(Eon-Kyung Lee)*

Finite negative unknotting number and Heegaard Floer homology
by Yuanyuan Bao p.17

Unstabilized Heeggard Splitting
by Yanqing Zou p.34

The annulus and disk complex is contractible
by Qilong Guo p.19

Whitney towers and Casson-Gordon style invariants of links
by Min Hoon Kim p.24

E11-102 *(Teruaki Kitano)*

A minor-closed class on graph 2-braid groups
by Hyo Won Park p.29

On braid type theory of nanophrases
by Tomonori Fukunaga p.19

The Lawerence-Krammer-Bigelow representation detects the dual Garside length
by Tetsuya Ito p.21

On free knots
by Kenta Taniguchi p.32

E11-103 *(Naoko Kamada)*

On two-point homogeneous quandles
by Koushirou Wada p.32

On a topological interpretation of quandle cocycle invariants of classical links.
by Takefumi Nosaka p.29

A presentation of the fundamental biquandle of the n-twist spun trefoil
by Sosuke Ashihara p.16

Enclosed by ( ) is the name of the chair-person of each session.

12 January

09:10–10:00 *(Boju Jiang)*

Quadrisecant approximation of minimal polygonal knots

by Gyo Taek Jin p.22

10:10–11:00 *(Akio Kawauchi)*

Free involutions and Z/p-actions on simply-connected 5-manifolds

by Yang Su p.31

11:10–12:00 *(Toshitake Kohno)*

n-dimensional foams and cocycles that are associated to G-families of quandles

by J. Scott Carter p.17

Abstracts

On the r-shake genes of a knot

Tetsuya Abe, RIMS

Let $X(K,r)$ be the 4-dimensional manifold which is obtained form D^4 by attaching (4-dimensional) 2-handle along a knot K in S^3 with framing r. The r-shake genus of K is the minimal number of genus of the closed surfaces whose homology classes generate the second homology group of $X(K,r)$. In this talk, we study the r-shake genes of a knot.

Geometric automorphisms of braid groups on surfaces

Byung Hee An, POSTECH

Let Σ be a compact, connected, orientable surface of genus $g \geq 1$ with boundary and $\bar{\mathbf{x}}^0 = \{x_1^0, \ldots, x_n^0\}$ be a distinct points in the interior of Σ. Then the braid group $\mathbf{B}_n(\Sigma, \bar{\mathbf{x}}^0)$ is defined as the fundamental group of configuration space. For given automorphism ϕ on $\mathbf{B}_n(\Sigma, \bar{\mathbf{x}}^0)$, we say that ϕ is *geometric* if there exists an automorphism f on $(\Sigma, \bar{\mathbf{x}}^0)$ such that the induced map f_* on $\mathbf{B}_n(\Sigma, \bar{\mathbf{x}}^0)$ is ϕ.

In this talk, we present the necessary and sufficient condition for ϕ to be geometric.

A presentation of the fundamental biquandle of the n-twist spun trefoil

Sosuke Ashihara, Hiroshima University

The fundamental biquandle is defined for an oriented surface link, which is an invariant of it. A surface link can be presented by a ch-diagram which consists of a singular link diagram and some markers. The n-twist spun trefoil has a periodic ch-diagram presentation. Using this fact, we will give a presentation of the fundamental biquandle of the n-twist spun trefoil.

Topological, PL, and geometric minimal surfaces

David Bachman, Pitzer College

We discuss a program to show that a topologically minimal surface (of arbitrary index) in a compact 3-manifold can be isotoped to meet a triangulation so that it meets each tetrahedron in precisely the same way that a geometrically minimal surface (of the same index) can meet a ball. We will then discuss the immediate applications to topology, as well as potential applications to geometry.

Quandle colorings and Alexander polynomials of links

Yongju Bae, Kyungpook National University

In this talk, we will study the colorability of link diagrams by the Alexander quandles in the view point of the Alexander polynomial of the given link.

Finite negative unknotting number and Heegaard Floer homology

Yuanyuan Bao, Tokyo Institute of Technology

If a knot can be transformed into the unknot by transforming finitely many positive crossings into negative crossings, we say this knot has finite negative unknotting number. Note that the sign of a crossing does not depend on the orientation of the knot. In particular, positive knots have finite negative unknotting number. In this talk, we give an obstruction for a knot to having finite negative unknotting number. This obstruction is derived from Heegaard Floer homology. We show some applications.

n-dimensional foams and cocycles that are associated to G-families of quandles

J. Scott Carter, University of South Alabama

In this talk, I will introduce the idea of an n-dimensional foam which generalizes trivalent graphs, and the usual notion of a surface foam. Such foams can be knotted in $(n+2)$-dimensional space. Local pictures for the crossing points are obtained in all dimensions. There are different crossing types that are easy to parametrize. Also local crossings have signs associated to them. In all dimensions it is possible to examine quandle colorings and group-flows on n-foams. As a result, group-families of quandles, and cocycles that are associated to these can be used to distinguish different knotted foams. The subject of this talk is being developed in conjunction with Masahico Saito.

Hidden torsion in 3-manifold groups and homology cobordism

Jae Choon Cha, POSTECH

We introduce a new type of torsion in 3-manifold groups we call hidden torsion, and an algebraic approximation we call local hidden torsion, regarding 4-dimensional homology cobordism. We construct hyperbolic 3-manifolds which have local hidden torsion in the transfinite lower central subgroup, and we show that our hyperbolic 3-manifolds are not pairwise homology cobordant, yet remain indistinguishable by any prior known homology cobordism invariants. We also give an answer to a question of T. D. Cochran and M. H. Freedman about transfinite lower central series of 3-manifolds.

An introduction to L^2-invariants I

Jae Choon Cha, POSTECH

In this series of lectures we introduce L^2-Betti numbers and L^2-signatures of manifolds and knots. We introduce the essentials of an algebraic formulation of the L^2-dimension theory, which is originally due to Wolfgang Lueck. Compared with the analytic approach, this is a flexible and easy-to-use setup that enables us to use standard techniques familiar to topologists. We discuss L^2-signatures and an Atiyah-type theorem for topological manifolds following the approach of Shmuel Weinberger. Some recent applications to knots are also introduced. Our treatment will be as elementary as possible, based on a minimal collection of analytic facts from graduate level functional analysis.

An introduction to L^2-invariants II

Jae Choon Cha, POSTECH

In this series of lectures we introduce L^2-Betti numbers and L^2-signatures of manifolds and knots. We introduce the essentials of an algebraic formulation of the L^2-dimension theory, which is originally due to Wolfgang Lueck. Compared with the analytic approach, this is a flexible and easy-to-use setup that enables us to use standard techniques familiar to topologists. We discuss L^2-signatures and an Atiyah-type theorem for topological manifolds following the approach of Shmuel Weinberger. Some recent applications to knots are also introduced. Our treatment will be as elementary as possible, based on a minimal collection of analytic facts from graduate level functional analysis.

An introduction to L^2-invariants III

Jae Choon Cha, POSTECH

In this series of lectures we introduce L^2-Betti numbers and L^2-signatures of manifolds and knots. We introduce the essentials of an algebraic formulation of the L^2-dimension theory, which is originally due to Wolfgang Lueck. Compared with the analytic approach, this is a flexible and easy-to-use setup that enables us to use standard techniques familiar to topologists. We discuss L^2-signatures and an Atiyah-type theorem for topological manifolds following the approach of Shmuel Weinberger. Some recent applications to knots are also introduced. Our treatment will be as elementary as possible, based on a minimal collection of analytic facts from graduate level functional analysis.

The optimistic limit of colored Jones polynomial

Jin Seok Cho, KIAS

We discuss how to calculate the complex volume of a hyperbolic knot using the optimistic limit of the colored Jones polynomial. This method is based on the colored Jones version of Yokota theory. This is a joint-work with Jun Murakami.

On braid type theory of nanophrases

Tomonori Fukunaga, Hokkaido University

In this talk we define "braid type phrases" which is a generalization of the notion of virtual braids. Then we talk about relation between braid type phrase and the homotopy theory of nanophrases. More precisely we introduce Alexander type theorem and Markov type theorem for braid type phrases. We also talk on a group structure of braid type phrases and some representations of braid type phrase groups if possible.

Pseudo-fiber surface and unknotting operation for fibered links.

Yukari Funakoshi , Nara Women's University

In [Ko], it is shown that the unknotting operations for unknotting number 1 fibered knots are realized by twists on fiber surfaces, which produce pre-fiber surfaces. In this talk, we propose a formulation generalizing the result for fibered links with unknotting numbers ≥ 2, that is, ascending sequence of pseudo-fiber surfaces. Then we show that how it works for torus knots.

[Ko] T. Kobayashi, Fibered links and unknotting operations, Osaka J. Math. 26 (1989), 699-742

The annulus and disk complex is contractible

Qilong Guo, Dalian University of Technology

The annulus and disk complex of a compression body is defined and is proved to be contractible for any non-trivial compression body.

On Conway-Gordon type theorems for graphs in the Petersen family

Hiroka Hashimoto, Tokyo Woman's Christian University

For every spatial embedding of each graph in the Petersen family, it is known that the sum of the linking numbers over all of the constituent 2-component links is congruent to 1 modulo 2. In this talk, we give an integral lift of the fact above in terms of the square of the linking number and the

second coefficient of the Conway polynomial. This is a joint work with Ryo Nikkuni.

Four-manifolds admitting hyperelliptic broken Lefschetz fibrations

Kenta Hayano, Osaka University

Broken Lefschetz fibrations were introduced recently as a generalization of Lefschetz fibrations to near-symplectic setting. In this talk, we will introduce hyperelliptic simplified broken Lefschetz fibrations and show that the total space of such a fibration admits an involution induced naturally by the hyperelliptic involution on fibers. We will also give a signature formula of this kind of fibrations. The results in this talk are joint work with Masatoshi Sato.

On diffeomorphisms over non-orientable surfaces standardly embedded in the 4-sphere

Susumu Hirose, Tokyo University of Science

For a non-orientable closed surface standardly embedded in the 4-sphere, a diffeomorphism over this surface is extendable if and only if this diffeomorphism preserves the Guillou-Marin quadratic form of this embedded surface.

Lattice stick number of small knots

Kyung Pyo Hong, KOREA UNIVERSITY

Lattice stick number $s_L(K)$ is defined to be the minimal number of sticks required to construct a polygonal representation of the knot K in the cubic lattice. It is known that $s_L(3_1) = 12$ and $s_L(4_1) = 14$. I will prove that $s_L(K) \geq 16$ for every non-trivial knot K except 3_1, 4_1 and $s_L(5_1) = s_L(5_2) = 16$.

Exceptional surgeries on components of two-bridge links

Kazuhiro Ichihara, Nihon University

We give a complete classification of exceptional Dehn surgeries on a component of a hyperbolic two-bridge link in the 3-sphere.

On the distance of bridge spheres for knots

Ayako Ido, Nara Women's University

Distance of Heegaard splitting introduced by Hempel has been extended to apply to bridge surface, and has been studied by several authors. For example, for a knot K in a closed 3-manifold, Tomova shows that either two bridge surfaces P, Q for K are equivalent or the distance $d(P, K)$ is at most $2-(Q-K)$. In this talk, we improve this inequality for the case of bridge sphere in the 3-shpere S^3. In fact, we show the following: Suppose that K is in a minimal

bridge position with a bridge sphere P. If $d(P, K) > |PK| - 2$, then K has a unique minimal bridge position.

A property of normalized arrow polynomials of checkerboard colorable virtual links

Takanori Imabeppu, Hiroshima University

A normalized arrow polynomial introduced by Kauffman is an invariant of virtual links, which is a generalization of a Jones polynomial. We give a property of this polynomial of checkerboard colorable virtual links and show that some virtual links are not checkerboard colorable by using these polynomials.

Quandle and link-homotopy

Ayumu Inoue, Tokyo Institute of Technology

In this talk, we define quasi-triviality of quandles. We show that a quandle cocycle invariant derived from a 2-cocycle of a quasi-trivial quandle is a link-homotopy invariant if the 2-cocycle satisfies a certain condition. It means that we have a lot of numerical link-homotopy invariants.

Invariants for handlebody-knots derived from Yetter–Drinfeld modules

Atsushi Ishii, University of Tsukuba

A handlebody-knot is a handlebody embedded in the 3-sphere. Two handlebody-knots are equivalent if one can be transformed into the other by an isotopy of the 3-spere. We introduce invariants for handlebody-knots derived from Yetter–Drinfeld modules. This is a joint work with Akira Masuoka.

The Lawerence-Krammer-Bigelow representation detects the dual Garside length

Tetsuya Ito, The University of Tokyo

The Lawerence-Krammer-Bigelow representation (LKB representation) is a linear representation of the braid groups, proven to be faithful by Krammer and Bigelow around 2000. In this talk we prove that the LKB representation detects the dual Garside length, that was conjectured by Krammer. It is remarkable that, despite the analogy with Krammer's algebraic result, our proof is rather based on Bigelow's geometric techniques. This is a joint work with Bert Wiest (Univ. Rennes 1).

New filtrations on homology cylinder group

Hye Jin Jang, POSTECH

Two homology cylinders M and N are homology cobordant if and only if there is a 4-manifold W bounding $M \cup N$ and $H_i(W, M) = H_i(W, N) = 0$ for $i = 1, 2$. By mollifying the H_2 condition, we can define two coarser equivalence relations on the set of homology cylinders than homology cobordism, namely "height (h) Whitney tower cobordism" and "(h)-solvable cobordism". We investigate the nontriviality of the filtrations using $L2$-signature invariants

Quadrisecant approximation of minimal polygonal knots

Gyo Taek Jin, KAIST

It is known that every nontrivial knot has a quadrisecant. Given a knot, we mark each intersection point of each of its quadrisecants. Replacing each subarc between two nearby marked points with a straight line segment joining them, we obtain a polygonal closed curve which we will call the quadrisecant approximation of the given knot. We show that for any heptagonal figure eight knot in general position, there are only six quadrisecants, and the resulting quadrisecant approximation has the same knot type. Furthermore, the resulting quadrisecant approximation has no new quadrisecants other than those of the heptagonal figure eight knot. We also discuss related results on some minimal polygonal torus knots.

On amphicheiral links

Teruhisa Kadokami, East China Normal University

We study geometric and algebraic properties of amphicheiral links. (joint partially with Akio Kawauchi and Yoji Kobatake)

Index polynomial invariants of virtual knots and twisted knots.

Naoko Kamada, Nagoya City University

The index polynomial is an invariant of a virtual knot defined by. Y. H. Im, K. Lee, and S. Y. Lee. It is defined by using virtual crossings. We show that the invariant can be calculated by using real crossings, instead of virtual ones. This interpretation enables us to extend the invariant of virtual knots to that of twisted knots.

Twisted biquandles and invariants of twisted links

Seiichi Kamada, Hiroshima University

A biquandle is a set with two binary operations satisfying certain conditions coming from Reidemeister moves. We consider an additional structure related

to twisted knots. The number of colorings is an invariant of a twisted knot. There is also a notion of the fundamental twisted biquandle of a twisted knot. This is a joint work with Naoko Kamada.

The primitive/primitive and primitive/Seifert knot in S^3.

Sungmo Kang, University of Quebec at Montreal

Let k be a simple closed curve in a genus two Heegaard surface Σ of S^3 bounding handlebodies H and H'. k is called a primitive/primitive or double-primitive curve if adding a 2-handle to H and H' yields a solid torus. Similarly k is called a primitive/Seifert curve if adding a 2-handle to ,say, H and H' yields a solid torus and a Seifert-fibered space respectively. Primitive/primitive and primitive/Seifert curves are of some interest because they have Dehn surgeries which yield lens spaces and Seifert-fibered spaces respectively. In this talk, I will explain how to find all primitive/primitive and primitive/Seifert knots in S^3 and how these have been grouped into the complete list of all such knots. The main tool for the classification uses R-R diagrams together with the fact that if adding a 2-handle to a genus two handlebody H along a nonspearating curve R on ∂H embeds in S^3 as a knot exterior, then the meridian of the knot exterior can be obtained by surgery on R along a wave. This is joint work with John Berge.

Topology of prion proteins

Akio Kawauchi, Osaka City University

The content of this talk is a joint work with Kayo Yoshida. A topological model of prion proteins (PrP^C, PrP^{SC}) which we call a prion-tangle is proposed to explain some entangling properties of prion proteins by a knot theoretical approach. We show that two splitted prion-tangles can be changed into a non-split prion-tangle with the given prion-tangles contained by a one-crossing change. We also determine for every $n > 1$ that the minimal crossing number of n-string non-split prion-tangles is $2n$ or $2n-2$, respectively, according to whether or not we count the assumption that the loop system is a trivial link.

Knotting surfaces in four-manifolds

Hee Jung Kim, POSTECH

We will discuss the surgery operation to modify embeddinds of surfaces in four manifolds and construct "exotic surfaces" which are homeomorphic but not diffeomorphic. I also construct, for any group G satisfying some simple conditions, a simply-connected symplectic manifold containing a symplectic surface whose complement has fundamental group G. In the case, we produce

infinitely many smoothly inequivalent surfaces that are equivalent up to smooth scobordism and hence are topologically equivalent for good groups.

Whitney towers and Casson-Gordon style invariants of links

Min Hoon Kim, POSTECH

In this talk, we give a natural geometric description of abelian, metabelian invariants of 2-component links with linking number 1 in terms of height of solvable cobordism very recently introduced by J. C. Cha.

Concordance class of the Hopf link

Taehee Kim, Konkuk University

Extending the work of M. Freedman on knot concordance, J. Davis showed that a 2-component link with (2-variable) Aelxander polynomial one is topologically concordant to the Hopf link. In this talk, answering a question of J, Davis, we show that there is a 2-component link with Alexander polynomial one and unknotted components that is not smoothly concordant to the Hopf link. We will discuss the key ingredients of the proof such as covering link calculus, blow-down for links and knot concordance invariants from Heegaard-Floer theory. This is joint work with Jae Choon Cha, Daniel Ruberman and Saso Strle.

On the Alexander polynomial of a knot as an obstruction for SL(2,Z/n)-representations of a knot group

Teruaki Kitano, Soka University

Let K be a knot in S^3 and $G(K)$ its knot group. It is known that the special value of the Alexander polynomial of K at an integer n gives an obstruction for the existence of representations of $G(K)$ into the symmetric group of some degree. In this talk I review this classical theory first. Secondly we mention the existence of $SL(2, Z/n)$-representations of $G(K)$ with the non-trivial Alexander polynomial for infinitely many n, as an application.

Quantum and homological representations of braid groups

Toshitake Kohno, The University of Tokyo

We describe a relation between homological representations of braid groups studied by Lawrence, Krammer and Bigelow and quantum representations appearing as the monodromy of KZ equations for generic parameters. In the case of special parameters these representations are extended to quantum representations of mapping class groups. We describe the images of such representations and show that the images of any Johnson subgroups contain non-abelian free

groups if the genus and the level are sufficiently large. The last part is a joint work with Louis Funar.

$\bar{\mu}$ invariant of nanophrases

Yuka Kotorii, Tokyo Institute of Technology

Two link diagrams are link homotopic if one can be transformed into the other by a sequence of Reidemeister moves and self crossing changes. Milnor introduced an invariant under link homotopy called $\bar{\mu}$. In this talk, we extend the link homotopy to nanophrases corresponding to virtual link and $\bar{\mu}$ invariant to nanophrases.

Arc index of pretzel knots of type $(-p, q, r)$

Hwa Jeong Lee, Chung-Ang University

We computed the arc index for the pretzel knots $K = (-p, q, r)$ with $p, q, r \geq 2$ and $r \geq q$, and at most one of p, q, r is even. If $q = 2$, then the arc index $\alpha(K)$ equals the minimal crossing number c(K). If $p \geq 3$ and $q = 3$, then $\alpha(K) = c(K) - 1$. If $p \geq 5$ and $q = 4$, then $\alpha(K) = c(K) - 2$.

Critical Heegaard surfaces obtained by amalgamation

Jung Hoon Lee, Chonbuk National University

Critical surfaces are defined by Bachman as topological index two surfaces, generalizing incompressible surfaces and strongly irreducible surfaces. In this talk we give a condition to obtain critical Heegaard surfaces by amalgamation. As a special case, we obtain critical Heegaard surfaces by boundary stabilization. It gives critical Heegaard surfaces of non-minimal genus, for 3-manifolds which do not admit distinct Heegaard splittings (up to isotopy).

Exactly 14 intrinsically knotted graphs have 21 edges.

Minjung Lee, korea univ.

Johnson, Kidwell and Michacl showed that intrinsically knotted graphs have at least 21 edges. Also it is known that K7 and the 13 graphs obtained by triangle-Y moves from K7 are intrinsically knotted graphs with 21 edges. In this paper, we proved that only these 14 graphs are intrinsically knotted graph with 21 edges.

Link invariants from homotopy groups of the 3-sphere

Fengchun Lei, Dalian University of Technology

We introduce the homotopy groups of spheres as link invariants for Brunnian-type links through the investigations on the intersection subgroup of the normal closures of the meridians of strongly nonsplittable links. The homotopy

groups measure the difference between the intersection subgroup and symmetric commutator subgroup of the normal closures of the meridians and give the invariants of the links obtained in this way. Some examples are given that their difference could be detected by the higher homotopy-group invariant but could not be detected by the Milnor invariants. This is a joint work with Jie Wu and Fuquan Fang.

On symmetry-structural links and the loop space of S^3

Fengling Li, Dalian University of Technology

In this paper, we define satellite symmetry-structural links and simplicial-structural links. By an argument of the link complement, we prove that the simplicial group obtained from link groups of the simplicial-structural links is homotopy equivalent to the loop space of S^3. (This is joint work with Prof. Fengchun Lei and Jie Wu.)

The support genus of certain Legendrian knots

Youlin Li, Shanghai Jiao Tong University

A contact structure on an oriented 3-manifold is a maximally non-integrable plane distribution in the tangent bundle. Around 2000, Giroux established a one-to-one correspondence between the contact structures on an oriented 3-manifold and its open book decompositions in some sense. A Legendrian knot in a contact 3-manifold is a smooth knot which everywhere tangent to the contact plane distribution. For any Legendrian knot L in the standard contact structure in 3-sphere S^3, there is a correspondent open book decomposition one of whose pages contains L, such that the page framing of L agrees with the contact framing. The minimal genus of the pages of such open book decomposition is called, by Onaran and some others, the support genus of L.

In this talk, we shall determine the support genus of all Legendrian right handed trefoil knots, some Legendrian torus knots, and some Legendrian twist knots. This answers a question of Onaran negatively. It is a joint work with Wang Jiajun.

The fixed subgroup of automorhpism of cofinite volume Klein group

Jianfeng Lin, Peking University

In this talk, we discuss the rank of fxed subgroup of the automorphism of a cofinite volume Klein group. This question comes from the Scott's conjecture. In this paper, we first give some counterexamples of the analogous Scott's conjecture in the Klein group case. That is a automorphism of cofnite volume Klein group whose fxed subgroup's rank is larger than the rank of the Klein group itself. Then we classify all the possible fxed subgroup of cofnite volume

Klein group. As a corollary we prove the weak version of scott's conjecture in cofnite volume Klein group case.

Involutions on spin 4-manifolds

Ximin Liu , Dalian University of Technology

In this talk, I will explain some recent results about Z_2 actions on spin 4-manifolds.

Delaunay inversive distance circle packings and hyperideal Fuchsian polyhedra with particles

Jiming Ma, Fudan University

Fixed $\Theta = (\theta_1, \theta_2, \cdots, \theta_n) \in (0, \pi)^n$, let $\mathcal{T}_{g,n}$ be the Teichmüller space of marked hyperbolic surfaces of genus g with n infinite area ends, we prove:

1. Delaunay inversive distance circle packings on Θ conical hyperbolic surfaces are parameterized by $\mathcal{T}_{g,n}$. We also prove the rigidity of Delaunay inversive distance circle packings.

2. The space $\mathcal{P}_{g,n}$ of hyperideal Fuchsian polyhedra with particles admits the given angles Θ is homeomorphic to $\mathcal{T}_{g,n}$.

These two results are proved simultaneously through 3-dimensional hyperbolic geometry and variational principle. This is a joint work with Jean-Marc Schlenker.

Volume preserving moves on hyperbolic graph and its applications

Hidetoshi Masai, Tokyo Institute of Technology

A spatial graph is hyperbolic if its complement admits a hyperbolic structure with parabolic meridians and geodesic boundaries. In this talk, I would like to talk about volume preserving moves on hyperbolic graphs and its applications.

Page moves on arc presentations

Masayuki Matsuo, Kobe University

Cromwell introduces the notion of an arc presentation of a knot. An arc presentation is an embedding of a knot in an open-book. We define a transformation on an arc presentation called a page move, and prove that any knot is transformed into the trivial knot by a single page move. We also study a relationship with the unknotting number.

The HOMFLY polynomial and admissible values

Yasuyuki Miyazawa, Yamaguchi University

The HOMFLY polynomial is a familiar and useful invariant for knots in knot theory. However, it cannot be said that characteristics of the HOMFLY polynomial are fully revealed. In this talk, we explore the HOMFLY polynomial and give some results about the structure of the polynomial. By using them, we detect admissible values of the polynomial.

On connected sum of generalized Kinoshita's theta-curves

Hiromasa Moriuchi, OCAMI

Kinoshita's theta-curve $\theta(1,1,1)$ is locally unknotted theta-curve, that is, its constituent knots are all trivial. We obtain generalized Kinoshita's theta-curve $\theta(i,j,k)$ by adding full-twists to $\theta(1,1,1)$. In this talk we discuss about order-3 vertex connected sums of $\theta(i,j,k)$ and $\theta(i',j',k')$.

Unknotting numbers of torus-covering knots

Inasa Nakamura, Kyoto University

A torus-covering knot is an oriented surface knot which is in the form of a covering over the standard torus. The unknotting number of an oriented surface knot F is the minimal number of disjoint 1-handles necessary to deform F to an unknotted surface knot by 1-handle surgery. In this talk we study unknotting numbers of torus-covering knots. In particular, we give examples of torus-covering knots with the unknotting number exactly n.

Non-identical twin groups of virtual knot

Takuji Nakamura, Osaka Electro-Communication University

Every virtual knot has a pair of groups called the upper and lower groups of the knot. In this talk, we give a sufficient condition for a pair of groups which are realized by a certain virtual knot as the upper and lower groups. This is a joint work with Y. Nakanishi, S. Satoh, Y. Tomiyama.

Epimorphisms between knot groups and special values of colored Jones polynomials

Masayuki Niimura, Soka University

When an epimorphism between knot groups exits, it gives a partial order on the set of knots. Recently there are lots of studies related this partial order, or epimorphisms. Along these directions we conjectured some inequality on special values of colored Jones polynomials that appears in the volume conjecture. In this talk I will explain the motivation and the back ground.

Further, we mention some example of torus knot and 2-bridge knot by using Mathematica. This is a joint work with Teruaki Kitano.

On invariants of knots and links in a spatial complete four-partite graph $K_{3,3,1,1}$

Ryo Nikkuni, Tokyo Woman's Christian University

It is known that every spatial complete four-partite graph $K_{3,3,1,1}$ contains a knot with Arf invariant one. In this talk, we give a formula for invariants of knots and links in a spatial $K_{3,3,1,1}$ in terms of the square of the linking number and the second coefficient of the Conway polynomial and its applications. This is a joint work with Hiroka Hashimoto.

Upper bound on lattice stick number of knots

Sung Jong No, Korea University

The lattice stick number $s_L(K)$ of a knot K is defined to be the minimal number of straight line segments required to construct a stick presentation of K in the cubic lattice. We find an upper bound on the lattice stick number of a nontrivial knot K, except trefoil knot, in terms of the minimal crossing number $c(K)$ which is $s_L(K) \leq 3c(K) + 2$. Moreover if K is a non-alternating prime knot, then $s_L(K) \leq 3c(K) - 4$.

On a topological interpretation of quandle cocycle invariants of classical links.

Takefumi Nosaka, Kyoto university

S. Cater and M. Saito et al. introduced quandle cocycle invariants of classical links using quandle 2-cocycles with local coefficients. However the construction is combinatorially by using link-diagrams. In this talk, for "some" quandles, we give a topological interpretation of all the quandle cocycle invariants. Precisely, the cocycle invariant is a linear sum of "colouring polynomial" introduced by M. Eisermann and of a certain part of the Dijkgraaf-Witten invariant.

A minor-closed class on graph 2-braid groups

Hyo Won Park, KAIST

As an effort to prove there are finitely many nuclei, we will discuss a class of finite graphs that is closed under minor relation and contains all finite graphs whose graph 2-braid groups are right angled Artin groups.

Meridional destabilizing number and connected sums of knots

Toshio Saito, Joetsu University of Education

From a viewpoint of Heegaard theory, we have two types of natural positions of knots in closed orientable 3-manifolds: a bridge position with respect to a Heegaard surface, and a core position of a handlebody bounded by a Heegaard surface. The latter has a close connection to Heegaard genus (or tunnel number) of knots. Meridional destabilizing number, which is defined by considering such two positions, will be introduced in this talk. We could say this together with Heegaard genus gives a binary complexity of knots. We will then discuss its behavior for composite knots.

Virtual graph presentations of ribbon surface-knots

Shin Satoh, Kobe University

In our previous study, we introduced a method to describe a ribbon S^2- or T^2-knot by use of a virtual arc or knot diagram, respectively. We generalize this method to a ribbon surface-knot with a virtual graph diagram, and study the stable equivalence of ribbon presentations in terms of virtual graph diagrams.

Linear 4-charts with four crossings (joint work with Teruo Nagase)

Akiko Shima, Tokai University

A chart is an oriented labeled graph in a disk with three kind of vertices called black vertices, crossings and white vertices. A chart represents an embedded surface in 4-space. We would like to research about embedded surfaces using charts. Let Γ be a 4-chart, and Γ_m the subgraph consisting of all edges of label m and their vertices. Let $Cr(\Gamma)$ be the set of all crossings in Γ. If $(\Gamma_1 \cup \Gamma_3) - Cr(\Gamma)$ consists of a disjoint union of trees, then Γ is called a linear chart. We show that there does not exist any linear 4-minimal 4-chart with four crossings.

Games based on region crossing changes

Ayaka Shimizu, OCAMI

A region crossing change at a region of a link diagram is defined to be the crossing changes at the crossing points on the boundary of the region. In this talk, we show that the region crossing change on a knot diagram is an unknotting operation. Using this algorithm, we introduce the game "Region Select" and its dual game "Region Lighten" as a joint work with Akio Kawauchi and Kengo Kishimoto. Let's enjoy !

Every link has a (3,4)-diagram

Reiko Shinjo, Waseda University

Given a diagram of a link, one can ignore which strand is the overstrand at each crossing and think of it as a planar 4-valent graph embedded on the 2-sphere. This graph divides the sphere into n-gons. A $(3,4)$-diagram is a diagram each of whose faces is a 3-gon or 4-gon. In this talk we show that every link has a $(3,4)$-diagram.

Milnor's invariants and Hirzebruch-type invariants of homology cylinders

Minkyoung Song, POSTECH

Homology cobordism groups of homology cylinders are studied as generalizations of string-link concordance groups and mapping class groups in the last decade, and many invariants have been defined. We consider a filtration of subgroups using Garoufalidis-Levine invariants and Milnor's $\bar{\mu}$-invarints on homology cylinders, and extend Hirzebruch-type invariants on the subgroups. Also we consider additivity of the invariants.

Free involutions and Z/p-actions on simply-connected 5-manifolds

Yang Su, Chinese Academy of Sciences

In this talk we will introduce the classification of free involutions on a class of simply-connected 5-manifolds. I will also discuss the problem of classifying free Z/p actions on these manifolds, p an odd prime.

Epimorphisms between knot groups and the images of meridians

Masaaki Suzuki, Akita University

We determined whether there exists an epimorphism between knot groups which maps a meridian to a meridian, in case of the knots with up to 11 crossings. The twisted Alexander polynomial is a key tool to determine the non-existence of an epimorphism. In this talk, we show some examples of epimorphisms which do not map meridians to meridians.

An algebraic formula of the Witten-Reshetikhin-Turaev invariant for 3-manifolds

Toshie Takata, Kyushu University

We give an explicit formula of the Witten-Reshetikhin-Turaev $SU(2)$ invariant associated a right integral and a central element of $Uq(sl(2))$ at a root of unity q.

The zeroth coefficient polynomial of a $(2,1)$-cable knot

Hideo Takioka, Osaka City University

The zeroth coefficient polynomial is the constant term of the HOMFLYPT polynomial with respect to one of the two variables. We show several calculation results for the zeroth coefficient polynomials of $(2,1)$-cable knots. In particular, we give examples of infinitely many knots with the same HOMFLYPT polynomials, which can be distinguished by the zeroth coefficient polynomials of their $(2,1)$-cable knots.

Interpretation of rack coloring knot invariants in terms of quandles

Kokoro Tanaka, Tokyo Gakugei University

It is known that quandles give us invariants of knots and racks give us that of framed knots. Considering a knot with an integer as a framed knot, Nelson constructed an invariant of (unframed) knots by using rack coloring invariants. It is natural to consider whether there is some relationship between his invariant and an invariant of knots derived from quandle theory. In this talk, we give an interpretation of his invariant in terms of quandles. This is a joint work with Yuma Taniguchi (Tokyo Gakugei University).

On free knots

Kenta Taniguchi, Kobe University

V.O.Manturov introduces the notion of a free knot which is relevant to a virtual knot.In this talk, we review the definition of a free knot and study topological properties;a numerical invariant,an enumeration, and so on.

On two-point homogeneous quandles

Koushirou Wada, Hiroshima University

A Riemannian symmetric space is regarded as a quandle. There is a notion called a two-point homogeneous Riemannian manifold in study of Riemannian symmetric spaces. A two-point homogeneous quandle is defined as an analogy of two-point homogeneous Riemannian manifold. In this talk, I classify two-point homogeneous quandles of cyclic type with order up to 12. This is a joint work with Professor Hiroshi Tamaru, Hirosima university.

On slope genera of knotted tori in the 4-space

Shicheng Wang, Peking University

We investigate genera for the slopes of a knotted torus in the 4-sphere analogous to the genus of a classical knot. We compare various formulations

of this notion, and use this notion to study the extendable subgroup of the mapping class group of the knotted torus.

This is a joint work with Liu Yi, Ni Yi and Sun Hongbin.

Free degrees of homeomorphisms on compact surfaces

Jianchun Wu, Soochow University

For a compact surface M, the free degree $FRD(M)$ of homeomorphisms on M is the minimum positive integer n with the property that for any self homeomorphism ξ of M, at least one of the iterates $\xi, \xi^2, \cdots, \xi^n$ has a fixed point. This is to say $FRD(M)$ is the maximum of least periods among all periodic points of self homeomorphisms on M. We show that $FRD(F_{g,b}) \leq 24g - 24$ for $g \geq 2$ and $FRD(N_{g,b}) \leq 12g - 24$ for $g \geq 3$. Joint work with Xuezhi Zhao.

Homological invariants of Hurwitz equivalence on tuples of simple braids

Yoshiro Yaguchi, Hiroshima University

Hurwitz equivalence on tuples of simple braids is studied, which can be used in the study of braided surfaces, surface braids and surface links. In this talk, we define a matrix for a tuple of simple braids by using the first homology classes of a punctured disk. We also introduce some invariants of Hurwitz equivalence on tuples of simple braids by using their matrices.

Some new results on new knot invariants

Zhiqing Yang, Dalian University of Technology

In this talk, we will introduce some new methods to define knot invariants, and give some claculations showing that they are better than the claassical knot polynomials in distingushing knots.

Nuclei and exotic 4-manifolds

Kouichi Yasui, Hiroshima University

We introduce a new generalization of Gompf nuclei and give applications. We construct infinitely many exotic smooth structures for a large class of compact 4-manifolds with boundary, regarding topological invariants and boundary 3-manifolds. To detect smooth structures using the adjunction inequality, we introduce a relative genus function. Time permitting, we also construct arbitrary many compact Stein 4-manifolds and infinitely many non-Stein 4-manifolds which are all homeomorphic but mutually non-diffeomorphic.

Bounds for fixed points and fixed subgroups on graph manifolds

Qiang Zhang, Xi'an Jiaotong University

In this talk, we consider homeomorphisms of compact connected orientalble graph manifolds, and give some bounds involving the rank and the index of fixed point classes. One consequence is a rank bound for fixed subgroups of graph manifold group automorphisms. We rely on the classification of 2-orbifolds homeomorphisms and the bounds on surfaces which is given in another paper.

Finiteness of integral points in relative moduli spaces of the one-holed torus

Ying Zhang, Soochow University

We show that the number of integral points in each relative moduli space of the one-holed torus is finite. This establishes the finiteness of the number of equivalence classes of integral solutions to each of a class of generalized Markoff equations. Joint wok with Lizhen Ji.

Unstabilized Heeggard Splitting

Yanqing Zou, Dalian University of Technology

In this talk, we will introduce some sufficient conditions which imply some particular type Heegaard splitting, such as Boundary stabilization, Self-amalgamtion, is unstabilized.

General Information

- **Conference Hall**

  Plenary Talks Room 304 in Creative Leaning Building (E11)

  Parallel Sessions Rooms 101, 102, 103 in Creative Leaning Building

- **Local Transportaton**

  - Two charter buses will take you from Toyoko Inn to KAIST campus every morning from Monday to Thursday. The buses leave at **8:20** outside Toyoko Inn.
  - In case you miss the provided buses or you want to go back to the hotel early, you may ride a local bus or a taxi. There is a local bus line 104 between the Government Complex west stop (Airport bus stop) and the KAIST main gate. The bus costs 1,200 won and a taxi costs about 5,000 won from the hotel to Creative Learning Building of KAIST or vice versa.

- **Meal**

  Breakfast Mon - Fri (7:00-9:30) : 1st floor of Toyoko Inn Hotel.
  Lunch Mon - Wed (12:00-13:00) : 2nd floor of Faculty Hall (E5).
  Meal tickets are provided in the registration packet.
  Thursday : Boxed lunch distributed in the tour bus

  Dinner

  - Sunday (1/8) - Bulgogi or spicy bone broth at Restaurant Daedaero within 3-minute walk from Toyoko Inn Hotel. The meal ticket can be found in the registration packet.
  - Monday - Reception at the 4th floor of the Hahiho hotel (Buffet together with beer). Charter buses leave at **17:45** in front of the Creative Learning Building.
  - Tuesday - Samgetang (chicken broth with ginseng) at a restaurant in Yuseong. Charter buses leave at **17:30** in front of the Creative Learning Building.
  - Wednesday- Korean barbecue with Maggeoli at Restaurant Sogane. Charter buses leave at **17:45** in front of the Creative Learning Building.

- **Tour**
  Afternoon to evening on Thursday, we visit Iksan jewelry museum and Jeonju Hanok Village, listen Korean folk music, and have a traditional dinner. Charter buses leave at **12:20** in front of Creative Learning Building.

- **Useful Phone Numbers**
  - Call Taxi: 042-524-9333, 042-672–5858, On campus taxis are waiting at the taxi stand near N13.
  - In emergency: 011-9554-8413 (Dr. Hyo Won Park), 010-5450-3184 (Professor Ki Hyoung Ko)
- **Participants are responsible for:**
  - Laundry services, meals, foods, goods that are not listed above
  - Phone calls

Local Information

- **Campus map**

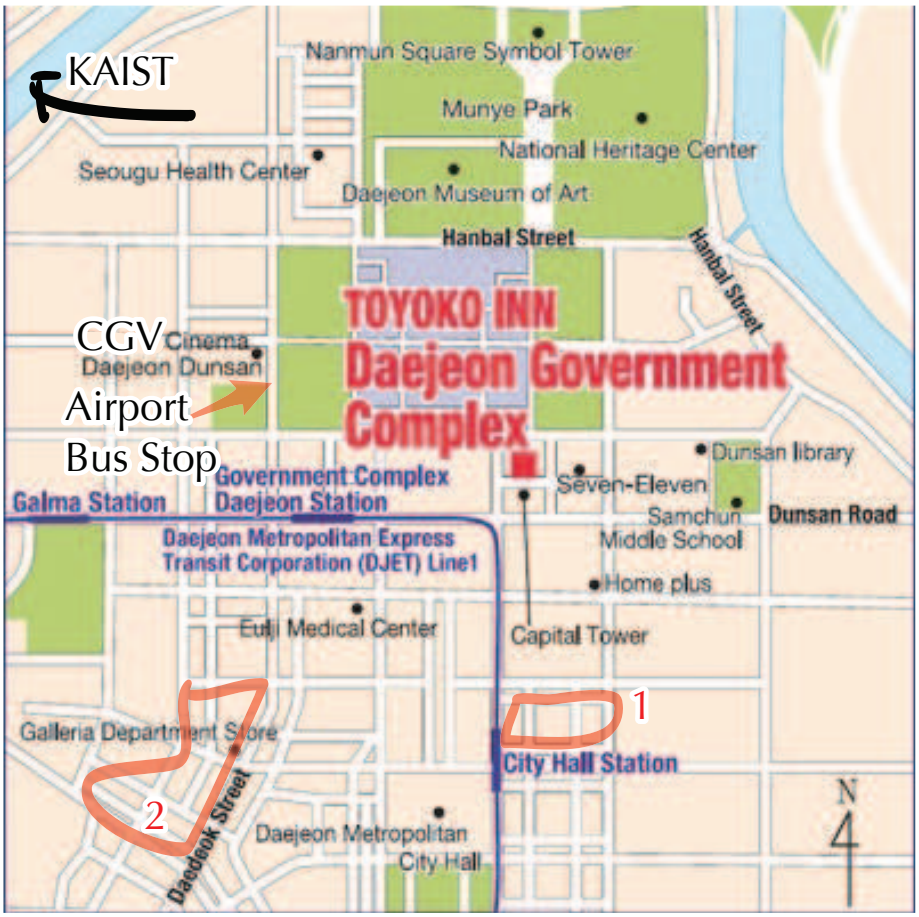
[E11]	Creative Learning Building
[E6-1]	Department of Mathematical Sciences.
[E5-1]	Dining Hall (Lunch)
[E9]	Main Library, Bookstore
[E4,W2-1,N11,E9]	Coffee Shop
[E3]	Dunkin Donuts
[W2]	DDDN Pizza, KAIST shop, Woori Bank
[N12]	Burger King, Snack bars, Post Office
[N13]	Taxi Stand

- **Toyoko Inn**

Address	922, Dunsandong, Seo-gu, Daejeon
Tel	+82-(0)42-545-1045 FAX: +82-(0)42-545-1046
Check-in Time	After 16:00
Check-out Time	Before 10:00

Internet service All rooms of the Hotel are equipped with internet connecting jack (free of charge)

Convenient store GS25, 1st floor of the Hahiho Hotel, next door



Lots of restaurants are located around City Hall Station (Area 1), Galleria Department Store (Area 2). Home plus is a near-by supermarket for groceries and many other goods.

List of Participants

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