Four Dimensional Topology

November 25 – November 27, 2016
Room E408, Department of Mathematics, Osaka City University

Abstracts

Naohiko Kasuya (Aoyama Gakuin University)

Non-Kaehler complex structures on R^4

(joint work with Antonio J Di Scala and Daniele Zuddas)

We construct the first examples of non-Kaehler complex structures on $\mathbb{R}^4$. For the construction, it is important to understand the genus-one achiral Lefschetz fibration $S^4 \to S^2$ found by Yukio Matsumoto and Kenji Fukaya.

Takahiro Oba (Tokyo Institute of Technology)

Inequivalent higher-dimensional Lefschetz fibrations from the 4-dimensional point of view

Lefschetz bifibrations are one of useful tools to construct higher-dimensional Lefschetz fibrations. Roughly speaking, a Lefschetz bifibration can be handled by the data of a Lefschetz fibration over the disk and a braided surface in the bidisk, which is an object of 4-dimensional topology. In this talk, by using Lefschetz bifibrations, we construct an infinite family of higher-dimensional Lefschetz fibrations over the disk such that they are pairwise inequivalent and induce the same open book on their boundaries.

Shigeru Takamura (Kyoto University)

Families of quotient families

I plan to discuss several topics about quotient families: (1) I introduce/construct "classifying spaces" of quotient families. (2) I construct "families of quotient families of Riemann surfaces" parameterized by Hurwitz spaces. (3) I introduce a new operation "pressing of subvarieties" in complex analytic varieties (in terms of branched coverings), which leads to the construction of new families —pressed families— from quotient families.

Kouki Sato (Tokyo Institute of Technology)

A full-twist formula for nu+ invariant

We give a full-twist formula for Hom-Wu's ν^+-invariant. By using this, we extend Wu's 4-ball genus bound for particular positive cable knots to all positive cable knots. In addition, we introduce a partial order on ν^+-equivalence classes, and discuss the relationship between the partial order and full-twist operations.

Akiko Shima (Tokai University)

The structure of a minimal chart with two crossings

(joint work with Teruo Nagase)

For a label m of a chart Γ we denote by Γ_m the union of all the edges of label m and their vertices. For a minimal chart Γ with exactly two crossings, we can show that the two crossings are contained in $\Gamma_\alpha \cap \Gamma_\beta$ for some labels $\alpha < \beta$. To propose a normal form for a minimal chart with two crossings, we study the structure of a disk D not containing any crossing but satisfying $\Gamma \cap \partial D \subset \Gamma_{\alpha+1} \cup \Gamma_{\beta-1}$, and we study the structure of a neighbourhood of $\Gamma_\alpha \cup \Gamma_\beta$.

Shin Satoh (Kobe University)

Fundamental deformations on unwrithed surface-knots

Every oriented surface-knot is presented by an *unwrithed* diagram such that it has no branch points and the lower decker set gives the null homology class of the surface. We prove that two unwrithed diagrams of the same surface-knot are related in the 3-sphere by a finite sequence of four kinds of Roseman moves missing branch points.

Hokuto Konno (The University of Tokyo)

Complex of surfaces violating the adjunction inequalities

For a given *spin*^{c} 4-manifold, we will study a simplicial complex consisting of all embedded surfaces violating the adjunction inequalities. To study this, we will introduce a cohomological version of Seiberg-Witten invariant. This is a candidate of a higher-dimensional version of Ruberman's works on Seiberg-Witten invariants for 1-parameters. As an application, our invariant shall be used to derive the adjunction inequalities for 4-manifolds whose (usual) Seiberg-Witten invariant vanishes.

Yuya Kato (The University of Tokyo)

Nonsmoothable actions on spin four-manifolds

We prove an equivariant version of Furuta's 10/8-inequality. As an application, we construct examples of Nonsmoothable group actions on spin four-manifolds.

Mizuki Fukuda (Tohoku University)
Distinguishing branched twist spins by knot determinants

A branched twist spin is a 2-knot in the standard 4-sphere and first appeared in the study of circle actions. It is known that a branched twist spin is a generalization of a twist spun knot. In this talk, I give a sufficient condition to distinguish two branched twist spins by the knot determinant of the original 1-knot.

Celeste Damiani (Osaka City University)
Alexander invariants for ribbon tangles and circuit algebras
(joint work with Vincent Florens)

Ribbon tangles are proper embeddings of tori and cylinders in the 4-ball, "bounding" 3-manifolds with only ribbon disks as singularities. We construct an Alexander invariant A of ribbon tangles equipped with a representation of the fundamental group of their exterior in a free abelian group G. This invariant induces a functor in a certain category of tangles, which restricts to the exterior powers of Burau-Gassner representation for ribbon braids, that are analogous to usual braids in this context. We define a circuit algebra over the operad of smooth cobordisms, inspired by diagrammatic planar algebras introduced by Jones, and prove that the invariant A commutes with the compositions in this algebra. On the other hand, ribbon tangles admit diagrammatic representations, throught welded diagrams. We give a simple combinatorial description of A and of the circuit algebra, and observe that our construction is a topological incarnation of the Alexander invariant of Archibald. When restricted to diagrams without virtual crossings, A provides a purely local description of the usual Alexander poynomial of links, and extends the construction by Bigelow, Cattabriga and the second author.

Seiichi Kamada (Osaka City University)
Classifying 1-handles attached to surface-links via quandles

F. Hosakawa and A. Kawauchi showed that 1-handles attached to surface-links are essentially determined by their cores. J. Boyle established a method of classifying 1-handles using double cosets of knot groups in a case where surface-links are connected and oriented. We introduce a method of classifying 1-handles using tensor products of knot quandles. Our method can be applied for any surface-link without the assumption of connectivity and orientability.

Inasa Nakamura (The University of Tokyo)
Unbraiding 2-dimensional braids by an addition of 1-handles with chart loops

We consider a surface in the form of a simple branched covering over an oriented surface-knot F, which is called a covering surface-knot over F or a 2-dimensional braid over F. Such a surface is presented by a certain graph called a chart on a surface diagram of F. We show that for a covering surface-knot, an addition of 1-handles with chart loops is an unbraiding operation which deforms the chart to a union of free edges.

Jieon Kim (Osaka City University)

On marked graph diagrams of immersed surface-links

(joint work with Seiichi Kamada and Akio Kawauchi)

An immersed surface-link is the image of the disjoint union of oriented surfaces in the 4-space $\mathbb{R}^4$ by a smooth immersion. In 1982, A. Kawauchi, T. Shibuya, and S. Suzuki introduced normal forms of embedded cobordisms. By using this, marked graph diagrams of immersed surface-links can be introduced. In this talk, we introduce marked graph diagrams of immersed surface-links and moves for equivalence.

Hironobu Naoe (Tohoku University)

On homology 4-balls with shadow complexity zero

Any compact, oriented, smooth 4-manifold can be represented by a 2-dimensional polyhedron called a shadow. By using shadows Costantino introduced the shadow complexity of a closed 4-manifold. It is natural to try to classify 4-manifolds by shadow complexity. The closed 4-manifolds with (special) shadow complexity zero have been completely classified by Costantino and Martelli. In this talk, we focus on the case of 4-manifolds with boundary, especially integral/rational homology 4-balls. We show that every integral homology 4-ball with shadow complexity zero is diffeomorphic to a 4-ball. We will also talk about a correspondence between shadows of rational homology 4-balls with shadow complexity zero and tree graphs.

Takayuki Okuda (The University of Tokyo)

Sequences of degenerations of propeller surfaces and their splittings

(joint work with Shigeru Takamura)

A propeller surface is a Riemann surface equipped with an automorphism that behaves like rotation of a propeller. In this talk, we consider degenerations of such propeller surfaces and splittings of their singular fibers. We show that the singular fibers with propeller monodromies can split into Lefschetz fibers. To be precise, we construct sequences of deformations in each of which a singular fiber splits into a simpler singular fiber and three Lefschetz fibers.

Motoo Tange (University of Tsukuba)

Infinite order corks

It is a famous fact that any two exotic closed simply-connected 4-manifolds are related by a order 2 cork. Recently, Gompf constructed infinite order cork, so called, Z-corks. In this talk we show that there exists an infinite exotic family that they are not related by any Z-cork. Also, applying Gompf's corks, we construct Z^n-corks with a Z^n-effective embedding.

Kouichi Yasui (Hiroshima University)

Nonexistence of twists and surgeries generating exotic 4-manifolds

It is well known that for any exotic pair of simply connected closed 4-manifolds, one is obtained by twisting the other along a contractible submanifold. In contrast, we show that for each positive integer n, there exists an infinite family of pairwise exotic simply connected closed 4-manifolds such that, for any 4-manifold X and any compact codimension zero submanifold W with $b_1(\partial W) < n$, the family cannot be generated by twisting X along W. As a corollary, we show that there exists no 'universal' 4-manifold with boundary generating all exotic families. Moreover, we give similar results for surgeries.

Takao Matumoto (Kyoto University)

On the smooth unknotting conjecture in dimension four XII

Let $S^2 \subset R^4$ be a smooth 2-spherical knot whose complement has an abelian fundamental group Z. We announced that there are generic 1-parameter families of smooth maps connecting successively the given knot to an unknotted one with only one pair of cusp birth and death. Using this we will show that the given knot becomes unknotted after taking a connected sum with an unknotted torus.

Osamu Saeki (Kyushu University)

Stable maps on 3-manifolds and signatures of 4-manifolds with boundary

Based on the signature formula for stable maps of closed oriented 4-manifolds into 3-manifolds, a Vassiliev type invariant of order one for stable maps of closed oriented 3-manifolds into surfaces can be defined. In this talk, we give an explicit formula for the invariant using a linking form of a certain framed link associated with a stable map on a 3-manifold. As a corollary, we get a signature formula for 4-manifolds with boundary in terms of singular fibers of their stable maps.