東北結び目セミナー 2012

アブストラクト集

田神 慶士（東京工業大学 大学院理工学研究科）

HQFT and Khovanov homology for link diagrams on surfaces

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

鈴木 敦美（埼玉大学 大学院理工学研究科）

Minimum step number of knots confined to tubes in the simple cubic lattice

Determining the minimum length required to form a closed polygon representing a particular kind of knot is a challenging mathematical problem. This problem is motivated by the fact that knots exist in abundance in places such as long polymer chains and circular DNA. Diao showed the minimum step number of the trefoil knot in the simple cubic lattice is 24. This result is generalized theoretically and numerically, especially with volume confinement. In 1-slab, i.e. the region between two planes with distance 1, the minimum step number of the trefoil is 26. In this talk, consider lattice knots in tube regions in the simple cubic lattice and show the minimum step number of the trefoil knot in 1×2-tube is 36. This is a joint work with Kai Ishihara, Rob Scharein, Yuanan Diao, Javier Arsuaga, Mariel Vazquez, and Koya Shimokawa.

比嘉 隆二（神戸大学 大学院理学研究科）

The quotient knots of a strongly invertible knot

For a knot K with an inverting involution h, we have a pair of knots K_1^h and K_2^h obtained by taking the union of the quotient and a part of the axis. We first show that the product of the determinants of K_1^h and K_2^h is equal to that of K. If K is a 2-bridge knot, exactly one of K_1^h and K_2^h is non-trivial under a certain involution, which is called a relative of K. We also study a sequence of 2-bridge knots $K = K_0, K_1, \cdots$, such that K_{i+1} is a relative of K_i.

中村 拓司（大阪電気通信大学 工学部）

State numbers for plane curves and knots

We introduce the notion of state numbers for plane curves. A state of a plane curve C is a collection of simple closed curves obtained from C by splicing all double points on C. Then n-state number of C is defined as the number of states of C consisting of n simple closed curves. In this talk we will discuss several properties of state numbers for plane curves. We also consider state numbers for knot diagrams and define the "minimal state number" for a knot. We will also discuss them.

鮑 園園（東京工業大学 大学院理工学研究科）

Heegaard Floer ホモロジーと空間グラフ

Ozsváth と Szabó，そして Rasmussen によって独立に，3 次元多様体における結び目の不変量である knot Floer homology が定義された．その後，Juhász によっては境界つき多様体である sutured 多様体の sutured Floer homology (SFH) が定義され，Lipshitz，Ozsváth と Thurston によって，任意の連結な境界を持つ 3 次元多様体の bordered Floer homology (BFH) が定義された．実際には，knot Floer homology は結び目補空間の不変量であり，補空間の SFH と BFH で表すことができる．これらの結果を参考し，空間グラフの Floer homology を定義することを検討する．

小沢 誠（駒澤大学 総合教育研究部）
On the Neuwirth conjecture for knots

Neuwirth asked if any non-trivial knot in the 3-sphere can be embedded in a closed surface so that the complement of the surface is a connected essential surface for the knot complement. In this paper, we examine some variations on this question and prove it for all knots up to 11 crossings except for two examples. We also establish the conjecture for all Montesinos knots and for all generalized arborescently alternating knots. For knot exteriors containing closed incompressible surfaces satisfying a simple homological condition, we establish that the knots satisfy the Neuwirth conjecture. If there is a proper degree one map from knot K to knot K' and K' satisfies the Neuwirth conjecture then we prove the same is true for knot K. Algorithms are given to decide if a knot satisfies the various versions of the Neuwirth conjecture and also the related conjectures about whether all non-trivial knots have essential surfaces at integer boundary slopes.
(This is a joint work with J. Hyam Rubinstein.)

山田 裕一（電気通信大学 大学院情報理工学研究科）
Divide knot presentations of sporadic knots of Berge's lens space surgery

Divide knot とは, 代数曲線の特異点論から生じたもので, 平面曲線から結び目を構成する方法のことです. 一方, Dehn surgery でレンズ空間を生じる結び目のリストとして「Berge のリスト」が知られています. どちらも, 典型的な例は正のトーラス結び目です. 今回は, Berge のリストの 3 種類の族の中で最も希少な例「Sporadic examples」を扱います. それらの結び目が（鏡像を除いて）Divide knot であることと「均整のとれた曲線表示」が分かりましたので紹介します.

水澤 篤彦（早稲田大学 大学院基幹理工学研究科）
ハンドル体絡み目の絡み数

いくつかのハンドル体の 3 次元多様体への埋め込みをハンドル体絡み目という。ハンドル体絡み目のすべての成分の種数が 1 の場合、絡み目と同一視できる。今回、絡み目の絡み数の拡張として、3 次元球面内のハンドル体絡み目に対する絡み数を定義した。本講演では、この絡み数の定義と幾何学的な意味を紹介したい。

岡崎 建太（京都大学 数理解析研究所）

On the state-sum invariants of 3-manifolds constructed from the E_6 and E_8 linear skeins

In this talk we give elementary and self-contained constructions of the state-sum invariants of 3-manifolds derived from $6j$-symbols of the E_6 and E_8 subfactors. We give such constructions by introducing the E_6 and E_8 linear skeins, motivated by the E_6 and E_8 planar algebras.

宮澤 康行（山口大学 大学院理工学研究科）

Knots with braid index 3 and their HOMFLY polynomials

We are concerned here with the HOMFLY polynomials of knots and links, and consider the question whether for links with v-span 4 the Jones polynomial determines the HOMFLY polynomial. For 3-braid links, Emmes announces that the Jones polynomial is equivalent to the HOMFLY polynomial. In this talk, we report some research results for knots.

河内 明夫（大阪市立大学 大学院理学研究科）

Signature theorem for an ∞-cyclic covering of a non-compact even-dimensional manifold

A signature theorem for an ∞-cyclic covering of a compact even-dimensional manifold is given in the speaker's earlier paper: On the signature invariants of infinite cyclic coverings of even dimensional manifolds, Advanced Studies in Pure Math. 9(1986), 177-188 (Cf. http://www.sci.osaka-cu.ac.jp/ kawauchi/index.html). In this talk, we show a non-compact version of the signature theorem.

市原 一裕（日本大学 文理学部）
Knots with arbitrary high distance bridge decompositions
（斎藤 敏夫 氏（上越教育大学）との共同研究）

We show that, for any given closed orientable 3-manifold M, any non-negative integers g, b except for $(g, b) = (0, 1), (0, 2)$, and any positive integer n, there exists a knot K in M which admits a (g, b)-bridge splitting of distance greater than n.

佐藤 進（神戸大学 大学院理学研究科）
The pallet graph of a Fox coloring

We introduce the notation of a graph associated with a Fox p- coloring of a knot, and we show that any non-trivial p-coloring requires at least $\lfloor \log_2 p \rfloor + 2$ colors. This lower bound is best possible in the sense that there is a p-colorable virtual knot which attains the bound.

谷山 公規（早稲田大学 教育学部）
Site-specific Gordian distances of spatial graphs

We discuss the minimal number of crossing changes between two spatial embeddings of a graph where each crossing change is performed between two specified edges. Using covering space arguments, we give a new proof of Przytycki-Sikora theorem on puzzle rings. We also determine components-specific unlinking numbers of Milnor type links.