研究集会「E-KOOK セミナー」

大阪市立大学理学研究科主催により，日本数学会トポロジー分科会・トポロジープロジェクトの一環として，平成 24 年度科学研究費補助金（基盤研究 (A)）「結び目理論研究」（研究代表者：河内明夫，課題番号 21244005）の助成により，下記の日程で標記の研究集会を開催いたします．

記

日時： 2013 年（平成 25 年）2 月 14 日（木）午後〜2 月 16 日（土）午前

場所： 大阪市立大学学術情報センター 10 階（杉本キャンパス）

住所： 〒 558-8585 大阪市住吉区杉本 3 丁目 3 番 138 号

アクセス： http://www.osaka-cu.ac.jp/info/commons/access.html

河内明夫先生退職記念パーティー： 2 月 15 日の講演終了後，学術情報センター 10 階にて開催いたします．参加を希望される方は，2 月 1 日（金）までに参加の申込みを数学研究所事務担当 小森祐子さんまでメールで連絡していただくようお願い申し上げます．y-komori@sci.osaka-cu.ac.jp

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PROGRAM

Thursday 14 February

13:20–14:00　Madeti Prabhakar（Indian Institute of Technology Roper, India）
Unknotting procedure for torus knots

14:10–14:30　清水 理佳（広島大・理）Ayaka Shimizu (Hiroshima University)
Irreducibility and reducibility of knot projections

14:30–14:50　岡崎 真也（大阪市大・数学研究所）Shin'ya Okazaki (OCAMI, Osaka City University)
Bridge genus and braid genus of lens space

15:00–15:20　鄭 仁大 （大阪府大・高等教育推進機構）In Dae Jong (Osaka Prefecture University)
On Seifert fibered surgeries on knots

15:20–15:40　岸本 健吾（大阪工業大）Kengo Kishimoto (Osaka Institute of Technology)
Simple ribbon fusions and primeness of knots

15:50–16:10　安部 哲哉（京都大・数理解析研究所）Tetsuya Abe (RIMS, Kyoto University)
Estimations for the alternation number of a link

16:10–16:30　森内 博正（大阪市大・数学研究所）Hiromasa Moriuchi (OCAMI, Osaka City University)
7 交点以下のタングルについての注意点 (A note on tangles with up to seven crossings)

16:40–17:00　金信 泰造（大阪市大・理）Taizo Kanenobu (Osaka City University)
Links which are related by a band surgery or crossing change

17:00–17:20　堤 康嘉（大島商船高専）Yasuyoshi Tsutsumi (Oshima National College of Maritime Technology)
Ohtsuki invarinats of Brieskorn-Hamm manifolds

Friday 15 February

10:00–10:40　Rama Mishra (Indian Institute of Science Education and Research)
On 3-superbridge knots

10:50–11:20　岩切 雅英（佐賀大・理工）Masahide Iwakiri (Saga University)
The numbers of crossings in charts and quandle cocycle invariants

11:20–11:50　秋吉 宏尚 （大阪市大・理）Hirotaka Akiyoshi (OCAMI, Osaka City University)
Concrete construction of cone hyperbolic structures

11:50–12:20　田中 利史 （岐阜大・教育）Toshifumi Tanaka (Gifu University)
On the maximal Thurston-Bennequin number for knots in a Legendrian graph

13:50–14:20　鎌田 聖一（広島大・理）Seiichi Kamada (Hiroshima University)
４次元空間内の曲面結び目について (Surface knots in 4-space)

14:20–14:50　宮澤 康行（山口大・理）Yasuyuki Miyazawa (Yamaguchi University)
HOMFLY polynomials for 3-component links with braid index 3

15:00–15:30　門上 晃久（華東師範大学数学系）Teruhisa Kadokami (East China Normal University)
日本の結び目理論概史（History of Knot Theory in Japan）

15:30-16:00　鎌田 直子（名古屋市大）Naoko Kamada (Nagoya City University)
A surface bracket polynomial based on a multivariable polynomial invariant

16:20–16:50　田山 育男（大阪市大・数学研究所）Ikuo Tayama (OCAMI, Osaka City University)
Tabulation of 3-manifolds of lengths up to 10

16:50–17:20　河内 明夫（大阪市大・理）Akio Kawauchi (OCAMI, Osaka City University)
On 4-manifolds with every 3-manifold embedded

Saturday 16 February

10:00–10:25　佐藤 進（神戸大・理）Shin Satoh (Kobe University)
On surface-tangles and welded knots

10:25–10:50　中村 拓司 （大阪電気通信大）Takuji Nakamura (Osaka Electro-Communication University)
On the state numbers for knots

11:10–11:35　作間 誠（広島大・理）Makoto Sakuma (Hiroshima University)
On the space of Kleinian groups generated by two parabolic transformations

11:35–12:00　中西 康剛（神戸大・理）Yasutaka Nakanishi (Kobe University)
Warping polynomials about the trefoil knot

E-KOOK Seminar

ABSTRACTS

Thursday 14 February

Madeti Prabhakar (Indian Institute of Technology Roper, India)

Unknotting procedure for torus knots

Unknotting numbers for torus knots and links are well known. In this talk, we present a new method for determining the position of unknotting number crossing changes in a toric braid $B(p;q)$ such that the closure of the resultant braid is equivalent to the trivial knot or link. Using this procedure we also provide a sharp upper bound on the region unknotting number for a large class of torus knots and proper links.

Ayaka Shimizu (Hiroshima University)

Irreducibility and reducibility of knot projections

We discuss the irreducibility and reducibility of knot projections which represent how irreducible and reducible a knot projection is. To estimate them, we consider unavoidable sets of regions for irreducible knot projections.

Shin'ya Okazaki (OCAMI, Osaka City University)

Bridge genus and braid genus of lens space

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

In Dae Jong (Faculty of Liberal Arts and Sciences, Osaka Prefecture University)

On Seifert fibered surgeries on knots

We report on our recent studies on Seifert fibered surgeries on knots. In particular, we give a complete classification of toroidal Seifert fibered surgeries on alternating knots. Precisely, we show that if an alternating knot admits a toroidal Seifert fibered surgery, then it is either the trefoil knot with the surgery slope zero, or the connected sum of a $(2,p)$-torus knot and a $(2,q)$-torus knot with the surgery slope $2(p+q)$ for $|p|,|q| \geq 3$. This talk is based on joint works with Kazuhiro Ichihara.

Kengo Kishimoto (Osaka Institute of Technology)

Simple ribbon fusions and primeness of knots

A simple ribbon fusion is a special kind of fusion for a link. We give a sufficient condition for a simple ribbon fusion on a knot to give a prime knot. This is a joint work with T.Shibuya and T.Tsukamoto.

Tetsuya Abe (RIMS, Kyoto University)

Estimations for the alternation number of a link

The alternation number of a link L, denoted by $\mathrm{alt}(L)$, is the minimal number of crossing changes to deform L into a non-split alternating link, which was introduced by Akio Kawauchi. We study estimations for the alternation number of a link using concordance invariants.

Hiromasa Moriuchi (OCAMI, Osaka City University)

7 交点以下のタングルについての注意点 (A note on tangles with up to seven crossings)

結び目や絡み目の表を作成するため、1969 年に J. H. Conway はタングルという概念を導入した。そのうち、初等タングルの和と積のみで構成されるものを代数タングルという。7 交点以下の代数タングルの表は 2008 年に講演者によって作られている。本講演では、代数タングルではないタングルについて述べる。

In 1969, J. H. Conway introduced the concept of a tangle in order to enumerate knots and links. A tangle is algebraic if it can be obtained from elementary tangles by addition and multiplication. We announced a table of algebraic tangles with up to seven crossings in 2008. In this talk, we study non-algebraic tangles.

Taizo Kanenobu (Osaka City University)

Links which are related by a band surgery or crossing change

We introduce some criteria for two links, which are related by a band surgery or crossing change, using the determinant, and the Jones, HOMFLYPT, and Q polynomials. This is a joint work with Hiromasa Moriuchi.

Yasuyoshi Tsutsumi (Oshima National College of Maritime Technology)

Ohtsuki invarinats of Brieskorn-Hamm manifolds

Let λ_1 and λ_2 be the first and the second Ohtsuki invariants of Brieskorn-Hamm manifolds which is a rational homology 3-sphere. We calculate λ_1 and λ_2. By the result, we show that λ_1 is not positive and λ_2 is positive.

Friday 15 February

Rama Mishra (Indian Institute of Science Education and Research, Pune, India)

On 3-superbridge knots

It is known that there are only finitely many knots with super bridge index 3. Jin and Jeon have provided a list of possible such candidates. However, they conjectured that the only knots with super bridge index 3 are trefoil and the figure eight knot. In this paper, we prove that the 5_2 knot and the 6_2 knot are also 3-super bridge knots by providing a polynomial representation of these knots in degree 6. This also answers a question asked by Durfee and O ' Shea in their paper on polynomial knots: is there any 5-crossing knot in degree 6?

Masahide Iwakiri (Graduate School of Science and Engineering, Saga University)

The numbers of crossings in charts and quandle cocycle invariants

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

Hirotaka Akiyoshi (OCAMI, Osaka City University)

Concrete construction of cone hyperbolic structures

We construct cone hyperbolic structures on the 3-dimensional cone manifold homeomorphic to the product of the interval and the torus with a single cone point from a "nice" fundamental polyhedra. The construction is based on a modification of the Ford domains of punctured torus groups characterized by Jorgensen. We show the results of numerical experiment, and discuss a finiteness condition (the BQ condition) for the holonomy representations for the cone hyperbolic structures.

Toshifumi Tanaka (Gifu University)

On the maximal Thurston-Bennequin number for knots in a Legendrian graph

We investigate a Legendrian embedding of a complete graph in the standard contact 3-space. We show that there exists a Legendrian embedding of the complete graph on 4 vertices such that all its cycles realize their maximal Thurston-Bennequin number.

Seiichi Kamada (Hiroshima University)

４次元空間内の曲面結び目について (Surface knots in 4-space)

This is a survey talk on the theory of surface knots in 4-space. Normal forms and braid presentations of surface knots are explained.

Yasuyuki Miyazawa (Yamaguchi University)

HOMFLY polynomials for 3-component links with braid index 3

We are concerned here with HOMFLY polynomials of 3-component links. Let L be a 3-component link and $P_L(v,z)$ the HOMFLY polynomial of L. Suppose that $v - span P_L(v,z) = 4$. Then, we express $P_L(v,z)$ in terms of some polynomials and show that if L has braid index 3, then $P_L(v,z)$ can be determined by the Jones polynomial of L.

Teruhisa Kadokami (Department of Mathematics, East China Normal University)

日本の結び目理論概史 (History of Knot Theory in Japan)

以下人名は敬称略とする。日本の結び目理論は、ドイツ留学を終え、1935 年大阪大学助教授（1936 年には教授）に就任した寺阪英孝から始まった。その頃のドイツには K. Menger,H. Tietze, H. Seifert が居た。論文としては 1952 年樹下真一との共著 “On unions of knots”(Osaka Mathematical Journal) から始まる。以降、幾人かの日本人が当時 Princeton 大学に居た R. Fox を訪問することにより日本の結び目理論は発展した。1960 年代に細川藤次により神戸トポロジーセミナーが創始され、1983 年には KOOK セミナー、1994 年には NKOOK セミナーと名称が変更し、継続している。東京では鈴木晋一が早稲田トポロジーセミナーを創始し、継続している。東京大学では数論学者である彌永昌吉が結び目理論の重要性に気付いていた。以降東京大学でも独自の発展を続けている。講演では幾人かに焦点を絞り、彼らの足跡を辿る。

Naoko Kamada (Nagoya City University)

A surface bracket polynomial based on a multivariable polynomial invariant

A twisted link, defined by Bourgoin, is an equivalence class of a link diagram that may have virtual crossings and bars. It is a non-orientable version of a virtual link. Miyazawa defined a multivariable polynomial invariant of a virtual link by using states of pole diagrams, and a similar invariant was defined by Dye and Kauffman. Dye and Kauffman also defined the surface bracket polynomial of a virtual knot based on the Jones polynomial. In this talk, we define a surface bracket polynomial for virtual knots and twisted knots based on pole diagrams. We discuss a relationship between the multivariable invariant and the surface bracket polynomials of twisted links.

Ikuo Tayama (OCAMI, Osaka City University)

Tabulation of 3-manifolds of lengths up to 10

This is a joint work with A. Kawauchi. A well-order was introduced on the set of links by A. Kawauchi. This well-order also naturally induces a well-order on the set of prime link groups and eventually induces a well order on the set of closed connected orientable 3-manifolds. With respect to this order, we enumerated the prime links and the prime link groups of lengths up to 10. In this talk, we show a list of the enumeration of 3-manifolds of lengths up to 10.

Akio Kawauchi (OCAMI, Osaka City University)

On 4-manifolds with every 3-manifold embedded

In an earlier work, it is known by the speaker that for every closed orientable 4-manifold, there is a closed orientable 3-manifold which cannot be embedded in it. An embedding f from a closed orientable 3-manifold M into an open orientable 4-manifold X is called a type I or type II embedding according to whether the complement $X - f(M)$ is connected or not, respectively. In this talk, we discuss some homological properties of open orientable 4-manifolds with all closed orientable 3-manifolds embedded by type I embeddings as well as type II embeddings.

Saturday 16 February

Shin Satoh (Kobe University)
On surface-tangles and welded knots

This is a joint work with Yasutaka Nakanishi. We give some topics about a tangle decomposition of a surface-knot and the bridge index of a welded knot: We consider the problem which surface-knot is decomposed into a pair of trivial surface-tangles. This problem is closely related to two ways of defining the bridge index of a welded knot.

Takuji Nakamura (Osaka Electro-Communication University)

On the state numbers for knots

We introduce the notion of state numbers for plane curves. A state of a plane curve P is a collection of simple circles obtained from P by splicing all double points on P. Then n-state number of P is defined as the number of states for P consisting of n simple circles. In this talk we will discuss several properties of state numbers for plane curves. We also define the n-state number for a classical (or virtual) knot K, which is the minimal number of n-states for all possible classical (or virtual) projections of K. We will discuss state numbers for the trefoil knot. This is a joint work with Y. Nakanishi, S. Satoh, and Y. Tomiyama.

Makoto Sakuma (Graduate School of Science, Hiroshima University)

On the space of Kleinian groups generated by two parabolic transformations

I will review the following results concerning the space of Kleinian groups generated by two parabolic transformations.

(1) Pioneering exploration by Robert Riley.

(2) The classification of non-free two parabolic generator Kleinian groups announced by Ian Agol, and related work by Donghi Lee and the speaker.

(3) Natural paths joining 2-bridge link groups to the Riley slice found by my joint work with Akiyoshi, Wada and Yamashita.

(4) Ohshika-Miyachi's work on the boundary of the Riley slice.

(5) An observation concerning relation between the boundary of the Riley slice with the space of the 2-bridge link groups, found by Gaven Martin and the speaker.

Yasutaka Nakanishi (Kobe University)

Warping polynomials about the trefoil knot

This is a joint work with R. Higa, S. Satoh, and T. Yamamoto. The warping polynomial is introduced and characterized by Shimizu. In this talk, we will characterize the warping polynomials about the trefoil knot.