# The 20th East Asian Conference on Geometric Topology

## February 4–7, 2025

**Graduate School of Mathematical Sciences**
**The University of Tokyo**
3-8-1 Komaba, Meguro-ku, Tokyo 153-8914, Japan

## 1. **Talk Schedule**

| Time | February 4th, TUESDAY | | |
|---|---|---|---|
| | 21 KOMCEE Lecture Hall | | |
| 9:50–10:00 | Opening Remarks | | |
| 10:00–11:00 | Osamu Saeki (Mini course 1) | | |
| 11:20–12:20 | Zhengyi Zhou | | |
| 12:20–13:30 | Lunch | | |
| | Room 1 | Room 2 | Room 3 |
| 13:30–13:50 | Fengling Li | Ingrid Irmer | Yuichi Yamada |
| 13:55–14:15 | Seonmi Choi | Wenyuan Yang | Motoo Tange |
| 14:20–14:40 | Inasa Nakamura | Jung Hoon Lee | Naoko Kamada |
| 14:45–15:05 | Biao Ma | Erika Kuno | Taehee Kim |
| 15:05–15:30 | Tea Time | | |
| 15:30–15:50 | Yuya Murakami | Sang-hyun Kim | Seiichi Kamada |
| 15:55–16:15 | Taehyeong Kim | Wonjun Chang | Jaewon Lee |
| 16:20–16:40 | Sanghoon Kwak | Aoi Wakuda | Chun-Sheng Hsueh |
| 16:45–17:05 | Kouki Yamagachi | Junseok Kim | Andreani Petrou |

Room 1 = Room 002, Room 2 = Room 117, Room 3 = Room 123

| Time | February 5th, WEDNESDAY | | |
|---|---|---|---|
| | 21 KOMCEE Lecture Hall | | |
| 9:50–10:50 | Hiroaki Karuo | | |
| 11:10–12:10 | Osamu Saeki (Mini course 2) | | |
| 12:10–13:30 | Lunch | | |
| | Room 1 | Room 2 | Room 3 |
| 13:30–13:50 | Teruhisa Kadokami | Sungmo Kang | Yanqing Zou |
| 13:55–14:15 | Seokbeom Yoon | Xuezhi Zhao | Faze Zhang |
| 14:20–14:40 | Mikami Hirasawa | Shijie Gu | Sangbum Cho |
| 14:45–15:05 | Lei Chen | Hongtaek Jung | Toshifumi Tanaka |
| 15:05–15:30 | Tea Time | | |
| 15:30–15:50 | Zhiyun Cheng | Hayato Imori | Geunyoung Kim |
| 15:55–16:15 | Naoki Kitazawa | Carl-Fredrik Nyberg-Brodda | Xiaolei Wu |
| 16:20–16:40 | Yuxuan Yang | Juhun Baik | Sunul Oh |
| 16:45–17:05 | Minkyu Kim | Katsunori Arai | Jumpei Yasuda |
| 18:00– | Banquet | | |

Room 1 = Room 002, Room 2 = Room 117, Room 3 = Room 123

| Time | February 6th, THURSDAY | | |
|---|---|---|---|
| | 21 KOMCEE Lecture Hall | | |
| 9:50–10:50 | Min Hoon Kim | | |
| 11:10–12:10 | Chao Wang | | |
| 12:10–13:30 | Lunch | | |
| | Room 1 | Room 2 | Room 3 |
| 13:30–13:50 | Huabin Ge | Ying Zhang | In Dae Jong |
| 13:55–14:15 | Jae Choon Cha | Qiang Zhang | Yuta Nozaki |
| 14:20–14:40 | Jianfeng Lin | Teruaki Kitano | Tatsumasa Suzuki |
| 14:45–15:05 | Jun Ueki | Fangting Zheng | Seungwon Kim |
| 15:05–15:30 | Tea Time | | |
| 15:30–15:50 | Migiwa Sakurai | Donggyun Seo | Byeorhi Kim |
| 15:55–16:15 | Zhechi Cheng | Genki Omori | Kento Sakai |
| 16:20–16:40 | Dongha Lee | Alexis Marchand | Manami Niijima |
| 16:45–17:05 | Honami Sakamoto | Takatoshi Hama | Yuanyuan Bao |

Room 1 = Room 002, Room 2 = Room 117, Room 3 = Room 123

| Time | February 7th, FRIDAY |
|---|---|
| | 21 KOMCEE Lecture Hall |
| 9:50–10:50 | Akira Yasuhara |
| 11:10–12:10 | Hyungryul Baik |
| 12:10–12:20 | Closing Remarks |
| 12:20–13:30 | Lunch |
| 13:30–18:00 | Excursion |
| 18:00– | Dinner |

## 2. **Program**

### February 4th, TUESDAY

**21 KOMCEE Lecture Hall**
**9:50–10:00** Opening remarks
**10:00–11:00 Osamu Saeki** (Kyushu University)
Topology of Reeb spaces of smooth functions on manifolds (Mini course 1)
**11:20–12:20 Zhengyi Zhou** (Chinese Academy of Sciences)
Kähler compactification of $\mathbb{C}^n$ and Reeb dynamics

**ROOM 1**
**13:30–13:50 Fengling Li** (Dalian University of Technology)
A three-variable transcendental invariant of planar knotoids
**13:55–14:15 Seonmi Choi** (Seowon University)
Homology of multi-biquandles
**14:20–14:40 Inasa Nakamura** (Saga University)
Charts of knitted surfaces of degree 2
**14:45–15:05 Biao Ma** (Tongji University)
Boundary maps and median spaces of finite rank

**15:30–15:50 Yuya Murakami** (Kyushu University)
Asymptotics and quantum modularity of WRT invariants of negative definite plumbed manifolds
**15:55–16:15 Taehyeong Kim** (KIAS)
Entropy in the cusp for diagonal flows on the space of lattices
**16:20–16:40 Sanghoon Kwak** (KIAS HCMC)
Non-unique Ergodicity on the Boundary of Outer Space
**16:45–17:05 Kouki Yamaguchi** (Kyoto University)
On the $n$-loop Kontsevich invariant of knots having the same Alexander polynomial

**ROOM 2**
**13:30–13:50 Ingrid Irmer** (Southern University of Science and Technology)
Sets of minima and generators of the Steinberg module of the mapping class group
**13:55–14:15 Wenyuan Yang** (Peking University)
Marked length spectrum rigidity in groups with contracting elements
**14:20–14:40 Jung Hoon Lee** (Jeonbuk National University)
The Powell Conjecture in genus three

**14:45–15:05 Erika Kuno** (Osaka University)
Curve graphs and right-angled Artin subgroups of mapping class groups for nonorientable surfaces

**15:30–15:50 Sang-hyun Kim** (KIAS)
Smoothability of actions by groups of subexponential growth
**15:55–16:15 Wonjun Chang** (POSTECH)
Quantitative Analysis of the Generalized Harer Conjecture
**16:20–16:40 Aoi Wakuda** (The University of Tokyo)
Puncture loops on a non-orientable surface
**16:45–17:05 Junseok Kim** (KAIST)
Outer automorphism groups of right-angled Artin groups and maximal SIL-pair systems

**ROOM 3**
**13:30–13:50 Yuichi Yamada** (The University of Electro-Communications)
Seifert manifolds that have two (integral/rational) Dehn surgery descriptions along torus knot
**13:55–14:15 Motoo Tange** (University of Tsukuba)
L-space embedding in negative definite closed 4-manifold constructed by Dehn surgeries of two knots
**14:20–14:40 Naoko Kamada** (Nagoya City University)
A method for constructing welded links from welded links
**14:45–15:05 Taehee Kim** (Konkuk University)
Satellite operators on the knot concordance group

**15:30–15:50 Seiichi Kamada** (Osaka University)
Generalized Alexander quandles and their classification
**15:55–16:15 Jaewon Lee** (KAIST)
Rational concordance of double twist knots
**16:20–16:40 Chun-Sheng Hsueh** (Humboldt University Berlin)
Open books in higher dimensions
**16:45–17:05 Andreani Petrou** (Okinawa Institute of Science and Technology)
Knots, links and Harer-Zagier factorisability

**February 5th, WEDNESDAY**

**21 KOMCEE Lecture Hall**

**09:50–10:50 Hiroaki Karuo** (Gakushuin University)
Center of stated SL($n$)-skein algebras

**11:10–12:10 Osamu Saeki** (Kyushu University)
Topology of Reeb spaces of smooth functions on manifolds (Mini course 2)

**ROOM 1**

**13:30–13:50 Teruhisa Kadokami** (Kanazawa University)
The half Alexander polynomials of amphicheiral 2-bridge knots

**13:55–14:15 Seokbeom Yoon** (Chonnam National University)
The (twisted/$L^2$)-Alexander polynomial of an ideally triangulated 3-manifold

**14:20–14:40 Mikami Hirasawa** (Nagoya Institute of Technology)
Some family of knots of divides with Salem Alexander polynomials

**14:45–15:05 Lei Chen** (Chinese Academy of Science)
Normal generators of Torelli groups

**15:30–15:50 Zhiyun Cheng** (Beijing Normal University)
Partial-dual genus polynomial and its categorification

**15:55–16:15 Naoki Kitazawa** (Kyushu University)
Reconstructing Morse functions, Morse-Bott functions, or naturally generalized functions with prescribed preimages

**16:20–16:40 Yuxuan Yang** (Peking University)
On the Volume Conjecture for hyperbolic Dehn-filled 3-manifolds along the twist knots

**16:45–17:05 Minkyu Kim** (KIAS)
The Lie operad as a subquotient of Jacobi diagrams in handlebodies

**ROOM 2**

**13:30–13:50 Sungmo Kang** (Chonnam National University)
Tunnel-number-one knot exteriors in $S^3$ disjoint from proper power curves

**13:55–14:15 Xuezhi Zhao** (Capital Normal University)
The word problem of Seifert manifold

**14:20–14:40 Shijie Gu** (Northeastern University)
BNPC $n$-manifolds ($n < 5$) are Euclidean

**14:45–15:05 Hongtaek Jung** (Seoul National University)
Generic properties of Hitchin representations

**15:30–15:50 Hayato Imori** (KAIST)
Immersed cobordism maps in Khovanov and singular instanton homology
**15:55–16:15 Carl-Fredrik Nyberg-Brodda** (KIAS)
Decision problems in Artin groups
**16:20–16:40 Juhun Baik** (KAIST)
Topological normal generation of big mapping class groups
**16:45–17:05 Katsunori Arai** (Osaka University)
A construction of multiple group racks

**ROOM 3**
**13:30–13:50 Yanqing Zou** (East China Normal University)
Genera and ranks of distance 2 Heegaard splittings
**13:55–14:15 Faze Zhang** (Northeast Normal University)
Angle structures on 3-dimensional pseudo-manifolds
**14:20–14:40 Sangbum Cho** (Hanyang University)
The separating disk complex for a handlebody
**14:45–15:05 Toshifumi Tanaka** (Gifu University)
On partial knots for symmetric unions

**15:30–15:50 Geunyoung Kim** (McMaster University)
Heegaard diagrams for 5-manifolds
**15:55–16:15 Xiaolei Wu** (Fudan University)
Groups acting on locally finite trees
**16:20–16:40 Sunul Oh** (POSTECH)
Hyperbolic Dehn filling, volume, and transcendentality
**16:45–17:05 Jumpei Yasuda** (Osaka University)
A formula for Alexander polynomials of 2-plat 2-knots

**18:00– Banquet**

**February 6th, THURSDAY**

**21 KOMCEE Lecture Hall**

**09:50–10:50 Min Hoon Kim** (Ewha Womans University)
Smooth homotopy 4-spheres admitting open book decompositions

**11:10–12:10 Chao Wang** (East China Normal University)
A lower bound of the crossing number of composite knots

**ROOM 1**

**13:30–13:50 Huabin Ge** (Renmin University of China)
Combinatorial Ricci flow, towards Thurston's geometric triangulation conjecture

**13:55–14:15 Jae Choon Cha** (POSTECH)
Quantitative bordism and linearity problems

**14:20–14:40 Jianfeng Lin** (Tsinghua University)
Configurations spaces and mapping class groups of 4-manifolds

**14:45–15:05 Jun Ueki** (Ochanomizu University)
An analogue of the classical Neukirch–Uchida theorem for 3-manifolds

**15:30–15:50 Migiwa Sakurai** (Shibaura Institute of Technology)
Infinitely many virtual knots with any sequence of $n$-writhes

**15:55–16:15 Zhechi Cheng** (Wuhan University)
Geography of the top term of knot Floer homology

**16:20–16:40 Dongha Lee** (KAIST)
The Renormalization of Volume and the Chern-Simons Invariant for Hyperbolic 3-Manifolds

**16:45–17:05 Honami Sakamoto** (Ochanomizu University)
Liminal $\mathrm{SL}_2\mathbb{Z}_p$-representations of twist knot and cyclic covers

**ROOM 2**

**13:30–13:50 Ying Zhang (Soochow University)**
Minimal reduced matrices in $\mathrm{SL}(2,\mathbb{Z})$ and highest geodesics

**13:55–14:15 Qiang Zhang** (Xi'an Jiaotong University)
Iwip endomorphisms of free groups and fixed points of graph selfmaps

**14:20–14:40 Teruaki Kitano** (Soka University)
An order on the set of prime knots via $\pi$-orbifold groups

**14:45–15:05 Fangting Zheng** (Xi'an Jiaotong-Liverpool University)

Recent progress on high-dimensional hyperbolic reflection groups

**15:30–15:50 Donggyun Seo** (Seoul National University)
The Pants Graph of a Rose
**15:55–16:15 Genki Omori** (Shibaura Institute of Technology)
Finite presentations for the balanced superelliptic mapping class groups
**16:20–16:40 Alexis Marchand** (Kyoto University)
Stable commutator length, surfaces, and rationality
**16:45–17:05 Takatoshi Hama** (Nihon University)
On the pure cactus group and the configuration space of points on the circle

**ROOM 3**
**13:30–13:50 In Dae Jong** (Kindai University)
Purely cosmetic surgeries on knots in homology spheres and the Casson-Walker invariant
**13:55–14:15 Yuta Nozaki** (Yokohama National University)
Torsion elements in the associated graded modules of filtrations over the Torelli group and the homology cylinders
**14:20–14:40 Tatsumasa Suzuki** (Meiji University)
On pochette surgery and its generalization
**14:45–15:05 Seungwon Kim** (Sungkyunkwan University)
Non-split, alternating links bound unique Seifert surfaces in the 4-ball

**15:30–15:50 Byeorhi Kim** (POSTECH)
On a classfication of surfaces embedded in 4-manifolds
**15:55–16:15 Kento Sakai** (Osaka University)
Uniform degeneration of hyperbolic surfaces along harmonic map rays
**16:20–16:40 Manami Niijima**
On Beloch's curve that appears when solving real cubics with origami
**16:45–17:05 Yuanyuan Bao** (Tohoku University)
A multivariable Alexander polynomial for framed trivalent spatial graphs

## February 7th, FRIDAY

**21 KOMCEE Lecture Hall**

**09:50–10:50 Akira Yasuhara** (Waseda University)

Milnor concordance invariants of classical links, welded links, and surface-links

**11:10–12:10 Hyungryul Baik** (KAIST)

Reconstruction of 3-manifolds from infinity

**12:10–12:20** Closing Remarks

**13:30–18:00 Excursion**

**18:00– Dinner**

## 3. **Abstracts**

### Mini course

**Osamu Saeki** (Kyushu University)

**Topology of Reeb spaces of smooth functions on manifolds**

Abstract: The Reeb space of a continuous function on a topological space is the space of connected components of the level sets. It is known that the Reeb space of a Morse function on a closed manifold has the structure of a graph, called the Reeb graph, which is used to study differential topological properties of the function from a combinatorial viewpoint. In the series of two talks, we first show that the Reeb space of a smooth function on a closed manifold with finitely many critical values has the structure of a finite graph. However, the finiteness of critical values is not a necessary condition. We then give a complete characterization of those smooth functions whose Reeb spaces have the structure of a finite graph. Such a result is obtained by using results in general topology related to Peano continuum.

#### References

[1] G. Reeb, *Sur les points singuliers d'une forme de Pfaff complètement intégrable ou d'une fonction numérique*, Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences **222** (1946), 847–849.

[2] O. Saeki, *Reeb spaces of smooth functions on manifolds*, International Mathematics Research Notices, Volume 2022, Issue 11, June 2022, 8740–8768.

[3] O. Saeki, *Reeb spaces of smooth functions on manifolds II*, Res. Math. Sci. **11** (2024), no. 2, Paper No. 24, 12 pp.

## Plenary talks

**Hyungryul Baik** (KAIST)

**Reconstruction of 3-manifolds from infinity**

Abstract: By work of Thurston, Calegari, Calegari-Dunfield, Fenley, and Frankel-Schleimer-Segerman, it is known that many 3-manifolds naturally have a circle at infinity which is usually referred as universal circle. We show that in many cases, we can reconstruct 3-manifolds from a universal circle. This talk is based on joint work with various subsets of {KyeongRo Kim, Hongtaek Jung, Chenxi Wu, Bojun Zhao}.

**Hiroaki Karuo** (Gakushuin University)

**Center of stated $\mathrm{SL}(n)$-skein algebras**

Abstract: To understand the representation theory for non-commutative algebras, the unicity theorem is helpful and implies the importance of their centers. Since there exists the quantum trace map, an embedding of the stated $\mathrm{SL}(n)$-skein algebra into the extended Fock–Goncharov algebra (a quantum torus), we can use properties of the quantum torus to understand those of the skein algebra. In this talk, we will give the center of the stated $\mathrm{SL}(n)$-skein algebra using that of the Fock–Goncharov algebra. Consequently, thanks to the unicity theorem, we can access to the representation theory of stated $\mathrm{SL}(n)$-skein algebras related to quantum moduli algebras. We also explain partial results on reduced stated $\mathrm{SL}(n)$-skein algebras potentially related to quantum cluster algebras. This talk is based on a joint work with Zhihao Wang (University of Groningen and Nanyang Technological University).

**Min Hoon Kim** (Ewha Womans University)

**Smooth homotopy 4-spheres admitting open book decompositions**

Abstract: In this talk, I will give a survey talk on smooth homotopy 4-spheres admitting open book decompositions focusing on Cappell-Shaneson spheres and Calegari spheres.

**Chao Wang** (East China Normal University)

**A lower bound of the crossing number of composite knots**

Abstract: Let $c(K)$ denote the crossing number of a knot $K$ and let $K_1\#K_2$ denote the connected sum of two oriented knots $K_1$ and $K_2$. It is a very old unsolved question that whether $c(K_1\#K_2) = c(K_1) + c(K_2)$. We show that $c(K_1\#K_2) > (c(K_1) + c(K_2))/16$. This is a joint work with Ruifeng Qiu.

**Akira Yasuhara** (Waseda University)

**Milnor concordance invariants of classical links, welded links, and surface-links**

Abstract: Milnor concordance invariants of classical links were defined by J. Milnor in the 1950's. While the original definition is topological, Milnor gave a combinatorial algorithm to calculate the invariants via diagrams of links. This induces a combinatorial definition, which can be applied to virtual diagrams, and gives Milnor 'concordance' invariants of welded links. In this talk, we define, for any positive integer $m$, $m$-dimensional cut-diagrams, which can be regarded as welded $m$-dimensional links, and Milnor 'concordance' invariants of $m$-dimensional cut-diagrams including $m$-dimensional links. When $m = 2$, an $m$-dimensional link is called a surface-link. We give several concrete applications of Milnor concordance invariants for surface-links. Our approach is combinatorial and does not require any deep knowledge in low-dimensional topology. Contents of this talk are based on a joint work with B. Audoux and J-B Meilhan.

**Zhengyi Zhou** (Chinese Academy of Sciences)

**Kähler compactification of $\mathbb{C}^n$ and Reeb dynamics**

Abstract: We will present two results in complex geometry: (1) A Kähler compactification of $\mathbb{C}^n$ with a smooth divisor complement must be $\mathbb{P}^n$, which confirms a conjecture of Brenton and Morrow(1978) under the Kahler assumption; (2) Any complete asymptotically conical Calabi-Yau metric on $\mathbb{C}^3$ with a smooth link must be flat, confirming a modified version of Tian's conjecture regarding the recognition of the flat metric among Calabi-Yau metrics in dimension 3. Both proofs rely on relating the minimal discrepancy number of a Fano cone singularity to its Reeb dynamics of the conic contact form and tools from symplectic topology. This is a joint work with Chi Li.

## Parallel Session

**Katsunori Arai** (Osaka University)

### A construction of multiple group racks

Abstract: A spatial surface is a compact surface embedded in the 3-sphere $S^3$. We assume that a spatial surface is oriented and that each connected component of a spatial surface is neither a disk nor without a boundary. A spatial surface is presented by a diagram of a spatial trivalent graph, which we call a diagram of the spatial surface. A multiple group rack is an algebraic structure corresponding to Reidemeister moves for diagrams of spatial surfaces. In this talk, we introduce a method for constructing multiple group racks and its applications.

**Juhun Baik** (KAIST)

### Topological normal generation of big mapping class groups

Abstract: For closed surfaces, it is well-known that the mapping class group is normally generated by one element. By Lanier and Margalit, any pseudo-Anosov map with stretch factor is less than $\sqrt{2}$ normally generates the mapping class group. Also, for closed surfaces of genus more than 2, any torsion element except hyperelliptic involution is a normal generator. For infinite type surface and its mapping class group (so called "big mapping class group"), it is uncountably generated and not compactly generated. We ask when the big mapping class group is (topologically) normally generated. In this talk, I will first introduce the topology of big mapping class groups. After that I will answer when the big mapping class group is topologically normally generated by one element, and give an upper bound of how many generators are needed to topologically normally generate the group.

**Yuanyuan Bao** (Tohoku University)

**A multivariable Alexander polynomial for framed trivalent spatial graphs**

Abstract: Viro defined a functor from the category of colored framed graphs to the category of representations of a Hopf subalgebra of quantum $gl(1|1)$. This functor gives rise to a multivariable Alexander polynomial for framed trivalent graphs. In this talk, we define rotation number of a graph, and propose a kauffman state sum and conjecture that it coincides with Viro's Alexander polynomial. This talk is based on a joint work with Zhongtao Wu.

**Jae Choon Cha** (POSTECH)

**Quantitative bordism and linearity problems**

Abstract: From a quantitative viewpoint, we discuss progresses on the Gromov linearity problem for smooth and PL bordisms over a group.

**Wonjun Chang** (POSTECH)

**Quantitative Analysis of the Generalized Harer Conjecture**

Abstract: The Generalized Harer Conjecture (GHC) is about the homology triviality induced by a (regular) embedding from braid groups to mapping class groups. In recent years, there has been an active research about the quantitative aspects of bordism. GHC gives rise to many interesting problems in this area, which can provide a deeper understanding of the embedding. In this talk, I will outline the proof of the GHC and discuss directions related to the quantitative study of bordism.

**Lei Chen** (Chinese Academy of Science)

**Normal generators of Torelli groups**

Abstract: Johnson showed that the genus 1 bounding pair maps generate the Torelli group of a surface when its genus is at least 3. We show that this does not generalize: the bounding pair maps of any fixed genus generate a normal subgroup of the Torelli group that is related to Casson invariant of 3-manifolds. This is joint with Justin Lanier.

**Zhechi Cheng** (Wuhan University)

**Geography of the top term of knot Floer homology**

Abstract: The top term of knot Floer homology is the first and an important place to look for information about a knot. For example, Ni showed that a knot is fibered if and only if the rank of the top term is one. For a top term with higher rank, it can be supported in different Maslov gradings, so it is natural to ask a geography question: which graded vector spaces can be realized as the top term of knot Floer homology. In this talk, we discuss some of the recent progress on this question.

**Zhiyun Cheng** (Beijing Normal University)

**Partial-dual genus polynomial and its categorification**

Abstract: The partial-dual genus polynomial of a ribbon graph is the generating function that enumerates all partial duals of the ribbon graph. In this talk, I will give a quick introduction to this polynomial and discuss the categorification of it. This is a joint work with Ziyi Lei.

**Sangbum Cho** (Hanyang University)

**The separating disk complex for a handlebody**

Abstract: When a surface bounds a handlebody, the separating disk complex for the handlebody is defined to be the full subcomplex of the curve complex for the surface, spanned by the vertices of separating curves that bound disks in the handlebody. We prove that the separating disk complex is connected. We present two proofs, one is based on the properties of primitive curves while the other one uses the action of the handlebody group on the complex. We also show that the reducing sphere complex for a double handlebody is connected. This is a joint work with Junghoon Lee.

**Seonmi Choi** (Seowon University)

**Homology of multi-biquandles**

Abstract: We review the concepts of multi-quandles and multi-biquandles in the context of colored links. In this talk, we introduce the homology theory of multi-biquandles and propose invariants for colored links. This is joint work with Sang Youl Lee and Seung Yeop Yang.

**Huabin Ge** (Renmin University of China)

**Combinatorial Ricci flow, towards Thurston's geometric triangulation conjecture**

Abstract: Thurston's geometric triangulation conjecture suggests that every hyperbolic 3-manifold can be geometrically decomposed into some ideal hyperbolic tetrahedra. So far, this conjecture has only been proven for a few special 3-manifolds. In this talk, I will present the connection between the combinatorial Ricci flow and Thurston's triangulation conjecture, namely that the combinatorial flow converges if and only if the triangulation is geometric. Therefore, the combinatorial Ricci flow provides a potential, general, and systematic approach to handling Thurston's triangulation conjecture.

**Shijie Gu** (Northeastern University)

**BNPC $n$-manifolds ($n < 5$) are Euclidean**

Abstract: In 1981, Gromov asked whether there exist simply connected topological manifolds, other than Euclidean space, that admit a metric of non-positive curvature in a synthetic sense. Since CAT(0) spaces are contractible, it follows from the classification of surfaces that any CAT(0) 2-manifold is Euclidean. In dimension 3, by combining results of Brown and Rolfsen, CAT(0) manifolds are homeomorphic to $\mathbb{R}^3$. Recently, Lytchak, Nagano, and Stadler proved that CAT(0) 4-manifolds are Euclidean. In this talk, I will discuss Gromov's question and introduce spaces of non-positive curvature in the sense of Busemann, abbreviated as BNPC spaces. This notion is what Gromov originally intended by "synthetic sense". I will discuss how to extend results above to BNPC manifolds. This is joint work with Tadashi Fujioka.

**Takatoshi Hama** (Nihon University)

**On the pure cactus group and the configuration space of points on the circle**

Abstract: The cactus group was introduced by Henriques and Kamnitzer as an analogue of the braid group. In this talk, we provide an explicit description of the relationship between the pure cactus group of degree four and the configuration space of five points on the circle.

**Mikami Hirasawa** (Nagoya Institute of Technology)

**Some family of knots of divides with Salem Alexander polynomials**

Abstract: The notion of knots and links of divides was introduced by N. A'Campo through the study of links of complex plane curve singularities. A monic reciprocal integral polynomial is called Salem if its zeros are unimodular except for one pair which are real. We study the zeros of Alexander polynomials of divide knots and present some families of divide knots whose Alexander polynomials are Salem and non-Salem. This is a joint work with K. Murasugi (University of Toronto).

**Chun-Sheng Hsueh** (Humboldt University Berlin)

**Open books in higher dimensions**

Abstract: We study open book decompositions on manifolds of dimension at least 4 using handle decompositions. We use handle moves to relate different open books on the same manifold and show that an open book with trivial monodromy can be alternatively constructed using a simple page and a non-trivial monodromy. As an application, we provide infinitely many examples in all dimensions at least 5 of diffeomorphic open books constructed using the same page but non-isotopic monodromy maps.

**Hayato Imori** (KAIST)

**Immersed cobordism maps in Khovanov and singular instanton homology**

Abstract: Khovanov homology is a combinatorially defined homological knot invariant equipped with a functorial property for link cobordisms. Framed singular instanton homology is a Yang-Mills gauge theoretical counterpart of Khovanov homology, and Kronheimer and Mrowka constructed a spectral sequence relating these knot homology groups. In this talk, we will prove that Kronheimer-Mrowka's spectral sequence relates cobordism maps in Khovanov homology theory and instanton Floer theory. Furthermore, our construction extends to immersed surface cobordisms between knots. This result also leads to topological applications related to knot concordance and exotic phenomena of immersed surfaces in 4-manifolds. This talk is based on joint work with Taketo Sano, Kouki Sato, and Masaki Taniguchi.

**Ingrid Irmer** (Southern University of Science and Technology)

**Sets of minima and generators of the Steinberg module of the mapping class group**

Abstract: It is a result due to Harer that the complex of curves of a closed orientable surface of genus $g \geq 2$ has the homotopy type of an infinite wedge of spheres of dimension $2g-2$. Moreover, it was shown by Broaddus that there is only one generator modulo the action of the mapping class group. In this talk it will be explained how to find a very simple and explicit generator in each genus, by identifying the generator with a simplicial complex obtained as the boundary of one of Schmutz's sets of minima in the Deligne-Mumford compactification of Teichmüller space of surfaces of genus $g$.

**In Dae Jong** (Kindai University)

**Purely cosmetic surgeries on knots in homology spheres and the Casson-Walker invariant**

Abstract: We present several conditions for the existence of purely cosmetic surgeries on knots in homology spheres, specifically Dehn surgeries that yield orientation-preserving homeomorphic 3-manifolds. Our primary tool is a rational surgery formula for the Casson-Walker invariant, applied to 2-component links in the 3-sphere. This is a joint work with Kazuhiro Ichihara (Nihon University).

**Hongtaek Jung** (Seoul National University)

**Generic properties of Hitchin representations**

Abstract: Let $G$ be a split real form of simple adjoint Lie group whose Weyl group contains $-1$. We show that, for any fixed hyperplane $H$ in a Cartan subalgebra of $G$, the Jordan projection of orbifold $G$-Hitchin representations is generically disjoint from $H$. As an application, we show that generic orbifold $G$-Hitchin representations are strongly dense in the sense of Breuillard, Green, Guralnick and Tao. This also partially generalizes a theorem of Breuillard, Guralnick and Larsen which shows that the complxification of $G$ contains strongly dense closed surface groups.

**Teruhisa Kadokami** (Kanazawa University)

**The half Alexander polynomials of amphicheiral 2-bridge knots**

Abstract: For a $(-)$-amphicheiral knot $K$, its Alexander polynomial at $t^2$ is of the form $f(t)f(t^{-1})$. Then $f(t)$ is called the half Alexander polynomial of $K$. We computed concretely for the case that $K$ is an amphicheiral 2-bridge knot.

**Naoko Kamada** (Nagoya City University)

**A method for constructing welded links from welded links**

Abstract: A welded link is defined as an equivalence class of welded link diagrams under an equivalence relation generated by classical Reidemeister moves, virtual Reidemeister moves, and welded moves. In this talk, we introduce a method for constructing a welded link diagram from an existing welded link diagram, ensuring that if two original diagrams are equivalent, then the constructed diagrams will also be equivalent. This defines a self-map on the set of welded links. A notable feature of our method is that even if the initial diagram is classical, the resulting diagram is not necessarily classical. This work is a collaboration with Seiichi Kamada.

**Seiichi Kamada** (Osaka University)

**Generalized Alexander quandles and their classification**

Abstract: Generalized Alexander quandles are a special case of homogeneous quandles and are also known as principal quandles. Recently, Akihiro Higashitani and Hirotake Kurihara have established a characterization theorem for finite generalized Alexander quandles under certain assumptions and classified those with up to 15 elements. In this talk, we extend their results by characterizing generalized Alexander quandles without assuming finiteness or other restrictive conditions. We classify those with up to 127 elements. This is joint work with Akihiro Higashitani, Jin Kosaka, and Hirotake Kurihara.

**Sungmo Kang** (Chonnam National University)

**Tunnel-number-one knot exteriors in $S^3$ disjoint from proper power curves**

Abstract: In this talk, we classify two disjoint simple closed curves $R$ and *beta* lying in the boundary of a genus two handlebody H such that a 2-handle addition $H[R]$ embeds in $S^3$ as a knot exterior and *beta* is a proper power curve. As a consequence, if $R$ is a nonseparating simple closed curve on the boundary of a genus two handlebody such that $H[R]$ embeds in $S^3$, then there exists a proper power curve disjoint from $R$ if and only if $H[R]$ is the exterior of the unknot, a torus knot, or a tunnel-number-one cable of a torus knot. This result will be used in the classification project of hyperbolic primitive/Seifert knots in $S^3$ which has been studied by J. Berge and S. Kang.

**Byeorhi Kim** (POSTECH)

**On a classfication of surfaces embedded in 4-manifolds**

Abstract: In 2019, D. Gabai introduced the Light Bulb Theorem, offering a partial solution to the classification of embeddings of 2-spheres in 4-manifolds. Since then, the theorem has been adapted and extended to yield results for other 2-manifolds. In this talk, we explore the classification of surfaces in 4-manifolds, building on the recent developments that have emerged as a continuation of Gabai's work.

**Geunyoung Kim** (McMaster University)

**Heegaard diagrams for 5-manifolds**

Abstract: We introduce a version of Heegaard diagrams for 5-dimensional cobordisms with 2- and 3-handles, 5-dimensional 3-handlebodies, and closed 5-manifolds. We show that every such 5-manifold can be represented by a Heegaard diagram, and two Heegaard diagrams represent diffeomorphic 5-manifolds if and only if they are related by certain moves. As an application, we construct Heegaard diagrams for 5-dimensional cobordisms from the standard 4-sphere to the Gluck twists along knotted 2-spheres. This provides some equivalent statements regarding the Gluck twists being diffeomorphic to the standard 4-sphere.

**Junseok Kim** (KAIST)

**Outer automorphism groups of right-angled Artin groups and maximal SIL-pair systems**

Abstract: The existence of separating intersections of links (or SIL-pairs, for short) serves as a criterion for classifying the defining graphs of right-angled Artin groups. Regarding this notion, we will define a maximal SIL-pair system to combine the parts of graphs generating SIL-pairs, so that one can decompose defining graphs to understand the group structures of the outer automorphism groups of right-angled Artin groups. We will also see how maximal SIL-pair systems help us to detect acylindrical hyperbolicity of a subgroup of the outer automorphism group of a right-angled Artin group, called the pure symmetric outer automorphism group.

**Minkyu Kim** (KIAS)

**The Lie operad as a subquotient of Jacobi diagrams in handlebodies**

Abstract: For an algebra $R$ and a multiplicative submodule $J$, the eigenring, denoted by $E_R(J)$, is a canonical subquotient algebra of $R$ by $J$. In the case where $J$ is a two-sided ideal, $E_R(J)$ coincides with the quotient algebra $R/J$. The formal resemblance of linear categories to algebras allows us to extend this construction to that of a subquotient linear category. This talk presents an example that arises in the context of quantum topology. The Kontsevich integral is a universal knot invariant with values in Jacobi diagrams which encode the Lie-algebraic structures. Habiro and Massuyeau extended the Kontsevich integral as a functor to a linear category $A$ generated by Jacobi diagrams in handlebodies. In this talk, we demonstrate how the Lie operad is understood as a 'categorified' eigenring of $A$.

**Sang-hyun Kim** (KIAS)

**Smoothability of actions by groups of subexponential growth**

Abstract: We prove that if a countable group does not contain a finitely generated subgroup of exponential growth, then every topological action of the group on a compact connected one-manifold can be blown-up to a $C^1$ action. The proof is based on a functional characterisation of such groups.

**Seungwon Kim** (Sungkyunkwan University)

**Non-split, alternating links bound unique Seifert surfaces in the 4-ball**

Abstract: We show that any two same-genus, oriented, boundary parallel surfaces bounded by a non-split, alternating link into the 4-ball are smoothly isotopic fixing boundary. In other words, any same-genus Seifert surfaces for a non-split, alternating link become smoothly isotopic fixing boundary once their interiors are pushed into the 4-ball. We conclude that a smooth surface in S4 obtained by gluing two Seifert surfaces for a non-split alternating link is always smoothly unknotted.

**Taehee Kim** (Konkuk University)

**Satellite operators on the knot concordance group**

Abstract: When a pattern is fixed, a satellite operator on knots descends to a function on the knot concordance group. It is conjectured that the image of a non-constant satellite operator with winding number zero is large; specifically, that this image generates a subgroup of infinite rank. In this talk, we establish this conjecture under the condition that the axis has a nontrivial Blanchfield self-linking form. We also discuss related problems that arise from iterating a satellite operator. This is joint work with Jae Choon Cha.

**Taehyeong Kim** (KIAS)

**Entropy in the cusp for diagonal flows on the space of lattices**

Abstract: One of the main differences between compact and non-compact spaces in dynamical systems is the possibility of flow divergence into the non-compact region. One possible approach to analyzing this situation is through entropy in the cusp. In this talk, we will explore the entropy in the cusp for a given diagonal flow in the space of lattices, focusing on how it captures the dynamical complexity near the cusp.

**Teruaki Kitano** (Soka University)

**An order on the set of prime knots via $\pi$-orbifold groups**

Abstract: For a knot in the 3-sphere, the $\pi$-orbifold group is defined as a quotient of the knot group. When there exists an epimorphism between $\pi$-orbifold groups, we define a relation $K \succeq K'$ between two knots $K, K'$. It is seen that it gives s a partial order when knots are sufficiently complicated. In this talk we talk about this order $K \succeq K'$ for a Montesinos knot $K$. Further we show that if $K$ is a small knot, then there are only finitely many knots $K'$ satisfying $K \succeq K'$. If we have the time, we discuss the case of links. This talk is based on joint works with Yuta Nozaki(Yokohama) and Michel Boileau(Marseille).

**Naoki Kitazawa** (Kyushu University)

**Reconstructing Morse functions, Morse-Bott functions, or naturally generalized functions with prescribed preimages**

Abstract: This talk presents our studies on reconstructing explicit smooth functions with prescribed preimages. We mainly reconstruct Morse functions, Morse-Bott functions, or functions of certain suitably generalized classes on low-dimensional manifolds. This is motivated by studies on reconstruction of nice smooth functions on closed surfaces, pioneered by Sharko in 2006 and later considered by Gelbukh, Masumoto, Michalak, Saeki, etc. As a related further study, if the time permits, we discuss classifications of Morse functions on closed surfaces and 3-dimensional manifolds of certain classes, including results of Gelbukh, Michalak and the speaker.

**Erika Kuno** (Osaka University)

**Curve graphs and right-angled Artin subgroups of mapping class groups for nonorientable surfaces**

Abstract: Koberda proved that for closed orientable surfaces $S = S_{g,n}$ of genus $g$ with $n$ marked points ($2-2g-n<0$) if $\Gamma$ is a finite full subgraph of the curve graph $\mathcal{C}(S)$ of $S$ then the right-angle Artin group $A(\Gamma)$ of $\Gamma$ is a subgroup of the mapping class group $\mathrm{Mod}(S)$ of $S$. Let $N = N_{g,n}$ be a closed nonorientable surface of genus $g$ with $n$ marked points. We consider the full subgraph $\mathcal{C}_{\mathrm{two}}(N)$ of the curve graph $\mathcal{C}(N)$ which consists of the isotopy classes of the two-sided essential simple closed curves, and we call it the two-sided curve graph of $N$. We generalized the result of Koberda to the two-sided curve graph of $N$, that is, we prove that if $\Gamma$ is a finite full subgraph of $\mathcal{C}_{\mathrm{two}}(N)$, then the right-angle Artin group $A(\Gamma)$ of $\Gamma$ is a sugroup of the mapping class group $\mathrm{Mod}(N)$ of $N$. This is a joint work with Takuya Katayama.

**Sanghoon Kwak** (KIAS HCMC)

**Non-unique Ergodicity on the Boundary of Outer Space**

Abstract: The Culler–Vogtmann's Outer space $CV_n$ is a space of marked metric graphs, and it compactifies to a set of $F_n$-trees. Each $F_n$-tree on the boundary of Outer space is equipped with a length measure, and varying length measures on a topological $F_n$-tree gives a simplex in the boundary. The extremal points of the simplex correspond to ergodic length measures. By the results of Gabai and Lenzhen-Masur, the maximal simplex of transverse measures on a fixed filling geodesic lamination on a complete hyperbolic surface of genus $g$ has dimension $3g-4$. In this talk, we give the maximal simplex of length measures on an arational $F_n$-tree has dimension in the interval $[2n-7, 2n-2]$. This is a joint work with Mladen Bestvina, and Elizabeth Field.

**Dongha Lee** (KAIST)

**The Renormalization of Volume and the Chern-Simons Invariant for Hyperbolic 3-Manifolds**

Abstract: For hyperbolic 3-manifolds, many interesting results support a deep relationship between volume and the Chern-Simons invariant. In this talk, we consider noncompact hyperbolic 3-manifolds having infinite volume, specifically convex-cocompact hyperbolic 3-manifolds. For these manifolds, there is a well-defined invariant called the renormalized volume which replaces classical volume. We will renormalize the Chern-Simons invariant and discover a close relationship with the renormalized volume.

**Jaewon Lee** (KAIST)

**Rational concordance of double twist knots**

Abstract: Double twist knots $K_{m,n}$ are known to be rationally slice if $mn = 0, n = -m \pm 1$, or $n = -m$. In this paper, we prove the converse. It is done by showing that infinitely many prime power fold cyclic coverings for the other cases do not bound a rational ball. Our rational ball obstruction is based on Donaldson' s diagonalization theorem.

**Jung Hoon Lee** (Jeonbuk National University)

**The Powell Conjecture in genus three**

Abstract: The Powell Conjecture states that four specific elements suffice to generate the Goeritz group of the Heegaard splitting of the 3-sphere. In 2018, Freedman and Scharlemann verified the Powell Conjecture when the genus of the splitting is 3. We present an alternative proof of the Powell Conjecture when the genus is 3, and suggest a strategy for the case of higher genera.

**Fengling Li** (Dalian University of Technology)

**A three-variable transcendental invariant of planar knotoids**

Abstract: As a generalization of the classical knots, knotoids are equivalence classes of immersions of the oriented unit interval in a surface. In recent years, a variety of invariants have been proposed for spherical and planar knotoids as extensions of invariants of classical and virtual knots. In this talk, we will introduce a three-variable transcendental invariant of planar knotoids which is defined via an index function of a Gauss diagram and discuss some properties of the transcendental invariant. This is joint work with Wandi Feng and Andrey Vesnin.

**Jianfeng Lin** (Tsinghua University)

**Configurations spaces and mapping class groups of 4-manifolds**

Abstract: Budney-Gabai proved that the mapping class group of a circle times a 3-dimensional disk is infinitely generated, using a new invariant called the $w_3$ invariant. This invariant is defined by studying strata-preserving maps between various configuration spaces associated to manifolds. In this talk, I will discuss a generalization of the $w_3$ invariant to many other 4-manifolds, showing that they have large mapping class groups. This is based on a joint work with Yi Xie and Boyu Zhang.

**Biao Ma** (Tongji University)

**Boundary maps and median spaces of finite rank**

Abstract: Median spaces of finite rank generalize both real trees and CAT(0) cube complexes of finite dimension. Since various types of results on superrigidity have been obtained for CAT(0) cube complexes, it is a natural question to extend these results to median spaces of finite rank. By exploiting Bader-Furman' s dynamics approach to superrigidity in the setting of median spaces of finite rank, we show the existence of boundary maps for groups acting on median spaces of finite rank Roller non-elementarily and Roller minimally. As a consequence, this dynamics approach allows us to remove the square-integrability condition from a result of Fioravanti concerning superrigidity of actions on median space of finite rank. This talk is based on joint work with Mohamed-Lamine Messaci.

**Alexis Marchand** (Kyoto University)

**Stable commutator length, surfaces, and rationality**

Abstract: Stable commutator length (scl) is a measure of homological complexity of group elements, which has attracted attention for its connections with notions of negative curvature in geometric group theory, such as Gromov-hyperbolicity. I will introduce scl, with a focus on algorithmic computations and rationality problems. I will present some results (joint with Henry Wilton) aiming to make progress towards understanding scl in surface groups.

**Yuya Murakami** (Kyushu University)

**Asymptotics and quantum modularity of WRT invariants of negative definite plumbed manifolds**

Abstract: One of the most important problems in quantum topology is finding asymptotic expansions and quantum modularity of quantum invariants. In this talk, I will report to prove this problem for negative definite plumbed manifolds. In the proof, we need to give modular transformation formulas and asymptotic expansions of the Gukov–Pei–Putrov–Vafa invariants. However, it is difficult since they involve very complicated calculations. We deal with this difficulty by constructing a framework called 'modular series.' This framework is not only a general theory that gives asymptotic expansions and quantum modularity but also a multivariable version of the Borel–Laplace transformation in resurgence theory.

**Inasa Nakamura** (Saga University)

**Charts of knitted surfaces of degree** 2

Abstract: Knitted surfaces are a generalization of braided surfaces, and a knitted surface is a surface with boundary properly embedded in a 4-ball which is constructed as the trace of transformations of knits. Here, a knit is a tangle obtained from a braid by splicing some crossings. A knitted surface has a graphical description called a chart description. In this talk, using charts, we show that any trivial surface-link is isotopic to the plat closure of some knitted surface of degree 2, and the plat closure of any knitted surface of degree 2 is a trivial surface-link. This is joint work with Jumpei Yasuda (Osaka University).

**Manami Niijima**

**On Beloch's curve that appears when solving real cubics with origami**

Abstract: The Justin–Huzita–Hatori Axiom 6 of origami related to "neusis" assures the solution of real cubic equations shown by Beloch in 1936. We investigate a certain real cubic curve $F(x, y) = 0$, say, Beloch's curve that appears in the algorithm and prove that its shape is determined by the signature of the Hessian $H_F = -4(4p + q^2)$ at its uniquely existing singular point $P(p, q)$. Especially, the rotation number, which is a topological invariant, is determined. This viewpoint would shed new light on the relationship between Axioms 5 and 6.

**Yuta Nozaki** (Yokohama National University)

**Torsion elements in the associated graded modules of filtrations over the Torelli group and the homology cylinders**

Abstract: Clasper surgery induces the $Y$-filtration $\{Y_n\mathcal{IC}\}_n$ over the monoid of homology cylinders, which serves as a 3-dimensional analogue of the lower central series of the Torelli group of a surface. In this talk, we investigate the torsion submodules of the associated graded modules of these filtrations. To detect torsion elements, we introduce a homomorphism on $Y_n\mathcal{IC}/Y_{n+1}$ induced by the degree $n + 2$ part of the LMO functor. Additionally, we provide a formula of this homomorphism for clasper surgery, and use it to demonstrate that every non-trivial torsion element in $Y_6\mathcal{IC}/Y_7$ has order 3. This is joint work with Masatoshi Sato and Masaaki Suzuki.

**Carl-Fredrik Nyberg-Brodda** (KIAS)

**Decision problems in Artin groups**

Abstract: Particular classes of Artin groups arise in many contexts, including knot theory and recently in the study of quasiconvex hierarchies of 3-manifold groups. Nevertheless, for the class of all Artin groups decidability of the word problem remains an open problem. In this talk, I will describe recent progress on decision problems in Artin groups, and give, among other results, a full classification of when the submonoid membership problem is decidable in Artin groups, in terms of forbidden subgraphs of the underlying graph. This is joint work with R. D. Gray (East Anglia).

**Sunul Oh** (POSTECH)

**Hyperbolic Dehn filling, volume, and transcendentality**

Abstract: Let $M$ be a 1-cusped hyperbolic 3-manifold. In this talk, we discuss experimental results concerning the behavior of the number $N_M(v)$ of Dehn fillings of $M$ with a given volume $v$. We also give necessary conditions for Dehn fillings that share the same complex volume or exhibit conjugate complex volume differences. Additionally, we show the transcendentality of the Neumann-Zagier volume formula, proving that the growth of $N_M(v)$ is slower than any power of its filling coefficient.

**Genki Omori** (Shibaura Institute of Technology)

**Finite presentations for the balanced superelliptic mapping class groups**

Abstract: The balanced superelliptic mapping class group is the normalizer of the transformation group of the balanced superelliptic covering space in the mapping class group of the total surface. We give finite presentations for the balanced superelliptic mapping class groups of closed surfaces, surfaces with one marked point, and surfaces with one boundary component. To give these presentations, we construct finite presentations for corresponding liftable mapping class groups in a different generating set from Ghaswala-Winarski's presentation.

**Andreani Petrou** (Okinawa Institute of Science and Technology)

**Knots, links and Harer-Zagier factorisability**

Abstract: The focus of this talk will be the HOMFLY–PT polynomial and its Harer-Zagier (HZ) transform, a discrete Laplace transform, which maps it into a rational function. For some special families of knots and links, generated by full twists and Jucys-Murphy braids, the latter has a simple factorised form and it is fully encoded in two sets of integers, corresponding to the numerator and denominator exponents. These exponents are related to Khovanov homology and its Euler characteristics. We conjecture that the HZ factorisability is in 1-1 correspondence with a relation between the HOMFLY–PT and Kauffman polynomials, which we prove in several specific cases.

**Kento Sakai** (Osaka University)

**Uniform degeneration of hyperbolic surfaces along harmonic map rays**

Abstract: Harmonic maps between surfaces provide a correspondence between hyperbolic surface and quadratic differentials on a Riemann surface. In particular, we focus on hyperbolic surfaces with geodesic boundaries. Through the correspondence, a ray in the space of the quadratic differentials generates the one-parameter family of hyperbolic surfaces. In this talk, we explain that hyperbolic surfaces along such rays uniformly converge on the entire surface in the sense of Gromov-Hausdorff.

**Honami Sakamoto** (Ochanomizu University)

**Liminal $\mathrm{SL}_2\mathbb{Z}_p$-representations of twist knot and cyclic covers**

Abstract: Let $p$ be a prime number and $(k, l) \in \mathbb{Z}^2$. We prove that if $p$ divides the size of the 1st homology group of some odd-th cyclic cover of the double twist knot $J(2k, 2l)$, then its group $\pi_1(S^3 - J(2k, 2l))$ admits a liminal $\mathrm{SL}_2F_p$-representation. In the course of the argument, we also point out a constraint for prime numbers dividing certain Lucas-type sequences by using the Legendre symbols. (Joint work with Ryoto Tange and Jun Ueki)

**Migiwa Sakurai** (Shibaura Institute of Technology)

**Infinitely many virtual knots with any sequence of $n$-writhes**

Abstract: Satoh and Taniguchi introduced the $n$-writhe $J_n$ for each non-zero integer $n$, which is an integer invariant for virtual knots. It is obvious that the virtualization of a real crossing is an unknotting operation for virtual knots. In our previous paper, we showed that if $\{r_n\}_{n\neq 0}$ is a sequence of integers with $\sum_{n\neq 0} nr_n = 0$, then there exists a virtual knot $K$ whose virtual unknotting number equals one and $J_n(K) = r_n$ for any $n \neq 0$. In this paper we show that there exist infinitely many virtual knots having such properties by using the vertex connected sum on Gauss diagrams.

**Donggyun Seo** (Seoul National University)

**The Pants Graph of a Rose**

Abstract: We introduce the concept of a pants decomposition for a rose, where a rose is defined as a wedge sum of finitely many circles, and construct the corresponding pants graph of a rose. A pants decomposition of a rose leads to the formation of a simplicial graph, referred to as the pants graph of a rose, consisting of all possible pants decompositions. Recall that the outer automorphism group of a free group is isomorphic to the group of homotopy classes of homotopy equivalences of a rose. The natural isometric action of this group on the pants graph induces a coarsely Lipschitz orbit map. Additionally, we construct a coarsely Lipschitz map from the pants graph to the free splitting complex. These results imply that the pants graph of a rose is both connected and unbounded.

**Tatsumasa Suzuki** (Meiji University)

**On pochette surgery and its generalization**

Abstract: A pochette is the boundary sum $P = S^1 \times D^3 \natural D^2 \times S^2$ of $S^1 \times D^3$ and $D^2 \times S^2$. Pochette surgery, which is a generalization of Gluck surgery and a special case of logarithmic transformation, was discovered by Iwase and Matsumoto in 2004. A pochette surgery on a 4-manifold $X$ is an operation of removing the interior of $P$ embedded in $X$ from $X$ and gluing $P$ to $X - \operatorname{int} P$ by a diffeomorphism of $\partial P$. In this talk, we focus on the fact that any pochette surgery is a surgery with a cord and a 2-knot, and classify the diffeomorphism types of pochette surgeries on the 4-sphere. We also introduce a generalization of pochette surgery defined by Nakamura in 2018. Furthermore, we show that any finite representation group is isomorphic to the fundamental group of one on a simply connected 4-manifold. This is joint work with Motoo Tange.

**Toshifumi Tanaka** (Gifu University)

**On partial knots for symmetric unions**

Abstract: A symmetric union is a ribbon knot defined as a generalization of the connected sum of a knot and its mirror image which are called partial knots. In general, the partial knots for a symmetric union are not unique. The set of alternating partial knots for any symmetric union is finite. However, it is not known whether the set of partial knots for any symmetric union is finite. In this talk, we show that there are only finitely many partial knots for a 2-bridge ribbon knot. Then, we determine the sets of partial knots for all two-bridge ribbon knots up to 10 crossings, except for $10_3$. We also show that there exists an infinite family of prime knots $\{K_m\}$ such that $K_m \sharp -K_m$ has at least two partial knots and we obtain a symmetric union presentation for $3_1 \sharp 8_{11}$ which was considered as a promising candidate of a ribbon knot which is not a symmetric union. This is joint work with Christoph Lamm.

**Motoo Tange** (University of Tsukuba)

**L-space embedding in negative definite closed 4-manifold constructed by Dehn surgeries of two knots**

Abstract: Greene resolved lens spaces realization problem by classifying change-maker lattices. His key condition is that any lens space is an L-space and has a sharp negative definite bound. In this talk we generalize Greene's torsion coefficient formula to analyze Dehn surgeries with non-sharp negative definite bound. As a result, we show a restriction that a rational Dehn surgery yielding an L-space is an integral surgery of another knot with orientation reversed. This is a joint work with Yuichi Yamada.

**Jun Ueki** (Ochanomizu University)

**An analogue of the classical Neukirch–Uchida theorem for 3-manifolds**

Abstract: The analogy between knots and primes, or 3-manifolds and number rings has played a role from the era of Gauss. A basic portion is the Galois theories of ramified covers. In number theory, the classical Neukirch–Uchida theorem asserts that a number field is determined by its absolute Galois group. In its proof, the Hilbert ramification theory and the Chebotarev density theorem play important roles. In low dimensional topology, McMullen constructed a sequence of knots obeying the Chebotarev law, and it may be seen as an analogue of the set of all prime numbers. For a 3-manifold endowed with such a sequence, an analogue of the absolute Galois group is defined, and we may discuss a Neukirch–Uchida type theorem. As is classically well-known, Mostow rigidity asserts that a hyperbolic 3-manifold is determined by its fundamental group. Our version asserts something different and new. This talk is based on a joint work with Nadav Gropper (U.Penn/Haifa) and Yi Wang (U.Penn/Illinois).

**Aoi Wakuda** (The University of Tokyo)

**Puncture loops on a non-orientable surface**

Abstract: On a connected surface $N$ with negative Euler characteristic, the free homotopy class of a loop obtained by smoothing the transverse intersection of two closed geodesics may wind around a puncture. Chas and Kabiraj showed that this phenomenon does not occur when the surface $N$ is orientable. In this talk, we prove that this phenomenon occurs only when $N$ is non-orientable and both geodesics involved in the smoothing are one-sided. Specifically, we show that the free homotopy class of a loop obtained by first winding one of the geodesics $m$ times and then smoothing its transverse intersection with the other geodesic can wind around a puncture for at most two values of $m$. Furthermore, when such $m$ values exist, they are consecutive odd integers.

**Xiaolei Wu** (Fudan University)

**Groups acting on locally finite trees**

Abstract: In this talk, we show discuss some properties of groups acting on locally finite trees, in particular when the action can be faithful. We then discuss how this can be used to embed groups into simple groups. This is based on joint work with Kai-Uwe Bux and Llosa Isenrich.

**Yuichi Yamada** (The University of Electro-Communications)

**Seifert manifolds that have two (integral/rational) Dehn surgery descriptions along torus knot**

Abstract: We try to extend Greene's changemaker lattice method to L-spaces in closed negative definite 4-manifolds. To construct such examples efficiently, we study pairs of integer and rational positive Dehn surgeries along torus knots whose results are orientation-reversing homeomorphic Seifert manifolds. Such pairs consist of some sequences, but have a simple summarized presentation. This is also an extension of our past joint work, where we constructed four sequences of lens spaces in $2\sharp\overline{\mathbb{C}P^2}$. This is a joint work with Motoo Tange.

**Kouki Yamaguchi** (Kyoto University)

**On the $n$-loop Kontsevich invariant of knots having the same Alexander polynomial**

Abstract: The n-loop Kontsevich invariant of knots takes its value in the completion of the space of $n$-loop open Jacobi diagrams, which is an infinite dimensional vector space. In this talk, we show that the subspace generated by the image of the $n$-loop Kontsevich invariant of genus $\leq g$ knots having the same Alexander polynomial is finite dimensional. This finiteness means that the image of the $n$-loop Kontsevich invariant of those knots can be presented by finitely many Vassiliev invariants. Further, we give some concrete calculations about those subspaces and dimensions in several simple cases. If time permits, we see its appreciation to the LMO invariant of 3-manifolds.

**Wenyuan Yang** (Peking University)

**Marked length spectrum rigidity in groups with contracting elements**

Abstract: In this talk, we shall discuss the marked length spectrum rigidity problem in Riemannian geometry from a coarse geometric point of view. Namely, given two cobounded isometric actions of a group $G$ on metric spaces $X$ and $Y$, the coarse marked length spectrum rigidity asks whether the same length spectrum for the two actions ensures an almost $G$-equivariant isometry between $X$ and $Y$. In contrast to the very few known classical rigidity results, we shall establish the coarse version, in a very general setting, for any group actions with contracting property. In addition, we prove a finer marked length spectrum rigidity from confined subgroups and further, geometrically dense subgroups. Our proof is based on the Extension Lemma and uses purely elementary metric geometry. This is joint work with Renxing Wan (ECNU) and Xiaoyu Xu (PKU).

**Yuxuan Yang** (Peking University)

**On the Volume Conjecture for hyperbolic Dehn-filled 3-manifolds along the twist knots**

Abstract: For a twist knot $K_{p'}$, let $M$ be the closed 3-manifold obtained by doing $(p, q)$ Dehn-filling along $K_{p'}$. In this article, we prove that Chen-Yang's volume conjecture holds for sufficiently large $|p| + |q|$ and $|p'|$ for $M$. In the proof, we construct a new ideal triangulation of the Whitehead link complement which is different from Thurston's triangulation. Our triangulation has led to some new discoveries regarding symmetry, including insights into "sister manifolds" as introduced by Hodgson, Meyerhoff, and Weeks. This work is a collaboration with Huabin Ge, Chuwen Wang, and Yunpeng Meng.

**Jumpei Yasuda** (Osaka University)

**A formula for Alexander polynomials of 2-plat 2-knots**

Abstract: A 2-knot is a smoothly embedded 2-sphere in 4-space. A 2-dimensional braid was introduced by Viro as a higher dimensional analogue of a braid. We can construct a 2-knot from a 2-dimensional braid of degree $2m$ by taking the plat closure, which is called an $m$-plat 2-knot. Every 1-plat 2-knot is known to be trivial. In this talk, we focus on 2-plat 2-knots. We will introduce a normal form for these 2-knots and provide a formula for their Alexander polynomials.

**Seok beom Yoon** (Chonnam National University)

**The (twisted/$L^2$)-Alexander polynomial of an ideally triangulated 3-manifold**

Abstract: Ideal triangulation is a useful tool for studying 3-manifolds. It allows us to efficiently compute certain 3-manifold invariants (e.g. volume and Chern-Simons invariant). In this talk, I would like to explain how the Alexander polynomial, as well as its twisted and $L^2$ versions, are related to ideal triangulations. This is a joint work with Stavros Garoufalidis.

**Faze Zhang** (Northeast Normal University)

**Angle structures on 3-dimensional pseudo-manifolds**

Abstract: Let $M$ be a compact 3-dimensional pseudo-manifold, which may or may not have a non-empty boundary, and let $T$ be an ideal topological triangulation of $M$. We demonstrate that if the pair $(M, T)$ admits a semi-angle structure, then there exists a necessary and sufficient condition for the existence of an angle structure on $(M, T)$. In particular, if $T$ is an ideal triangulation of the interior of $M$ and the link of each vertex in $T$ is a closed surface with genus greater than 1, we can prove that the existence of a semi-angle structure implies the existence of an angle structure on $(M, T)$. This is a joint work with Huabin Ge and Longsong Jia.

**Qiang Zhang** (Xi'an Jiaotong University)

**Iwip endomorphisms of free groups and fixed points of graph selfmaps**

Abstract: In a paper from 2011, Jiang, Wang and Zhang studied the fixed points and fixed subgroups of selfmaps on a connected finite graph or a connected compact hyperbolic surface $X$. In particular, for any selfmap $f : X \to X$, they proved that a certain quantity defined in terms of the characteristic $\mathrm{chr}(f, \mathbf{F})$ and the index $\mathrm{ind}(f, \mathbf{F})$ of a fixed point class $\mathbf{F}$ of $f$ is bounded below by $2\chi(X)$, where $\chi(X)$ is the Euler characteristic of $X$. In this talk, we give a sufficient condition for when equality holds and hence we partially answer a question posed by Jiang in the 5th East Asian School of Knots and Related Topics (2009). We do this by studying iwip outer endomorphisms of free groups acting on stable trees.

**Ying Zhang** (Soochow University)

**Minimal reduced matrices in** $\mathrm{SL}(2,\mathbb{Z})$ **and highest geodesics**

Abstract: An $\mathrm{SL}(2,\mathbb{Z})$-matrix $A = [[a,b][c,d]]$ is said to be reduced if $0 \leq a \leq c \leq d$. For an $\mathrm{SL}(2,\mathbb{Z})$-matrix $M$, the Gauss Reduction Theory produces a conjugate of $\pm M$ in $\mathrm{SL}(2,\mathbb{Z})$ which is reduced. In general, however, there are more than one reduced conjugates for a given $\mathrm{SL}(2,\mathbb{Z})$-matrix. A question asked by Oleg Karpenkov in his book *Geometry of Continued Fractions* is to find the reduced conjugates with minimal value of $(2,1)$-entry. This is equivalent to the question for the quotient orbifold of the upper half-plane model $H^2$ of the hyperbolic plane by $\mathrm{SL}(2,\mathbb{Z})$ to find the highest lifts in $H^2$ of the axis of $M$ acting as a Möbius transformation. We solve the problem for the so-called Cohn matrices related to Markov numbers or the simple closed geodesics on the modular torus. This is joint work with Xiangfei Li and Luyang Zhao.

**Xuezhi Zhao** (Capital Normal University)

**The word problem of Seifert manifold**

Abstract: The word problem of the fundamental group any compact 3-manifold is known to be solvable. In this talk, we illustrate an algorithmic solution of word problem of fundamental groups of Seifert manifolds, by giving concrete Grobner-Shirshov bases. As an application, we can decide homomorphisms from a non-orientable surface group to the fundamental groupsof a Seifert manifold, which are the same as the solutions of quadratic equations. This is a joint work with J. Liao.

**Fangting Zheng** (Xi'an Jiaotong-Liverpool University)

**Recent progress on high-dimensional hyperbolic reflection groups**

Abstract: In this talk, I will provide a brief overview of hyperbolic reflection groups, and conclude with some new results that have been achieved in recent years, particularly in high dimensions. Our contributions will be discussed in the end, which are based on a series of joint works with Jiming Ma.

**Yanqing Zou** (East China Normal University)

**Genera and ranks of distance 2 Heegaard splittings**

Abstract: It is well known that for a distance at least 3 Heegaard splitting, it is of a hyperbolic 3-manifold. A natural question arises: what about a distance at most 2 Heegaard splitting? We build examples of distance 2 Heegaard splittings with nontrivial JSJ decomposition. More precisely, for any pair of integers $g$ and $n$ with $g \geq 3$ and $1 \leq n \leq g$, we build a 3-manifold with a distance-2, genus-$g$ Heegaard splitting so that (1) it contains $n$ pairwise disjoint and nonisotopic essential tori; (2) after cutting it along those disjoint tori, one resulting piece is hyperbolic while the others are small Seifert fibered spaces; (3) it provides a positive result to the rank versus genus problem. This is a joint work with Wenjie Diao.