Kazuhiro Ichihara and Yuichi Kabaya

JSJ decompositions of toroidal 3-manifolds obtained by Dehn surgeries on pretzel knots

We will report computer experiments and some topological results on JSJ decompositions of toroidal 3-manifolds obtained by Dehn surgeries on pretzel knots. This is a joint work with In Dae Jong (Osaka City University)).

Jason Behrstock

(Talk 1) Quasi-isometric classification of 3-manifold groups

Any finitely generated group can be endowed with a natural metric which is unique up to maps of bounded distortion (quasi-isometries). A fundamental question is to classify finitely generated groups up to quasi-isometry. Considered from this point of view, fundamental groups of 3-manifolds provide a rich source of examples. We will survey the world of 3-manifold groups from classical results to the recent resolution of some long standing questions. This talk will be accessible to a broad mathematical audience. (Joint work with Walter Neumann.)

Kenichi Kawagoe

On limits of HOMFLY polynomials of knots and links

As an analogue of the Volume conjecture from Jones polynomials, we calculate the limits of the HOMFLY polynomials of 5_2, 6_1 knots and the Whitehead link. We will demonstrate these numerical calculations.

Hiroyuki Inou

Complex dynamics and computer

In the study of complex dynamics, fractal sets (such as Julia sets and the Mandelbrot set) naturally appear. Visualization of those sets by computer has been playing an important role in the development of complex dynamics. In this talk, I would like to introduce relationships between complex dynamics and computer, from visualization of fractal sets to recent results depending on rigorous computation.

Juan González-Meneses

(Talk 1) The conjugacy problem in braid groups

First solved by Garside in 1969, and having classical applications to knot theory, the conjugacy problem in braid groups has recently been proposed to be of potential use in cryptography. We will present the state-of-the-art of the solutions to this problem. We will explain a new algorithm (joint work with Volker Gebhardt) which can be generalized to a wider family of groups called Garside groups (including Artin groups of spherical type). Although this algorithm is very efficient in the generic case, we will see that there exist families of examples for which it has exponential complexity: Understanding the nature of these examples is crucial either for improving the algorithm or for finding secure keys for some proposed cryptosystems.

Yasushi Yamashita

On Fellows' conjecture

A cover (resp. emulator) of a graph is a locally bijective (resp. surjective) homomorphism. In 1988, Mike Fellows formulated the following naturally looking conjecture. "A connected

graph has a finite planar emulator if and only if it has a finite planar cover." In this talk, we consider this conjecture. This is a joint work with Yo'av Rieck of University of Arkansas.

Hiroshi Matsuda
Transversely non-simple knot types – calculating HFK by computer
When we study knots in S^3 endowed with the tight contact structure, it is natural to study transverse (and Legendrian) knots. For every topological knot type, there exist infinitely many transverse knots that are NOT isotopic to each other "through transverse knots." If a topological knot type is the trivial knot, then the corresponding transverse knots are distinguished by the self-linking number, an invariant of transverse knots. A topological knot type is transversely non-simple if the self-linking number does not distinguish some of the corresponding transverse knots. We construct examples and candidates of transversely non-simple knot types.

Kenneth Shackleton
On the synthetic geometry of the pants complex
We discuss the synthetic geometry of the pants graph in comparison with the Weil-Petersson metric, whose geometry the pants graph coarsely models following work of Brock's. We also restrict our attention to the 5-holed sphere and the 2-holed torus, finding that the boundary is visible - any two points in the bordification may connected by an (in)finite geodesic - and that pseudo-Anosov mapping classes, when raised to a high power, have an invariant geodesic axis.

Masaaki Suzuki
Epimorphisms between the groups of 2-bridge knots with up to 12 crossings
In the same way as Horie-Kitano-Matsumoto-Suzuki, we show all pairs of 2-bridge knots with up to 12 crossings which admit surjections between their groups. Moreover, we compare them with Ohtsuki-Riley-Sakuma's systematic construction of surjections between 2-bridge link groups. (joint work with Teruaki Kitano)

Takuya Sakasai
Factorization formulas of higher-order Alexander invariants for homological fibered knots
Homological fibered knots are knots whose exteriors satisfy the same homological conditions as fibered knots. We discuss factorization formulas of higher-order Alexander invariants, which were defined by Cochran, associated to derived quotients of groups of such knots by using Magnus representations and Reidemeister torsions for homology cylinders of a surface. The discussion includes examples of explicit calculations of these invariants by computers. (joint work with Hiroshi Goda)

Jason Behrstock
(Talk 2) Geometry of graph manifold groups
Surprisingly, a concise way to describe the quasi-isometric classification of 3-manifolds is in terms of a concept in computer science called "bisimulation." In this talk, we will focus on an interesting family of 3-manifolds known as "graph manifolds," as for these manifold the quasi-isometric classification has a particularly nice description. We will focus on describing

this classification and a geometric interpretation of bisimulation. Finally, time permitting, we will provide applications to the study of Artin groups. (Joint work with Walter Neumann.)

Alex Bene

Factoring Mapping Classes Via Fatgraph Nielsen Reduction

It has long been known that mapping classes of a surface can be decomposed into elementary diagonal flips on triangulations of the surface. Dually, one can explore the mapping class group by elementary Whitehead moves on fatgraphs embedded in the surface, where the collection of all such moves comprises the so-called Ptolemy groupoid, an object of interest in various fields of topology and geometry. While several algorithms have been proposed to determine a sequence of Whitehead moves representing a given mapping class, all are "topological" in that they rely on resolving intersections of curves and arcs in the surface. In this talk, I will describe an easily implemented "algebraic" algorithm which explicitly determines a sequence of Whitehead moves representing any mapping class for a once bordered surface, when that mapping class is given purely by its action on the fundamental group of the surface. The proof relies on the combinatorics of a certain kind of fatgraphs called linear chord diagrams and the elementary chord slide moves on them. In particular, we show that there exists a certain "energy function" on the set of all embedded linear chord diagrams, and the above mentioned algorithm is given by an energy reducing path.

Hiroshi Kokubu

A method for constructing databases of global dynamics of multi-parameter systems

A computational method for constructing a database of global dynamics of a multiparameter dynamical system is introduced. An outer approximation of the dynamics for each subset of the parameter range is computed using rigorous numerical methods and is represented by means of a directed graph. The dynamics is then decomposed into the recurrent and gradient-like parts by fast combinatorial algorithms and is classified via the so-called Morse decompositions. These Morse decompositions are compared at adjacent parameter sets via continuation to detect possible changes in the dynamics. The Conley index is used to study the dynamics of isolated invariant sets associated with the computed Morse decompositions. The power of the developed method is illustrated with an application to the two-dimensional, density-dependent, Leslie population model. An interactive visualization of the results of computations can be accessed at the website `http://chomp.rutgers.edu/database/`, and the source codes of the software used to obtain these results, as well as other relevant information, have also been made freely available. (This is a joint work with Zin Arai, Bill Kalies, Konstantin Mischaikow, Pawel Pilarczyk, Hiroe Oka)

Zin Arai

Hyperbolicity, Stability and Monodromy of Dynamical Systems

The focus of this talk is the interplay between two distinct areas of dynamical systems: one is the monodromy theory of polynomial maps with complex variables; the other is so-called "pruning front" theory for dynamical systems with real variables. We prove that, provided some hyperbolicity conditions, the dynamics of a map with real variables is governed by the monodromy of the same map extended to complex variables. Using this relation and rigorous

computational algorithms for proving uniform hyperbolicity and for computing monodromy, we obtain the complete descriptions of several subshifts of finite type that appear in the Henon map.

Hiroki Takahasi
Toward a rigorous measure estimate of the stochastic parameter set for the quadratic family
We develop a constructive version of Jakobson's inducing argument for the quadratic family, with a view to giving a computer-assisted lower bound for the Lebesgue measure of the parameter set for which the corresponding maps have absolutely continuous invariant probability measures.

Tetsuya Ito
Computation of finite-Thurston type orderings of braid groups
Thurston type orderings are left-invariant total orderings of the braid groups, defined via hyperbolic geometry. In this talk we explain how to translate the geometric construction of the orderings into combinatorial one, and the method to compute orderings by Garside structure of the braid groups. This method provides an efficient algorithm to compute braid orderings.

Juan González-Meneses
(Talk 2) Nielsen-Thurston theory and braids
Braids can be seen as isotopy classes of automorphisms of the punctured disc, hence Nielsen-Thurston theory of automorphisms of surfaces can be applied to braids. We will see how, using these techniques, one can show theoretical results like Makanin's conjecture (two n-th roots of a braid are conjugate), or one can improve the solutions to the conjugacy problem in braid groups. We will also show how the algebraic algorithm described in the first talk can be used to determine the Nielsen-Thurston type of a braid.