

Four Dimensional Topology

November 20 – November 22, 2015

Room E408, Department of Mathematics, Osaka City University

Abstracts

Akio Kawauchi (Osaka City University)

Splitting criteria for a definite 4-manifold with infinite cyclic fundamental group

Two criteria for a closed connected definite 4-manifold with infinite cyclic fundamental group to be TOP-split are given. One criterion extends a sufficient condition made in a previous paper. The result is equivalent to a purely algebraic result on the question asking when a positive definite Hermitian form over the ring of integral one-variable Laurent polynomials is represented by an integer matrix.

Hokuto Konno (The University of Tokyo)

Bounds on genus and configurations of embedded surfaces in 4-manifolds

For finitely many surfaces with zero self-intersection number embedded in a 4-manifold with $b_1 = 0$, we show a lower bound on genus for at least one of the surfaces under some conditions on the surfaces. As an application we derive a constraint for a pair of genera of two embedded surfaces and we also give an alternative proof of the adjunction-type inequality by Strle for configurations of surfaces with positive self-intersection numbers.

Shigeru Takamura (Kyoto University)

Degenerations, splittings, and quotient families of Riemann surfaces (Topics on propeller surfaces, quotient families of type D, fibrations of Riemann surfaces associated with (semi)regular polyhedra) (joint work with Kenjiro Sasaki and Ryota Hirakawa)

Degeneration of Riemann surfaces is regarded as a theory of "cyclic group action on a Riemann surface + its 1-dimensional representation". We introduced the notion of quotient family, which is a wide-ranging generalization of this concept; it is a theory of "finite group action on a Riemann surface + its (irreducible) representation". In this talk, we introduce three series of quotient families: (1) Modular series (including quotient families constructed from the order 168 group

action on the Klein curve of genus 3), (2) Polyhedral series (constructed from (binary) polyhedral group actions on cable surfaces of semi-regular polyhedra), (3) Dihedral series (e.g. constructed from a dihedral group action on a propeller surface — this is also related to some splitting of singular fibers, from which a recurrence relation among monodromies is derived). We provide some interesting examples investigated jointly with R. Hirakawa and K. Sasaki.

Kentaro Saji (Kobe University)

Criteria for Morin singularities of fiber type and its applications

Morin singularities are fundamental singularities, and they appear most frequently on maps between manifolds. In this talk, convenient criteria for Morin singularities will be given. As an application, bifurcation diagrams of singularities which appear in low-dimensional topology will be presented.

Kouichi Yasui (Hiroshima University)

Corks, exotic 4-manifolds and knot concordance

We give a method for producing framed knots which represent exotic (Stein) 4-manifolds. To obtain the method, we introduce a new description of cork twists. As a corollary, we obtain non-concordant knots with the same 0-surgery, disproving the Akbulut-Kirby conjecture given in 1978.

Hironobu Naoe (Tohoku University)

Infinitely many corks with special shadow complexity one

A cork is a compact Stein surface which gives rise to exotic pairs of 4-manifolds. We find infinitely many corks with special shadow complexity one among the 4-manifolds constructed from contractible special polyhedra having one true vertex by using the notion of Turaev's shadow. We also show that there are just two types of polyhedra which are shadows of corks with special shadow complexity one.

Noriyuki Hamada (The University of Tokyo)

Finite covers of Lefschetz fibrations (joint work with Kenta Hayano)

Although the obvious fact that taking an unbranched finite cover of a Lefschetz fibration/pencil gives a new Lefschetz fibration/pencil is a simple idea, it seems to have been rarely considered. Once it is studied with attention, however, it

turns out to be a fruitful source of new Lefschetz fibrations/pencils. In the talk, I will demonstrate how to imply the monodromy factorizations of finite covers of a given Lefschetz fibration, then give various examples with neat monodromy factorizations. As an application, I will also introduce several new Lefschetz pencils with notable features.

Naoyuki Monden (Osaka Electro-Communication University)
scl of Dehn twists and surface bundles (joint work with Kazuya Yoshihara)

In this talk, we give a factorization of a power of a Dehn twist as a product of commutators. As a corollary, we construct surface bundles over surfaces with positive signatures.

Kouki Sato (Tokyo Institute of Technology)
Heegaard Floer correction terms of (+1)-surgeries of $(2, q)$ -cablings

The Heegaard Floer correction term (d -invariant) is an invariant of rational homology 3-spheres equipped with a Spin^c structure. In particular, the correction term of 1-surgeries along knots in S^3 is a ($2\mathbb{Z}$ -valued) knot concordance invariant d_1 . In this talk, we estimate d_1 for the $(2, q)$ -cable of any knot K . This estimate does not depend on the knot type of K . If K belongs to a certain class which contains all negative knots, then equality holds. As a corollary, we show that the relationship between d_1 and the Heegaard Floer τ -invariant is very weak in general.

Motoo Tange (University of Tsukuba)
Double branched covers and rational homology balls

Any double branched cover of a slice knot bounds rational homology 4-ball. By Lisca and Matic, it is well-known that the converse is also true for any 2-bridge knot. In general, this converse is not true. For example, several torus knots do not satisfy the converse. We show several Whitehead doubles of some torus knots do not also satisfy the converse by using the Heegaard Floer d -invariant.

Yuichi Yamada (The Univ. of Electro-Comm.)
Exceptional Dehn surgeries along the Mazur link and its generalization

The Mazur link is a two component symmetric link which gives the Mazur manifold, contractible but not a 4-ball. The Mazur link has some lens space

surgeries and Seifert space surgeries, with integer coefficients. The Akbulut-Yasui links, a generalization of the Mazur manifold as cork (a contractible piece that changes differential structures), have also non-hyperbolic surgeries. We determine non-hyperbolic Dehn surgeries along the links, by Martelli-Petronio-Roukema's results on the minimally twisted five chain link, from the view point of exceptional Dehn surgery.

Akiko Shima (Tokai University)

CS-minimal charts with exactly six white vertices (joint work with Teruo Nagase)

Two charts are said to be CS-equivalent if one deforms to the other by a finite sequence of C-moves, conjugations, stabilizations and destabilizations. Let Γ be an n -chart, $w(\Gamma)$ the number of white vertices in Γ , and $f(\Gamma)$ the number of free edges in Γ . The pair $(w(\Gamma), n - f(\Gamma))$ is called the CS-complexity of Γ . A chart Γ is CS-minimal if its CS-complexity is minimal among the set of charts CS-equivalent to Γ with respect to the lexicographical order of the pair of integers. In this talk, we prove that if Γ is a CS-minimal chart with $w(\Gamma) = 6$, then Γ is CS-equivalent to the product of a ribbon chart and a 'chart' representing a 2-twist spun trefoil.

Takao Matumoto (Kyoto University)

Smooth unknotting conjecture in dimension four

The idea which completes the final stage of the proof will be sketched. We use the fact that if $w\sigma_{i_1}^2w^{-1} = \sigma_{i_2}^2$ then the word w can be simplified until the identity element e by the following three kinds of steps:

- (1) $x\sigma_i^2x^{-1} = \sigma_i^2$ ($x \sim e$),
- (2) $\sigma_k^\epsilon\sigma_i^2\sigma_k^{-\epsilon} = \sigma_i^2$ ($|i - k| \neq 1, \epsilon = \pm 1$) and
- (3) $\sigma_i^\epsilon\sigma_j^\epsilon\sigma_i^2\sigma_j^{-\epsilon}\sigma_i^{-\epsilon} = \sigma_j^2$ ($|i - j| = 1, \epsilon = \pm 1$).