研究集会　Intelligence of Low-dimensional Topology

京都大学数理解析研究所 RIMS 共同研究（公開型）として、また、トポロジープロジェクトの一環として、標記の研究集会を開催いたします。また、この研究集会は科学研究費補助金 基盤研究 B 「グラフィクスとカンドル理論の観点からの４次元トポロジーの研究」（課題番号 19H01788、研究代表者 鎌田聖一氏（大阪大学））と科学研究費補助金 基盤研究 A 「３次元双曲多様体上の量子トポロジー」（課題番号 21H04428、研究代表者 大槻知忠（京都大学））と科学研究費補助金 挑戦的研究（萌芽）「ゲージ理論に関連する３次元双曲多様体の不変量」（課題番号 19K21830、研究代表者 大槻知忠（京都大学））の援助をうけています。

日程：２０２３年 5月２４日 (水)〜 5月２６日 (金)
場所：京都大学 数理解析研究所 420 大講演室
アクセス：https://www.kurims.kyoto-u.ac.jp/ja/access-01.html
研究集会ホームページ：https://www.kurims.kyoto-u.ac.jp/~ildt/

この研究集会は、ハイブリッド型（対面とオンライン (Zoom) の併用）で開催することを計画しています。会場の密を避けるために対面参加の人数制限を当日に行う可能性があります。参加される方（対面もオンラインも）は、5 月 8 日までに、参加登録をお願いします。参加登録の際に「配信映像を録画・録音しないこと」のご同意をお願いします。参加登録方法について、研究集会ホームページ（上記 URL）をご覧ください。

コロナの社会情勢によって、開催方法を「完全オンライン」に変更する可能性があります。最新情報を研究集会ホームページで随時確認していただきますようお願いいたします。

5月２４日 (水)

13:40〜14:20　正井 秀俊 (東京工業大学)
Visualizing deformations of hyperbolic and complex structures on 4-punctured spheres

14:40〜15:20　谷口 雄大 (大阪大学理学研究科数学専攻)
Knot quandles of oriented 2-knots

15:40〜16:20　Ramanujan Santharoubane (Paris-Saclay University) (online)
An embedding of the Kauffman bracket skein algebra of a surface into a localized quantum torus

5月25日 (木)

10:30〜11:10　平澤 美可三 (名古屋工業大学)
Construction and manipulation of Seifert surfaces in knot theory

11:30〜12:10　小菅 亮太朗 (東京大学大学院数理科学研究科)
The rational abelianization of the Chillingworth subgroup of the mapping class group of a surface

13:40〜14:20　鈴木 咲衣 (東京工業大学)
Quantum invariants based on ideal triangulations

14:40〜15:20　寺垣内 政一 (広島大学大学院人間社会科学研究科)
Upsilon and secondary Upsilon invariants of L-space knots

15:40〜　Problem Session

5月26日 (金)

10:30〜11:10　張 娟姬 (奈良女子大学)
On keen bridge splittings of links

11:30〜12:10　沢辺 俊 (早稲田大学 基幹理工学研究科)
On the potential function of the colored Jones polynomial with arbitrary colors

13:40〜14:20　山口 貢輝 (京都大学 数理解析研究所)
On the calculation of the 3-loop invariant and the degree 2 part of the LMO invariant

14:40〜15:20　鈴木 正明 (明治大学)
On the vanishing and the non-vanishing of the twisted Alexander polynomial

組織委員：秋吉宏尚、大槻知忠、鎌田聖一、鎌田直子、河野俊丈
世話人：大槻知忠 (京大 数理研)、渡邉忠之 (京大 理学研究科)

Intelligence of Low-dimensional Topology

May 24–26, 2023

This conference is planned to be held at

Room 420, RIMS, Kyoto University,

whose live streaming is distributed online.

Depending on the social situation of the corona virus, we might hold the conference as an online conference. Please verify the latest information at the website of the conference.

Program

May 24 (Wed)

13:40–14:20 Hidetoshi Masai (Tokyo Institute of Technology)
Visualizing deformations of hyperbolic and complex structures on 4-punctured spheres

14:40–15:20 Yuta Taniguchi (Department of Mathematics, Graduate School of Science, Osaka University)
Knot quandles of oriented 2-knots

15:40–16:20 Ramanujan Santharoubane (Paris-Saclay University) (online)
An embedding of the Kauffman bracket skein algebra of a surface into a localized quantum torus

May 25 (Thu)

10:30–11:10 Mikami Hirasawa (Nagoya Institute of Technology)
Construction and manipulation of Seifert surfaces in knot theory

11:30–12:10 Ryotaro Kosuge (Graduate School of Mathematical Sciences, The University of Tokyo)
The rational abelianization of the Chillingworth subgroup of the mapping class group of a surface

13:40–14:20 Sakie Suzuki (Tokyo Institute of Technology)
Quantum invariants based on ideal triangulations

14:40–15:20 Masakazu Teragaito (Graduate School of Humanities and Social Sciences, Hiroshima University)
Upsilon and secondary Upsilon invariants of L-space knots

15:40– Problem Session

May 26 (Fri)

10:30–11:10 Yeonhee Jang (Nara Women's University)
On keen bridge splittings of links

11:30–12:10 Shun Sawabe (Department of Pure and Applied Mathematics, Waseda University)
On the potential function of the colored Jones polynomial with arbitrary colors

13:40–14:20 Yamaguchi Kouki (RIMS, Kyoto University)
On the calculation of the 3-loop invariant and the degree 2 part of the LMO invariant

14:40–15:20 Masaaki Suzuki (Meiji University)
On the vanishing and the non-vanishing of the twisted Alexander polynomial

Scientific Committee: Hirotaka Akiyoshi, Naoko Kamada, Seiichi Kamada, Toshitake Kohno, Tomotada Ohtsuki

Organizers: Tomotada Ohtsuki (RIMS, Kyoto University), Tadayuki Watanabe (Department of Mathematics, Kyoto University)

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Abstract

Mikami Hirasawa (Nagoya Institute of Technology)

Construction and manipulation of Seifert surfaces in knot theory

In this talk, I present a survey of our construction and manipulation of Seifert surfaces in knot theory, including Seifert surfaces preserved by a strong involution (with Sakuma and Hiura), fiber surfaces with hidden Hopf plumbings (with Murasugi), fiber surfaces with arbitrary enhanced Milnor number (with Rudolph), new fiber-producing twisting operation (with Van Quach) and so on.

Yeonhee Jang (Nara Women's University)

On keen bridge splittings of links

In this talk, we extend the concept of (strong) keenness for Heegaard splittings to bridge splittings, and show that, for any integers $n \geq 1$, $g \geq 0$ and $b \geq 1$ except for $(g, b) = (0, 1)$, and $(g, b, n) = (0, 3, 1)$, there exists a strongly keen (g, b)-splitting of a link with distance n. We also show that any $(0, 3)$-splitting of a link with distance 1 cannot be keen. This talk is based on a joint work with Ayako Ido and Tsuyoshi Kobayashi.

Ryotaro Kosuge (Graduate School of Mathematical Sciences, The University of Tokyo)

The rational abelianization of the Chillingworth subgroup of the mapping class group of a surface

The Chillingworth subgroup of the mapping class group of a compact oriented surface with one boundary component is defined as the subgroup whose elements preserve non-vanishing vector fields on the surface up to homotopy. In this work, we determine the rational abelianization of the Chillingworth subgroup as a full mapping class group module, which is given by the Johnson homomorphism and the Casson-Morita homomorphism for the Chillingworth subgroup. And, we also determine the kernel of the Casson-Morita homomorphism for the Chillingworth subgroup.

Hidetoshi Masai (Tokyo Institute of Technology)
Visualizing deformations of hyperbolic and complex structures on 4-punctured spheres

We present movies and pictures of hyperbolic and complex structures on 4-punctured spheres. The deformation space of both structures is known as Teichmueller space, and there are several natural paths that capture natural deformations of hyperbolic and complex structures. For example, Teichmueller geodesics and earthquake deformations will be discussed. I will also talk about the motivations of those drawings in relation to hyperbolic volumes of fibered manifolds e.g. the fibered closure of braids of 3 strands.

Ramanujan Santharoubane (Paris-Saclay University)
An embedding of the Kauffman bracket skein algebra of a surface into a localized quantum torus

I will explain how to build a new embedding of the Kauffman bracket skein algebra of a surface into a localized quantum torus via Dehn-Thurston coordinates. The quantum torus is said to be localized because certain extra elements need to be inverted. An important property is that the localized quantum torus is somehow a finite extension of the skein algebra. As an application I will show how to recover a proof of the unicity conjecture already proved by Frohman, Kania-Bartoszynska and Le. An explicit description of most irreducible representations of the skein algebra at root of unity will be possible. This is joint work with Renaud Detcherry.

Shun Sawabe (Department of Pure and Applied Mathematics, Waseda University)
On the potential function of the colored Jones polynomial with arbitrary colors

The volume conjecture, which states that a certain limit of the colored Jones polynomial gives the hyperbolic volume of a knot complement, is one of the most crucial problems in quantum topology. Considering the potential function of the colored Jones polynomial is known to be one idea to prove the conjecture. In this talk, we introduce the potential function of the colored Jones polynomial for a link with arbitrary colors and provide its geometric meanings. We also consider the potential function of the Witten-Reshetikhin-Turaev invariant for 3-manifolds. Furthermore, we will view the relationship between the colored Jones polynomial and the A-polynomial, such as the AJ conjecture.

Masaaki Suzuki (Meiji University)
On the vanishing and the non-vanishing of the twisted Alexander polynomial

We consider the twisted Alexander polynomial of knot groups associated to the regular representations of finite groups. Friedl and Vidussi showed that for any non-fibered knot there exists a finite group such that the corresponding twisted Alexander polynomial vanishes. In this talk, we determine the vanishing or the non-vanishing for knots with up to 10 crossings and finite groups of order up to 120. Moreover, we see several properties concerning the vanishing of the twisted Alexander polynomial. This is joint work with Takayuki Morifuji.

Sakie Suzuki (Tokyo Institute of Technology)
Quantum invariants based on ideal triangulations

We explain a new construction of quantum invariants of knots and closed framed 3-manifolds based on ideal triangulations. The invariant is defined for any finite dimensional Hopf algebra such as small quantum groups. The construction is simple and easy to be understood intuitively; the Pachner $(2,3)$ move (framing equipped version) is ensured by the pentagon equation of the canonical element of the Heisenberg double, and a twist of a framing effects as the square of the antipode. This talk is based on a joint work with S. M. Mihalache and Y. Terashima.

Yuta Taniguchi (Department of Mathematics, Graduate School of Science, Osaka University)
Knot quandles of oriented 2-knots

Joyce and Matveev associated a quandle to an oriented n-knot K in S^{n+2}, which is called the knot quandle of K. It is known that there exist oriented 1-knots with the same knot group but different knot quandles. In this talk, we give a first example of oriented 2-knots with the same knot group but different knot quandles. If time permits, we also discuss the quandle homology group of the knot quandle of an oriented 2-knot. This talk is based on a joint work with Kokoro Tanaka (Tokyo Gakugei University).

Masakazu Teragaito (Graduate School of Humanities and Social Sciences, Hiroshima University)
Upsilon and secondary Upsilon invariants of L-space knots

The Upsilon invariant is a concordance invariant of a knot introduced by Ozsvath, Stipsicz and Szaboin in 2017. For an L-space knot, it is determined only by the Alexander polynomial, and Borodzik and Hedden show that it is the Legendre transform, or convex conjugate, of a certain function having the same information as the Alexander polynomial. From this viewpoint, we give infinitely many pairs of hyperbolic L-space knots that have distinct Alexander polynomials, but share the same Upsilon invariant. Conversely, we also examine restorable Alexander polynomials from Upsilon invariants. If there is time, we will discuss the secondary Upsilon invariant introduced by Kim and Livingston, and show that it is the concave conjugate of a certain function.

Kouki Yamaguchi (RIMS, Kyoto University)
On the calculation of the 3-loop invariant and the degree 2 part of the LMO invariant

The 3-loop invariant (or, the 3-loop polynomial) of a knot is a rational form (or, a polynomial) presenting the 3-loop part of the Kontsevich invariant of knots. In this talk, we define the 3-loop invariant and we calculate it for some knots, and we give some formulas about the 3-loop invariant. Further, we show the relationship between the 3-loop invariant of knots and the degree 2 part of the LMO invariant of 3-manifolds, and we give some examples of its calculation.