The First KOOK-TAPU Joint Seminar (TOP Seminar) on Knot Theory and Related Topics

ABSTRACTS*

Osaka City University

August 18–20, 2009

August 18 Tuesday

On the Alexander polynomials of knots with Gordian distance one

Akio Kawauchi

Osaka City University

We give a condition on the Alexander polynomials of a pair of knots with Gordian distance one. By this condition, we investigate which pair of the Alexander polynomials of degree two is realizable or not by a pair of knots with Gordian distance one. We show that there are infinitely many pairs containing the pair of Alexander polynomials of the trefoil knot and the figure-eight knot which are not realizable by any pair of knots with Gordian distance one, answering questions asked by Y. Nakanishi and in general by In Dae Jong.

*August 23, 2009

An index polynomial invariant of virtual links and applications

Young-Ho Im

Pusan National University

We introduce an index polynomial invariant of virtual links that is non-trivial for many virtuals, but is trivial on classical links. Also this polynomial is sometimes useful to find the virtual crossing number of virtual knots. We give various properties of this polynomial and examples.

The triple point number of the 2-twist-spun figure-eight knot

Shin Satoh

Kobe University

In 2004, Hatakenaka proved that if an orientable surface-link has a non-trivial 5-dihedral quandle invariant, then the triple point number is greater than or equal to SIX. In this talk, we prove that the best lower bound is equal to EIGHT, which is attained by the 2-twist-spun figure-eight knot and another surface-link.

On the C_n-distance and Vassiliev invariants

Sumiko Horiuchi (jointly with Yoshiyuki Ohyama)

Tokyo Woman's Christian University

A local move called a C_n-move is closely related to Vassiliev invariants. A C_n-distance between K and L, denoted by $d_{C_n}(K, L)$, is the minimum number of C_n-moves needed to transform K into L. We consider two knots K_1 and K_2 with $d_{C_n}(K_1, K_2) = r$. In this paper, we show that for any given natural number m and for any natural number p and q with $p + q = r$, there exist infinitely many knots J_i $(i = 1, 2, \dots)$ such that they have the same value on every Vassiliev invariant of order less than or equal to m and $d_{C_n}(K_1, J_i) = p$ and $d_{C_n}(J_i, K_2) = q$.

Knots with a trivial coefficient polynomial

Yasuyuki Miyazawa

Yamaguchi University

By using tangle decomposition of a knot, we refer to a claim on construction of a knot with the lowest trivial HOMFLY coefficient polynomial. We also give an explicit example based on the claim and show that there exist infinitely many 2-bridge knots with such a coefficient polynomial. It follows that there exist infinitely many knots with the same lowest HOMFLY coefficient polynomial as a given knot.

The existence of epimorphisms between 2-bridge link groups

Donghi Lee

Pusan National University

We show that every 2-bridge link group has a one-relator presentation with some useful peculiarities including small cancellation conditions. Using this presentation, we give a necessary and sufficient condition for the existence of upper-meridian-pair-preserving epimorphisms between 2-bridge link groups.

Conway polynomial of braids through short circuit closure

Sergei Duzhin

Steklov Mathematical Institute, Petersburg Division

I will give some formulas for the Conway polynomial transferred from knots to pure braids via short circuit closure due to Mostovoy and Stanford. The symbol of that invariant in the spirit of the Magnus expansion will also be discussed.

August 19 Wednesday

On the Δ-unknotting number of Whitehead doubles of knots

Sang Youl Lee (jointly with H. J. Jang and M. Seo)

Pusan National University

The purpose of this talk is to discuss the question: "*Whether or not the Δ-unknotting number of a Whitehead double remembers its companion knot*". First we give a brief review for the Δ-unknotting number of knots and some known results. Then we present a bound for the Δ-unknotting number of a Whitehead double in terms of the unknotting number and a certain integral invariant of its companion knot. As applications, we show that the Δ-unknotting number of m-twisted Whitehead doubles of certain knots does not remember companion knots, and is equal to the twist number m. We also give possible Δ-unknotting number of m-twisted Whitehead doubles whose companions are knots with unknotting number 1, certain twist knots, amphicheiral knots, and braid positive knots.

On self delta-equivalence of links

Tatsuya Tsukamoto

Osaka Institute of Technology

Self delta-equivalence on links was defined by T. Shibuya in 1996. In this talk, we review works on this subject and present a recent result.

Lagrangian submanifolds and related volume variational problems

Hui Ma

Tsinghua University, and OCAMI, Osaka City University

Lagrangian submanifold is a fundamental and important object in symplectic geometry. It is interesting and fruitful to study differential geometry of Lagrangian submanifolds in specific Kähler manifolds. In this talk, we will discuss volume variational problem related to Lagrangian submanifolds. We will give a short survey on this area and finally we will mention our recent work on Lagrangian submanifolds in complex hyperquadrics obtained from isoparametric hypersurfaces. This talk is based on the joint work with Prof. Yoshihiro Ohnita.

Complementary regions of knot, link and spatial graph diagrams

Reiko Shinjo

OCAMI, Osaka City University

A part of this talk is a joint work with Colin. C. Adams and K. Tanaka. Given a diagram of a knot or link, one can ignore which strand is the overstrand at each crossing and think of it as a 4-valent planar graph embedded on the 2-sphere. This graph divides the sphere into n-gons which we call faces. In this talk, we focus on faces of diagrams and investigate some combinatorial properties. This talk consists of two topics: one is the notion of "universal sequence" and the other is minimizing the number of odd-sided regions of a given knot or link. The concept of "complementary regions" can be naturally extended to spatial graph diagrams. We also give some results for odd sided regions of spatial graph diagrams.

Colored Turaev-Viro invariants of twisted doubles series and cable series in lens spaces

Yuya Koda

Tokyo Institute of Technology

In 2007, Barrett, Garcia-Islas and Martins defined a new series of invariants, colored Turaev-Viro invariants, of a pair (M, L), where M is a closed oriented 3-manifolds and L is an oriented link embedded in M. These invariants are defined as state-sums on a special polyhedron, restricting only to states such that certain regions have a certain pre-fixed color. In this talk, we briefly review the definition of these invariants and we explain a method for constructing special polyhedrons for twisted doubles and cable knots of a core of a solid torus appearing in the genus one Heegaard splitting of in lens spaces. Then we provide a formula for colored Turaev-Viro invariants of these knots using these spines. This is joint work with T. Taniguchi.

Bounds on exceptional surgery slopes

Kazuhiro Ichihara (including a joint work with Kimihiko Motegi and Hyun-Jong Song)

Nara University of Education

I will report results on two bounds about exceptional surgery slopes for a hyperbolic knot. It will be shown that at least one of the following always holds: One is about denominators of such slopes, and the other is about the range of such slopes in terms of genera of the knots. Both of them are actually conjectured to hold for hyperbolic knots in the 3-sphere by Gordon and Teragaito respectively. To establish this, we will discuss about the distance between a degeneracy slope for an essential lamination and a boundary slope of an essential embedded surface. Related the result, I will also show the examples of hyperbolic small knots admitting longitudinal Seifert fibered surgeries. This part is based on the joint work with Kimihiko Motegi and Hyun-Jong Song.

August 20 Thursday

Factorizations of homotopies of nanowords

Andrew Gibson

Tokyo Institute of Technology

A nanoword is a Gauss word with an associated map from the letters appearing in the Gauss word to a fixed set. Turaev defined an equivalence relation on nanowords, called homotopy, parameterized by a homotopy data triple. Different homotopy data triples give different equivalence relations.

We will show that a homotopy data triple can be factorized into a product of prime triples. We will then explain the relation between the homotopy given by a homotopy data triple and the homotopies given by the triple's prime factors.

Topological behavior of constant mean curvature surfaces

Wayne Rossman

Kobe University

In this talk, we will look at some of the history, over the last 40 years or so, of the theory of minimal and constant mean curvature surfaces, with particular attention paid to the topology of those surfaces. The ambient spaces under consideration for these surfaces will include other spaces than Euclidean space, such as hyperbolic and spherical spaces. Although the topology of the ambient space is always trivial (i.e. simply-connected) in this talk, the choice of ambient space will have nontrivial effects on the possible topologies of the immersed constant mean curvature surfaces.

Band surgery on knots and links

Taizo Kanenobu

Osaka City University

We give some relationships of the Jones and Q polynomials between two links which are related by a band surgery. Then we consider two applications: The first one is to an evaluation of the ribbon-fusion number, the least fusion number of a ribbon knot. The second one is to DNA knot theory, helping us to understand the action of the Xer site-specific recombination at *psi* site.

The Bollobás-Riordan polynomial in the knot theory

Yongju Bae

Kyungpook National University

The Jones polynomial in the knot theory is closely related to the Tutte polynomial in the graph theory, while the Bollobás-Riordan polynomial in the ribbon graph theory is related to the Kauffman Bracket polynomial in the virtual link theory.

In this talk, we will give a formula for the Bollobás-Riordan polynomial of certain class of ribbon graphs and try to obtain the corresponding formula of the Kauffman Bracket polynomial in the virtual link theory.